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PLENARY AND KEYNOTE LECTURES

Plenary Lecture

FOOD AND TECHNOLOGY, NUTRITION AND WELLBEING, FROM PAST TO THE FUTURE (REFLECTION ON CEFOOD CONGRESSES CONTRIBUTION ON OCCASION OF 10TH ANNIVERSARY)

Peter Raspor

University of Ljubljana, Biotechnical Faculty, Food Science and Technology Department, Chair of Biotechnology, Microbiology and Food Safety
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Reflection on the food science, nutrition and technology area shows, that there are many triggers that determine how we look at food commodity today and how we will look at it in the years to come. The author analyzes the state of the art in the field of food area respecting last 10 years development in the view of current perspective. He defines local against global integration paradigm, and concludes with suggestions on the future work in this area. It is clear that all scientific and technological meetings in the last 10 years started to touch human key issues differently. We face evolution of terms like abundability, acceptability, accessibility, adoptability, affordability, allowability, availability, attractability to describe the quantity of food which is on disposal for humans, what brought some confusion to communication within food supply chain. Regarding food quality we started to move from food composition and safety to evidence based nutrition. This is the use of the current good research practices with proven effectiveness in nutrition decision-making regarding food nutrition, satiety and obesity. In processing nanotechnology and tailor made dishes are entering to industrial production scale. Respecting consumer needs and market accessibility of food items local supply and sustainability entered research and practical discussion within food systems. In last ten years we face development on various levels within food supply chain. Since the links between climate and environmental change, food security and food safety in connection to demographic issues have been largely explored in relation to impacts on crop productivity and food production, we have to take in account also other issues. Indisputability we have seriously affected traditional food supply chain concept and values and we have to consider, develop and implement novel concepts and paradigms in accordance with the state of the art in technology and society development. The hottest issues which need immediate reactions can be clustered as follows for food producers and food consumers:

1. Ethical and moral issues
2. Educational and training issues
3. Legislation and standardization issues
4. Safety and security issues
5. Research and development issues
6. Discarded foods and processing waste issues
7. Fertile soil and potable water issues

It can not be ignored that this situations are tightly linked to human rights, security and sustainable development. They are also interlinked with environmental and demographic challenges. Finally there are connected to good practices. On top of them good life practice shall come true to achieve what humans need.
Key words: food, nutrition, technology, development trends, ability to adapt

Plenary Lecture

SAFE FOOD AND HEALTHY DIETS

Elke Anklam

Joint Research Centre Unit, The Institute for Health and Consumer Protection, European Commission, Italy

Consumers request a good variety of affordable food and consumer products, that both look and taste good, are as natural as possible and have as long a shelf life as possible. The main consumer concern however is the safety of products, as there were a number of food scandals over the past decades. Food safety control is now well established in Europe and also increasingly worldwide. Appropriate legislation is put in place in order to ensure high quality food products on the market.

Safe food products make certainly the basis for a healthy diet, however this is not enough to ensure healthy and sustainable eating. There is a clear albeit complex link between nutrition and health. While there are many actions already in place to promote healthy diets and lifestyles, there is common understanding that more can be done to prevent non communicable diseases that can be linked to nutrition and physical activity.

This presentation will elaborate on the impact of food safety versus a balanced diet on the health of consumers

Plenary Lecture

2020 IS NOW; HOW CAN THE FOOD INDUSTRY COPE WITH EVOLVING CHALLENGES?

Eyal Shimoni

Department of Biotechnology and Food Engineering, Technion – Israel Institute of Technology, Israel

With the pressures in the food industry today and the challenges facing global concerns, companies have to focus all their systems and keep them up to date with the latest technologies. This has to be a part of the DNA. There are two extremes in the world today: developing and developed countries. These extremes are reflected in nutrition, which has two faces: hunger and obesity; food security and food quality. The common factor is that consumers seek health and wellness to improve their quality of life.

Still, we must keep in mind that consumer needs are more complex and include sustainability and social responsibility. Demography is yet another changing parameter. As life expectancy increases and the age distribution of our consumers changes, their needs change and should be answered. Technology should be at the forefront to enable companies to be on top of this ever changing game.

This talk will address main global trends, the challenges they impose on the food industry, and how food science, technology, and engineering can provide solutions – with some examples. It will also review the unique approach of Strauss group to drive cutting edge technologies into the company innovation pipeline.

Plenary Lecture

GASTRONOMIC ENGINEERING FOR HEALTH AND TASTE

José Miguel Aguilera

Department of Chemical and Bioprocess Engineering, P. Universidad Católica de Chile

Gastronomic engineering is the application of the science of food materials and principles of engineering to: i) understand the mechanisms by which molecules are organized at different scales into recognizable elements that give foods and dishes their desirable properties; ii) visualize and characterize food structures so they can be related to sensorial and physiological responses; iii) be able to control the physical and chemical transformations during processing and cooking, in order to design structures that are appealing, tasty, safe and more nutritious; iv) understand the role that food structure plays in the release and absorption of nutrients (bioavailability) inside our bodies, and; v) utilize the fascinating examples of the engineering taking place inside foods during processing and cooking to teach students and chefs, and bring people closer to the engineering in foods. This presentation will present examples of applications of gastronomic engineering in various contexts.

Plenary Lecture

EXTRUSION – A NOVEL FOOD PROCESSING TOOL

Mian N. Riaz, Ph.D

Food Protein Research & Development Center; Texas A&M University, College Station, Texas, 77843, USA

During the recent years quite a number of technologies in food processing have been emerged and made an impact on the availability and variety of food products. Food extrusion is one of these latest multidimensional food processing techniques. Great possibilities are offered in food processing field by the use of extrusion technology to modify physicochemical properties of food components. The extruded food, besides its preserved and frequently even enhanced biological value, can be characterized by physicochemical properties superior to the original raw material. Extrusion cooking is defined as a unique tool to introduce the thermal and mechanical energy to food ingredients, forcing the basic components of the ingredients, such as starch and protein, to undergo chemical and physical changes. Extrusion combines several unit operations including mixing, cooking, kneading, shearing, shaping and forming so it is a highly versatile unit operation that can be applied to a variety of food processes. Extrusion has for years provided the means of producing new and creative foods. One major advantage of extrusion cooking is the capability to produce a wide range of finished products with minimum processing times and by using inexpensive raw material. Some of the extruded food products are: snack foods, protein fortified healthy snacks, breakfast cereals, baby foods, fortified ready to eat rice, extruded biscuits, structured meat analogs, meat extender, high moisture meat analogs, stabilized rice bran for food fortification and recycling the food waste. Other than these products there are several other places where extrusion technology can be employed or is being used presently. Some of the examples are; ease in oil expelling, beverages powders, boiled sweets, breads (miscellaneous, expanded, and dense), breading substitute; candy sticks, caramel, chewing gum; chocolates, cocoa and crump; crisp bread; confectionery; cooked grains (barley, corn/sorghum, mixed); dairy products; dried food mixes; egg rolls; fabricated potato chips; flavoring, food additives; frozen confectionery; fudges; full fat and partially de-fatted soy flour; imitation nuts; pasta products (noodles, spaghetti, macaroni); pastry dough; precooked and modified starches; pressed tablets, pretzels; protein (textured and gluten), soup and gravy mixes; sugar crust liqueurs, three dimensional confectionery and toffees.

Plenary Lecture

NONTHERMAL PROCESSING OF FOODS

Gustavo V. Barbosa-Cánovas

Washington State University, USA

Conventional approaches to process foods have proven to offer very safe products but, in some cases, the quality of the final product is significantly lower to the original one. Nonthermal processing of foods has emerged as a viable alternative to those conventional processing techniques by offering safe products of excellent quality and at very reasonable cost. These emerging technologies utilize nonthermal microbial stress factors as the main inactivation mechanism. In some cases, external sources of heat or self-generated heat are utilized to supplement the main inactivation mechanism. This combination becomes very relevant in the case of the sterilization of low-acid foods by pressure assisted thermal processing (PATP). This presentation analyzes some of the most relevant nonthermal technologies where some of them are already in use by the food industry and others will be adopted in the very near future. It is the case that these nonthermal technologies could be used in combination among themselves or with other preservation approaches seeking synergistic effects in order to have shorter processes and very good quality food products.

Plenary Lecture

EMERGING TECHNOLOGIES FOR TRADITIONAL PRODUCTS

Dietrich KNORR

Technische Universität Berlin, Department of Food Biotechnology and Food Process Engineering, Koenigin-Luise-Str. 22, D-14195 Berlin, Germany

An increasing number of emerging technologies including high hydrostatic pressure, pulsed electric fields, cold plasma and ultrasound have been evaluated and developed during the last year. They were originally intended to replace conventional thermal processes as gentle preservation tools. However, besides the preservation effects, these technologies proofed also effective for modification of foods and food constituents. This enables their integration into existing processing lines and open opportunities for not only integration into existing processing lines but to also improve traditional processes and products.
Examples of research on process-structure-function relationships of food materials will be given demonstrating the importance of a science based integration and implementation of emerging technologies in existing food processing operations. In addition, examples of energy and resource efficient processes based on the incorporation of emerging technologies will be given.

Keynote Lecture

THE FATE OF PHYTOCHEMICALS IN THE FOOD CHAIN. THE CASE STUDY OF POLYACETYLENES IN APIACEAE

Valverde, J.

Teagasc, Ashtown Food Research Centre, Ashtown, Dublin 15

Phytochemicals are can occur in many sorts of plants, and are common constituents of fruits and vegetables that are part of the human diet. Numerous studies suggest that some phytochemicals can be responsible for considerable health benefits to humans such as reduction of the risk of developing many forms of cancer (lung, prostate, pancreas, bladder and breast) and cardiovascular diseases, and other benefits such as anti-inflammatory properties. However the there are many factors that can affect the phytochemicals levels and bioactivity all along the food chain. The main steps of the food chain; food production, supply and distribution, and consumption can have significant effect in the levels of intake and the bioavailability in relation to human health. Therefore the importance to have a farm to fork research approaches to obtain holistic overview on the fate of phytochemicals in the food chain, and also to highlight areas were knowledge gaps were present.

Polyacetylenes are widely distributed in nature and can be found in plants, fungi, lichens, moss, marine algae and invertebrates. More than 1400 different acetylene-type compounds have been characterized in plants, and approximately half of these are polyacetylenes. Among higher plants polyacetylenes are common in several botanic families. Polyacetylenes are commonly found in *Apiaceae* such as *Daucus carota* (carrot) and *Pastinaca sativa* (parsnip) which are commonly consumed as foods by humans.
Polyacetylenes have shown to have multiple bioactivity effects and can be classified in four groups, depending on the impact that they have on human heath; (1) Anti-inflammatory and anti-platelet; (2) Anti-fungal and anti-viral; (3) Anti-bacterial/mycobacterial and (4) Cytotoxicity and anti-cancer.
Knowledge on the impact on polyacetylene levels during the different steps of the food chain is necessary in order to ensure that foods keep their nutritional and functional value when they are consumed. This lecture is a review on recent advances on the assessment of the impact of different steps of the food chain in polyacetylenes in different Apiaceae vegetables.

Keywords: Apiaceae, Phytochemicals, Polyacetylenes, Farm to Fork.

Keynote Lecture

ANALYSIS OF BIOACTIVE COMPOUNDS IN PLANTS AND FOOD PRODUCTS

VesnaTumbas, Jasna Čanadanović-Brunet, Sonja Đilas, Gordana Ćetković

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In addition to many essential nutritional components, plants contain various groups of biologically active non-nutrients. 'Bioactive compounds' are defined as compounds that cause a specific biological response in humans and animals. Foods produced with bioactive compounds can be marketed as functional foods. Functional foods are defined as foods or food components that provide health benefits beyond basic nutrition (for the intended population). Increasing the content of bioactive compounds in foods are specifically addressed to produce new food products with improved nutraceutical values, able to prevent chronic diseases.

For proper understanding of the benefits they provide there is a need for optimized and effective protocols and methods for isolation, accurate detection and valorization of bioactive compounds, and determination of their biological effects.

Accurate and reproducible identification and quantitation of bioactive compounds is essential to establish relationships between different food components and their influence on health to proclaim health benefits. Also, this is essential for establishing appropriate dietary intake levels and safety guidelines necessary (for justifying health claims) achieving desired health-beneficial properties.

The aim of this work is to provide an overeview on the protocols and methods presented in literature for detection of bioactive compounds, focusing on polyphenols, carotenoids, vitamin C, tocopherols and betalains.

Acknowledgement: This keynote lecture presented the topics and the results of the research within the project TR31044 financially supported by the Ministry of Education and Science of the Republic of Serbia.

Keynote Lecture

THE *TRANS* MONOUNSATURATED FATTY ACIDS IN RUMINANT: BIOSYNTHESIS AND TISSUE METABOLISM, DISTRIBUTION IN MEAT PRODUCTS AND HEALTH VALUE FOR HUMAN CONSUMERS

Dominique BAUCHART

Research Unit on Herbivores, INRA of Theix, 63122 Saint-Genès-Champanelle, France

In ruminant animals, *trans* isomers of monounsaturated fatty acids (MUFA, mainly *trans* isomers of 18:1) are generated by rumen microflora from dietary fatty acids by a series of chain reactions consisting in partial biohydrogenation of dietary n-6 and n-3 polyunsaturated fatty acids (PUFA) followed by *trans* isomerization of the double bond of produced MUFA. After their absorption by small intestine and their subsequent transport in the blood, *trans* MUFA are finally i) deposited in tissues or secreted into milk lipids such as they are, or ii) converted into conjugated linolenic acids (CLA), especially into rumenic acid (9*cis*,11*trans* 18:2) (Aldai et al, 2011). Chemical analysis of *trans* 18:1 from beef products by preparative HPLC followed by GLC–mass spectrometry showed the presence of 11 distinct isomers varying by the position of the *trans* double bound (from *t*6 to *t*16) (Bauchart et al, 2011). In such products, *trans* 18:1 are dominated by the *t*9 and *t*10 isomers detrimental for human health (pro-atherogenic) and more especially by the *t*11 isomer (vaccenic acid) beneficial (anti-atherogenic) for human health. Beef *trans* 18:1 isomers varied in composition and in concentration with breeding factors linked to animals (breed, gender, age, muscle type) and their feeding conditions (composition of the basal diet, lipid supplements). Quantitatively, they are mainly deposited in triglycerides of intramuscular adipose tissues, especially in cattle breed exhibited early lipogenesis (ex. Aberdeen Angus; Bauchart et al, 2011) or tissue lipid accumulation in old cull cows (Habeanu et al, 2012). Qualitatively, dietary 18:3n-3 abundant in grass feeding (Dannenberger et al, 2004; Bispo et al, 2011) and in linseed supplemented diets (Bauchart et al, 2011; Habeanu et al, 2012) improved the nutritional value of *trans* 18:1 by favouring deposition of *t*11 18:1 and to the detriment of *t*9 18:1. Dietary factors can affect also beef *t*12 to *t*15 18:1 deposition but the potential beneficial effects of these isomers warrant further investigation.

Keynote Lecture

IN VITRO AND IN VIVO INVESTIGATION OF THE PROBIOTIC PROPERTIES OF FREE AND IMMOBILIZED *LACTOBACILLUS CASEI* ATCC 393

Marianthi Sidira (1), Petros Ypsilantis (2), Georgia Saxami (1), Alex Galanis (1), Constantinos Simopoulos (2), and Yiannis Kourkoutas* (1)

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Nowadays an upsurge of interest in developing novel foods containing probiotic microorganisms is observed. Such functional foods have a great potential in promoting human health. To deliver the health benefits, probiotics need to contain an adequate amount of live bacteria, able to survive the acidic conditions of the upper GI tract and proliferate in the intestine, a requirement that is not always fulfilled. Since it is well established that cell immobilization enhances the viability of cultures, the aim of the present study was to assess (a) the in vitro and in vivo survival of immobilized *Lactobacillus casei* ATCC 393 on apple pieces contained in probiotic fermented milk in comparison to free cells after GI transit, (b) the in vivo adhesion to the intestinal mucosa, and (c) potential regulation of intestinal microbial flora in a rat model. In in vitro GI stress tolerance tests, immobilized L. casei ATCC 393 exhibited significantly higher survival rates compared to free cells. At a second stage, probiotic fermented milk produced by either free or immobilized cells was administered orally at a single dose or daily in Wistar rats. By 12h after single dose administration, both free and immobilized cells were detected by microbiological and molecular analysis at levels ≥ 6 logcfu/g of feces. Moreover, the adhesion of the probiotic cells at the large intestine (cecum and colon) was recorded at levels ≥ 6 logcfu/g (suggested minimum levels for conferring a probiotic effect) following daily administration for 7 days. Their levels were lower at the small intestine (duodenum, jejunum, ileum) (≤ 3 logcfu/g), indicating that adhesion was a targeted process. Finally, daily administration of the probiotic products led to significant reduction of staphylococci, enterobacteria, coliforms and streptococci counts in rat feces.

Keynote Lecture

BEER AS AN INTEGRAL PART OF HEALTHY DIETS – CURRENT KNOWLEDGE AND PERSPECTIVE

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Beer is one of the oldest beverages. Throughout history, it has been accepted not only as a refreshing drink, but also as a liquid bread, a source of energy, a healing remedy and, lastly, as a safe drink that can promote well being. Nowadays, beer is one of the most popular beverages all over the world and an integral part of diets in most countries. For the last decade, it has been in focus of significant medical research and the numerous results have given the scientific confirmation of the statement known for centuries: beer is far more than a thirst-quenching low-alcohol beverage. Published data have indicated that beer contains a wide range of nutrients with bioactive properties and, if consumed moderately and in a responsible manner, can be a useful part of a healthy diet. Of particular interest are its polyphenol, mineral, trace element and vitamin composition, as well as its antioxidant properties. It seems that we have reliable enough results to claim that beer has a potentially positive influence on low blood pressure, atherosclerosis and cardiovascular diseases, and may help protect against gallstones and kidney stone formation, dementia, osteoporosis etc. However, several facts deserve to be discussed: the latest information considering the beer's beneficial action, the meaning of moderation in each particular case, the significance of beer versus wine in health promotion, the thirst-quenching effect as a low-alcohol beverage, the influence on the energy intake and the problem with obesity, and, finally, the perspective in terms of the new beer types with new sensory and functional properties.

Key words: beer, bioactivity, antioxidants, minerals, cardiovascular diseases

Keynote Lecture

CHALLENGES IN QUALITY CONTROL OF PROBIOTICS IN FOOD AND DIETARY SUPPLEMENTS AND IN FUNCTIONAL STUDIES

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Probiotic products comprise different functional foods, dietary supplements and drugs. Among the main challenges related to the quality control of probiotic products there is determination of their viability where strain-specificity of the analysis is needed, and monitoring of the phenotypical and genotypical stability of commercial probiotic strains. The producers should provide the methods for the quantification including sample preparation since the formulation have great impact on the results of the quantification. Only a few laboratories are accredited to date for the analysis of probiotic products. In the light of the EFSA's recent rejection of several probiotic related claims for food products everybody are aware that stronger evidence of the mechanisms of action of probiotics intended for food and dietary supplements is needed. The challenges of functional studies of probiotics include tracking of individual probiotic strains in complex samples such as intestines, faeces, mucosa, etc. A total genome sequencing is expected to become a routine analysis enabling for example in silico identification of strain specific genes or control of genetic stability. Development of probiotic formulations that enable prolonged survival of probiotics at room temperature is also an important topic. The above mentioned problems and challenges will be demonstrated through presentation of selected results of our own research in probiotic field and experiences of our recently established laboratory for the control of probiotic products.

Keynote Lecture

FACTORS AFFECTING ELIMINATION OF CARCINOGENIC COMPOUNDS FROM FOOD PRODUCTS.

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This presentation will deal with effects of environmental and physicochemical factors affecting polyaromatic hydrocarbon (PAH) elimination from smoked meat products and liquid smoke flavoring (LSF). In the introductory part, some essential information will be aimed at principles of food smoking and PAH formation during smoke generation as a result of incomplete wood combustion. Also, an application of alternative technology for food aromatization using LSF will be briefly mentioned. Similarly, latest European legislation, biological effects, and analytical aspects of PAHs will be mentioned concisely. The main part will be devoted to physicochemical factors affecting the PAH content in smoked meat products, such as light, additional cooking, and packaging, which are able to decrease considerably PAH content in some meat products. The most important effect on PAH concentration decrease in LSF has low-density polyethylene (LDPE) package due to sorption processes on a surface of the plastic with subsequent diffusion into the plastic bulk. A less effective material is polyethylene terephthalate (PET), when only a surface adsorption process comes into account. Moreover, this process is affected also by other compounds presented in liquid media able to compete for the adsorption center on the PET surface.

Keynote Lecture

NIR SPECTROSCOPY AND IMAGING: VERSATILE TOOLS OF QUALITY CONTROL IN CEREAL SCIENCE AND TECHNOLOGY

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The infrared spectroscopic methods (NIR, NIT, FTIR, FTNIR) are the most promising techniques to measure the quality characteristics fast and non-destructively, but this indirect technology need big sample sets and sophisticated calibration, validation procedures and chemometric tools and methods.
The presentation demonstrate the benefits of near infrared spectroscopy and imaging in the quality assessment of macro components, physical and rheological properties as well as some bioactive minor constituents like arabinoxylans, beta-glucans, sterols and alkylresorcinols in cereal seed.
NIR is an important tool for breeders and producers to control the seed quality or milling fractions composition as well as in the monitoring the genetic and environmental effects with high throuhput.
The application of NIR/NIT in the monitoring of milling technology helps to optimize the composition of fractions with targeted quality and also help to enhance the yields of dedicated products, so this technique could be an essential part of process analytical technology.
Plant physiological processes like maturation or germination can be followed or monitored also by NIR technique where the qualitative evaluation of fine details of spectra could help to understand the fine biochemical details of physiological processes
The presentation highlights the benefits of NIR imaging in the recognition and monitoring of quality anomalies.

Keynote Lecture

MILD FOOD PROCESSING AND MULTIEXPOSURE TO BACTERIAL PATHOGENS AND TOXINS IN FOOD

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Introduction

Some of the foodborne pathogens are characterized by the ability to produce toxins. These toxins play an important role in array of virulence factors being often the principal mechanism by which these pathogens cause a disease.

The strains of *Bacillus cereus* can cause diarrheal and emetic (vomiting) food poisoning and are commonly found in a wide range of foods and environments[5]. The diarrheal type of *B. cereus* food poisoning is caused by protein enterotoxins such as haemolysin BL, non-haemolytic enterotoxin, enterotoxin FM and cytotoxin K (cytK), all upon the production in small intestines. Contrastingly, by growth of *B. cereus* in food an emetic peptide-like toxin (cereulide, CER) is produced inducing emetic food poisoning. Staphylococcal enterotoxins (SEs) are extracellular proteins, produced mainly by *Staphylococcus aureus*, causing food intoxication when ingested. To date, 21 SEs, excluding variants, have been identified.

In current science, the combined exposure to foodborne bacterial toxins is an unknown factor for the food safety risk assessment. The current project aims to offer some fundamental answers on this pressing issue.

Methods and materials

The influence of the contemporary food processing technologies on physiology of toxigenic bacterial pathogens, production and toxicity of the selected toxins (factors affecting combined exposure) was investigated as follows:

a. Ability of B. cereus to sustain injury, adapt to stress, to grow and to produce toxins in food produced using mild hurdle-technology
b. Ability of S. aureus to sustain injury, adapt to stress, to grow and to produce toxins in food produced using mild hurdle-technology
c. Ability of co-inoculated B. cereus and S. aureus to grow and produce toxins in the same RTE food

Results

Results of the current study showed that in the same RTE food, exemplified by lasagna, both B. cereus and S. aureus can grow and produce different toxins. This has been verified at 12°C and 22°C, under aerobic and modified atmosphere conditions.

Conclusions

Taking into account presumed intoxication doses, this innovative investigation showed completely new risk profile based on the presence of multiple toxins in the same food sample.

Keynote Lecture

HYGIENIC ENGINEERING AND DESIGN: THEORY AND PRACTICE

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Hygienic engineering and design is application of different design techniques that allows efficient and effective cleaning of the all manufacturing assets (buildings, infrastructure, equipment, etc), in order to eliminate or minimize the risks from any kind of hazards. Hence, it can be considered as a HACCP prerequisite program.

Food safety systems/standards are well known worldwide for more than 50 years, but legislative supporting this system was ambling behind it. Finally, in 2002 the EU enforced Regulation (EC) 178/2002 laying down the General Principles and requirements of food safety. Even later EU adopted crucial Directive 2006/42/EC for machinery which was requiring that handling, preparation processing and packaging of food is done hygienically using hygienic machinery and in hygienic premises. This Regulation is still not adopted in all Balkan countries and there are still no details and technical rules or guides defining Regulation requirements.

Hygienic engineering is highly promoted by European Hygienic and Design group (EHEDG) which is trying to fill this gap. This guidance is especially valuable to the equipment manufacturers and users who are responsible to implement these requirements, because EHEDG provides them guidelines and documents on the essential hygienic design standards which should be in compliance with national and international legislation.

However, lack of detailed legislative rules and awareness about EHEDG guidelines, lack of formal and non-formal education about hygienic engineering aspects, weak technological development, innovations etc, resulted with practical problems for food safety controlling bodies and food industry. These problems are usually solved with improvisations which are creating even more complex situation in practice.

Keynote Lecture

FOOD PROCESSING USING SUPERCRITICAL FLUIDS

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A “green” revolution as a part of necessary sustainable development, use also high pressure as a tool. The main impetus for this conversion is on one way driven by a concern to the environment to reduce the usage of solvents and energy. On the other hand increasing consumer demand on new and natural products use high pressure as a tool to design and produce the natural products with completely new characteristics.
Research in supercritical extraction technology started about two decades ago. Meanwhile several hundreds supercritical extraction plants are in operation world-wide, with a strong increase in the past decade. Extraction of plant materials, like hop constituents, decaffeination of tea and coffee, separation of lecithin from oil are high pressure processes, which are performed on large industrial scale. Several smaller industrial units are in operation also for extraction of spices for food industry and natural substances for use in cosmetics.
The unique thermo-dynamic and fluid-dynamic properties of different gasses used as dense fluids, e.g. sub- or super-critical fluids can be used also for integrated extraction and in situ formulation like impregnation of solid particles, for formation of solid powderous emulsions, particle coating, e.g. for formation of solids with unique properties for the use in different applications will be presented.
We could summarize that extraction of substances from solids or liquids and their integrated formulation in products with specific properties is one of the very promising applications of supercritical fluids and several laboratory scale as well industrial scale applications, including fundamental data for design of high pressure processes, will be presented in details.

Keynote Lecture

ACRYLAMIDE FORMATION IN FOODS: ROLE OF COMPOSITION AND PROCESSING

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Detection of acrylamide levels in processed foods has been an intensive area of research shortly after the discovery of acrylamide in heated foods by the Swedish researchers in April 2002. Several researchers have established that the main pathway of acrylamide formation in foods is linked to the Maillard reaction and, in particular, the amino acid asparagine. Thermally processed foods encompass a vast range of different products with many ingredients, processes, recipes and scales of operation. The resulting acrylamide concentrations in these foods change with great deviations as influenced by product composition and heating conditions.

This presentation overviews the basic facts and figures on the formation of acrylamide in thermally processed foods. In addition, recent research findings and technological developments about the mitigation of acrylamide by means of recipe and process modifications are discussed.

Keynote Lecture

GLOBAL FOOD SECURITY AND BIOFUEL PRODUCTION UNDER THE LIGHT OF RESOURCE MANAGEMENT ETHICS AND INCREASING WORLD POVERTY

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While biofuel production is gaining wider acceptance as a promising alternative for generation of renewable energy, there is a growing skepticism and a major concern regarding its negative impact on food security and sustainable development. This concern is based on the fact that land use competition may lead to lower food production and higher food prices, leading to decreased access to food for even larger impoverished populations.

It is estimated that 1.02 billion people (that is 15% of the present world population) are suffering of hunger (FAO, 2009)**.** Compared to the 2006 estimate of 854 million hungry, this is a tremendous increase (~ 20%) within a very short time and an alarm for negative developments to come. Food insecurity is not limited to developing countries; it is a rapidly growing concern for developed communities as well. In fact, recent statistics describe a staggering defeat of whatever efforts are made to eradicate the world hunger problem. To feed a world population that is expected to surpass 9 billion in 2050, it is estimated that agricultural output will have to increase by 70% between now and then (WSFS, 2009).

A number of factors are expected to further complicate the world hunger problem. Such factors include: limited access and loss of produced food due to poor infrastructures in developing countries; increased poverty; negative impact of globalization on world agricultural trade (i.e. agricultural dumping); loss of land and productivity due to climate change; loss of vital land due to *"land-grabbing"*; increased food prices (due to climatic change, higher fuel prices, market speculation, etc). *"Loss"* of land to biofuel production appears to be an additional, severe threat, if the appropriate policies and measures are not effectively applied.

There are various social, economic, environmental and technical aspects to biofuel production and use. Biofuel production is in fact a complex, multi-factorial, multi-dimensional issue that has to be addressed in a globally harmonized manner, with sound resource management ethics that will protect universal human values and respect human rights, especially the *"right to food".* The real threat of a devastating impact to food security, should lead both scientists and policy makers to wise application of the *"Precautionary principle",* so that any irreversible, negative effects can be avoided or minimized.

A series of questions should be carefully addressed:

Is biofuel production a sustainable and viable option? How "green" is biofuel?

Does biofuel compete against food?

Can global demand for both agrofuels and food stimulate new forms of corporate land grabbing and expropriation, thus leading to increased poverty? Are we moving towards an *'agrofuels capitalism'* as a new form of *"capitalist monocrop production"?*

Are there tools that will *"make biofuels work" (become green)?*

Are there alternative (especially non-land) biofuel production options?

Can we balance the blend of food and biofuel?

Can we produce biofuel without robbing the world population of the food it needs?

Can *"advanced generation"* biofuels vault us beyond the need to choose between food and fuel?

Can we take measures and apply policies to assure that biofuel development is pro-poor, environmentally friendly and supports food security and nutrition?

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Keynote Lecture

FOOD COLD CHAIN MANAGEMENT AND OPTIMIZATION

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Reliable information on the cold chain conditions, the main shelf life determining post-processing parameter, is an essential prerequisite for effective shelf life management of food products. Application of an optimized quality and safety assurance system for the distribution of chilled and frozen products requires continuous monitoring and control of storage conditions. FRISBEE is a Food Refrigeration Innovation for Cold Chain European project. Within FRISBEE a user friendly web-based cold chain database (http://frisbee-wp2.chemeng.ntua.gr/coldchaindb/) is being built. At all stages of the cold chain, the needs of consumer and European industry were considered, gaining a greater insight into deviations between real cold chain data and targeted specifications.

Systematic data collection and processing allowed identification and evaluation of the weak links of the cold chain of chilled and frozen products. Data from all stages (production to consumption) of the cold chain were collected from researchers, industry, distributors, retailers and consumers. The developed FRISBEE cold chain database web based platform linked to appropriate shelf-life predicting tools offers the potential to effectively manage and improve cold chain weak links using appropriate shelf-life decision systems leading to an optimized handling.

Using the response of Time-Temperature Integrators (TTI), inexpensive, smart labels that show an easily measurable, time-temperature dependent change reflecting the temperature history of the food product, the integral effect of temperature can be monitored, and quantitatively translated to food safety and quality, from production to the point of consumption. SLDS (Shelf Life Decision System) and SMAS (Safety Monitoring and Assurance System) are TTI chill chain management systems that lead to an optimized handling of products in terms of quality and safety risk.

Key words: cold chain, management, TTIs, FRISBEE

Keynote Lecture

INNOVATIONS IN FOOD PACKAGING MATERIALS

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Changing lifestyles drive growth in modern food packaging industry. Type of material and packaging design has become as integral to food item itself. This trend is most noticeable in western countries lead by USA Europe and Japan but China, India and other developing countries are fast catching up.
Nowadays consumer demand for more convenient, fresher, safe and better-tasting food is driving the need for better and more functional packaging. At the same time, consumers are also seeking packaging that is recyclable and environmentally friendly, as waste regulations in EU and other countries are putting increasing demands on the packaging industry to develop new ecological materials, which are also degradable at the end of their service life.
Instead of relying on oil-based packaging materials, many domestic and EU funded research programs looked at packaging that can be made with natural polymers such as cellulose, proteins, starch, sugars, fatty acids and novel biodegradable polymers such as PLA or PHA. In most cases the goal is to produce packages that are combustible, compostable, renewable and carbon-dioxide neutral.
Nowadays food related industry is looking for novel packaging materials, which combine at least two very important added values: they are biobased and smart with appropriate functional properties. In addition to the specific mechanical properties related to type of selected package, such materials must have also the adequate permeability to water vapor and oxygen. The gas barrier requirements of the packaging depend upon the products characteristics and the intended end-use application. Moreover flavour and odour absorbers like films and sachets along with antimicrobial surfaces have been introduced to help keeping food items fresh and natural for a long times. Many new indicators combine with digital technology has been already integrated into the packaging to look into the freshness of food items.
This presentation will focus on the latest results related to novel innovative packaging materials mainly based on biobased solutions.
Over the last ten years many companies have developed a number of sustainable technologies that apparently meet the above goals whilst maintaining product integrity, value and desirability. In the future both, producers and consumers with help of novel eco-oriented regulations will decided which of this novel materials and packaging technologies will win this important and fascinating race.

Keynote Lecture

ECO-SUSTAINABLE FOOD PACKAGING BY NANOMATERIALS

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For long period of time traditional polymers derived from fossil fuels have played the major role in common packaging material because of their several desired properties like softness, lightness and transparency. However, traditional polymers are non-biodegradable and impractical for recycling so their increased use has led to ecological problems. New demand for eco-friendly sustainable food packaging put the more attention to the biobased polymer materials as possible alternative. However, these polymers still have some disadvantages considering performance, processability and cost. Recently, polymer nanotechnology brings new opportunities and innovative solution to improve their performance. This article gives short reviews of different type of biobased polymer nanocomposites for food packaging application.

Key words: biobased polymer, polymer nanocomposites, sustainable food packaging

Keynote Lecture

PROCESSES OPPORTUNITIES AND CHALLENGES FOR IMPROVING CORN (MAIZE)-TO-ETHANOL

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The replacement of fossil fuels as an energy source has intensified the search of new refining processes that would reduce the cost of ethanol production by a more effective utilization of non-fermentable components of cereal grains. Dry-milled and dry-fractionated corn germ is a non-fermentable fraction that is undervalued for two main reasons. First, high starch content of dry-milled germ reduces the efficiency of oil extraction process and, second, the loss of starch with the germ fraction directly effects profitability of ethanol plants. Corn pre-processing technologies before ethanol fermentation are being developed to capture oil and protein value of the germ and to improve economic stability of corn processing plants by making corn (endosperm) starch a more cost-competitive feedstock for biofuel production.

In this presentation, we report a novel germ wet milling method developed to improve germ (protein, oil) purity. In a series of bench and pilot -scale experiments, we demonstrated that starch content of dry-milled germ can be reduced from 33% to 9%. As a result protein content of the germ increased from 18% to 29% and oil content from 16% to more than 35%. Germ-soaking temperature, time, and pH are processing conditions that can be varied to tailor germ protein, starch, and oil contents in order to maximize byproducts value and overall process economics. For example, the oil content of germ after soaking at pH 7 and 60°C for 2 h was similar to that typically seen in traditional wet milling (42 to 50% db). To produce protein concentrate from defatted germ require controlling soaking time, temperature, and pH. Germ soaking at 25°C and either pH 6 or pH 9 was optimal for increasing protein concentration and maintaining protein functionality. Germ flour and corn protein concentrates produced from wet processed germ had a very good amino acid profile for feed and food applications.

Keynote Lecture

MICROBIAL POLYSACCHARIDES: BETWEEN OIL WELLS, FOOD AND DRUGS

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Microbial exopolysaccharides (MPSs) such as xanthan, dextran, gellan or pullulan have been commercially used, in their natural or modified state, for many years.
A large number of these natural polymer applications is a consequence of their excellent physical and chemical properties, based on their capacity to alter the basic properties of water (e.g. thickening or gelling). In addition, these polymers have related secondary functions, such as emulsification, suspension, stabilization, encapsulation, flocculation, film forming, binding and coating.
MPSs, and particularly exopolysaccharides have many other novel properties to offer, and discovery of immune modulation and bifidogenic effect of some of them should provide other applications.
This work focuses on the more recent developments in the extent of application of microbial polysaccharides in the various fields what makes these polymers promising and versatile materials in future, and also on our investigations within these natural products.

Key words: microbial polysaccharides (MPSs), properties, material, application, industry

Keynote Lecture

ENCAPSULATION TECHNOLOGIES FOR FOOD INDUSTRY

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Incorporation of bioactive compounds–such as cells, vitamins, antioxidants, nutrients, bioactive peptides into food systems provide a simple way to develop novel functional foods that may have nutritional benefits or reduce the risks of diseases. However, the production of these active ingredients and their incorporation in a variety of food products require new and innovative technologies because such ingredients are sensitive to a variety of environmental processing factors that may cause the loss of biological functionality, chemical degradation and/or premature or incomplete release. The paper focuses on exploiting of novel extraction techniques, cells and enzyme encapsulation technologies, bioprocessing and combined processes for food ingredients production, modification and incorporation in food products to improve the sensory quality, health effects and safety of food. The paper will be focus on research part on screening, isolation and characterization of bioactive compounds, optimization of bioprocess based on the immobilized biocatalysts for synthesis and/or tailored modification of bioactive compounds, development of advanced micro- and nano-encapsulation technology with improved encapsulation and delivery properties, and *in vivo* and *in vitro* release study of the encapsulated food ingredients from the food matrix. Toxicological and safety studies of the produced functional food products will be also included.

Keynote Lecture

FUNCTIONAL STRUCTURE PROCESSING BY CO-EXTRUSION IN THE PRODUCTION OF PROBIOTICS-ENRICHED MICROBREADS

L.Piazza, S. Guglielmetti, T. Roversi, L. Valsecchi

DISTAM – University of Milan, Italy

In the recent past, there has been an explosion of probiotic health-based products. Many reports indicated that there is poor survival of probiotic bacteria in these products. Further, the survival of these bacteria in the human gastro-intestinal system is questionable. Providing probiotic living cells with a physical barrier against adverse environmental conditions is therefore an approach currently receiving considerable interest. The purpose of the study was therefore to evaluate strategies to preserve probiotics physiology under acid conditions of simulated gastric digestive fluid with the aim of making them come alive and active until the intestine.

A function-tailored encapsulation process is presented and a reverse engineering approach is recommended. This means starting from the functions to be delivered (survival of probiotic bacteria), the composition and structure of the beads are designed for the generation of such structure and finally optimized extrusion operation is developed and adapted. Consequently the Property-Structure-Process relationship applies.

The analyses were made possible by using a bioluminescent Bifidobacterium longum as probiotic filler. The use of the biosensor containing the insect luciferase gene allowed the evaluation of the metabolic state of cells directly inside the capsules.

The efficacy of different prebiotic to preserve the cell physiology under gastric acidic conditions was first assessed.

Structuring the bifidobacter-enriched microcapsules by two different technologies of encapsulation was then considered: the co-extrusion process (based on coaxial fluid streams) and the simple extrusion process were compared and the respective ability to protect the Bifidobacterium longum at the drastic environment of the stomach was evaluated. It was shown how the coextruded capsules would guarantee a greater survive of the bacterium during the phases of production. However there was no difference between the two encapsulation techniques in terms of protection at the acidic conditions. A double coating alternative was then successfully experimented considering an outer coating of chitosan over the calcium-alginate gel beads : the metabolic state of cells in the acid gastric environment was preserved, with the higher efficacy shown by the coextruded beads.

Keynote Lecture

ROLE OF SUGARS IN FLAVOUR RELEASE AND PERCEPTION IN FOOD MATRICES

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Flavour release is of utmost importance for food acceptability. Kinetic and thermodynamic mechanisms control the rate of release and the concentration of the aroma in the head space that, in turn, depend on the intrinsic characteristics of the volatiles and the food matrix, environmental factors and the interactions occurring with no-volatile compounds.

The interactions of aroma compounds with food macromolecules (proteins, carbohydrates, etc.) has been largely investigated, whilst scarce attention has been given to the presence in the food matrices of small solutes like mono-and di-saccharides and their importance in affecting the liquid-vapor partition and the kinetics of aroma release even if they influence some important physico-chemical (a_w) and physical properties (viscosity, Tg) of the water phase.

This presentation is dealing with the role of small carbohydrates and their concentration on the release kinetics of aroma compounds and their vapour partition in model and real food matrices (coffee beverage, candies, custard).

In model systems the release kinetics of volatiles depend mainly on their hydrophylicity as well as type and concentration of the sugar. Viscosity affects the kinetics of the release only above a given solute concentration, different depending on the aroma type, being mainly affected at lower solute concentration by changes of water freedom. Partition coefficient (*k*) of the volatiles was significantly affected by sugar type and concentration that, at high solute concentration could be related to physico-chemical and physical changes occurring in the saccharide solution.

Aroma compounds could be considered as reliable probes of physical changes occurring in the liquid phase of saccharide solutions and the aroma release an interesting tool for their investigation.

In real complex food matrices, however, the interactions of the volatile with the non volatile compounds may become the prevalent factor affecting the partition, reducing the effects and the importance of the small saccharides.

Keynote Lecture

IMPROVEMENT OF PRODUCTION AND PLACEMENT OF TRADITIONAL DAIRY PRODUCTS IN SERBIA

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Traditional food products represent a heritage and are the result of accumulated empirical knowledge that is passed through the generations.
Dairy products, including cheeses and kajmak, have a long tradition of production and consumption in Serbia. The two known groups of autochthonous Serbian cheeses are white brined and pasta filata cheeses which are represented in central and south parts of Serbia, respectively. Kajmak is a dairy product with unique composition and sensory properties and with great potential to be recognizable brand of domestic agriculture.
Nowadays, the most of these products are usually produced in households and small craft dairy plants which are poorly organized. Such manufacturing methods of traditional dairy products differ greatly from region to region, yielding products of uneven quality and safety with wide variation in composition and characteristics. All of these are certainly the main reasons why such a delicious dairy products are not recognized as traditional products with protected origin as well as have been left out of the world market and remains only significant on a local level.
This paper discusses the main problems and difficulties of the traditional dairy products manufacture such as organization of primary milk production, quality of raw milk, conditions in the production dairy plants, lack of knowledge etc.
Also, the available and missing resources in traditional dairy products manufacture were considered in order to indicate the possibilities and the main ways for improvement of traditional production and placement on market. The main goals in future should be based on the detailed defining of composition, properties and method of production of selected dairy products, establish better control, better connection between different public and private Institutions, association and collective actions of producers on market, the education of producers as well as consumers etc.
The increasing of the supply of products with tradition and geographical designation of origin should be an important commitment for rural development as well as overall agriculture in Serbia. All of these can help for better positioning and distribution of valued traditional Serbian dairy products on domestic and world markets.

Key words**:** traditional production, cheese, kajmak, PDO

Keynote Lecture

FOOD SAFETY ASPECTS CONCERNING TRADITIONAL FOODS

Belc Nastasia, Duta Denisa, Manolache Fulvia

National R&D Research Institute for Food Bioresources

This paper aims to present the situation of traditional food in Romania. Special attention has been given to qualitative methods of investigation to allow us evaluation of the dynamics in the field. The safety aspects are envisaged.

Since 2008 has been established ONPTER (The Romanian National Office of traditional and ecological products), with seven teritorial branches (*zone*), serving all 41 counties (excepting Bucharest). Criteria for attestation are applied for 10 categories of products. Since 2005, over 3000 products have been recognized as beeing traditional food. The predominant categories are dairy products (43,16%), meat products (24,75%), bakery products (19,26%). At regional level the leader is Transilvania with more than 1500 attested products, followed by Muntenia with over 1000, Moldova with over 500, Banat and Dobrogea. Constantly, every year, the dairy products have been predominant, followed by meat products and bakery products.

The named traditional products represent a national inventory made by the Ministry of Agriculture, through its territorial infrastructure. Each product is assessed based on the declared specifications and is granted with an attestation. To qualify for protection, like PDO, PGI, TSG, food should be registered at Community level. At moment the problem of ‘group’ which means any association, irrespective of its legal form or composition, working with the same agricultural product or foodstuff is the most sensitive aspect. Even they are reluctant to go into an associative form, the high dynamics of the domain should be an indicator of opportunities and advantages for local communities to keep their traditions in a sustainable way.

Keynote Lecture

QUALITY STANDARDIZATION OF TRADITIONAL DRY FERMENTED SAUSAGES - CASE OF *PETROVSKÁ KLOBÁSA* -

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The European market of dry-cured meat products is characterized by a wide range of traditional fermented sausages, which come from different parts of the continent, primarily from the Mediterranean. Production of these products has lasted for centuries and when the first sausage was produced remains uncertain, because its production dates from the period before written history. Traditional dry fermented sausages originating from different countries and regions are characterized by specific sensory and physicochemical properties caused by the environmental conditions in the delimitated area of production, composition of spontaneous microflora, special customs, habits, traditions, religion and other specificities of the local population. Diversity in appearance, color, taste, smell and texture of these products can contribute to the preservation of gastronomic heritage and culture, as well as economic development of rural areas by increasing consumption and production volume. Specific quality and characteristics are affected by raw materials, production method, activity of present microflora, biochemical and physicochemical changes occurring during the smoking, fermentation, drying and ripening process. The Republic of Serbia also has a long tradition of dry-fermented sausages production. It takes place in small scale processing units and rural households, according to experience and traditional technology, during the winter period, when the air temperatures are around 0 ºC or lower. Aming to explain the specificity in fermented sausages production, requirements necessary to achieve during its standardization and preservation of specific characteristics of the product, the case of Petrovská klobása was used. The results of physicochemical, biochemical and microbiological changes during the spontaneous fermentation and ripening of Petrovská klobása are shown. Afterwards, observed models of fermentation, drying and ripening were transferred into the controlled production conditions in order of standardize sausage quality and to ensure successful and continuous production during the whole year.

Key words: traditional products, Petrovská klobása, dry fermented sausages, quality standardization.

Keynote Lecture

CONTEMPORARY FEED PRODUCTION AIMED AT INCREASING COMPETITIVENES QUALITY AND SAFETY

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The concept of animal nutrition undergoes constant changes, similarly to the concept of human nutrition. In addition to enhancing animal performance, optimal animal feed is also expected to have positive effect on human health. Animal health represents the basis for quality, safety and utility of food of animal origin used in human nutrition. In order to develop this new concept of nutrition, it is necessary to investigate links between bioactive components in feed and food, as well as an influence of individual food components and complete diets on human health. It is also important to optimize technological processes in animal feed production in order to ensure that all ingredients of the formulated mixture maintain their prescribed concentrations, activities and other characteristics when these processes are completed. Furthermore, for optimal feed utilisation, it is necessary to ensure a proper physical form, consistency and stability of feed during processing. Technological processes used in feed industry, often a neglected link in the food chain, inevitably impact all above mentioned aspects. Thus, their permanent development and improvement is necessary for further progress. Challenges to feed industry represent challenges also to science, research and development in the whole feed to food chain. In order to achieve the nutritional content, functionality, palatability, taste, smell and texture, animal feed must be carefully formulated. It is also necessary to define parameters for milling, mixing, liquid component application, pelleting, expanding, extruding, drying, cooling, vacuum coating etc. based on research results. Scientific approach must contribute to economically, socially and environmentally sustainable development of feed industry by defining practical and acceptable methodologies in the food production chain. This approach is important not only for manufacturers, but also for attaining better production parameters, while securing well-being of animals and fulfilling requirements of milk, meat and eggs consumers. The industry must recognise that it needs to adopt the rules of good manufacture and hygiene practice in order to achieve the necessary level of feed and food competiveness, quality and safety.
Key words: feed, technology, production, quality, safety

Aknowledgement**:** This keynote lecture presented the topics and the results of the research within the project III 46012 “Investigation of Contemporary Biotechnological Processes in Animal Feed Production aimed at increasing Food Competitiveness, quality and safety” funded by the Ministry of Education and Science of the Republic of Serbia.

Keynote Lecture

FEED FOR FOOD AND FOOD FOR FEED

Arnaud Bouxin

Deputy Secretary General of FEFAC

Animal products are an integral part of human diets. The global demand for animal products is expected to grow dramatically over the coming decades, driven by an ever increasing population and better per capita income which translates into a higher demand for animal products. The FAO estimates that meat consumption will increase globally from 37.4 kg/person/year in 2000 to over 52 kg/person/year by 2050. In practice, this means that the global consumption of meat and milk will almost double, while the demand for seafood is expected to develop at an exponential rate (+37 mio. t between 2004 and 2030).

The demand for feed is developing at a rapid pace, in line with the increasing demand for animal products.The feed industry is indeed an integral part of the production of animal products and plays a crucial role in ensuring sustainability and the responsible use of global resources. The key challenges for the livestock and the feed sector are therefore to contribute to food safety, while complying with high safety standards and meeting the demand for high quality and cost effective products.

To address these challenges, the feed sector shall be able to improve its efficiency and reduce its environmental impact by e.g. exploring new sources of feed, in particular co-products generated by other industrial sectors (food, biofuels) and also surplus food, as recommended by UNEP in 2009 in its report entitled "The Environmental Food crises: Environment's role in averting future food crises". The minimisation and valorisation of food waste has been identified as a priority policy objective for the EU policy for the years to come. In this sense, feed can be even more complementary to food and biofuels, improving each other sustainability.

However, this requires a huge attention to be paid to the possible consequences in terms of safety of animal products and animal health: processed products may generally carry more hazards than unprocessed products, due in particular to the concentration effect of certain processes for contaminants and the potential hazards resulting from chemical reactions during the process (e.g. dioxin). Likewise, food waste may pose risks for feed safety for a number of reasons: former foodstuffs may include substances perfectly fit for human consumption, but potentially at risk for feed (e.g. chocolate unsafe for dogs); traceability of former foodstuffs may also be interrupted, leading to a loss of identity and history of the product and also possible contaminations during handling, transport and processing of these materials. Safe feed is essential for the safety of food of animal origin but food safety is also a precondition for feed safety. Feed safety standards are being developed more and more on a global scale to address these challenges.

Animal nutrition can also help addressing global challenges other than food security and safety. Animal nutrition can for example be part of the solution to control the development of antimicrobial resistance. Good hygiene and good feeding practices are prerequisites to maintain the animal health status and feed formulation can play an additional role in favouring an optimize gut health status, thus putting animals in better conditions to resist to face outbreaks.

Keynote Lecture

THEORY AND PRACTICE OF EXPLOITATION OF FEEDMILLS OF THE IV GENERATION

Bogdan Yegorov

Odessa National Academy of Food Technologies

The selection of a technological process flow chart plays a determining role in the future exploitation efficiency of feedmills. The most widespread are technologies of the IV generations characterized by the high flexibility of the technological process, low specific expenditure of energy for production of mixed fodders, high quality and productive action of the mixed fodders. Further perfection of the production technology of the mixed feeds requires a theoretical argumentation and practical confirmation of the offered measures. First of all, requires perfection the technological process of grinding of mixed fodders components portions, since some of them contain fractions that do not need grinding. As a result, such components, as soy-bean schrot or limestone are overgrinded.

Estimation of efficiency of the materials grinding has been carried out by the granulometric method applied to the particles. The expenditure of energy was determined by correlation of the set power to the productivity, while stability of technological process was estimated by the index of stability, which was determined as correlation of minimum and maximum dispersion of distributing of the registered quality index.

Content of farinaceous fraction has been determined in the soy-bean schrot and limestone. The expenditure of energy for grinding of a portion of raw materials, and also on the production of one ton of the prepared mixed feeds have been determined as well.

It has been found during the conducted studies that it is advisable to put a sieve separator before the hammer mill for separation of a farinaceous faction from the portion of the components that are grinded. As a result, the expenditure of energy for the mixed feeds production can be reduced by 10-15%, while stability of the technological process increases from 0.85-0.90 to 0.95-0.97.

Keynote Lecture

RESEARCH IN EUROPE BETWEEN NOW AND 2020 AS ENVISAGED BY THE EUROPEAN TECHNOLOGY PLATFORM *FOOD FOR LIFE*

Professor Brian McKenna

Emeritus Professor of Food Science, UCD, Dublin, Ireland and Co-ordinator, European Technology Platform Food for Life

The European food industry faces many demanding challenges if it is to maintain its competitiveness and stop the current decline in its market share. To do this it must address some key research questions that will enhance its competitiveness and lead to greater innovation within a fragmented industry of close to 400,000 enterprises, many of them small and medium sized enterprises.

Without doubt it will require a complex range of new technologies if it is to meet the society driven demands for healthy, safe, sustainably produced foods that are convenient, perhaps individual, promote healthy aging and are perceived as natural. If scientists are to succeed in enhancing European competitiveness, there will be a need to have food items tailor-made for Europe that respect sustainability, that are functionally enhanced, that reduce waste, water use and packaging and, in all probability, show a shift from meat to plant based protein sources.

The detailed future research needs as defined by the European food industry through the European Technology Platform *Food for Life,* are outlined under the headings:

- Health, well-being and longevity;
- Safe foods the consumer can trust;
- Sustainable and ethical production;
- Food processing, quality and packaging;
- Food and consumers;
- Food chain management;
- Communication, training and technology transfer.

How these themes fit with the published goals of the European Commission and its Horizons 2020 programme are also outlined.

I
FOOD INGREDIENTS, HEALTH AND NUTRITION, FUNCTIONAL FOODS

INFLUENCE OF JAM PROCESSING UPON THE CONTENTS OF PHENOLICS AND ANTIOXIDANT CAPACITY IN STRAWBERRY FRUIT (FRAGARIA ANANASSA × DUCH.)

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Introduction

The aim of this study was to evaluate changes after thermal processing by characterizing three strawberry cultivars through their content of individual anthocyanins, phenolic acids and flavonols, as well as antioxidant capacity and colour parameters, before and after jam production. Jams were prepared under vacuum with addition of sucrose and under atmospheric pressure with addition of sucrose or fructose.

Methods and materials

Strawberry fruits (Fragaria × ananassa Duch.) of three cultivars (Honeoye, Clery and Asia) were obtained from commercial orchards near Zagreb (Croatia) and hand-harvested at the commercial maturity stage. All phenolic compounds were determined by HPLC-UV/VIS PDA analysis. Antioxidant capacities were measured by four different methods: DPPH, ABTS, FRAP and ORAC. Colour parameters were measured by tristimulus colourimeter (CIELAB system).

Results and conclusions

The major anthocyanin in all investigated samples was pelargonidin-3-glucoside, without considerable differences found among investigated cultivars. Regarding to phenolic acids, in all investigated samples hydroxybenzoic acids were predominant, followed by hydroxycinnamic acids and flavonols. Ellagic acid was found in the highest concentrations, followed by p-hydroxybenzoic acid and p-coumaric acid. When looking concentrations of phenolic acids, remarkably variations among investigated cultivars were found.

During processing the most stable were hydroxybenzoic acids where vacuum procedure influenced increase by 1-49 % and atmospheric pressure by 17-41 %. The stability of anthocyanins did not considerably differed by various processing procedure, but in most cases, jams prepared with addition of fructose showed lower stability during processing compared to jams with added sucrose. Furthermore, during processing, determined colour parameters L, a, b and C decreased, while H values increased, with no considerably influence of processing procedure, added sugar or strawberry cultivar.

Principal component analysis was found to be of value in visual representation of fruit samples based on processing procedure where fresh strawberries and jams distinguished well on the score plot and loading plot.

MEDICINAL PLANTS AS A SOURCE OF IRON IN FUNCTIONAL FOODS

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Nutritive anaemia appears as a consequence of insufficiency of iron, often followed by the lack of folats and vitamin B12. Iron as important oligoelement; participate in haemoglobin synthesis, in formation of muscle pigment (myoglobin) and certain cellular enzymes. Some of the medicinal plants are important source of mineral substances, especially iron. For this reason use of plants is recommended in the prevention and elevation of difficulties caused by nutritive anaemia.
The goal of our research is the formulation of the herbal mixture, rich with iron (pulvis and thickened extracts), that can be added in food products-functional products.
We have added the fruit of wild rose-rose hip, as a source of vitamin C, in the mixture of nettle leaf and Mountain tea's herb. Phytochemicals tests revealed that the nettle (Urtica dioica L.) has chlorophyll, flavonoids, carotenoids, vitamins (C, B group, K1), and triterpenes, sterols (beta-sitosterol) minerals (Fe), various organic acids, tannins. Mountain tea (Sideritis scardica Griseb.), contains essential oil, terpne, triterpenic saponins, flavonol glycosides, polifenolic compounds, tanins and considerable amount of Fe. Vitamin C is essential constituents (0.3-1.7%) of Rose hips - Cynosbati fructus (fruits of rose - Rosa canina L.). Besides, the fruits are rich in vitamin E, fatty oil, tannins, sugars, pectins, fruit acids, carotenoids traces of flavonoids and anthocyans.
We have determined the content of iron in the nettle leaf and Mountain tea's herb, as well as in their thickened extracts, that are made by pharmacopoeia regulation.
All analysis were carried out on a iCAP 6000 inductively coupled plasma optical emission spectrometer (Thermo Scientific, Cambridge, United Kingdom) which use an Echelle optical design and a Charge Injection Device (CID) solid state-detector.
Content of the iron (mg/g) in the samples is: Urticae folium 1.95±0.13; U. extractum spissum 0.87±0.09; Sideritis scardicae herb 0.93 ± 0.13; S. scardicae extractum spissum 0.57 ± 0.09. Results of the analysis are suggesting that in the formulation of the herbal mixture, that is intended to prevention a nutritional anemia, should be used chopped plants.

Key words: iron, anemia, medicinal plants, functional food

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MULTIFUNCTIONAL PROPERTIES OF HYDROLYSATES DERIVED FROM PUMPKIN OIL CAKE GLOBULIN

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The demand for high-quality food proteins has increased over the past few decades. Particulary regarding consumers acceptance and preferences, methods for modifying the functional and bioactive properties of proteins are of increasing interest in order to develop health foods. Controlled enzymatic hydrolysis of proteins is proved to be suitable method for improving various functional properties, such as solubility, foaming and emulsifying properties and increasing the field of protein application. On the other hand, bioactive peptides with antioxidant properties derived from various proteins by enzymatic hydrolysis have become a topic of interest for pharmaceutical, health food and processing/preservation industries.

This study was focused on utility pumpkin oil cake globulin-cucurbitin as source of multifunctional hydrolysates which could be applied in food formulations. Evaluation of the antioxidant ability of cucurbitin hydrolysates by three proteases by means of different assays (ABTS and reducing power), as well as testing the functional properties (solubility, emulsifying and foaming properties) of these hydrolysates were carried out in order to find hydrolysates with both antioxidant potency and good functionality. SDS-gel electrophoresis was used to study the molecular weight distribution of proteins and peptides before and after hydrolysis.

Cucurbitin was enzymatically hydrolysed with three different enzymes: alcalase, flavourzyme and pepsin. Antioxidant and functional properties of hydrolysates were strongly dependent on the used enzyme and degrees of hydrolysis (DH) values. The highest antioxidant activity was found in the hydrolysate obtained by alcalase at DH 25.6 %, with the reducing power (RP=0.25±0.01 A700nm) and ABTS scavenging activity (3.34±0.02 mmol/l TEAC). Protein solubility increased in the whole pH range. The best emulsion properties (EA=0.777±0.03 A500nm and ES=87.5±0.36 min) had hydrolysates with flavourzyme (DH 9.2%) whereas alcalase produced hydrolysates with the best foaming properties (FC=242±3.21). The results demonstrate that these hydrolysates have good potential for using in different food systems.

NATURAL EXTRACTS FROM PTEROSPARTUM TRIDENTATUM AT DIFFERENT VEGETATIVE STAGES: EXTRACTION YIELD, PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY

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The aerial parts of Pterospartum tridentatum plants, a wild growing species in Portugal used in traditional medicine and gastronomy, were collected at different vegetative stages and used to obtain aqueous extracts. The effect of extraction time on yield, phenolic content (PC) and antioxidant activity (AA) of the extracts was studied. Plant samples (25 g) were subjected to consecutive extraction steps in boiling water (100 ml). After each step the aqueous phase was recovered and liophilized, and fresh water was added. It was observed a decrease extraction yield throughout the consecutive extraction periods. However, a plateau was not reached, meaning that the plant material had still unextracted compounds even after 180 min. The average overall extraction yield range between 15 and 25 % w/w (d.m.). It was observed that more than 75% of the overall mass extracted was recovered in 120 minutes.
No substantial variation of PC, evaluated by measuring the absorbance at 280 nm in aqueous solutions, was observed throughout the consecutive extracts obtained. For the flowers, PC ranged from 275 to 400 mg gallic acid equivalents per g dry matter. Probably different phenolic compounds are extracted at different rates and there are other compounds co-extracted. Beyond phenols, polysaccharides were also detected in the extracts.
The AA was determined by the radical scavenging activity method using 2,2-diphenyl-1-picrylhydrazyl radical (DPPH). The greatest radical scavenging activity was observed in the flowers extracts (2 mMTrolox/100g dry mater), and no significant differences were observed for the different batches. This result is in agreement with the PC profile. Moreover, it can be concluded that the extracts maintain a good antioxidant activity even after subjecting the plant material to long heating periods. An exhaustive chemical characterization of the extracts is being carried out in order to correlate the chemical compounds to the bioactive properties.

STRATEGY FOR SCREENING ANTIOXIDANT CONSTITUENTS IN PROTEIN HYDROLYSATES

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Much attention is attributed to the antioxidant properties (AP) of protein/peptide hydrolysates. It is well documented that Y, W, C, H, M are mainly responsible for the peptide's AP. However, neither the influence of the location of an amino acid within a peptide, nor the effects of their interaction on this peptide's AP have been properly elucidated. Modern high-resolution mass spectrometry techniques provide identification of hundreds of peptides in food protein hydrolysates. The complexity of these hydrolysates makes the assignment of the antioxidant effects to specific peptides present in these mixtures a challenging task. The present study was aimed to develop a strategy for screening the antioxidant constituents in protein hydrolysates based on the descriptors of AP established through dipeptide analysis and confirmed by the data of quantum chemical DFT calculations.

Analysis of the antioxidant capacity (AOC) of dipeptides by ORAC assay revealed that the high AOC of the peptide could be due to C-terminal position of the M residue, along with the presence of motifs WY, YK, YR and absence of the motifs YD, YE. In the case of TEAC assay, N-terminal Y is preferred in motifs RY, KY, with H or M adjacent to the Y residues. Based on the descriptors thus established a parameter I is proposed for integral characterization of peptide's AOC. For the peptides with high AOC the values of parameter I exceed 0.3-0.5.

Feasibility of the outlined strategy was demonstrated in the case of novel food ingredients - poultry protein hydrolysates (PPH) possessed high AOC. A total of 573 peptides were identified in PPH. 18 peptides were selected as candidates with potentially high AOC based on their I index.

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HARMONIZED INFORMATION ON EXISTING KNOWLEDGE OF DIET-RELATED PROBLEMS AMONG THE RISK OF POVERTY (ROP) POPULATIONS

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Introduction:
The diets of low-income groups are likely to be inadequate. For evidence based nutrition action aimed to improve nutritional status and decrease the risk of disease in low income populations, a critical assessment of available information on the main nutritional criticalities is needed.The objective was to provide information on food-related health problems, including main nutritional deficiencies and over-nutrition, in low income groups in several European countries.
Methods and Materials:
Systematic literature review and qualitative analysis of the relevant studies from Medline and Web of Science (WoS) databases (and other sources, e.g. grey literature) that report on dietary intake of food groups/subgroups/micronutrients in low income groups (>100 participants) compared to high income groups or to reference values, in adults in Europe.
Results:
The search resulted in 1009 and 1430 titles and abstracts from Medline and WoS, respectively, screening of which left 64 relevant studies for extraction into a special database. The food groups that were considerably most studied for different consumption level in low income groups were fruit and vegetables, in all countries being less consumed among them in comparison to high income groups, or to dietary reference values. Data on micronutrient consumption in low income groups was very limited.
Conclusions:
Where available, data from all countries reported intake of fruit and vegetables as well as whole grain products being lower in low income groups in comparison to more affluent groups. Scattered data on other food items suggest that the contribution of fat to total energy intake and the higher consumption of processed meat is more likely among economically disadvantaged groups than in high income groups. Low intake of vitamins and mineral, in particular vitamin C, vitamin A, vitamin B12, vitamin D, iron (in women) and calcium were identified in all the involved countries.

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HEALTHY BREAD AS AN ALTERNATIVE TO TRADITIONAL BREAD

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Today, bread is part of the culture and eating habits of most people and can be considered one of the most consumed foods in the world. Since it was first produced for thousands of years, it has undergone changes both in terms of production methods and in terms of its constitution, thus giving place nowadays to a wide variety of breads available on the market.
The objectives of this study were to compare the sensory and nutritionally attributes of a special healthier bread, “Pão São”, which is a recent product in the Portuguese market. Nutritionally this type of bread turned out to be a food with high nutritional value, with a low salt content (0.4%, about half of traditional bread), and being a good source of omega-3 (0.67%), fibre and protein when compared with the traditional bread. These differences are mainly due to the wide variety of raw materials selected to the preparation of this bread, including the mixture of flour (wheat flour type 150 and 65 and rye flour type 70), oatmeal, sunflower and linseed seeds, soy, fish oil extracts rich in omega 3, malt and milk protein.
From the results of the sensory analysis, conducted by a panel of 40 untrained tasters aged 7 to 63 years, it was found that the traditional breads from the region closest to the marketing of “Pão São” were preferred by the tasters, especially for their wood and bread flavour, as well as elasticity. The “Pão São” was evaluated as a denser bread, with a more intense fermented flavour.
With this work it was concluded that the “Pão São” is a nutritious and healthy bread, being currently recommended by the Portuguese Foundation of Cardiology. However from the sensory point of view, consumers enjoy and prefer the traditional bread.

PHENOLIC PROFILE AND BIOPOTENTIAL OF PLANTAGO ARGENTEA CHAIX

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Ancient use of plantains (genus Plantago L., Plantaginaceae) as herbal remedies is a consequence of their astringent, anti-toxic, antimicrobial, expectorant and diuretic properties. Plantago argentea Chaix (silver plantain) is distributed in the south Europe and Balkan Peninsula, but there are no data about biological activity of this species. In order to valorize medicinal use of P. argentea, some tests on antioxidative and anti-inflammatory activities of methanolic extract of this plantain, collected from area of mountain Rtanj (Serbia) have been undertaken. The presence and content of 44 phenolics in extract was studied using LC-MS/MS, where following dominant compounds were found: apigenin (24.9±0.2 mg/g of d. e.), apigenin-7-O-glc (1.42±0.04 mg/g of d. e.), luteolin (1.67±0.02 mg/g of d. e) luteolin-7-O-glc (0.86±0.02 mg/g of d. e), crizoeriol (0.99±0.1 mg/g of d. e.), p-hydroxybenzoic (0.82±0.06 mg/g of d. e.), cinnamic (0.45±0.04 mg/g of d. e.) and vanillic acid (0.49±0.04 mg/g of d. e.). The radical scavenger capacity (RSC) was evaluated towards several radicals using spectrophotometry [1], indicating comparable or higher extract activity than activity of synthetic antioxidants as BHT or BHA (butylated hydroxytoluene / hydroxyanisol). Anti-inflammatory activity was examined by means of cyclooxygenase-1 (COX-1) and 12-lipooxygenase (12-LOX) inhibition, quantifying the COX-1 product 12-HHT (12-hydroxy-5,8,10-heptadecatrienoic acid) and 12-LOX product 12-HETE (12-hydroxy-5,8,10,14-eicosatetraenoate) by RP-HPLC-MS/MS [2]. Extract inhibited both COX-1 and 12-LOX (IC50=2.2±0.3 and 0.56±0.05 mg/mL, respectively).

In this study, we report for the first time about detailed phenolic profile and anti-inflammatory activity of P. argentea, and accordingly consider this species as a promising source of natural antioxidant and anti-inflammatory agents.

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POTENTIAL USE OF OREGANO POSTDISTILLATION PLANT WASTE MATERIAL AS A SOURCE OF NOVEL FOOD ADDITIVES AND FUNCTIONAL FOODS

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Introduction:
We are now, especially in Western society, experiencing a trend of 'green' consumerism, desiring fewer sythetic food additives with possible toxicity, products with the smaller impact on environment and revival of the use of traditional approaches to protecting livestock and food from diseases, pests and spoilage. Aromatic herbs have long tradition of use in medicine, nutrition and cosmetics. Among them, oregano (Origanum vulgare L., Lamiaceae) has been appreciated as a spice and food flavouring agent owing to the presence of essential oil. However, postdistillation waste, remaining after the isolation of essential oil, is still unused. Thus, in this study we investigated antioxidant and antimicrobial activity of oregano herb postdisillation waste material.
Methods and materials:
After the hydrodistillation of essential oil of oregano herb, postdistillation waste material extracts were made from decoction and used herb (with 45% v/v and 75% v/v ethanol). Chemical composition was determined by means of high performance liquid chromatography. In vitro scavenging activity was evaluated using DPPH (2,2-diphenyl, 1-picrylhydrazile) and hydroxyl (OH) radical. The effect on the peroxidation of membrane lipids was assayed by Thiobarbituric acid (TBA)-test, following the effect of investigated extracts on Fe2+/H2O2 induced lipid peroxidation (LP) in corn oil as a model system. Minimal inhibitory concentration (MIC) was determined with broth microdilution assay against selected gram-positive (Staphylococcus aureus and Bacillus cereus) and gram-negative bacteria (Salmonella infantis, Escherichia coli).
Results:
All investigated extracts were rich in phenolcarboxylic acids (rosmarinic, protocatechuic, gallic and chlorogenic acid) and flavonoids (rutin and apigenin). They exhibited relatively strong antioxidant and antibacterial activity (especially extract obtained with 75% ethanol from used herb) when compared to standardised oregano herb extract.
Conclusions:
This study confirms postdistillation plant waste material for possible use in pharmaceutical and food industry and gives very informative insight into antioxidant and antibacterial profile of investigated oregano extracts.

NOVEL NUTRACEUTICAL MEAT PRODUCTS CONTAINING LAURICIDIN AS A DIETARRY SUPPLEMENT WITH ANTIMICROBIAL PROPERTIES

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The novel nutraceutical foods are today in the focus of the research that refers to healthy food and concerns both the food engineers and the nutricionists. Different kinds of ingredients and food supplements having certain bioregulating function, such as vitamins, antioxidants or antimicrobials, are nawadays readily incorporated in new kinds of funcional foods that are becoming more and more attractive for the consumers of healty food. The partial glyceride monolaurin that is well known as a food additive with emulsifiing properties is also known for its antimicrobial and antiviral activity. So, it is having both nutritional and health properties that are supporting the immune system of the organism in a unique way. The monolaurin is also known as a food supplement by its commercial name Lauricidin. The aim of the study presented in this paper was to investigate the possibilities for incorporation of this food supplement in emulsified meat products and to investigate its antimicrobial activity towards certain microbial strains. For this purpose the emulsified precooked meat sausages were prepared and infected by 10 mL inocula of seed cultures of Aspergillus niger and Saccharomyces cerevisiae. The monolaurin was added to the sausages in a concentration of 0.3 g per 100 g. The infected sausages were kept for 72 h on a temperature of 28 oC. Cell enumeration of the sausage samples was performed by using the procedure of standard plate counts and calculated as a number of colony forming units on a gram sample. The number of colony forming units of the fungus Aspergillus niger counted for the sausages that contained monolaurin was 3·107 cfu/g sausage, for the samples taken from the inside of the sausages. This number was more than 33 times lower than the number of colony forming units of Aspergillus niger of 100·107 cfu/g counted for the inside of the sausages without monolaurin. The case was similar in the sausages that were infected by the seed culture of Saccharomyces cerevisiae, only here the inhibitory effect of the monolaurin was less pronounced. The number of colony forming units counted for the inside of the sausages with monolaurin was more than 2 times lower than that counted for the inside of the sausages that were free of monolaurin. But when the samples of the whole sausages have been taken, the inhibitory effect of monolaurin on Saccharomyces cerevisie was even stronger, 70·107 cfu/g for sausages with monolaurin compared to 300·107 for the sausages without monolaurin.

Key words: nutraceutical meat products, monolaurin, antimicrobial activity

OLEIC ACID CONTENT IN COW'S MILK AND VEGETABLE OILS ON SERBIAN MARKET

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Introduction:
Oleic acid has many beneficial effects on human health. One of the main dietary sources of oleic acid is olive oil. Non-Mediterranean European countries, including Serbia, have low habitual olive oil consumption, but other vegetable oils, milk and diary products, also contain different amounts of oleic acid. Content of oleic and other fatty acids could markedly vary in the same foods, depending on the region. Thus the aim of this study was to determine content of oleic acid in cow's milk and in eight vegetable oils available on Serbian market.

Methods and material:
FA composition of milk and vegetable oils was determined by gas chromatography. Eight vegetable oils: processed and cold pressed sunflower oil, olive oil, rapeseed oil, pumpkin seed oil, grape seed oil, linseed oil, and light sesame oil were analysed. Three samples of cow's milk were also analysed.

Results:
Oleic acid was found in all investigated vegetable oils in different percentages. Olive oil and rapeseed oil are main sources of oleic acid (67.0±0.4% and 64.3±0.5% of total FA, respectively), which is the least present in grape seed oil and linseed oil (18.1±0.2% and 18.7±0.1%, respectively). Pumpkin seed oil is also rich in oleic acid (45.7±0.4%). Furthermore, significant amounts of oleic acid were found in cow's milk (24.3±1.1% of total fatty acids).

Conclusion:
In addition to olive oil, rapeseed oil and pumpkin seed oil are good vegetable sources of oleic acid, while cow's milk also contains considerable amounts of this fatty acid. Regarding beneficial effects of oleic acid, increased consumption would lead to improvement of overall health.

THYMOL DEPLETION IN THE PIG STOMACH

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Aromatic plants and their extracts have been used in human and veterinary medicine since ancient times. However, the exact mode of action and kinetics or these compounds are generally poorly understood. The aim of this work was to determine the degradation and absorption kinetics of thymol in the pig stomach.
An improved GC method was developed to easily measure thymol content in samples extracted into ethylacetate. The GC separation was achieved on a 30 m × 0.25 mm × 0.25 mm film thickness Equity™ - 1701 fused silica capillary column, resulting in a standard curve over 1-500 mg/L. Isolated pig stomach was incubated for 360 min at 37°C in an incubator with 95% O2:5% CO2 atmosphere on an oscillating plate at 40 rpm. Tyrode's solution pH 6.5 was used as incubation fluid. Thymol (0.4 mM) was inoculated internally into the stomach contents and samples collected at intervals during incubation were extracted as is or after treatment with a lysis buffer, the latter to release thymol that may have been internalized by endogenous bacteria.
Thymol concentrations in unlysed stomach samples decreased rapidly, being reduced more than twofold by 30 min incubation. Conversely, thymol concentrations in lysed samples increased rapidly, achieving after 60 min incubation concentrations that were twice those measured in unlysed stomach contents at the beginning of the incubation. Thymol concentrations in lysed samples remained nearly double those in unlysed samples even after 360 min.
Differing thymol concentrations measured in lysed and unlysed samples suggest luminal depletion resulting from bacterial uptake of thymol. Upon ingestion, luminal depletion would be expected to occur rapidly in stomach contents but whether this sequestration would make thymol unavailable for absorption in the stomach or more distally is not known. Further investigations are needed to identify the bacteria responsible for this "thymol sequestration" phenomenon.

B-CONGLYCININ, STATIN AND FENOFIBRATE IN RATS FED HYPERCHOLESTEROLEMIC DIETS

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Introduction:
The growing importance of treating hyperlipidemia and hypercholesterolemia with a diet-drug combination is well recognized and increasingly diet therapy moves in this direction. Several studies have highlighted the diet as an important element among the possible forms of intervention aimed to reducing lipids in the plasma. Thus, we studied the hypocholesterolemic effect of conglycinin alone and combined with fenofibrate or rosuvastatin in rats fed hypercholesterolemic diet.

Material and Methods:
Protein and drug were administered orally by 28 days. Sixty-three rats were divided in seven groups (n=9): 1.standard (STD; Casein), 2.High cholesterol (HC, STD plus 1% cholesterol and 0.5% de cholic acid), 3.HC+conglycinin (HC+7S, 300 mg/body weight/day), 4.HC+fenofibrate (HC+FF, 30 mg/body weight/day), 5.HC+rosuvastatin (HC+RV, 10 mg/body weight/day), 6.HC+7S+FF and 6.HC+7S+RV. At the end of the treatment, food consumption, weight gain, feeding efficiency ratio and fecal excretion of the rats groups were not significantly different.

Results:
Conglycinin group have decreased total cholesterol (TC) and triacylglycerols (TG) plasma levels in 22.9 and 34.8%, and hepatic TC and TG in 20.9 and 14.8% respectively. The fenofibrate also reduced the plasma levels of TC (35.8%) and TG (45.7%), however it has increased the hepatic TC and TG (32.3 and 5.4%, respectively), while rosuvastatin reduced TC and TG plasma (18.1 and 7.6%), and hepatic TC and TG (38.3 and 27.3%). The simultaneous administration of conglycinin and drugs (fenofibrate and rosuvastatin) showed no change in the hypocholesterolemic effect observed separately.

Conclusion:
These results represent an evidence of reducing properties of cholesterol and lipids in the plasma and liver in hypercholesterolemic rats by the soybean 7S protein as compared with hypolipidemic drugs. However, the combination protein-drug did not change the parameters related to the treated groups.

Key words: soybean vicilin; cholesterol-lowering drugs; hypolipidemic.

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ANTIOXIDANT AND ANGIOTENSIN I CONVERTING INHIBITORY ACTIVITY OF PUMPKIN OIL CAKE PROTEIN HYDROLYSATE UNDER SIMULATED GASTROINTESTINAL DIGESTION

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Bioactive protein hydrolysates have great potential as functional food ingredients for health promotion and disease risk reduction. On the other hand, their production using proteases is an opportunity for value addition of proteins and utilisation of food industry wastes. In our laboratory, a variety of pumpkin (Cucurbita pepo L.) oil cake (PuOC) proteins derived enzymatic hydrolystes with antioxidant and angiotensin I converting (ACE) inhibitory activities have been described. While these results established their potential as bioactive food ingredients, their bioavailability remains to be determined, including their stability to the digestive proteases. In this work, the changes in bioactivity of the PuOC protein hydrolysate with the most potent antioxidant and ACE inhibitory properties was examined during simulated human gastrointestinal (GI) digestion.

The bioactive hydrolysate was previously prepared by alcalase. To simulate the process of GI digestion of the hydrolysate, an in vitro digestion model system (a pepsin treatment for 30 min followed by a trypsin and α-chymotrypsin treatment for 90 min, at 37ºC) was used. The GI digestion of the hydrolysate was characterised by sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) and reversed-phase high performance liquid chromatography (RP-HPLC) at molecular level, while the bioactivity of the hydrolysate and its final GI digest were characterized by spectrophotometric methods.

The SDS-PAGE and RP-HPLC profiles revealed structural changes in the hydrolysate, after the GI digestion. However, the results of bioactivity testing showed that the 2,2-azino-bis3-ethylbenzo-thiazoline-6-sulphonic acid (ABTS+●) radical cation scavenging activity of hydrolysate increased from 7.59±0.1 mM TEAC/mg to 10.25±0.3 mM TEAC/mg, while the ACE inhibitory activity at 70.01±6.92% (EC50=0.437±0.086 mg/ml) was not affected during the GI digestion. According to these results, the PuOC protein alcalase hydrolysate showed an advantage to retain the biological activities in the human upper digestive system, appearing as a promising bioactive ingredient to formulate functional foods.

MILK WITH FUNCTIONAL FOOD PROPERTIES

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In this paper results of the trial, focused on obtaining of milk enriched with omega-3 fatty acid, i.e. milk with properties of functional food, are presented. As source of omega-3 fatty acids product of French company Vitalac called «TRADI-LAN» was used. This product was made by patented procedure of special flax cultivar. Trial was carried out on 20 trial and 20 control cows of Simmental breed and it lasted 80 days. Average content of omega-3 in trial and control group was 0.586 and 0.284 g/100g of extracted fat (P≤0.01), whereas content of omega-6 in same order of treatments was 3.141 and 3.011 g/100g of extracted fat (P≤0.05). Ratio omega-6/omega-3 fatty acids of 10.602 (control) was declined to 5.360 (trial group), which is considered to be desirable from the aspect of nutrition with milk as functional food. Also, content of these acids in other milk final product so called “mladi kajmak” obtained by taking off milk fat from the surface of heat treated and cooled milk, which is declared under this title in sale with expiration period of 10 days. In this product content of omega-3 in trial and control group showed the same trend, 0.76 and 0.41 g/100g of extracted fat (P≤0.01), and content of omega-6 were 3.90 and 3.79 g/100g of extracted fat (P≤0.05). Ratio of omega-6/omega-3 in control group was 9.24 and as result of feeding treatment this ratio was reduced to 5.10 which are considered to be extremely favourable. Chemical constituents of milk, somatic cell count as well as total plate count showed no differences between groups (P>0.05). Also, investigated treatment had no effect on changes in biochemical blood parameters.

THE INFLUENCE OF AGGREGATION AND MUCIN-BINDING FACTORS ON THE ADHESION OF LACTOCOCCUS LACTIS SUBSP. LACTIS BGKP1 TO THE INTESTINAL MUCOSAL SURFACE

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Lactococcus lactis subsp. lactis BGKP1, isolated from artisanal semi-hard homemade cheese was selected due to its strong auto-aggregation phenotype. This strain carries plasmid pKP1 encompassing, among other, genes responsible for the aggregation phenomenon (aggL) and gene potentially involved in mucin binding (mbpL).

The aim of our study was to investigate the influence of the AggL and MbpL factors on the adhesiveness of the strain to rat colon mucosa (ex vivo) and different cell types, including Caco-2 intestinal epithelial cell line. In this study, along with wild type strain, a non-aggregating derivative of BGKP1, BGKP1-20, lacking mucin-binding protein (AggL-, MbpL-), BGKP1-20 Agg+ (strain with pAZIL vector containing AggL from BGKP1), BGKP1-20 Muc+ (strain with pAZIL vector containing MbpL from BGKP1) and BGKP1-20 pAZIL (strain with pAZIL vector) were tested.

Although lactococcal aggregation protein was sufficient for the cell aggregation, preliminary ex vivo experiments with colon sections from the rat indicated that AggL is not involved in the adhesion to the gastrointestinal epithelium. Moreover, the experiments revealed that MbpL might be involved in interaction with rat colon mucosa. In conclusion, BGKP1 carries plasmid pKP1 that provides this strain with two specific abilities - interaction with bacteria (AggL) and interaction with the host (MbpL).

THE INFLUENCE OF ULTRAFILTRATED ACID WHEY CONCENTRATE AND BREAD SUPPLEMENTED WITH IT ON THE NUTRITIONAL AND PHYSIOLOGICAL INDICES OF RATS

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Laboratory concentrates obtained from acid whey by the membrane separation processes (nanofiltration, nanofiltration with diafiltration, ultrafiltration) were used during in vivo experiment as a 20% supplement of the rats diets. The standard rats diet was used as a control. Changes in the growth indicators and the influence on metabolism were determined. The biochemical indices of blood, lipids metabolism, physiological reaction of caecum and colon were analysed. For small mammals fed with the diet containing acid whey separated by ultrafiltration method distinguishing characteristics were observed: (1) a high content of protein and calcium in the concentrate, enabled the reduction in casein content, which constitute a source of protein in the diet and the decrease in inorganic calcium substance from a mineral mixture added to the diet; (2) comparable to the control group the relationship of growth and food intake; (3) the small impact on transit (excessive accumulation) content in the small intestine; (4) positive effect on the parameters of the caecum (wall mass and caecum contents, pH and ammonia content); (5) comparable to the control group digestibility and utilization of nitrogen; (6) high coefficient of digestibility and retention of phosphorus and calcium from the diet; (7) statistically significant lower glucose level in blood and the reduced level of triacylglicerols in comparison with the control group.
On the basis of the results obtained in this experiment the ultrafiltrated acid whey concentrate will be used as a supplement of wheat or wheat-rye bread. Experimental functional baking products will be used during in vivo experiment. The control group will be fed with the diet containing wheat or wheat-rye bead.

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DEVELOPMENT OF LYSINE FORTIFIED FUNCTIONAL FOODSTUFFS WITH OUTSTANDING ANTIOXIDANT ACTIVITY

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Due to the rapidly growing number of conscious customers in the recent years, there is an increasing need for products with positive physiological effects. The intake of functional foodstuffs with enhanced antioxidant content is of crucial importance, as antioxidants might be regarded as efficient tools for the prevention of chronic diseases. New, efficient technologies are also elaborated in order to preserve the maximum biological effect of the produced foods.
During the baking process the production of compounds with high antioxidant-activity obtained by the reaction of carbohydrates and proteins (Maillard-reaction) was key point of our study. The object was to optimize the antioxidant-generating technological circumstrances. Therefore several lysine-sugar model systems were produced. During the accomplished experiments the composition of the samples as well as the baking time and temperature were varied on a large scale. The antioxidant capacity and the lysine content (remained after the reaction) of the obtained samples were precisely analysed, monitored with the progress of the thermal treatment.
The optimalized circumstances were analogously applied during the evolvement of the functional biscuits in order to serve suitable circumstances for the generation of the MRPs having functional properties.According to the model systems, antioxidant activity of the biscuit samples was also monitored by FRAP and DPPH methods.
The obtained results get us closer to find the technologically optimal processing circumstances and the appropriate basic materials in order to make these food products functional to promote our health. A new functional biscuit (LIZINER) was developed with unique composition and outstanding antioxidant activity.

EFFECT OF FLAVONOID STRUCTURE ON FLUIDITY OF MODEL LIPID MEMBRANES

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Many phenolic compounds of plant origin have an antimicrobial effect, are very effective chelators of metal ions and powerful antioxidants. In addition to specific effects, the antioxidant activity of phenolics, results in reduced oxidation of biologically important molecules and consequently has a beneficial effect on health. The focus of our research has recently been turning primarily to the study of the interactions of flavonoids (catechin, epicatechin, epigallocatechin, epigallocatechin-3-gallate, quercetin), which are known constituents of fruits, vegetables, wine and green tea extracts and synthetic antioxidant butylated hydroxytoluene with membranes. Small unilamellar vesicles (ULV) were used to follow changes in membrane fluidity induced with selected phenolics by electron paramagnetic resonance (EPR), fluorescence anisotropy (FA) and differential scanning calorimetry (DSC). From the line-shape of the EPR spectra ordering and dynamics of phospholipids alkyl chains were estimated. With both methods, EPR and FA, we obtained comparable results. Addition of the tested phenolic compounds to the ULV increased the ordering and decreased dynamics of phospholipids alkyl chains. This means that the membranes became less fluid. In contrast, the addition of the antioxidant BHT to the ULV decreased the ordering and increased dynamics of phospholipids alkyl chains. The membrane became more fluid. The largest effect was obtained by quercetin and epigallocatechin-3-gallate, although relatively hydrophilic compounds. We believe that in both cases conversion occurred on or just below the surface of the liposome membrane. Additionally, DSC results show that quercetin and epigallocatechin-3-gallate, in addition to BHT, have the highest impact on the thermodynamic profile of gel-to-liquid phase transition of the DPPC liposome. Both compounds can form a number of hydrogen bonds with the hydrophilic parts of phospholipids and therefore the dynamics of movement of the alkyl chain decreased.
We discuss the implications of our results for understanding the mechanism of interaction of phenolic compounds with biological membranes.

THE IMPORTANCE OF FUNCTIONAL FOOD IN HUMAN NUTRITION AND COMPARISON WITH CONVENTIONAL PRODUCTS

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The functional food is modern concept in human nutrition, considering the fact that this type of food contains ingredients which have usefull effect on one or more purpose functions in organism and contribute the general medical health and/or decrease the risk of some diseases. The ingredients of functional food are: macronutritients with special physiological treatment (polysaccharides, omega-3 fatty acids, etc.), essential micronutritients (folic acid, vitamin B6, B12), nonessential ingredients (some of oligosaccharides), biologically active phytonutritients (carotenoides, flavons, catechins, etc.), friendly bacteria – probiotics. Modern research indicates expansive development and production of functional food in this area as well as around the world. That requires appropriate legislation which defines the field of functional food production. The objectives of this study are to emphasize the importance of functional food in daily nutrition. Furthermore, using sensorical analisys for three different product types with functional characteristics, it should prove that the food with functional characteristics does not deviate in total values from the similar conventional products.

Key words: functional food, omega-3, omega-6, bioactive supstances, conventional products

BIOPOTENTIAL AND CHEMICAL CHARACTERISATION OF NEEDLES AND CONES OF JUNIPERUS FOETIDISSIMA WILLD. 1806

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All over the world plants from the Juniperus genus have always been regarded as a well-known traditional remedy and are used for healing various disorders: common cold, urinary and kidney infections, dermatological disorders, bronchitis, pneumonia, dysentery, hemorrhage, rheumatic arthritis, stomachache, diarrhea and for regulation of the menstruation and in relieving menstrual pains [1]. Moreover, plants from the Juniperus genus are widely used in cookery as a spice which adds unique flavour, preferably for pickling meat. Furthermore, they are indispensable additive in making process of couple beverages, such as gin and ”klekovača”. However, there are only few literature data about their pharmaceutical activity and chemical composition.
In this study, chemical composition of extracts and essential oils of J. foetidissima Willd. 1806 needles and cones were determined. Additionally their antioxidant and anti-inflammatory properties were evaluated. The presence and content of 44 phenolics in extract was studied using LC-MS/MS. Dominant compounds in needles and cones extracts were, respectively: catechin (202.92 and 61.36 mg/g d. e.), quercitrine (125.21 and 67.42 μg/g d. e.) and epicatechin (78.39 and 24.36 mg/g d. e.). Chemical composition of essential oils was determined using GC-MS. Results shown that sabinen was most dominant (39.9% needles, 29.9% cones). Furthermore, cones have shown characteristic diterpene profile. Antioxidant potential was determined with standard tests [1]. Anti-inflammatory capacity was determined using assay which measure inhibitory potency toward COX-1 and 12-LOX enzymes in human platelets [2]. In all assays, extracts and essential oils have shown considerable activity, comparable with examined standards. Needles were more active then cones, particularly considering anti-inflammatory activity.
According to obtained results, examined J. foetidissima species could be regarded as a promising source of bioactive natural compounds, which can be used both as a food supplement and as a remedy.

Keywords: J. foetidissima, extracts, essential oils, LC–MS/MS, GC-MS, antioxidant, anti-inflammatory activity

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SOUR CHERRY SEED KERNEL: A VALUABLE SOURCE OF NUTRIENTS FROM A WASTED STREAM OF JUICE INDUSTRY

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Sour cherry seed kernels are wasted materials from fruit juice or jam processing industry. Although they are rich in nutritional compounds due to being plant-based, they do not take place as a food ingredient or as a raw material in food industry. Since sour cherry seed kernel contains oil ranging from 17 to 20%, sour cherry seed kernel oil can be a potential use as a food ingredient for food industry.

This study aimed to chemically characterize both solid and oil part of sour cherry seed kernel. For this purpose, sour cherry seed oil was extracted by using supercritical carbon dioxide at (300 bar at 60oC), and classical solvent extraction. Chemical composition of sour cherry seed kernel oil in terms of fatty acids and tocopherols, antioxidant capacity, and phenolic compounds was investigated. In addition to that, the analyses in oil-free residue of sour cherry seed kernels were performed for protein and minerals using Kjeldahl and atomic absorption methods, respectively.

The results revealed that supercritical extracted oil is a good source of some bioactive compounds, especially tocopherols. Apart from presence of phenolic compounds, “oil-free sour cherry seed kernel” is composed of high amounts of protein, roughly 33% and limited amounts of sugars (0.6%). In additon, supercritical carbon dioxide is more efficient than classical solvent extraction in terms of the recovery of phenolic compounds from sour cherry seed kernel.

IN VITRO MICROBIOTA MODULATION PROPERTIES AND FERMENTATION PROFILES OF DIFFERENT INULINS AND RESISTANT STARCHES

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The actions of human colonic bacteria have considerable effects on the well-being and health of the host and there is much interest in it's manipulation through the dietary intervention of prebiotics. Our aim was to evaluate the effectiveness of some commercially available inulins and resistant starches (RSs) to develop new foodstuffs.

Seven RSs, six inulin preparations and their mixes were tested in an intestinal model culture using 2 probiotic and 2 potentially pathogenic species. Probiotic preparations were added to the anaerobic basal medium as the sole carbon source at 1 % concentration. Carbohydrate free medium was used as a control. Samples were taken three times: 0, 24, and 48 hours of anaerobic conditions at 37 °C. Bacterial enumeration was performed by cultivation on selective agar plates. In order to compare the prebiotic effect of the resistant starches and inulin samples the 'prebiotic index' and growth rates of probiotic strains were calculated. Short chain fatty acid levels were determined in samples taken after 24 and 48 hours incubation using gas chromatography.

The inulin preparations gave higher PI scores than the RSs. The greatest increase in the number of bifidobacteria was observed on Frutafit CLR among the inulins and on Novation 4600 and 5600 from RSs. The highest growth rates of lactobacilli were found after 24 hours of fermentation on the Beneo GR and after 48 hours on Frutafit CLR. Regarding to the RSs the highest colony number in lactobacilli was presented on Novation RSs containing tubes. The mix of inulin and RS preparates showed high prebiotic index scores: the three most effective combinations were the Beneo Synergy1 + Novation 5600, Frutafit CLR + Novation 5600 and Frutafit CLR + Novation 4600. Acetic and butyric acid were the most abundant SCFA produced from all fibers.

THE COMPARISON OF VOC COMPOSITION OF ACACIA HONEY AND ACACIA FLOWERS BY GCXGC-TOF MS

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Solid phase microextraction (SPME) followed by comprehensive gas chromatography coupled to time of flight mass spectrometer (GCxGC-TOF-MS) was used to characterise volatile organic compounds present in acacia flowers (*Robinia pseudoacacia)* and acacia honey in order to identify volatile compounds that come to honey directly from acacia plant. Acacia honey as well as acacia flowers were collected in Komarno-Komarom district at Slovak-Hungary border. Up to 500 volatile organic compounds were detected in acacia honey at given signal to noise ratio 200, while only 216 were identified. They belong to various chemical classes (hydrocarbons, alcohols, aldehydes and ketones, terpens, benzene derivatives and compounds containing heteroatom). On the contrary, acacia flower scent was characteristic by presence 680 volatile organic compounds.

Key words: *honey, VOC, CGxGC, comprehensive gas chromatography*

SELENIUM-SUPPLEMENTATION TRIALS ON PORTUGUESE WHEAT CULTIVARS IN ACTUAL FIELD CONDITIONS

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Selenium (Se) is a trace element essential to the well-being and health quality of humankind. The present paper focuses on the ability of bread wheat (Triticum aestivum L.) and durum wheat (Triticum durum Desf.) to accumulate Se after supplementation via foliar-addition and soil-amendment procedures. Two of the most representative wheat cultivars in the country -- Jordão (bread) and Marialva (durum) -- have been selected for field trials, following the same agronomic practices and schedules as the regular (non-supplemented) crops of those varieties. Soil supplements were applied at the sowing time, whereas foliar additions were performed at the booting and grain-filling stages, in either case by using sodium selenate and sodium selenite solutions at three different Se concentrations, equivalent to field supplementation rates of 4, 20 and 100 g of Se per ha (with and without potassium iodide, as a joint additive). After harvesting, Se contents in these cereal grains were compared to data from regular wheat samples (field blanks) grown at the same soil/time, yet devoid of any supplements. Total Se in all field samples -- a three-fold replication, in a full-factorial design -- have been determined by instrumental neutron activation analysis, via the short-lived nuclide 77mSe (half-life time: 17.5 s), at the Portuguese Research Reactor (RPI-ITN, Sacavém; pool-type reactor; maximum nominal power: 1 MW). Quality control of the instrumental procedure has been asserted through concurrent analyses of NIST-SRM 1567a (Wheat Flour). The results show that foliar additions can increase Se contents in mature grains up to 35 times, when compared to non-supplemented crops, and that selenate-based treatments seem more effective in enhancing such contents. Jordão and Marialva may respond differently to the stage of application though. Overall, for any given field supplementation rate, foliar application appears to translate into higher Se concentrations in wheat grains than each soil counterpart.

CASEIN-WHEY PROTEIN INTERACTIONS IN HEATED CAPRINE MILK: WHETHER ARE SIMILAR TO BOVINE MILK?

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Casein-whey protein interactions in heat treated caprine milk were present, since whey protein/κ-CN complexes were registered. But, until now, no information is available for their distribution between micellar and serum phase of milk and how the pH of heated milk influences the distribution. Whether the distribution is the same or similar as in the heat-treated bovine milk? Can we knowledge gained by studying the changes in heat-treated bovine milk applied to heat-treated caprine milk? It is known that the average composition of caprine milk is very similar to bovine milk but, it is well established that these two types of milk performed different technological-functional properties.

In the present study, we intended to give the answers on these questions by determining the distribution of denatured whey proteins and κ-CN in soluble and micelle-bound complexes formed in thermally treated caprine milk at 90ºC during 10 minutes, after adjusting the pH of milk samples between 6.5 and 7.1, using fractionation technique based on renneting and three electrophoretic techniques, SDS-R-PAGE, SDS-NR-PAGE and native PAGE.

Upon heating, about 2% of the total β-LG and about 3% of the total α-LA were in the native state at all pHs. Fractionation analysis of major caprine whey proteins was revealed that all denatured β-LG and α-LA were located on the surface of micelles as micelle-bound complexes at lower pHs (≤6.7), whereas at higher pHs (≥6.9) the presence of soluble complexes was detected in lesser extent. These data indicate that the majority of whey protein/κ-CN complexes are located at the surface of casein micelles at all investigated pHs. These findings are different from data obtained for bovine milk and could indicate to difference in the structure of caprine and bovine casein micelles, which could strongly influence the technological-functional properties of these milk.

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SCANDICEAE TRIBE SPECIES FROM FRUŠKA GORA MOUNTAIN – POTENTIAL INGREDIENTS OF FUNCTIONAL FOOD

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Numerous Apiaceae species are cultivated and have established position in cuisine. However, even more are only wild-growing and have only limited local usage. This holds for members of Scandiceae tribe, including Anthriscus sylvestris, A. cerefolium and Chaerophyllum temulentum, commonly growing in Serbia. To evaluate their potential, chemical composition of 70 % methanolic extracts was investigated by LC-MS-MS and Al3+ test for total flavonoids, and bioactivity was assayed for antioxidant activity (DPPH and FRAP test), eicosanoid pathway inhibition, and anti-proliferative activity (MTT test). LC-MS-MS analysis confirmed extracts were rich in phenolics – chlorogenic acids (free and acylated caffeoyl- and dicaffeoylquinic acids), flavonoid aglycones and O-glycosides (predominantly derivatives of luteolin) and coumarins (scopoletin). Significant differences in phenolic profiles were observed. In A. cerefolium, only a few chlorogenic acids and flavonoids were abundant, C. temulentum contained a wide spectrum of chlorogenic acids and, in root, abundant scopoletin, while A. sylvestris was rich in lignans (dibenzylbutyrolactones and aryltetralins), accompanied by several chlorogenic acids and flavonoids. All extracts exhibited moderate antioxidant activity, with IC50 for DPPH scavenging ranging 14.8–48.7 μg/mL, and reducing capacity ranging 5.00–20.8 μg Fe/mL. In case of A. sylvestris and C. temulentum, activities of herb and root extracts were comparable, while for A. cerefolium herb was significantly more active, corresponding to relative abundances of phenolics in these plant parts. All samples except A. cerefolium root exhibited dose-dependent inhibition of 12-HHT (COX-pathway product) and 12-HETE (12-LOX-pathway product) synthesis, with IC50 ranging 0.39–1.42 mg/mL. A. sylvestris appeared the most active, due to presence of lignans. Lignans also can be responsible for observed antiproliferative activity of A. sylvestris, with IC50 ranging 0.771–19.2 μg/mL. In conclusion, examined species contain numerous bioactive products and show potential as components of functional foods, although additional toxicological investigations will be necessary to confirm the safety of use.

PH-RESPONSIVE LYOTROPIC LIQUID CRYSTALS FOR CONTROLLED DRUG DELIVERY IN THE GASTROINTESTINAL TRACT

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INTRODUCTION:
Stimuli-responsive drug delivery systems can undergo suitable changes in response to specific environmental fluctuations. Non-charged polar lipids are valuable candidates for this purpose due to their capacity to self-assemble in presence of water into a variety of reversed lyotropic liquid crystals (LLC) depending on different variables. In particular, the release of hydrophilic drugs from LLCs is diffusion controlled and regulated by the symmetry of the mesophase, and it is possible to trigger structural changes which are reflected directly on the release rate of the drugs.

METHODS:
The LLCs were prepared by mixing the lipid blend (monoglyceride and linoleic acid) and water solution at the required pH and loaded or not by phloroglucinol (model drug), depending on the specific experiment. UV-Vis spectrometer was used to measure the concentration of the drug and the LC mesophase characterized by Cross Polarized Light Microscope (CPOM) and small angle X-ray diffraction (SAXS).

RESULTS:
SAXS analysis reveals the presence of the Im3m bicontinuous cubic phase at pH 7 and the HII reverse hexagonal phase at pH 2. Different release rates of the drug from the two different mesophases were found and the bicontinuous cubic phase released four times faster than the hexagonal phase. The system is specifically designed to reversibly change from a reverse Im3m bicontinuous cubic phase to a HII reverse columnar hexagonal phase, when changing the pH from neutral to acidic conditions. The pH-responsiveness is provided by the linoleic acid, which being a weak acid is in the de-protonated charged state at pH 7 and mainly neutral at pH 2, imposing changes in the critical packing parameter (CPP) of the LLC.

CONCLUSIONS:
The resulting pH-responsive food-grade nano-carrier can be efficiently used to spontaneously trigger the release of drugs in the gastrointestinal tract (pH 7), while preventing premature release in the stomach environment (pH<2).

ACRYLAMIDE FORMATION IN COOKIES WITH COFFEE EXTRACTS

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The aim of this study was the development of improved cereal products with various type of extracts prepared from coffee and the evaluation of quality and safety of these novel products. Coffee polysaccharides, which are galactomannans and arabinogalactans, present immunostimulatory activity and are associated with decreased risk of a number of disorders including colorectal cancer, constipation, diverticulosis, cardiovascular diseases and type II diabetes. Phenolic compounds, namelly chlorogenic and caffeic acids, as well as melanoidins that are formed during roasting, are known for their antioxidant properties. On the other hand, some of these components are also potential reagents in process of Maillard reaction in which acrylamide, a known health-hazardous compound, is naturally formed during baking of cereal products in significant levels.
In this study, the addition of freeze-dried aqueous and ethanol extracts and oil of coffee to simplified cookies was evaluated on acrylamide content and preliminary sensory acceptance by consumers. High and low molecular weight fractions from aqueous extract were separated using microfiltration. All kinds of coffee extracts and coffee oil were incorporated into the formulation of cookies in various concentrations (from 0.1 % up to 5 %). None of coffee extracts increased acrylamide formation. Moreover, in the case of aqueous extracts, acrylamide elimination up to 10 % was observed (from 223 ± 6 μg/kg to 198 ± 3 μg/kg) which is important from the safety point of view. It was observed that the highest intensity of coffee flavour was in cookies with ethanol extract in comparison to other coffee extracts.
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BIOACTIVE CARBONYLS PROMOTE ACRYLAMIDE FORMATION IN MODEL SYSTEMS

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Acrylamide is classified as a probable human carcinogen hence it has been taking wide attention in food safety research area and its formation in foods is linked to the Maillard reaction. Studies to date clearly show that asparagine is mainly responsible for acrylamide formation in heated foods and acrylamide formation is promoted in the presence of carbonyl compounds.

It is a fact that certain bioactive compounds bear carbonyl group that may contribute to the thermal decarboxylation of amino acids. In the case of asparagine, such carbonyl compounds may compete with reducing sugars in Maillard type reaction leading to acrylamide during heating.

This study aimed to understand the role of certain bioactive carbonyls on acrylamide formation at elevated temperatures. Model asparagine-bioactive carbonyl systems were employed to investigate the potential formation of acrylamide during heating. In a tightly closed glass vessel, equimolar amounts of asparagine and curcumin, vanillin, coumarin, silymarin, ascorbic acid or dehydroascorbic acid were singly homogenized with silica gel and 5 µmoles of water to resemble thermal processing conditions of solid foods having limited water. Model reaction systems were heated at 180^{o}C for 10 and 20 min to monitor the formation of acrylamide over time.
According to the results, significant amounts of acrylamide were generated in all model systems just after 10 min of reaction. The most remarkable results were obtained in the model systems containing vanillin besides asparagine. The amount of acrylamide was approximately 100 times higher in the model system of asparagine-vanillin heated at 180°C for 20 minutes than that of asparagine. On the other hand, the addition of equimolar amount of fructose increased the amount of acrylamide by a factor of 40. The results revealed that vanillin is more effective than reducing sugars in the Maillard reaction leading to acrylamide.

ANTIOXIDANT CAPACITY OF NATURAL, MODIFIED PROTEINS AND MELANOPROTEINS

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Proteins can act as antioxidants mainly by the reducing action of their sulfhydryl groups, proton donation of amino acids aromatic residues to electron deficient radicals, but also indirectly by metal chelation. Phe, Tyr, Trp, Met, Lys, Cys, and His are examples of amino acids that cause antioxidant activity. Moreover, antioxidant compounds, such as β-carotene, phenolics, ascorbic acid, can stick to the protein surface by hydrophobic interaction to become part of the protein-antioxidant complexes. Finally, a significant part of the insoluble antioxidant compounds is constituted during food processing by the material formed through Maillard reaction which leads to the formation of brown polymers called melanoidins mainly constituted by protein and the term of ‘‘melanoproteins’’ was coined for them.

Many food proteins, protein-antioxidant complexes and melanoproteins are largely insoluble, therefore their contribution was not considered by using the usual extraction procedures. In this study, antioxidant capacity of pea protein isolates and hydrolysates, as well as, of maize and wheat proteins was measured by the direct procedure (QUENCHER method). Model system composed of reducing sugar and pea protein was used to obtain antioxidant capacity of melanoproteins and formed furosine determination. In addition, effect of water on protein antioxidant capacity during thermal treatments was evaluated.

In our study, the highest antioxidant capacity had gluten from durum wheat (71 mmol Trolox/kg d.m.). Pea protein isolates and corn proteins had lower antioxidant capacity ranged from 15.31 to 33.91 mmol Trolox/kg d.m. Melanoproteins formed after heating of 5 min at 180oC had a high antioxidant capacity (100.19 mmol Trolox/kg d.m.) that was about 3-fold higher than the initial activity of the pea protein isolate. At same thermal condition content of furosine was the highest and amounted 62.49 mg/kg d.m.

Besides important nutritional and functional properties, proteins can have high antioxidant activity depend on the composition, structure and hydrophobicity.

THE INFLUENCE EXTRACT OF ROSEMARY AND GREEN TEA ON OXIDATIVE STABILITY OF VEGETABLE OILS

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Lipid oxidation has been recognised as a major problem in edible oils and causes a change in the chemical, sensory and nutritional properties.
Today, it is wellknown that the antioxidant activity of plant extracts cause a change in oxidation stability of vegetable oils. This paper deals with an influence of natural antioxidants of rosemary extract and extract of green tea, in content of 0.2%, on the oxidative stability of extra virgin olive oil, high oleic sunflower oil and their blends. The oxidative stability of vegetable oils, with and without added natural antioxidant, was investigated using the Oven test conditions. Test results are presented as the value of peroxide number during four days of testing. High oleic sunflower oil has a better stability to oxidation because of the high content of oleic acid. The investigation results showed that higher antioxidant activity had rosemary extract OxyLess CS compared to StabilEnhance OSR and extract green tea.

Key words: vegetable oils, oxidative stability, natural antioxidants, Oven test

EFFECTS OF SUPERCRITICAL FLUID EXTRACTION PARAMETERS ON YIELD AND TOCOPHEROL COMPOSITION OF SOYBEAN OIL

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For many applications supercritical fluid extraction has several advantages compared to extraction with classical solvents (e.g. hexane). There are no solvent residues in the extract and the low process temperatures are used. Fragrances and aromas remain unchanged. The extraction agent CO2 is nontoxic, nonexplosive, inflammable, cheap, readily available and easily removed from extracted products.
Supercritical fluid extraction of soybean oil at different conditions of temperature and pressure was studied. Soybean oil was fractionated into few fractions collected at different time intervals during extraction. Fractionation was performed at following temperatures: 40, 50 and 60 °C and at pressures 300, 400 and 500 bar. The composition of tocopherols in different fraction of soybean oil obtained at different extraction process conditions was determined.
The results show that the extraction yields are significantly affected by applied extraction pressures. In order to describe the extraction process, the Sovová model was used and very good agreement with experimental results was obtained. The extraction was successfully scaled-up to pilot plant maintaining the ratio solvent flow rate/raw material mass and ratio packed column height/packed column diameter constant between small and large scales. The extraction conditions statistically significant influenced the tocopherols composition. In all obtained extracts, the content of γ-tocopherol was significantly higher compared to content of α- and δ-tocopherol, while the content of β-tocopherol was low or not detected in obtained fractions. Furthermore, the total tocopherol content extracted from soybean oil by n-hexane was less than that extracted by the supercritical CO2.

ANTIGENIC ACTIVITY AMONG 7S PROTEIN TYPE FROM SOYBEAN, COWPEA AND ADZUKI SEEDS

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Introduction:
The vicilin (7S) and legumin (11S) represented the majority fractions from legume seeds. Previous studies have suggested that the high homology of the structural and functional characteristics among vicilins from different species occur by the presence of ancestral common genes derived from a convergent evolution. The objectives of the work were to isolate and purify 7S proteins from soybean, cowpea and adzuki beans and verify its antigenic activities among these species.
Material/Methods:
The vicilins were isolated by solubilization, precipitation and dialysis by reference methods. The proteins were purified on Sepharose CL-6B (2x100 cm) and analyzed by PAGE-SDS. Rabbits were immunized with a purified solution of 7S from soybean, cowpea and adzuki beans and the anti-7S and anti-11S obtained were tested by immunoenzimatic reaction (ELISA) with native 7S proteins. Tests of immunoblotting were made for bands identification with antigenic activity.
Results: Immunoenzyme tests showed that vicilins have a good antigenic activity among the species studied. The vicilin from cowpea showed reactivity of 93.5, 89.2, 79.3 and 70.2% in the dilutions 1/400, 1/800, 1/1600 and 1/204800, respectively, with anti-7S soybean serum. The adzuki bean showed reactivity of 95.4, 83.6 and 68.7% for the same dilutions. However, when analyzed for anti-vicilins beans the antigenicity of vicilin soybean was significantly lower. The reactivity with anti-7S cowpea was 4.19 in dilution 1/400, reaching levels not detectable in 1/25600 and anti-7S of adzuki was 21.6%, with a limit detection of 1/51200. Activity among beans species was 100% in the 1/400 dilution and remained above 60% up to 1/204800. The IgG-specific immunoblot reaction showed responsible bands for antigenic activity among species.
Conclusion:
In general, anti-vicilin serum of the species studied showed good reactivity with the globulins from soybean, cowpea and adzuki beans. However, the vicilin from adzuki demonstrated best identity with soybean characterized by immunological assays.

Key words: legume, vicilin, antigenic activity.

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EFFECTS OF ADZUKI BEAN IN RATS FED A HIGH FAT AND CHOLESTEROL DIET

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Introduction:
The hypolipidemic and body fat-lowering effects of isolated vicilin (7S) from adzuki bean (AB) were studied.
Material/Methods:
Wistar rats were divided into four groups (n=9): standard diet (STD, casein alone), hypercholesterolemic (HC) diet (STD plus 20g/100g palm oil, 1g/100g cholesterol and 0.5g/100g cholic acid), HC diet+7S-A (HC plus 300mg of 7S/kg/body weight/day) and HC diet+SVT (HC plus 50mg of simvastatin/kg/body weight/day). The protein and the drug were administered by gavage for 28 days.
Results:
Food intake was similar among the STD, HC and HC+7S-A groups, indicating that these parameters were not affected by diet and treatment, but HC+SVT showed decrease of 13.9% related to them ($P<.05$). Fecal excretion and feeding efficiency were similar among the HC, HC+7S-A and HC+SVT, however, these were higher ($P<.001$) when compared to STD. The HC+7S-A and HC+SVT groups have reduced body weight gain in 11.8 and 12%, respectively, related to HC ($P<.05$). Administration of vicilin (AB) caused significant decrease in liver and adipose tissue epididymal weights of 16.5 and 18.6%, respectively, compared to the HC. It was not observed significant changes for HC+SVT group. Animals that ingested 7S (AB) had lower serum levels of cholesterol (-33.1%), triacilglycerides (-17.8%), and non-high-density lipoprotein (-53.4%), and increase of HDL-C (+52.9%), while those that received simvastatin had reduction of cholesterol in 20.4%, triacilglycerides in 6.9%, non-HDL-C in 30.7% and increase in HDL-C of 18.6%. The atherogenic indexes of HC+7S-A and HC+SVT groups were 67.1 and 31.7% lower than that of HC group, respectively. The liver of the animals from HC+7S-A showed lower concentrations of total lipids (-13.9%) and cholesterol (-9.2%) while HC+SVT showed reduction of 8.8 and 11.3%, respectively, compared to animals fed only the HC diet.
Conclusion:
Vicilin (AB) showed to be beneficent for the reduction of body weight and body fat and its hypolipidemic property improved the plasma lipids profile.

Key words: adzuki vicilin; hypolipidemic; cholesterol-lowering.

Acknowledgments: FAPESP, PADC/FCF/UNESP and FUNDUNESP

EFFECTS OF COWPEA VICILIN IN RATS FED ENRICHED FAT–CHOLESTEROL DIET

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Introduction:
In recent years, many studies have focused on the protein and peptides from legumes in the prevention and treatment of lipid disorders especially hypercholesterolemia, hypertriglyceridemia and hyperglycemia. We studied the evaluation of the hypolipidemic effects of vicilin from cowpea and a statin like simvastatin.
Material and Methods:
Rats were divided into groups (n=9): 1.standard (STD; casein), 2.high-fat and cholesterol diet (HC; STD plus 20% palm oil, 1% cholesterol and 0.5% cholic acid), 3.HC+7S-C (HC + 300mg/kg/day of 7S) and 4. HC+SVT (HC + 50 mg/kg/day of simvastatin). The protein and the drug were administered by gavage for 28 days.
Results:
The animals fed HC diet showed a weight gain significantly higher ($P < .05$) than those fed STD diet. The 7S-C group had significantly lower final body weight and epididymal adipose tissue than the HC (8.4% and 19.4%, respectively), but no alterations in the food intake and feeding efficiency was observed. Dried fecal weight was significantly higher in the HC+7S-C than HC and HC+SVT groups. The 7S-C group showed increased excretion fecal of total lipids, cholesterol and triacilglycerides compared to HC, and a decrease in the total serum cholesterol, non-HDL-C and the atherogenic index (32.5, 54.3 and 70.7%, respectively), compared with rats fed HC diet, and these values were higher than those treated with simvastatin. Serum HDL-cholesterol levels were increased (57.1%) in the HC+7S-C group and hepatic cholesterol and triglyceride contents were also significantly lower than in the HC (13.7 and 17.1%, respectively). The lipoprotein lipase activity was significantly ($P < .001$) higher in the HC+7S-C group than the others; however, there were no differences in glutamic pyruvic transaminase activities among them.
Conclusion:
Based on these data, it can be suggested that the oral daily administration of isolated vicilin from cowpea (300mg/kg/day) can promote a hypolipidemic and body fat-lowering effects in rats fed hypercholesterolemic diets.
Key words: cowpea vicilin; hypolipidemic; hypercholesterolemia.
Acknowledgments: FAPESP, PADC/FCF/UNESP and FUNDUNESP.

CONTRIBUTION OF DIFFERENT BIOACTIVE COMPOUNDS OF COCOA PRODUCTS TO THEIR CYTOTOXIC AND ANTIOXIDANT/PROOXIDANT ACTIVITY ON HUMAN LARYNGEAL CARCINOMA CELL LINE

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BRIEF INTRODUCTION:
Cocoa products are studied for the most part because of the in vitro antioxidant and antiradical properties of their bioactive constituents on different cellular models of oxidative stress. However, these effects cannot be attributed solely to polyphenols, given that cocoa and their products also contain methylxanthines, peptides, biogenic amines and micronutrients which can influence the observed beneficial health effects of cocoa products, by either enhancing or reducing their biological activity. In this study the relation of polyphenols, methylxanthines and minor and major elements of several cocoa products with their cytotoxic activity and reactive oxygen species formation on one human carcinoma cell line was determined.
METHODS AND MATERIALS:
Non-fat cocoa solids (NFCS), total polyphenol content (TPC) and methylxanthines content of cocoa product extracts were determined using UV/Vis spectrophotometric methods and HPLC analysis. Inductively coupled plasma atomic emission spectrometry (ICP-AES) was used for the determination of major and minor elements present in different cocoa products. Cytotoxic and anti-oxidative/prooxidative effects of cocoa product extracts in the presence of hydrogen peroxide were determined on human laryngeal carcinoma cell line (HEp2).
RESULTS:
The cocoa products containing higher NFCS exhibited higher TPC and methylxanthines content, while the content of major and minor elements was characterized by higher variability depending on the cocoa product. Non-cytotoxic concentrations of some cocoa products induced an increase in ROS formation, while higher concentrations resulted with the highest HEp2 cell growth inhibition and a decrease in ROS formation. Antioxidative nature of cocoa product extracts was detected in cells treated with hydrogen peroxide, except the highest concentrations where dark chocolate and cocoa liquor induced ROS formation.
CONCLUSIONS:
Experiments revealed a strong relationship between the type of product/concentration/time of exposure and antioxidant/prooxidant character of cocoa products. The observed prooxidant activity of dark chocolate and cocoa liquor may be attributed to higher contents of methylxanthines and transition metals present in these products.

POTENTIAL ANTIOXIDANT AND ANTIMICROBIAL ACTIVITY OF MULBERRY FRUITS (MORUS ALBA L.) GROWN IN SERBIA

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Mulberry trees are distributed throughout Serbia. Besides its use in forage and food for animals, it is also used as herbal medicine. This study is carried out to determine total phenolics content, total flavonoids content, total monomeric anthocyanins, as well as DPPH assay, reducing power assay and minimum inhibitory concentration of the fruits of mulberry species (Morus alba L.) grown in Serbia. Fresh fruits of mulberry were extracted by four different solvents (water, ethanol, methanol and acetone). Determination of fruit weight, total soluble solids, total dry weight, pH and acidity were performed. The total phenolics content (TPC) and total flavonoids conetent (TFC) in mulberry extract were determined spectrophotometrically. The total monomeric anthocyanins (TMA) were estimated by a pH differential method. Antioxidant activity (AA) of mulberry extracts was evaluated using DPPH* radical scavenging method. The reducing power of extracts and standard (ascorbic acid) were determinate by Oyaizu method. The minimal inhibitory concentration (MIC) of the extract and cirsimarin against tested bacteria were determined based on a microdilution method. Methanolic mulberry fruits extract with the highest amount of total phenolic component, was the most potent antioxidant in all the assays used. At the other hand, MIC determination showed that all the other extracts have higher antimicrobial activity. This is the first report of Morus alba fructus grown in Serbia and determination of the potential antioxidant and antimicrobial activity of mulberry fruits extract. This information will be of considerable value to the commercial producers of mulberry trees cultivation or pharmaceutical industry for potential new mulberry supplement production. Financial support of this work by the Serbian Ministry of Education and Science, Project No. TR 31013, is gratefully acknowledged.

TECHNOLOGY OF GERODIETETICAL SMOOTHIE

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Considering the demographic situation in the world, particularly the role of nutritional factors in the untimely aging process, gerodietetics became an independent branch of science. However, functional food assortment for elderly people is currently insufficient in diversity and amount of products. Gerodietetical food production is based on realization of a combinatorial approach to nutrition analysis which provides increase in useful substances to the level consistent with physiological consumption rates of an elderly person (within the range of 15-50% daily requirement).

The study of human senescence permits to discover a number of symptoms of aging which reveal the most intensive age-related changes in a particular functional system. For more than 100 years the scientists have been aware of a connection between aging and the state of thyroid gland. The physicians state that primary hypoterios is typical for the elderly (more than 99% of all cases).

By preventing and controlling hypoterios in the elderly one should consider a possibility of achieving liquidation of iodine deficiency and selenium deficit by correcting food rations with increase of food product share containing fruit and vegetable sources of selenium and antioxidant vitamins.

The development of vegetable, fruit and berry gerodietetical smoothie production is to solve the problem of nutritional preventive measures against hypoterios in the elderly.

The ground seeds have already proved to be the nutritional ingredients which enrich food products with mineral substances, vitamins, dietary fibers, polyunsaturated fatty acids, microelements (zinc, chromium, manganese, selenium) and are used to prevent diseases.

The degree of ground seed swelling and viscosity of model systems “vegetable puree – the ground seeds” have been studied to prove the optimal technical parameters for forming the texture of ready smoothies. The analyses of the degree of swelling of ground silybum marianum seeds in tomato juice and ground flax seeds in kefir have been carried out at 18 °C and hydro modules 1:10, 1:15, 1:20. The swelling process stopped for all the samples after 45-55 min. Then the volume of the swollen ground seeds didn’t practically change. According to the results of the study the most optimal viscosity of model systems is that with 2% ground pumpkin seeds and 4% ground silybum marianum seeds.

The smoothie-gerodietical manufacturing technique has been designed based on the systems approach. The proposed smoothies provide an elderly organism with 40…80% mineral substances, dietary fibers, and antioxidant vitamins of daily requirement and help it achieve its improvement.

ANALYSIS OF OMEGA-3 FATTY ACIDS' CONTENT IN FRESH SEA FISH

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Introduction
Fish lipids are rich dietary sources of n-3 long-chained polyunsaturated fatty acid (LC-PUFAs). Among n-3 fatty acids, the most important are eicosapentaenoic (20:5 n-3 EPA) and docosahexaenoic (22:6 n-3 DHA) acids. EPA and DHA have important roles in the prevention and treatment of different diseases.
The aim of this study was to analyze the fatty acid content of fresh sea fish available on the Serbian market.

Material and methods
In five species of sea fish (salmon, tuna, mackerel, sardines and hake) the content and composition of fatty acids were analyzed. After lipid extraction, fatty acids were derivatized into volatile methyl-esters. Fatty acids were determined using capillary gas chromatography.

Results and discussion
Analyses of total lipid content in fresh fish samples and their fatty acid composition revealed that mackerel (4.6 g/100 g) and sardines (4.5 g/100 g), were the best dietary sources of LC-PUFAs. All analyzed fish samples had significantly higher DHA than EPA content. The highest average EPA content per 100 g of edible fish was observed in samples of sardines (2.0 g). Interestingly, tuna and hake had very low EPA content. The results showed that the DHA content of sardines, mackerel and salmon were similar – 2.2 g, 2.6 and 2.3 g/ 100 g, respectively. Hake (0,6 g/100 g) and tuna (0,4 g/100 g) had significantly lower DHA contents. Significant variation of n-3 fatty acids' content was noted among individual fish samples. The evaluation of prices for 1 g of fish-derived omega-3 fatty acids was done depending of the fish type.
Fresh seafish available on Serbian market can be cheap and valuable source of LC-PUFAs in daily diet.

Key words: n-3 fatty acids, marine fish, analysis

DETERMINATION OF GLUTEN IN DIETARY PRODUCTS FROM SERBIAN MARKET

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Introduction:
Celiac disease (CD) is a digestive illness caused by gluten's toxic effect, which damages the intestinal tract and interferes with nutrient absorption. The treatment of CD is based on life-long total avoidance of wheat gliadin (and related prolamins from barley, rye and oats) from the diet. Attention should be given to dietary products that might contain gluten as impurities in industrial starch or other ingredients added during manufacturing.

Materials and method:
Sixty-five samples were analyzed: 30 foods for infants and young children and 35 food supplements that according to their nature should not contain gluten. All samples were homogenized and tested in duplicate using the Ridascreen Gliadin sandwich R5 enzyme-linked immunosorbent assay with cocktail extraction.

Results:
The most of the analyzed samples (88%) contained less than limit of quantification of 5 parts per million (ppm) for gluten. Gluten content of 5-20 ppm was determined in 3 samples. 5 of 65 samples (8%) contained mean gluten levels ≥ 20 ppm and would not be considered "gluten-free" according to the health safety of dietary products.

Conclusion:
The regular control of the presence of gluten in the raw materials, as well as to avoid gluten contamination during the manufacturing process of gluten-free dietary products is necessary in order to protect health of people with coeliac disease.

This work was supported by the Project No III-46009, Ministry of Education and Science, Republic of Serbia

WALNUT KERNELS AS DIETARY SOURCES OF MICROLEMENTS

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Introduction:
Walnut kernels (Juglans regia L.) have significant nutritive value and medicinal importance for human health. Walnuts are considered to be a good source of dietary microelements. Literature data on mineral composition of walnut kernels from Serbia are very limited. The aim of this study was to determine whether walnuts originated from Serbia could be good sources of microelements in daily nutrition.

Material and method:
The concentrations of microelements: copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) in walnut kernels samples collected from ten different cities from Serbia were determined by atomic absorption spectrometry after dry digestion.

Results:
The concentrations of Cu, Fe, Mn and Zn in the samples were in the range of 0.19–1.71, 1.93–3.04, 0.93–3.35 and 1.98–3.35 mg/100g, respectively. The order of microelements depending on their average content/100g of walnut was Zn >Fe >Mn >Cu. The profil of microelements found in this study is comparable with those reported in the literature for walnuts from other countries.

Conclusion:
These results showed that Serbian walnut kernels presented important sources of dietary microelements and walnut kernel consumption can contribute to a well balanced diet.

This work was supported by the Project No III-46001, Ministry of Education and Science, Republic of Serbia.

RHEOLOGICAL PROPERTIES OF FUNCTIONAL SPREAD OF HULL-LESS PUMPKIN SEED FLOUR AND WHEAT FIBRE GEL

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Functional food products contain biologically active micro and macronutritients (vitamins, minerals, fibre), that provide adequate nutrition and health effects. Suitable raw material for functional food products can be obtained by milling the cake of hull-less pumpkin seed, which is by-product of mechanical oil extraction. Such flour is very sustainable and rich in metabolically adoptable proteins, minerals and antioxidants. The aim of this work was to determine the rheological properties of the spread based on hull-less pumpkin seed flour.

Fat phase of primary spread, with sunflower oil, was totally replaced with colloidal wheat fibre gel. The gels were prepared in different concentrations, 0.1 to 10%, and were added in different amounts, 60, 70 and 80%, calculated on the total mass of the spread. Wheat fibres formed liquid gels in water at low concentrations, 0.1 and 0.5%. Stable gel structures were obtained at concentrations above 1% and had anti-thixotropic flow properties.

The spreads of hull-less pumpkin seed flour and wheat fibre gel were thixotropic systems. Statistically insignificant ($p>0.05$) changes pointed that application of fat replacer, compared to control spread, regardless amount and concentration of the gel, did not affect the yield stress of the spreads. The interaction of these factors, as well as their separate influence, were statistically significant ($p<0.05$) for rheological parameters thixotropic loop area and tan δ. Creep and recovery compliance increased with increasing amount of the gel in spread composition.

Optimal rheological properties of the spreads were achieved with low concentrated gel, 0.5 or 1%, in amount of 70%. Energy value of the spread with applied fat replacer was reduced five times, compared to control spread with sunflower oil.

EFFECT OF SOYA MILK ON ANTIOXIDANT ACTIVITY CHANGES IN CHOCOLATE

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Properties of chocolate depend on raw chocolate composition, manufacturing process and properly guided phase of precrystallization. In this paper chocolate was produced in a non-conventional way, in the ball mill. Milk powder, as most commonly used raw material for milk chocolate production, was replaced with soy milk powder. In Western countries, soya milk is used in a diet of people who are intolerant to lactose, or who do not consume foods of animal origin. Three types of chocolate have been produced: R1 chocolate mass with 20% milk in powder, chocolate mass R2 with 15% soy milk powder and R3 chocolate mass with 20% milk powder in laboratory ball mill.
The aim of this research was to examine the influence of the milk powder and soya milk powder (15% and 20%) on the total phenolic content. The total phenolic content (TPC) increased with the increase of soya milk content in chocolate samples. Antiradical scavenging activity was in a direct relationship with the total phenolics content. The lowest IC50 showed the sample of chocolate with 20% of soya milk.

Key words: chocolate, soya milk, ball mill, solid fat content, hardness, total phenolics, antioxidant activity

UTILIZATION OF THE MIXTURE "OLD" BREAD

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There is an evident problem of several days old bread and its waste in Serbia, both in terms of quantity but also from an environmental, health and safety aspect. Currently, there is no organized way of collecting and distributing of such bread for further processing. In order to find a new use for old bread and to protect health of vulnerable population who uses such bread we made a mixture of old bread and corn meal by extrusion. In the process of extrusion corn meal was used with 12% of moisture and bread crumbs were added and mixed in 50 : 50 and 60 : 40 ratio in the mixer and then obtained mixture was moistened to the total of 18% moisture before the extrusion process. Extrusion of old bread and corn meal was carried out on the extruder (manufactured by Metal-matic Beočin, Serbia) at the temperature of 95-105 °C and with an extruder head that had a 10 mm in diameter and eight holes. The obtained results confirm that the obtained product was correct by microbiological and toxicological criteria and the total number of fungi and microorganisms was below the maximum allowable concentration.

Key words: “old” bread, corn meal, extrusion, health and safe food

DIET AND HEAT TREATMENT EFFECT ON FATTY ACID COMPOSITION IN DIFFERENT PIG TISSUES

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Linseed is one of the most useful crops that has been cultivated as a commercial plant all over the world. Recently there has been a growing interest in linseed oil due to the high concentration of linoleic and especially α-linolenic acid. Since animals are not able to synthesize these essential fatty acids, changes in fatty acid content in meat can be achieved through the changes in animal diet. The aim of this study was to evaluate the influence of diet supplemented with linseed rich additive on fatty acid profile and ω-fatty acids content in pig meat. Furthermore, fatty acid composition of roasted meat of pigs fed with control and experimental diet was investigated.

Twelve pigs were divided in a control and experimental group and grown to 110 kg of live weight. The experimental group was fed a standard diet enriched with 2.5% of commercial additive. Fatty acid composition of fresh meat samples and heat treated meat were determined by GC-FID. Meat was roasted in oven at the temperature of 80 850C until the temperature in the centre reached 690C (about 1 hour). STATISTICA software, version 10 was used for performing ANOVA and Fishers comparison of means.

Samples from the experimental group fed with linseed enriched diet showed significantly higher ($p < 0.01$ and $p = 0.01$, respectively) content of both ω-3 (8.25% vs. 1.33%) and ω-6 fatty acids (25.68% vs. 20.68%) in all tissues, thus making it better for a human consumption from a health perspective. Heat treatment significantly decreased ($p < 0.05$) content of stearic and linoleic acid in control tissue samples, but decrease was insignificant ($p > 0.05$) in samples from experimental group.

In conclusion, diet enriched with linseed had a beneficial effect on the majority of monitored parameters in the study.

ENRICHMENT OF GLUTEN-FREE EXTRUDATES WITH FLAXSEED

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The European market of functional snack and breakfast cereals is growing. Especially gluten-free foods that are often of low nutritive value need to be enriched. The aim of this study was to develop a gluten-free extruded snack product from corn meal and rice flour enriched by flaxseed as naturally rich source of lignans and omega-3 fatty acids.
Ground flaxseed was added in amounts of 3, 5 and 7 g/100 g of corn meal and rice flour mixture (1:1). Material was extruded by twin-screw co-rotating extruder. Physical and chemical properties of extrudates were determined by standard methods. Total phenolics were determined by Folin-Ciocalteu method and antioxidant capacity evaluated using DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid)) assays. Lignans were quantified by gas chromatography-electron capture detection.
Any enrichment with flaxseed resulted in a significant decrease of index of expansion and increased bulk density. The correlation coefficient between the flaxseed amount and water absorption index of extrudates was positive, whereas with water solubility index was negative. The content of protein, total fibre, and unsaturated, saturated and omega-3 fats significantly positively correlated to the flaxseed amount. The average energy value was 379kcal/100g, and only slightly increased upon adding flaxseed. Fibre content of samples with 5 and 7% of flaxseed was higher than 3g/100g. Depending on the flaxseed content, 23-39g of enriched extrudates would satisfy daily requirements of adults for omega-3 fatty acids, while saturated fats were lower than 1g/100g. Further, content of lignans and total phenolics significantly increased by more than 45%. However, the antioxidant capacity remained similar as in non-enriched sample.
In conclusion, the addition of ground flaxseed in amount of 5% can be recommended for the enrichment of gluten-free snack or breakfast cereal. Such product could be labelled as a source of fibre and high in omega-3 fatty acids.

EFFECT OF TURKISH COFFEE, YERBA MATE TEA AND SUMAC (RHUS CORIARA) ON THE POSTPRANDIAL GLYCEMIC RESPONSE TO MANKOUCHEH, A TRADITIONAL BREAKFAST DISH IN LEBANON

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Introduction:
Several non-carbohydrate dietary components, including caffeine and polyphenolic compounds present in some beverages or plant-based ingredients, can influence postprandial glycemia and glycemic control. Understanding their effects is important in preventing and managing glucose metabolic abnormalities. This study aimed to evaluate the effect of three typical constituents of the Lebanese diet (Turkish coffee, Yerba mate tea, Sumac spice) on the postprandial glycemic response to Mankoucheh (a traditional starch-based breakfast) and to determine the glycemic index (GI) of this food.

Materials and methods:
Twelve normoglycemic healthy subjects consumed on separate days, in randomized order, the following test-meals: Mankoucheh prepared without sumac (control-meal, M); Mankoucheh prepared with Sumac (M+S, traditional recipe); Mankoucheh served with unsweetened Turkish coffee (M+T) or Yerba mate tea (M+Y). Each constituent was tested at a dose usually consumed and its double. Each meal contained 50g available carbohydrates and a standard volume of water. Capillary blood glucose was measured at fast and postprandially (15, 30, 45, 60, 90, 120min). The GI of Mankoucheh was determined using FAO/WHO standard protocol with a solution of glucose as reference.

Results and conclusions:
The consumption of S, T or Y with M did not significantly modify the glycemic responses, at any time-point, compared to the control-meal ($p>0.05$). Incremental areas under the glycemic response curves did not differ significantly but M+Y presented the highest mean and variability. The GI of Mankoucheh (58±5, 61±6, 61±5, mean±SEM) was not significantly affected by the content of Sumac. We conclude that S, T and Y, at customary, relatively low doses, do not significantly affect the postprandial glycemic response to Mankoucheh and that this food, in its traditional recipe, has a medium GI. More studies are required to test the glycemic effects of S, T and Y, at higher doses or in extract forms enriched in bioactive components.

MINERAL NUTRIENTS AND TOXIC ELEMENTS IN EDIBLE PARTS OF CLEOME GYNANDRA L. FROM BURKINA FASO AND EFFECT OF TRADITIONAL COOKING

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Introduction:
A number of wild or locally cultivated food plants, including Cleome gynandra L., remain incompletely characterized. This can hinder their use for nutrition and food security, as well as the recognition and conservation of their genetic diversity. Cleome leaves can be a rich source of micronutrients but there are no reports specific to the varieties occurring in Burkina Faso, West Africa, and consumed mostly during times of food scarcity. This study aimed to determine the content of mineral nutrients and some toxic elements in edible parts of C. gynandra from this country and to assess the effect of traditional cooking on mineral content.

Materials and methods:
Samples of fresh C. gynandra (locally known as 'Kinebdo') were purchased from the Zogona market in Ouagadougou in March. They were brought quickly to the laboratory and washed with distilled water. Leaves and stems were separated and analyzed as fresh samples or after cooking in boiling distilled water for up to 90min. Samples were dried before further analyses. The determination of 12 mineral nutrients and 3 toxic elements was made by inductively coupled plasma-atomic emission spectroscopy (ICP-AES) after sample preparation in a microwave system.

Results and conclusions:
The greatest concentrations of macro- and micro-minerals were found in leave samples, except for K which was higher in the stems. Fresh leave samples had relatively high concentrations of P, Mg, K and Ca (80-440mg/100g) and moderate amounts of Cu, Mn, Zn and Fe (0.1-1.6mg/100g). The levels of Cd, Hg and Pb (leaves and stems) were acceptable for human consumption. Boiling reduced the mineral contents, with losses after 90min ranging from 30-70%. This study showed that Kinebdo has a high mineral nutrient density. The promotion of this underutilized food plant should include information about the methods that preserve nutritional quality in the supply chain, including household.

ANTIOXIDANT POTENTIAL OF DIFFERENT GENOTYPES OF BASIL (*OCIMUM* SPP.) GROWN IN SERBIA

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Basil (Ocimum spp. L., family Lamiaceae) has been grown traditionally in Serbia as a decorative, medicinal, seasoning and ritual herb. With Orthodox people it has a religious and ritual meaning, and in India and Pakistan basil is a herb dedicated to Goddess Tulsa. Secondary metabolytes from Ocimum species possess an exceptional biological activity and have: bactericide, fungicide, repellent, antiinflammatory, antioxidative, antidiarrheic, chemopreventive and radioprotective effect.

One part of the multidisciplinary research was examination of the antioxidant potential of different genotypes of Basil in Serbia according to their anti-radical capacity (Free Scavenging Capacity - RSC).The object of examination were these genotypes: Genovese, Lattuga, Holanđanin, Fino verde, Compact, Lime, Cinnamon, Siam queen, Blu spice, Purple ruffles, Purple opal, Osmin and Holy red.

There are few methods for measuring anti-radical capacity.Common for them is spectrophotometric measuring of stable free radicals like $ABTS^{\cdot+}$ (2,2'-azino-bis(3-ethylbenzthiazoline-6-sulphonic)), $DPPH^{\cdot}$(2,2-diphenyl-1-picrylhydrazyl) or some other colored radicals. These method are good for preliminary Examination of The antioxidant potential because for a short time is possible to analise great number of samples and high level of method sensitivity provide detection of antioxidants in low concentrations.In this experiment we used method with DPPH as a stable free-radical form who reacted directly with examine herbal extracts or compounds. Methanol is used as a control and positive control was Trolox (water soluble analog of α-tocopherol) and ascorbic acid. IC_{50} values (mg/ml) are obtained by linear regression and represent the concentration of a sample that is required for 50% inhibition activity of DPPH radical. The results of examination these genotypes indicate that the highest antioxidant potential (IC_{50}=0,14 mg/ml) has genotype Purple opal

Key words: antioxidant potential, anti-radical capacity, basil, DPPH, genotype, Serbia

INFLUENCE OF ORIGANUM HERACLEOTICUM L. ESSENTIAL OIL ON REDUCTION OF STAPHYLOCOCCUS AUREUS USING BROTH MODEL MEDIA

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Staphylococcus aureus is considered the third most important cause of disease in the world among the reported foodborne illnesses. Pathogenesis of S. aureus depends on the ability of the strain to survive, multiply under a variety of conditions and produce various extracellular compounds. This study was undertaken in order to investigate the effectiveness of the Origanum heracleoticum L. essential oil on growth inhibition and survival of S. aureus isolated from food using broth model media and ability of essential oil to reduce coagulase activity.
Cell viability assays were carried out with exposure of S. aureus to various concentration of the O. heracleoticum L. essential oil (1.0, 0.5, 0.3, and 0.1 µL/mL) in time intervals 15, 40, 60, 120, 240 min and 24h.
The results showed that O. heracleoticum L. essential oil after only 15 min at 1 µL/mL completely inhibited the growth of S. aureus. Lower concentrations of essential oil (0.5, 0.3 and 0.1 µL/mL) inhibited the cell viability of S. aureus. After 1.5h, 1 and 0.5 µL/mL of essential oil suppressed physiological attributes of the tested S. aureus strains - coagulase activity. After 24h, tested essential oil at 0.3 µL/mL suppressed coagulase activity.
The oil interfered on the coagulase activity in a dose-dependent manner. O. heracleoticum essential oil could be a novel antimicrobial with capability to suppress some physiological characteristics, in addition to inhibit the growth and survival of pathogen bacteria in foods, particularly S. aureus.

DETERMINATION OF INFLUENCE OF EXTRACTION PARAMETERS ON ANTIOXIDANT PROPERTIES OF MANDARIN PEEL EXTRACTS

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Introduction:
Citrus peels are a potential source of natural flavanones such as hesperidin, naringin, eriocitrin, etc. Because of their pharmacological activity and antioxidant properties, they are very interesting for pharmaceutical and food industry. In the present work, the influences of extraction parameters on the antioxidant properties of mandarin peel extracts were studied.

Methods and Materials:
By Taguchi experimental design four extraction parameters of conventional solvent extraction were tested: extraction temperature, extraction time, material to solvent ratio and number of stages. Antioxidant properties of mandarin extracts were determined by three different methods: radical scavenging activity against 2,2-diphenyl-1-picrylhydrazyl hydrate (DPPH) and Antioxidant Capacity of Lipid soluble (ACL) and Water soluble compounds (ACW), which were determined by PHOTOCHEM (Analytik Jena AG, Germany). The influence of extraction parameters on antioxidant properties were evaluated by ANOVA method. The composition and the content of flavonoids in obtained extract were determined by HPLC method.

Results and conclusion:
Using Taguchi experimental design four extraction parameters at three levels were tested. The highest antioxidant properties were determined for mandarin extract obtained at extraction conditions: temperature 60 °C, extraction time 90 min, material to solvent ratio 1:50 g/mL and three stages of extraction. In the obtained extracts three flavanones were identified mainly hesperidin and narirutin and traces of didymin.

PGSSTM FORMULATION AND CHARACTERIZATION OF YELLOW PIGMENT EXTRACT FROM CURCUMA

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Introduction:
One of the newest trends in food science and technology is functional food. Curcumin is a yellow pigment of turmeric. It has been used primarily as a food colorant. Curcumin is a natural polyphenolic compound with anti-oxidation, anti-inflammation, and anti-cancer properties. The aim of this study was to formulate powdereous products from curcuma and test its antioxidant activity.

Materials and methods:
Curcumin extract was purchased from Etol (Celje, Slovenia). In the first step the 10 % of curcumin extract was further formulated with various carriers using supercritical fluid technology, namely Particles from Gas Saturated Solution technique (PGSSTM). The PGSSTM formulation was carried out using supercritical carbon dioxide, which results in an organic solvent-free powderous product. DPPH radical-scavenging activity of the curcuma extract was measured with the stable 2,2-diphenyl-1-picrylhydrazyl (DPPH, Sigma Aldrich, Slovenia) free radical. The reduction capability (on the DPPH radical) is determined by the decrease in its absorbance at its absorption maximum at 515 nm that is induced by antioxidant. Extract solutions were prepared by dissolving 0.01 g of micronized powder in 10 ml of methanol. The solution of DPPH• in methanol was prepared daily, before UV measurements. 3 mL of this solution were mixed with 77 µl extract solution in the flask. The samples were kept in the dark for 15 min at room temperature and then absorbance was measured at 515 nm.

Results and conclusions:
The obtained curcuma products are homogenously coloured fine free-flowing powders with colours from light yellow to orange. The micronized powders showed potent DPPH radical -scavenging activities in range between 0.26 to 14.46 % and are applicable as colorants in food or pharmaceutical industry.

BUCKWHEAT AND QUINOA SEEDS AS SUPPLEMENTS IN WHEAT BREAD PRODUCTION

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Abstract. The aim of this work was to compare the nutritional characteristics of wheat bread and the bread produced of wheat flour supplemented with the seeds of quinoa and buckwheat. Bread making properties of these blends were analyzed in order to provide their ability to make moulded bread. Quinoa seeds (Chenopodium quinoa Will.) and buckwheat seeds were produced in the vicinity of Belgrade. The addition of pseudocereal seeds, at levels of 30% and 40%, and a selected technological process, which includes hydrothermal preparation of supplements, produced a significant effect on nutritive value of the breads. In comparison with control wheat bread, the increase of protein and crude fiber content, for 4.5% and 100% in 30% supplemented breads, were registered. Incorporation of 40% of investigated seeds, increased the proteine content for 6% and cellulose for 62%. With regard to the starch, oil and ash content, there were no significant differences. Seed supplemented breads were nutritionally superior to the wheat bread. The chemical composition of the selected seeds is also included.

The results showed that the blends containing 30% and 40% of selected seeds expressed high potential in production of moulded bread. The applied technological procedure with well blended combination of supplements resulted in a good volume of the bread and excellent sensory properties of the aroma-odor and taste.

Key words: quinoa, buckwheat, bread functional food

CHANGES IN PURKINJE CELLS OF CEREBELLUM IN ACRILAMIDE INTOXICATED RATS

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As recent discoveries reveal an amount acrylamide (AA) in cooked amylum foods, the toxicity of AA have received much attention. In this study the effects of AA intoxication on the Purkinje cells of cerebellum has been evaluated by histological analysis. The experiment was carried out on three groups of peripubertal Wistar rats. First and second group was gavaged with AA at dose of 25 mg/kg and 50 mg/kg, respectively, five days per week, for 3 weeks. Third group was control and received equivalent volume of distillated water by gavage. According ours results the number of abnormal Purkinje cells in form of degenerated and picnotic cells increased and also, change of arrangement and loss of these cells from ganglionar layer were noticed in the cerebellum of rats in the both AA-treated groups, under light microscope. As the only efferent neurons in the cerebellum, Purkinje cells are associated with movement coordination and regulation of body balance. In our study, no change in the movement of the rats in the 25 mg/kg group was observed, while rats in the 50 mg/kg group exhibited obvious hind limb weakness, ataxia, and inability to support body weight. Therefore, AA-induced ataxia is probably through damage of the Purkinje cells, but the sceletal muscle weakness migt be relevant to the peripheral neurophaty indused by AA. Our results support findings that AA intoxication might be associated with dose-independent Purkinje cell injury and with dose-dependent progressive nerve terminal degeneration.

THE CONTENT AND RADICAL SCAVENGING CAPACITY OF PHENOLIC COMPOUNDS FROM BLACK RADISH ROOTS OF VARIOUS SIZES

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Phenolic compounds are product of secondary metabolism of plants and have free radical scavenging abilities, antimutagenic and anticancerogenic activities. This is reason why there are the increasing interests for phenolics compounds in food today. In this paper content of phenolic compounds from black radish (Raphanus sativus L. var niger) roots of different size were examined. Black radish grown in Serbia, with the same period of development, grouped by size into three groups: (R1) with mass of 350±15 g; (R2): 100±10 g and (R3): 35±5 g, were used. The roots were cut in cube shape (1.5 x 1.5 x 1.5 cm), dried at 45 oC during 6 h, left at room temperature for 1 h, and milled to average particle size of 0.5 mm. Plant extracts were prepared by using 80% (v/v) ethanol and total phenolics content was determined by spectrometric method on a standard curve (PC = (A280-0.1083)/4.89x10-4 in μmol chlorogenic acid/per dm3 of extract). The free radical scavenging abilities was determined by DPPH radical method measuring the Ab value at 518 nm on a VARIAN UV–Vis Cary-100 spectrophotometer. The phenolics content was in range 42.9 (R1) to 19.7 (R3) μmol chlorogenic acid per g of absolute dried plant material, i.e. 443.7 to 208.6 μmol chlorogenic acid per g of dry extract. The radical scavenging capacity ranged from 88.3 (R1) to 55.6% (R3) and the EC50 values were from 1.59 to 2.24 mg/ml. The phenolic compounds content and radical scavenging capacity depended on root size in such a way that bigger root means higher content of phenolic compounds and higher scavenging capacity. By statistical analysis, there was a positive correlation between the phenolic compound content and radical scavenging capacity and Euclidean linkages distances results showed higher similarity between R2 and R3 sample.

EXTRACTION OF CAFFEINE AND CHLOROGENIC ACID FROM GREEN COFFEE BEANS AND GUARANA SEEDS

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Introduction:
The influence of operating parameters on extraction of caffeine and chlorogenic acid from Green coffee beans and Guarana seeds was studied. Extractions were performed using two different processes, conventional extraction with organic solvents (water, methanol) and supercritical fluid extraction (SFE) with carbon dioxide.

Methods and materials:
Conventional extraction was performed with maceration at temperature 20 °C and at solvent boiling temperature. SFE was performed with supercritical carbon dioxide on a semi continuous flow apparatus at pressures 200 and 300 bar, and temperatures of 40, 60 and 80 °C. The raw material, residual material and the extracts were analysed on caffeine and chlorogenic acid content using HPLC method.

Results:
With conventional extraction both, caffeine and chlorogenic acid, were concentrated in the extract while by SFE with CO2, the caffeine was concentrated in extract and chlorogenic acid was concentrated in the residual material. The highest total extraction yield in case of Green coffee beans was obtained at 300 bar and 80 °C and it was 13.8 % and in case of Gurana it was 3.63 %. The extraction efficiency of caffeine from Green coffee beans was the highest at 200 bar and 60 °C where the extract contained 14.59 wt. % of caffeine and decreases with higher pressure. The extraction efficiency of caffeine from Guarana seeds was the highest at 300 bar and 60°C where the extract contained 31.75 wt.% of caffeine. The results were compared with those obtained using conventional extraction with methanol where the efficiency of caffeine was 8.13 wt.% and 21.68 wt.% for Green coffee and Guarana, respectively. The caffeine was concentrated in supercritical extract, while the chlorogenic acid remained in the residual material.

Conclusions:
It can be concluded, that separation of caffeine from chlorogenic acid can be performed using SFE. In comparison with conventional extraction, where both compounds were extracted, only caffeine was extracted with CO2, while chlorogenic acid remains in the residual.

EFFECT OF DRYING ON THE PHENOLIC COMPOUNDS OF SEA BUCKTHORN LEAVES

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Sea buckthorn leaves has attracted increasing interest during the past few years. It is explained by their remarkable antioxidant potential due to the high polyphenol content. Leaves of this plant mainly were used in a folk medicine and as animal feed but they could be applied as natural food additives in food processing as well. Therefore the drying of leaves is necessary for making further sea buckthorn leaf products. Decrease of moisture content not only preserve seasonal plants and extend their shelf life but also reduce packaging requirements, lower costs for storage and shipping. Although drying is the most traditional method for preserving, it can significantly affect the quality and quantity of antioxidant substances.

The aim of the present work was to evaluate the effect of different drying methods on the chemical composition of sea buckthorn leaves to find the most effective approach for achieving the dry material with high nutritional value.

All experiments were carried out at Latvia State Institute of Fruit-Growing in Department of Experimental Fruit and Berry Processing. The research object was sea buckthorn leaves of both genders harvested in summer and autumn. Freeze drying (-50 ± 1 ºC, 0.065 μBar), microwave-vacuum drying (18.7 W g-1) and conventional hot air drying (+40 ± 2 ºC) was performed. All samples were dried to reach a moisture content of 8% and less. Total phenolic and total flavonoid content of leaf ethanolic extracts was analyzed.

Results indicated that there are differences between drying methods and leaf collection time in the content of phenolic compounds.

Further research of particular phenols and other constituents is needed to define the most appropriate method for sea buckthorn leaf drying.

DIETARY FIBRE AS BIOACTIVE COMPOUNDS

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In daily diet, dietary fibre frequently become an integral part. Epidemiological studies and experience put the amount of dietary fiber in inversely relation with type 2 diabetes, obesity, cancer and cardiovascular disease. All fractions of dietary fiber does not act identically and do not have the same effect. The aim of this study was to verify that foods of our region, contain the optimal amount and ratio of certain fractions of dietary fiber.
Therefore, this work was made to see what is the content of dietary fiber in foods that are used every day, and then the content and the ratio of beta-glucan and fructan as components of daily diet.
Fiber, which is related to the first statement from the Food and Drug Administration is beta-glucan which refers to the impact of dietary fiber on blood cholesterol. Also it take place in the activation of the immune system, decrease postprandial glucose and insulin responses.
Fructan has a role in reducing colorectal cell proliferation, increasing absorption of calcium and leads to cholesterol reductions.
In the thirty samples, thermally treated and untreated (legumes, grains and breakfast cereals), is determined content of total dietary fiber, beta-glucans, fructan, and energy value. The standard AOAC methods are applied. The results show a negative correlation between beta-glucan and fructan, also an important fact that legumes does not contain beta-glucan. It was noted that during the cooking, the total content of dietary fiber, beta-glucans and fructan was reduced.
Foods that are consumed daily should contain the recommended amounts of dietary fiber, as well as the amounts of beta-glucan and fructan that are useful for human health. The practice of giving good results should not be changed. Therefore, the results have great importance in formulating the proper nutrition of people in weight-reduction diets, also in healthy population.

DEVELOPMENT OF A QUINCE SNACK ENRICHED WITH INULIN AND STEVIA

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In recent years there is an increased demand for food enriched with physiologically active components. Quinces were selected as a raw material in this study. They belong to the same family of fruits such as pears and apples. The quinces that have been examined had around 20% dry mass, 1.7 % fibers, more than 6 mg vitamin C per 100 g fruit, pectin, antioxidants, and other components. Because of the astringent, tart flavor, quinces are commonly processed into marmalades and jellies, with addition of sucrose to improve their taste. Therefore the purpose of this investigation was to develop a new quince snack product which besides functional properties, will also have improved taste due to the infusion of the alternative sweetener, stevia. This study was carried out to evaluate selected quality attributes of a quince snack enriched with prebiotic (inulin) and alternative sweetener (stevia) accompanied with an antibrowning agent by the use of vacuum impregnation. The porosity of the quince was 0.35 cm3/cm3, confirming that its tissue was highly suitable for vacuum infusion. Texture profile analysis was measured on texture analyzer using the compression test that simulates the mastification process. The L*, a* and b* color values were recorded and used to calculate the browning index in all processing steps, in order to obtain the kinetics of the browning reaction. Due to the quince's susceptibility to intensive browning, the kinetics of the browning reaction was necessary to optimize the concentration of the antibrowning agent.

QUANTITATIVE DETERMINATION OF TOTAL ANTHOCYANINS AND FLAVONOIDS IN NATURAL PRODUCTS OBTAINED FROM GRAPES AND MALT

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Wines and beers are a rich source of different compounds that show beneficial effects to the human body and their consummation in reasonable amounts can improve health. Among them, the most important are phenolic compounds (nonflavonoids, flavonoids, tannins), which possess antioxidative properties and could be responsible for prevention of many diseases. The aim of this study was to determine the content of total flavonoids, monomeric and total anthocyanins in samples of wines from different grape varieties produced in Serbia and beers produced with the addition of grapes.
Analysis was performed on 14 samples including 6 red wines made from grape varieties from Serbia, one regular beer, and 7 beer samples enriched with different grape varieties and percentage of grape. Monomeric and total anthocyanins were determined spectrofotometrically by the pH differential method, while the total flavonoid content was determined according to the colorimetric Folin-Ciocalteu method after precipitation with formaldehyde.
Anthocyanins were quantified in all analyzed samples, except in regular beer. The highest values were found in wines made from variety Prokupac (270,80 mg/l and 388,79 mg/l malvidine-3-glucoside equivalents, for monomeric and total anthocyanins, respectively). Flavonoids were present in all analyzed samples. Wine samples showed higher content of flavonoids (the highest in Merlot wine) than beer and drinks from beer and grapes. The content of anthocyanins and flavonoids in beer samples enriched with grapes increased with the increase of added amount of grapes. Obtained results showed that relatively high concentrations of flavonoids and anthocyanins are present in wines produced in Serbia. Also, addition of grape in beer increased content of these beneficial phenolic compounds, which can be important factor for quality of a new developed product.

ANTIOXIDANT ACTIVITY OF THE SPECIES AGROCYBE AEGERITA IN RELATION TO TOTAL PHENOLIC AND FLAVONOID CONTENT

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Agrocybe aegerita (Brig.) Sing., also called Agrocybe cylindracea or Pholiota aegerita is an edible, medium-size mushroom species broadly distributed in our region mostly on poplar wood. Aiming to discover indigenous fungal species Agrocybe aegerita for its antioxidative activities, crude ethanolic extract from wild-growing lignicolous species originated from Novi Sad (Serbia) was analyzed for FRAP assay, DPPH free radical scavenging capacity (RSC) and total redox potential in relation to total phenolic and total flavonoid content measured colorimetrically by the Folin – Ciocalteu assay. FRAP assay, RSC and total redox potential of the extracts were in direct positive correlation with total phenol content. A. aegerita showed very good RSC activity reaching EC50≈28.88μg/ml in DPPH assay, the total phenol content (21.58±5.70 mg gallic acid equivalents/g of dry extract) and total flavonoid content (0.84±0.16 mg equivalent of quercetine/g d.w) and the FRAP value (13.47±2.64 mg ascorbic acid eq. mg/g dried extract).
The HPLC determination showed that analyzed species contain caffeic, gallic, protocatechic and vanilic phenolic acids. Demonstrated results suggest that analyzed fungus contain phenolics that directly contribute to expressed activities and could be valuable source of natural antioxidants in nutrition.

Key words: antioxidative activity, extracts, radical scavenging capacity, phenolic acid, Agrocybe aegerita, total redox potential

VALUE-ADDED SOYBEAN PRODUCTS AS A RESULT OF ORGANIC PRODUCTION METHODS

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According to the preliminary analysis of development indicators, food production in Serbia has been identified as one of top national priorities. The food industry represents one of the leading industries in our country, and it is developed most in Vojvodina, where it participates with 36.3% in the industrial structure (www.vojvodina.gov.rs). Serbia's food industry is comprised mostly of small and medium-sized businesses. As integral parts of all market economies, small and medium-sized businesses are important factors in economic development in all countries. These small and medium-sized businesses produce considerable amounts of food, so it is clear that food safety of their products affects the integrity of the whole food supply chain. One member of this group of businesses is the company “Galus d.o.o.“, based in Pancevo, which has a business unit for the production of vegetarian food products “Soya Food“, located in the village Lokve. The main activity of “Soya Food“ business unit is the production and processing of soybeans and vegetarian food products. In our country, soybean is grown on an average of around 140,000 hectares, with only a slight portion being produced by organic production methods.
Starting with 2011, the company “Galus d.o.o.“ has introduced the organic production standard in its total production area, thereby establishing the prerequisites for the produced raw materials and subsequent finished products to carry the label “organic soybean products“. This has created favourable conditions for reaping financial and ecological benefits from organic production, and added value of the existing and some new soybean products. This paper will examine in more detail the structure of this company, production and processing of organic products, and production methods regulated by law.

SCREENING OF ANTIBACTERIAL ACTIVITY OF CELERY AND PARSLEY FRUIT EXTRACTS OBTAINED BY SUPERCRITICAL FLUID EXTRACTION

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Implementation of natural food additives is one of the most important trends in food industry today. Application of additives produced by synthetic chemical processes into food products has been severely limited or even completely banned for some food categories. On the other hand, many naturally occurring compounds found in plants have been shown to possess considerable antibacterial properties.
In this work, extracts obtained by supercritical carbon dioxide from celery and parsley fruits were investigated as potential antibacterial agents against selected foodborne pathogens belonging to Bacillus, Staphylococcus and Listeria species. Bacterial strains were isolated from food, victuals of animal origin and clinical specimens. The extracts were isolated at the temperature of 40oC and pressures of 10 MPa and 30 MPa. Bacillus species were shown to be the most sensitive to the presence of investigated extracts with MIC values from 80 to 160 µg/ml. Generally, celery extracts expressed stronger antibacterial activity against tested Staphylococcus and Listeria strains showing moderate activity with MIC values from 320 – 640 µg/ml.

OLIGOSACCHARIDES IN LEGUME GRAINS

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Oligosaccharides are functional food ingredients that have great potential to improve the quality of food. Oligosaccharides have been associated with many health-promoting functions, which had been identified in many clinical studies, such as promoting the growth of Bifidobacterium in human intestine and balance of intestinal bacteria, modulating the immune response, inhibition of cancer and tumour and stimulation of mineral absorption. As natural components, raffinose family oligosaccharides can be found in soybean and other legume grains.
Oligosaccharides from legume species which were produced in few regions of Croatia were investigated. Eight traditionally cultivated legumes were analysed: common bean (Phaseolus vulgaris L.), faba bean (Vicia faba L.), lentil (Lens culinaris Medic.), white lupin (Lupinus albus), chickpeas (Cicer arietinum L.) cowpea (Vigna unguiculata L.), soybean (Glycine max (L.) Merr.) and grass pea (Lathyrus sativus). The soluble saccharides (monosaccharides, sucrose, raffinose and stachyose) were extracted with water and then separated by high performance liquid chromatography. Saccharides were identified by their retention time and quantified by peak area using external standard procedure.
The results showed that the total saccharides content ranged from 2,24% to 8,10%, and oligosaccharides represented 36,38% to 69,29% of the total saccharides in investigated dry legume seeds. Stachyose was the main oligosaccharide in all grains, except for chickpeas, in which the main oligosaccharide was raffinose. Different amounts of sucrose and small amount of glucose, galactose and fructose were present in all legume grains. Significant difference in total saccharides, raffinose and stachyose content was found between investigated legume species. According to obtained results, the investigated legumes can be considered a good source of oligosaccharides.

THE INFLUENCE OF DIET ON THE CONTENT OF ROUTINE PLANT IN BUCKWHEAT LEAVES

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Examined the content of the methanol extract routines MeOH dried buckwheat leaves that were collected from several sites in the full flowering of plants. Extracts were prepared by heating with return cooler with the addition of methanol p.a. After extraction was performed filtration of extracts, prepared in such extracts was determined by the content of routine HPLC analysis method kvantotativne using external standards (rutin) over the calibration curve. Fagopyri herba drug is described in European Pharmacopoeia VI as well as routine analytical procedure content (Ph.Eur.6.0).
Routine biennial examination content in leaves of buckwheat and collection of samples included four sites - Valjevo, Pancevo, Kucevo (Velika Plana) and Surduk. For the purposes of this study was selected local variety of buckwheat dove was grown in the system optimal mineral nutrition of plants with the addition of NPK nutrients hydrogel and zeolite to bind water in the surface layers of soil and prevent its evaporation loss. Routine analysis of the contents in the leaves were done using liquid chromatography on HPLC apparatus Hewlwt Packard, HP 1090 LC with Dioden-Array detector. The results showed that the diet of plants and significantly contributed to the site of synthesis and accumulation in leaves of routine. Average content in leaves of routines was 3.23%. In the variant without the use of NPK mineral fertilizers in both years this value was significantly lower than in the variants of the diet of plants and amounted to 2.87%. Mineral nutrition of plants routines content in leaves increased significantly (3.06%). Funds for water binding hydrogel and zeolite significantly affect the synthesis routine. Increasing the amount of routine in these variants compared to compared to the variant with NPK mineral nutrients was about 10%. The content is varied routines and locations. At least it was routine in the locality lisotvima buckwheat Surduk 2.78%, and most of the experiments in Kucevo and Petrovac, 3.71%. Isolated extraction procedure, routine use in the pharmaceutical and food industries.

Keywords: buckwheat leaves, rutin, HPLC, Food plant, the site.

OPTIMISATION AND APPLICATION OF ANTIHEMOLYTIC ASSAY ON FAGOPYRI HERBA EXTRACTS

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Fagopyri herba, a herbal drug derived from common buckwheat (Fagopyrum esculentum Moench) is a very rich source of various phenolic compounds which are known as potential antioxidants. The main active compound is a flavonol glycoside rutin. The aim of this study was to investigate antihemolytic activity of the Fagopyri herba extracts as a parameter which indicates their antioxidant potential in biological systems. Antihemolytic activity assay measures the ability of a tested extract to inhibit hemolysis of erythrocytes in buffer solution caused by oxidative damage of their cell membrane. Since this test is highly dependent on various parameters (cell suspension concentration, species from which the blood was taken, concentration of reagents, type of extract), they were optimized for testing the investigated water and ethanol Fagopyri herba extracts. Optimal concentration of hydrogen peroxide solution was found to be 0.0625% (v/v) while 2 μM of sodium azide was added to the erythrocyte suspension to inhibit catalase enzyme. Ethanolic extract showed lower IC50 value (3.46±0.185 mg/mL) in comparison to water extract (42.2±7.27 mg/mL), which is in accordance with their rutin content determined by high performance liquid chromatography.

Key words: Fagopyri herba, antihemolytic assay, method optimisation

EVALUATION OF PROTEIN AND LIPID CONTENT AND DETERMINATION OF FATTY ACID PROFILE IN SELECTED SPECIES OF CYANOBACTERIA

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Microalgal biomass is a rich source of some nutrients, such as n-3 and n-6 fatty acids, β-carotene, proteins, minerals, and other essential nutrients, which could potentially be used as functional food ingredients. In this work, the fatty acid composition and protein content of Spirulina Platensis and several non-toxic strains of Nostoc spp. originating from Serbia was investigated. Analyses of fatty acid methyl esters (FAMES) were carried out by gas ghromatography coupled with flame ionization detection (GC-FID), and the content of crude protein was determined by Dumas combustion method. The results show that 16 carbon (16:0 and 16:1 types) and 18 carbon (18:1, 18:2 and 18:3 types) chain fatty acids represent the most significant constituents of these species. Content of the relatively rare γ-linoleic acid (GLA, 18:3n-6) was highest in the Spirulina samples, while it is also shown to be present in the Nostoc species, depending on the chemical composition of the growth medium used. All of the investigated species showed very high crude protein content in the dry algal biomass (ranging from 42.8% to 76.5%). It can be concluded that the investigated species of cyanobacteria represent potential rich sources of protein and commercially attractive fatty acids and, since they are shown to be non-toxic, they can be considered as components of various functional food products.

QUALITY AND ANTIOXIDANT CAPACITY OF NOVEL BEVERAGES BASED ON LEMON AND EXOTIC BERRIES

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INTRODUCTION

Nowadays it is widely accepted the fact that diets rich in fruits and vegetables have a positive impact on health and wellbeing. In this sense, wild fruits and so called 'superberries' are interesting and novel sources of phenolic antioxidants, especially anthocyanins. Following previous research on lemon juice enriched with berries, the aim of this work was to perform a deeper phytochemical characterization of lemon juice, maqui, açai and blackthorn berries, to design a new blend made of lemon juice enriched with berry fruit concentrates, and to determine their antioxidant capacity by different radical scavenging methods.

METHODS AND MATERIALS

Lyophilized berries were added to lemon juice and citric acid control in a 5% (w/v) proportion. Freshly-prepared lemon juice was also assayed as control. A deep characterization of coloured and non-coloured flavonoids of all the fruits was performed by HPLC-DAD-ESI-MSn. The antioxidant capacity was assessed against different reactive species: DPPH•, superoxide ($O_2^{\bullet-}$), and hydroxyl radicals (•OH) and hypochlorous acid (HOCl).

RESULTS AND CONCLUSION

The metabolite profiling of the fruit concentrates revealed a wide range of bioactive phenolics: anthocyanins, flavonols, chlorogenic acid and ellagic acid derivatives. Lemon juice displayed flavones, flavanones, flavonols, and hydroxycinnamic acids. Concerning DPPH•, the maqui sample displayed the strongest activity. All the samples, controls, and beverages showed a similar strong effect against $O_2^{\bullet-}$, being the mixture of maqui berries plus lemon juice (LM) the most interesting. Regarding HOCl the activity was of lesser intensity, but again LM was the most active sample. LM and the mixture of açai berries and lemon juice exerted the highest capacity against •OH. Thus, the novel beverage based on lemon juice and maqui berry (LM) is the most interesting blend in terms of antioxidant activities and further bioactivity and bioavailability studies for its health-promoting actions are guaranteed.

ENHANCEMENT OF POMEGRANATE JUICE QUALITY THROUGH THE COMBINATION OF THERMAL TREATMENTS AND BLENDING WITH LEMON JUICE

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INTRODUCTION

Consumer acceptance of healthy food is subordinated to quality and sensory properties. Nevertheless, red fruit juices can display unpleasant brown colour because of thermal treatments and consumers might reject them. As an attempt to solve these browning problems, in pomegranate juices, the effect of two different heat treatments on the phytochemical composition and colour parameters of pure and blended juices was assessed through storage.

METHODS AND MATERIALS

Slightly coloured Mollar de Elche varietal juice was mixed with lemon juice (75%+25%, ML) in order to assess the effect of blending on Mollar de Elche preservation. Mollar de Elche 100% (M100) was kept as control. Juices were heat treated at 65ºC for 30 s (LTLT pasteurization) or 90ºC for 5 s (HTST pasteurization), and stored at 25ºC. Analyses of phytochemicals (individual anthocyanins and vitamin C) were performed by HPLC-DAD. Colour parameters were also recorded.

RESULTS AND CONCLUSION

Blended juices (ML) showed a protective effect on colour even though high falls in anthocyanins were recorded. Vitamin C was kept in blend containing lemon juice (ML) but not in pure pomegranate juices (M100). Heat processing had a remarkable effect on ML as LTLT-treatment preserved the bioactive composition much better than HTST. Overall, blended juices protected juice characteristics in a greater extent than Mollar de Elche juice.

ANTIOXIDANT ACTIVITY OF SUGAR BEET INTERMEDIATE PRODUCTS

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While the nature of antioxidants in sugar cane processing is well documented and understood, little information exists about the antioxidant activity of sugar beet manufacturing products. In this work, besides basic quality parameters, antioxidant activity of A (white) sugar, B (raw) sugar and affined C sugar, obtained from the process of sugar production was tested. As the antioxidant activity of cane brown sugars was connected with the presence of polyphenol compounds and Maillard reaction products, the content of these compounds was measured, as well.

Apart from the highest sucrose content (99.50 °Z), A sugar was characterized with the lowest invert sugar (0.008%/DM) and coloured matter content (54 IJ/DM). However, A sugar showed no antioxidant activity and also it did not contain a detectable amount of plant phenolics. Contrary to this, sugars B and C contained less sucrose (99.22 and 97.6 °Z, respectively) and more coloured matter (329 and 20366 IJ/DM, respectively). Antioxidant activity of C sugar was higher than that of B sugar, which corresponds with higher total phenolic and coloured matter content of C sugar.

Our results indicate that both, plant phenolics and Maillard reaction products can be associated with the antioxidant activity. Despite the fact that colour of the final product presents a key quality measurement in sugar industries, with regard to the antioxidant activity, consumption of brown sugars can be recommended.

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ANTIOXIDANT COMPONENTS AND PROPERTIES OF BUCKWHEAT (*FAGOPYRUM ESCULENTUM* MOENCH) GRAIN FRACTIONS

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Buckwheat (*Fagopyrum esculentum* Moench) is an alternative crop belonging to the *Polygonaceae* family. Phenolic compounds isolated and identified in buckwheat include rutin, orientin, vitexin, quercetin, isovitexin, kaempferol-3-rutinoside, isoorientin, and catechins. In comparison to antioxidant activity of frequently used cereals, buckwheat has been reported to posses higher antioxidant activity, mainly due to high rutin content.
The objective of this work was to determine the main antioxidant compounds and antioxidant activity of buckwheat grain fractions (wholegrain, hull and groat).
Buckwheat grain fractions were extracted with ethanol/water (80/20, v/v). Total phenolic content and DPPH radical scavenging activity of buckwheat grain fractions extracts was determined spectrophotometrically, and results were expressed as gallic acid equivalents (GAE) and IC_{50} values (mg/mL), respectively. Determination of phenolic compounds and tocopherols was performed by HPLC.
Total phenolic content in buckwheat grain fractions ranged from 1.69 mg GAE/g for groat to 2.09 mg GAE/g for hull.
Protocatechuic acid, siringic acid, ferulic acid, sinapic acid, rutin and quercetin were quantified in all tested fractions, whereas vanilic acid was found in wholegrain and hull.
The content of total tocopherols in samples ranged from 9.95 μg/g for hull to 25.8 μg/g for groat.
Hull was superior in scavenging activity on $DPPH^{\bullet}$ in comparison to other two buckwheat fractions and BHT as evidenced by its lower IC_{50} value.
Obtained results can broaden the utilization of buckwheat, especially a share of hull in wholegrain flour production. Bakery products containing wholegrain buckwheat flour may be regarded as health-promoting functional foods.

KEYWORDS: Buckwheat grain fractions; Phenolics; Tocopherols; DPPH radicals

EVALUATION OF BIOACTIVE COMPOUNDS IN SESAME SEEDS FROM DIFFERENT GEOGRAPHIC ORIGINS

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Sesame seed (Sesamum indicum L.) is one of the most important oil crops and contains high amount of bioactive compounds [1]. It is widely grown in Asian and African countries. The seeds are used as a source of vegetable oil, for the production of tahini, salad dressings and bakery products. It contains not only high amount of oil, but also biologically active components such as phenolics, tocopherols and lignans [2]. This study aimed to investigate the variations in bioactive compounds in sesame seeds from different geographic origins.
The seeds were obtained from different countries including Ethiopia, Nigeria, Mozambique, Sudan, Burkina Faso, Uganda, and India. After milling, the seeds were extracted with three solvents (ethanol, water, and ethanol-water). Total polyphenol content (TPC) was determined using the Folin-Ciocalteu colorimetric method. Individual polyphenols and tocopherols were analyzed by HPLC. The total antioxidant capacity was determined by using DPPH method.
The results showed that chemical compositions and bioactive compounds of sesames vary depending on the origin. The seeds showed antioxidant activity in the range of 15.5±0.7 and 26.2±1.7 mmol TEAC/kg. Phenolic compound extraction with either water or ethanol-water (50:50) was more efficient for the recovery of total phenols and TPC values in the ethanol:water extracts of sesame seeds were 5.63±0.25-10.70±0.19 mmol GAE/kg.

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ANTIMICROBIAL AND ANTIOXIDANT AGENTS AS A POTENTIAL SOURCE IN WILD MUSHROOMS

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Mushrooms have been widely used as human food for centuries and have been appreciated for texture and flavour as well as some medicinal and tonic attributes. However, the awareness of mushrooms as being a healthy food and as an important source of biological active substances with medicinal value has only recently emerged. Mushrooms are rich in proteins, fiber, vitamins and minerals, while the content of taf is low. In addition, edible mushrooms usually contain many different bioactive molecules, such as phenolic compounds. The mushrooms played an important role in the treatment of various diseases, including infectious ilnessess and therefore some naturally occurring chemical compounds identified in mushrooms served as models for clinically proven drugs. However, the interest in the use of mushrooms for the development of neutraceuticals and functional ingredients is quite recent. This interest has been boosted by the increased consumer demand for functional foods with beneficial bioactive compounds. In the present study, the antibacterial activity and antioxidant properties of seven wild mushroom extracts (Polyporus schweinitzii, Inonotus hispidus, Tricholoma columbetta, Tricholoma caligatum, Boletus xchrysenteron, Hydnellum ferruginemum, Agaricus bisporus) were tested. The extracts were obyained by using different polarity solvents. The contents of potential antioxidant components and antibacterial properties in these extracts were determined. Among the studied mushrooms species, several seemed to be potentially used as functional food or as source of bioactive compounds, acting as myconeutraceuticals.

EVALUATION OF ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES OF UNDERUTILIZED WILD MUSHROOMS EXTRACTS

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Mushrooms have been widely used as human food for centuries and have been appreciated for texture and flavour as well as for medicinal and tonic attributes. However, the awareness of mushrooms as healthy food and as source of biological active substances with medicinal value has only recently emerged. Mushrooms are rich in proteins, fibers, vitamins and minerals, have low fat content and may contain many different bioactive molecules, such as phenolic compounds. On the other hand, mushrooms played an important role in the treatment of various diseases, including infectious ones and therefore some naturally occurring chemical compounds identified in mushrooms served as models for clinically proven drugs. However, interest in the use of mushrooms for the development of neutraceuticals and functional ingredients is quite recent. This interest has been boosted by the increased consumer demand for natural functional foods with beneficial bioactive compounds. In the pMushrooms have been widely used as human food for centuries and have been appreciated for texture and flavour as well as for medicinal and tonic attributes. However, the awareness of mushrooms as healthy food and as source of biological active substances with medicinal value has only recently emerged. Mushrooms played an important role in the treatment of various diseases, and therefore some naturally occurring chemical compounds identified in mushrooms served as models for clinically proven drugs. However, interest in the use of mushrooms for the development of neutraceuticals and functional ingredients is quite recent. This interest has been boosted by the increased consumer demand for natural functional foods. In the present study, antioxidant and antibacterial properties of 7 underutilized wild mushroom extracts (Polyporus schweinitzii, Inonotus hispidus, Tricholoma columbetta, Tricholoma caligatum, Boletus xchrysenteron, Hydnellum ferruginemum, Agaricus bisporus) were evaluated. Dried mushrooms were sequentially extracted by organic solvents with increasing polarity (cyclohexane, dichloromethane, methanol, water) while the antioxidant and antibacterial activities of extracts were determined respectively by using DPPH, ABTS and FRAP methods and agar diffusion assay. Antioxidant activity of various mushroom extracts was dose-dependent, and in the case of the highest dose (0,1%) of Inonotus hispidus, Phaeolus sweinitzii it exceeded the antioxidant capacity of the standard molecules trolox and ascorbic acid added respectively at a concentration of 0,0125% and 0,0050%. Antimicrobial activity tests showed that Gram-negative bacteria were more sensitive than Gram-positive to mushrooms extracts compounds. Indeed, 16 extracts were active against Pseudomonas aeruginosa, 10 extracts inhibited the growth of Bacillus subtilis and 14 extracts inhibited the yeast Candida albicans while minimal inhibitory concentration of extracts was in the range of 0.1–20 mg/mL. Methanolic extract of Inonotus hispidus and Phaeolus schweinitzii presented the highest antioxidant and antimicrobial activities among the 7 mushrooms understudy.
This study was supported by Research Council of Lithuania and by Midi-Pyrénées Regional Council.

FUNCTIONAL AND SENSORY PROPERTIES OF PASTA ENRICHED WITH LIGHT BUCHWHEAT FLOUR

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Standard wholegrain wheat flour pasta formulation was modified by replacement of wholegrain wheat flour with 20% of light buckwheat flour in order to improve functional properties of pasta. Content of free and bound phenolic compounds in dry and cooked pasta was determined by HPLC/DAD. Sample colour was measured using Minolta Chromameter CR-400. Sensory properties of dry and cooked pasta were evaluated by panelists using a 5-point category scale.
The results have demonstrated a decrease of about 44% in total phenolic compounds after cooking in comparison to dry pasta, while 8.37% of the total phenolic compounds from dry pasta was present in cooking water. Light buckwheat flour substitution led to a decrease of lightness (L*), but did not significantly ($P < 0.05$) affect redness (a*), yellowness (b*) and hue angle (h) values. Scores for sensory properties were between 4.00-4.80 for dry, and 2.70-4.60 for cooked pasta, indicating the satisfactory pasta quality.

BUCKWHEAT ENRICHED WHOLEGRAIN WHEAT PASTA - COOKING PROPERTIES AND MINERAL CONTENT

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Light buckwheat flour was used to substitute 20% of wholegrain wheat flour in formulation of wholegrain wheat flour pasta (tagliatelle).
Rheological test on control dough (wholegrain wheat flour) and dough supplemented with light buckwheat flour (20%) was used to predict the behaviour of dough that influenced the quality of the final product. The rheological parameters of investigated dough were obtained by using Mixolab. Results indicated that substitution of wheat flour with buckwheat flour in the formulation of pasta resulted in minor changes that did not influence the quality of enriched pasta.
Proximate composition, cooking quality and mineral content of buckwheat enriched wholegrain wheat pasta were analysed and compared with those of wholegrain wheat pasta.
Buckwheat enriched wholegrain wheat pasta was characterized with significantly higher ($P < 0.05$) content of P, Mg, K, Zn and Fe, while its Ca content was significantly lower ($P < 0.05$) compared to control pasta.
As a result of mineral leaching during cooking, both types of pasta lost minerals, especially buckwheat enriched pasta, but even after cooking buckwheat enriched pasta was superior in K, Zn and Fe content. The content of calcium increased during cooking in both types of pasta.
The obtained results suggest that light buckwheat flour could be used as an ingredient in functional pasta formulation.

FATTY ACID COMPOSITION OF SEEDS OF HOROZ KARASI AND BÜZGÜLÜ GRAPE CULTIVARS (VITIS VINIFERA L.) GROWN IN TURKEY

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In this study, fatty acid compositions of seeds of Horoz Karası and Büzgülü grape varieties (Vitis Vinifera L.) grown in Konya Province in Turkey were determined by gas chromatography method. It was identified 18 different fatty acids in seeds of the cultivars. The polyunsaturated fatty acid (PUFA) content was found to be more than the monounsaturated fatty acid (MUFA) and saturated fatty acid (SFA) content in the cultivars. Unsaturated fatty acids are the most. Linoleic acid (C18:2) was determined the most dominant fatty acid, 69.79% in Horoz Karası and 61.51% in Büzgülü.

Key Words: Vitis vinifera L., grape seed, fatty acid composition

THE INFLUENCE OF POLYPHENOLS ON GENERATION OF FREE RADICALS AS THE PRECURSORS OF MAILLARD REACTION PRODUCTS

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Thermaly treated foods, like bakery products, contain Maillard reaction products which are proved as the substances with antioxidant properties. There are many literature data stating that Maillard reaction products together with polyphenols as the potent antioxidants contribute to the overall antioxidant capacity of some bakery products. It was found that pyrazine cation radicals are the precursors in formation of Maillard reaction products.
The aim of this work was to investigate the interaction of these radicals with some polyphenols that are frequently contained in ingredients used for bakery production.
The formation of relatively stable free radicals in alkaline reaction mixtures (pH 9.0) of the model systems consist of D(+)-glucose (1.0 M) and structural isomers of aminobutanoic acid (1.0 M) heated at the temperature of 98 °C for 20 minutes has been detected by electron spin resonance (ESR) spectrometry. Based on the analyses of hyperfine structure of ESR spectra of reaction mixtures of model systems, the presence of 1,4-disubstituted pyrazine cation radicals formed at the initial stage of Maillard reaction was found. Different polyphenols (gallic, caffeic, ferulic, chlorogenic acid, and tannic acid) were added in model systems to investigate their influence on the generation of pyrazine cation radicals. Decrease of relative intensities (RI) of ESR spectra signals indicated polyphenols' ability to inhibit the generation of the pyrazine cation radicals. It was found that tannic acid was the most efficient of all investigated polyphenols in inhibiting the formation of free radicals at the initial stage of Maillard reaction followed by gallic, caffeic, chlorogenic and ferulic acid in descending order.
These findings indicate a complex relation between antioxidants and the precursor of Maillard reaction products. Further investigation is needed to reveal the overall contribution of both polyphenol(s) and Maillard reaction products to antioxidant capacity of thermally treated product.

ANTIOXIDANT PROPERTIES OF GENISTEIN AND DAIDZEIN – TWO POTENT SOYA ISOFLAVONES

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Soybean and full-fat soybean products contain approximately 20% of oil and are susceptible to lipid peroxidation, particularly during the storage and distribution of raw material and thermal treatments which are used in full-fat soybean production.

Antioxidant properties of soybean isoflavones (genistein and daidzein) have been investigated in soybean oil model systems by measuring the ability of genistein and daidzein to inhbit the generation of radicals which were stabilized in the presence of spin trap N-tert-butyl-α-phenylnitrone (PBN) and detected in by electron spin resonance (ESR) spectrometry.

In both thermal and catalytic oxidation of soybean oil, the same hyperfine coupling parameters (aN=14.75 G and $aH\beta$=2.80 G) confirmed the generation of PBN-OOL/-OL spin adducts (lipid oxyradicals). The antiradical activity of genistein and daidzein, in the 0.005-0.02% concentration range, was tested by measuring their ability to inhibit the generation of lipid oxyradicals during the thermal and catalytic oxidation of soybean oil.

The antioxidative nature of genistein and daidzein was also tested by using DPPH test and chelating activity on Fe2+ assay. It was found that genistein inhibited the thermal oxidation of soybean oil by decreasing the concentration of lipid oxyradicals, while during the inhibition of catalytic oxidation of soybean oil it acted as a chain-breaking antioxidant and a metal chelator. Daidzein acted as a very weak chain-breaking antioxidant and did not demonstrate chelating activity on Fe2+ ions.

PHYSICAL PROPERTIES OF FUNCTIONAL COFFEE BEVERAGES – INULIN AND OLIGOFRUCTOSE ENRICHMENT

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Coffee is a wide spread commodity nowadays, which millions of people consume daily. The idea of this work was to enhance the nutritional composition of coffee by inulin and oligofructose enrichment. Inulin and oligofructose are known for its prebiotic properties and have many health benefits. Powdered mixture of inulin and oligofructose was added to three most common coffee beverage types: milled coffee, instant coffee and cappuccino. Physical properties of the control samples (without the addition of functional ingredients) and the samples containing the functional ingredients were monitored. Particle size, moisture content, colour, bulk density, cohesion index, powder flow speed dependency profiles and caking profiles were determined in order to get an insight on the changes caused by the addition of the functional powdered ingredient. Results showed that the addition of inulin and oligofructose lowered the cohesion index of the functional mixtures for all three tested coffee preparations. The addition of the functional ingredient also caused a decrease in cake strength in the case of instant and milled coffee. Colour change was visible for all samples based on the calculated ΔE values (ΔE = 4.64 for cappuccino, ΔE = 5.48 for instant coffee and ΔE = 1.01 for milled coffee). A slight decrease was also detected in Hausner ratio values. Furthermore, moisture content had a significant influence ($p<0.05$) on the cohesion index, caking profiles and Hausner ratio, while particle size strongly influenced cake height ratios recorded during the caking test. These findings suggest that the addition of functional ingredients does not lead to a deterioration of physical properties, and that functional coffee beverages represent an interesting aspect of future research.

LIMITED HYDROLYSIS OF PEA (*PISUM SATIVUM*, L.) PROTEIN ISOLATES

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In last twenty years limited enzymatic hydrolysis has been recognized as effective and, from the standpoint of safety, the most appropriate way of plant protein modification. In order to obtain desirable functional properties of plant protein hydrolysates, hydrolysis must be done under strictly controlled conditions to a specified degree of hydrolysis. A limited degree of hydrolysis usually improves solubility, as well as emulsifying and foaming capacities, whereas excessive hydrolysis often causes decline in some of these functionalities. Numerous authors have studied limited proteolysis of plant proteins. Most of these studies have been conducted on pure soybean storage proteins and soy protein products, including soy flour, concentrates and isolates. Less attention has been paid to pea been (*Pisum sativum* L.) proteins. However, use of storage proteins of pea seeds is very interesting for the formulation of new food products, because of their high nutritive value, non-allergenic character and good functional properties.

The aim of this study was to investigate the effects of partial enzymatic hydrolysis on functional properties of two different pea protein isolates obtained from two pea genotypes, Maja and L1. Papain and commercial protease (Streptomyces griseus Protease) were used for protein modification. Solubility, emulsifying and foaming properties were estimated at four different pHs (3.0; 5.0; 7.0; 8.0). Both enzymes, especially papain, showed different impact on functional properties of each isolates. Papain increased solubility of L1 pea protein isolate at pH 3.0, 5.0 and 8.0, emulsifying properties and foaming capacity at all pH values. Otherwise, papain increased solubility of Maja pea protein isolate only at pH 8.0. This pea protein isolate modified with both enzymes, formed emulsions with improved stability at lower pH (3.0, 5.0). These isolates also formed extremely stable foams. The commercial protease-prepared pea protein isolates showed generally low solubility and significantly different emulsifying and foaming properties. Proper selection of enzyme, conditions of hydrolysis and genotypes could results in production of pea protein isolates with excellent functional properties.

TOTAL PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY OF SPRAY-DRIED SOUR CHERRY MARASCA (PRUNUS CERASUS VAR. MARASCA) JUICE

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Introduction
Spray drying is an appropriate process for heat sensitive products such as fruit juices rich in polyphenols. However, because of the high sugar content, fruit juices are difficult to dry without carriers and are affected by different drying parameters. Therefore, the influence of two types of malt dextrin added in different concentrations and inlet air temperature on total phenols and antioxidant activity of spray-dried sour cherry Marasca juice was studied.

Materials and methods
Sour cherry Marasca concentrated juice (65°Brix) produced in 2011 was used in experiment. Juice was diluted to 15°Brix before spray drying and mixed with 30%, 35% and 40% (w/v) of malt dextrin (MD) 4-7 DE and 13-17 DE. Juice was dried using pilot spray dryer (Labplant, UK) at constant air flow and feed rate, varying the inlet temperature (160, 170 and 180 °C). Phenols were extracted in 80% methanol with 0.1% HCl at 50 °C in water bath, 20 minutes. Total phenols (TP) were determined using Folin-Ciocalteu method and antioxidant activity (AOA) using FRAP method.

Results
Type of malt dextrin used as carrier agent significantly affected the TP content which was higher when using MD 13-17 DE, while there was no significant influence on AOA of powders. The highest TP content was determined in powders with lower concentration of carrier agent, although using MD 13-17 DE in concentration of 35 % resulted in higher content of TP then at concentration of 30 and 40%. Temperature of 160 °C was found to be optimal for spray drying of sour cherry Marasca juice.

Conclusions
All studied parameters affected significantly TP content and AOA of sour cherry Marasca powders. The highest content of phenolic compounds was determined in powders obtained using 35 % of MD 13-17 DE at inlet air temperature of 160 °C.

GLUTEN-FREE DIET SUPPLEMENTED WITH INULIN DIVERSIFIED BY CALCIUM SUPPLY AFFECTS CAECAL ECOSYSTEM, MINERALS ABSORPTION AND DUODENAL CALBINDIN-D9K LEVEL.

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Calcium deficiency is the well-known disorder associated with a gluten-free diet. Very few gluten-free products are enriched in calcium as their wheat-containing equivalents, making calcium supplementation necessary. The development of such products could be a useful adjunct therapy to the diet. In animal experiments it was shown that fructooligosaccharides may support mineral absorption due to a specific metabolism.
In the present study the influence of gluten-free diet with inulin on intestine physiological indices, bones geometric and mechanical properties, minerals absorption and duodenal calbindin-D9K content was studied in vivo in rats. Animals received gluten-free diet with optimal or deficient calcium content enriched with inulin. Dietary intake, faeces and urine were monitored. After laparotomy, blood samples were taken. Caecum with contents was used for immediate SCFA analysis and bacterial enzymes activity. Bones geometric and mechanical properties were determined. Western blot analysis of duodenal calbindin-9kDa was carried out.
Our results showed that the weight of caecal tissue and digesta was greater in rats fed with inulin, in comparison with the control group. Inulin increased the intestinal calcium and magnesium absorption. Besides, inulin significantly induced the formation of SCFA in the caecal digesta. Concentration of acetic and propionic acids increased independently from calcium supply in the diet, whereas butyrate concentration increased in rat fed with optimal Ca diet. Calcium deficient diet with inulin activated glycolytic bacterial enzymes, simultaneously reducing activity of β-glucuronidase. Generally inulin did not influence geometric properties of analysed bones, however the work (Fmax) to femoral neck fracture was the highest in rats received optimal Ca diet. The amount of duodenal calbindin-D9K was lower in rats fed with inulin. Inulin did not influence directly the calcium bioavailability in the small intestine, however significantly affected analysed physiological indices in rats.

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DETERMINATION OF PLANT PHENOLIC PROFILE AND ANTIOXIDANT ACTIVITY OF STINGING NETTLE (URTICA DIOICA L.) EXTRACTS

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Stinging nettle (Urtica dioica L.) is a wild-growing plant species from Urticaceae family. It has been used in traditional medicine, primarily as a diuretic. It is also edible, and has been used since the ancient times as a leaf vegetable. However, the results on chemical composition and the antioxidant activity are very scarce. Therefore, in this work the LC-MS-MS method for rapid and simultaneous quantification of 45 plant phenolics in Urtica extracts has been applied as well as the six tests for assessment the antioxidant potential.

Using the LC-MS-MS method, phenolic content of stinging nettle extracts was determined. Of the 45 examined phenolics, only 15 were detected, 5 of them – quinic acid, 5-O-caffeoylquinic acid, caffeic acid, quercetin-3-O-glucoside and rutin – being dominant. A significant difference in phenolics profile of different plant parts was observed. The leaf extracts had the highest phenolic content, followed by herb extract whereas the root extract was very poor in phenolics, with only several compounds being present in significant amount.

Antioxidant potential of the extracts was assessed by various assays that measure inhibition of lipid peroxidation (the lowest IC50 85.95 μg/ml), reducing power (the highest reduction capacity of 29.7 mg ascorbic acid equivalents/g, as determined by FRAP assay), and free radical scavenging ability: DPPH (11.3 μg/ml), hydroxyl (236.4 μg/ml), superoxide anion (65.80 μg/ml) and nitric oxide radical (252.7 μg/ml) scavenger capacity. In all the assays (except the lipid peroxidation) herb and leaf extracts expressed higher antioxidant potential comparing to the root extracts, which is to be expected due to higher phenolic content.

Based on the obtained results, it was determined that stinging nettle represents a rich source of several polyphenols with well-known beneficial effects on human health, and that further research of its phytopharmacological potential should be conducted.

LYCOPENE CONTENT AND ANTIOXIDANT CAPACITY OF TOMATO JAM

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The tomato (Solanum lycopersicum) is the world's second largest vegetable crop after the potato, and a major source of lycopene. Lycopene is a red carotenoid and an efficient free radical scavenger, which presence in the diet positively correlates with reduced risk of chronic diseases. Although tomatoes are usually used as a salad vegetable, more than 80 % of tomatoes consumption comes from processed products such as ketchup, tomato juice, pickled tomatoes, sauces etc. Jam is another possibility interesting enough to be examined.

Tomato jam was produced in an open 120 liters oil jacketed stainless steel kettle. The proportion of sugar to fruit was 1:2.5, while the final concentration was 65°Brix (Bx). Lycopene content was estimated spectophotometrically at 503 nm and concentration was calculated using molar extinction coefficient of 17.2 x 104 M-1cm-1. An examination of the antioxidant capacity of samples was performed using DPPH assay.

Obtained results indicate that lycopene content of tomato jam was slightly lower compared to fresh ones (79.66 mg/kg in fresh tomatoes and 75.54 mg/kg in tomato jam), while antioxidant capacity has increased during processing (0.07 and 0.24 mM Trolox equivalents for fresh tomatoes and tomato jam, respectively). Moreover, heat processing of tomatoes could result in increased bioavailability of lycopene. Based on the results, it may be concluded that tomato jam can be a high-quality product which can be a desirable component of healthy diet.

Keywords: tomato jam, lycopene, antioxidant capacity

NUTRITIONAL VALUE OF THE OIL EXTRACTED FROM THE PUMKIN SEED OIL CAKE

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Oil cake is a by-product which remains after the pressing of pumpkin seeds. Until recently, it was mainly used as animal fodder, but lately it has been increasingly used for nutritious food products or ingredients. As the cake retains a considerable portion of oil, the aim of this research was to determine the content of oil in the cakes obtained after pressing 7 samples of naked pumpkin seeds and 3 samples of husk pumpkin seeds, and the nutritional value of the residual oil. The content of oil varied from 11 to 16 % in dry matter. After that, in the next 24 hours, the oil left behind in the cake was extracted by hexane, at room temperature. The composition and content of fatty acids and the total content of tocopherols were determined. The dominant acids were oleic acid (37,1 – 43,9%) and linoleic acid (30,8 – 44,5%), an ω-6 fatty acid. There was also a small portion (0,1 – 0,3%) of linolenic acid, an ω-3 fatty acid. The total content of tocopherols was considerably high (28.76 – 54.53 mg/100g), with the γ-isomer being the dominant one (73,64 – 85,28 % of the total content).

ANTIOXIDANT PROFILE OF LAMIACEAE PLANT EXTRACTS: IMPACT OF ROSMARINIC ACID CONTENT

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Introduction.
There is a great demand in the food industry for compounds that effectively inhibit the oxidation of lipids, which is the major cause of food deterioration. This auto-oxidation process may be avoided or delayed by antioxidants. The possible toxicity of the conventional synthetic antioxidants, together with consumers' preference for "natural" products have intensified research of different plant extracts which are known to possess the antioxidant activity. Among the plants reported to have antioxidant activity, Lamiaceae plants (mint family) are the most widely used and commercialized. The aim of this study was to compare the antioxidant properties of five different Lamiaceae extracts using spectra of different methods and to investigate the influence of the rosmarinic acid content on the antioxidant properties of investigated plant extracts.

Methods and materials.
The research includes five plant extracts: Melissa officinalis, Mentha piperita, Origanum vulgare, Salvia officinalis and Thymus serpyllum. The antioxidant properties of plant extracts were evaluated using eight different antioxidant assays: Folin-Ciocalteu method, Ferric Reducing/Antioxidant Power (FRAP), free radical scavenging activity using two stabile synthetic radicals (DPPH and ABTS) and against superoxide anion radical, Fe2+ chelating activity, inhibition of the Briggs-Rauscher reaction and efficiency in preventing the oxidation of emulsified linoleic acid using β-carotene bleaching method. The content of the rosmarinic acid in plant extracts was determined using HPLC-RP-DAD.

Results and conclusions.
All extracts were extremely rich in phenolic compounds and contained extremely high concentrations of the rosmarinic acid. The highest rosmarinic acids content as well as the best results for antioxidant properties using most of the methods were obtained for Melissa officinalis extract. The significance and role of the rosmarinic acid in the antioxidant properties of Lamiaceae plant extracts was confirmed and undoubted, but the contribution of other compounds and their possible cumulative or synergistic action should not be neglected.

RESISTANT STARCH AS FUNCTIONAL INGREDIENT IN DIETARY FIBRE-ENRICHED COOKIES

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Resistant starch (RS) from different sources has attracted huge interest, mainly because of its health benefits and functional properties. RS have properties of dietary fibre such as positively influences the functioning of the digestive tract, microbial flora, the blood cholesterol level, the glycemic index and assists in the control of diabetes. From technological aspect, compared with traditional sources of fibre, RS has lower impact on the sensory properties of food. Among its desirable physicochemical properties are its swelling capacity, viscosity, gel formation and water-binding capacity, which make it useful in a variety of foods. The objective of this study was to observe functional properties of two types of RS (type III, IV) in short dough cookies production.

Partial substitution of the flour with the RS has contributed to significant changes in rheological properties of the system. In all samples the use of the RS resulted in the increase of storage and loss moduli of the dough, and the lowering of loss tangent value, which indicates its pronounced elastic character. Increasing the portion of RS, type III and type IV, as substitutes for flour, contributed to dough elasticity, due to the ability of RS to bind water.

The study involved baking test, as an important criterion for evaluating the quality of flour and RS. The application of RS in the formulation of short dough resulted in the products of improved sensory and nutritional quality. Addition of the starch, type III, showed better results in terms of overall sensory quality. The findings show a good potential of the RS as a functional ingredient referring to its application in the production of cookies and related products rich in dietary fibre.

APPLICATION OF SOLVENT-ENHANCED EXTRACTION FOR OBTAINING ACHILLEA MILLEFOLIUM EXTRACT WITH POTENTIAL USAGE IN FOOD INDUSTRY

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Yarrow (Achillea millefolium L., Asteraceae) has been known for its valuable healing properties, whose applications have been approved by German Commission E. Its internal usage comprises treatment of gastrointestinal tract discomforts. The aim of our study was to obtain Yarrow extract with optimal content of active herbal ingredients (polyphenols), known for beneficial effects in food, as antioxidants.

Fixed amounts of the drug and 70% ethanol, applying Timatic micro extractor, based on pressure enhanced solvent extraction, were used. The drug:extract ratio was 1:3, while the process parameters i.e. compression time (TP1), decompression time (TP0), and the number of cycles (CL) were varied in accordance to 23 factorial design. Namely, each of the stated parameters was set to two values, thus deriving eight experimental points. Evaluation of extraction efficiency was assessed by determination of dry residue, as well as total flavonoids, tannins and polyphenols content. The statistical analysis of experimental results was performed by the software DESIGN EXPERT 7.0 in order to reveal which of the examined parameters affects extraction efficiency and in what manner.

It could be noted that the greatest impact of all the parameters was on dry residue, except that TP1 and TP0 had negative, and CL positive effect. When considering phenolic compound content, the overall impact of all three parameters was the highest on polyphenols content (TP1 had positive, while TP0 and CL had negative effect) and the lowest on total flavonoids content (TP1 and CL-positive; TP0-negative effect). Interaction observed between TP1 and TP0 indicate that the with TP0 set on its lower value the increase of TP1 increases tannins and polyphenols content. Thus, it can be concluded that for obtaining the extract of Yarrow rich in phenolic compounds, TP1 should be set on its higher level, TP0 on its lower level and CL on its higher level.

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EFFECT OF COMPOSITION ON BIOACTIVE PROFILE OF CHOCOLATE LIQUEURS

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BRIEF INTRODUCTION:
Liqueur is a sweetened alcoholic beverage, flavoured with fruit, herbs, nuts, chocolate or cream and it is mostly popular among female consumers. Although chocolate beverages are attractive because of their desirable sensory properties, they could also be presented as a good source of bioactive compounds, derived from cocoa. Cocoa and cocoa products have received increased scientific attention due to their health benefits attributable to interesting phytochemical composition, especially high content of polyphenols and methylxanthines. Since the processing parameters and different recipes, in chocolate liqueur production, can influence the content of bioactive compounds in the final product, the purpose of this study was to determine the best combination of type of chocolate (regarding cocoa solid content) and ethanol content aimed to produce functional chocolate liqueurs.
METHODS AND MATERIALS:
Two types of chocolate (dark chocolate with 50% of cocoa solids and milk chocolate with 32% of cocoa solids) were combined with spirits containing 20%, 25% and 30% (v/v) of ethanol in order to prepare chocolate liqueurs. Content of polyphenolic compounds (total phenols, nonflavonoids and flavonoids, proantocyanidins and flavan-3-ols) were determined by UV/VIS spectrophotometric methods. Antioxidant capacity of prepared liqueurs was evaluated using DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid) assays.
RESULTS:
Dark chocolate based liqueurs have shown higher content of total phenols, flavonoids, nonflavonoids, flavan-3-ols and proantocyanidins then those prepared with milk chocolate. Regarding the ethanol content, dark chocolate liqueurs containing 20% of ethanol have shown the highest values of previously mentioned parameters, while 30% ethanol containing liqueurs have shown the lowest. In comparison with dark chocolate based liqueurs, milk chocolate liqueurs were expressed directly contrary results, which values were the highest in 30% ethanol containing milk chocolate liqueurs. Antioxidant capacity of chocolate liqueurs followed result pattern from phenolic analyses with good correlations.
CONCLUSIONS:
The obtained results have shown that chocolate liqueur prepared with dark chocolate and containing 20% of ethanol has the best potential to produce functional beverage, which may has positive effect on human health.

THE EFFECT OF RESVERATROL ON THE HUMAN UMBILICAL VEIN WITHOUT ENDOTHELIUM

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Introduction:
Resveratrol induces vasorelaxation through both endothelium-dependent and -independent mechanisms. The effect of resveratrol on human umbilical vein (HUV) is not known. Therefore, the aim of our study was to define the role of K+ channel in the vasodilatation of HUV induced by resveratrol.
Materials and Methods:
Serotonin (5-HT) or 100 mM K+ were used for precontraction of the HUV without endothelium. The cumulative concentration-response curves were obtained by adding increasing concentrations (1-100 μM) of resveratrol. K+-channel inhibitors were added in the bath before resveratrol in order to tested the role of vascular K+ channels in its effect.
Results:
Resveratrol induced concentration-dependent vasodilatation (EC50 = 16.5 μM). A selective blocker of KATP channels, glibenclamide (10 μM) and 4-aminopiridine (4-AP, 1 mM), a blocker KV channels, induced significant shift to the right ($P < 0.05$) of the concentration-response curves for resveratrol. Tetraethylamonium (TEA, 10 μM), which predominantly inhibits KCa channels and barium-chloride (BaCl2, 1 mM), a blocker of Kir channels, antagonized the response to resveratrol. The high concentration of resveratrol
(> 30 μM) relaxed HUV bathed by a medium containing 100 mM K+, with maximum response of 94 % and EC50 of 47 μM, $P < 0.05$).
Conclusions:
Results suggest that resveratrol induced endothelium-independent vasorelaxation of HUV. The glibenclamide-, 4-AP, TEA- and BaCl2-sensitive K+ channels are involved in resveratrol vasodilatatory effect. It seems that resveratrol has additional K+-channel independent mechanism of action.

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PROBIOTICS AS A TOOL TO IMPROVE SOFT CHEESE MICROBIAL QUALITY

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Functional foods incorporating probiotic bacteria such as bifidobacteria and lactobacilli have a variety of beneficial health effects in human. The objective of the present study was to investigate the survival of L. acidophilus and bifidobacterium lactis during manufacture and storage of Damietta cheese stored (4±1oC) in brine and to determine the effects of Lactobacillus acidophilus and bifidobacterium lactis on the microbial quality of Damietta cheese. Cheese samples were analyzed for Coliforms and Staphylococcus aureus. There were significant (P >0.05) differences in the counts of Coliforms and S.aureus in the probiotic cheese with those in control cheese. The obtained results verify that using Lactobacillus acidophilus and Bifidobacterium lactis as probiotics had a greater inhibitory effect on Coliforms and Staphylococcus aureus counts in cheese. Lactobacillus acidophilus probiotic cheese is more effective in inhibition of S.aureus than either probiotic cheese with bifidobacterium lactis or combination between them (P >0.05). The final numbers of L. acidophilus and bifidobacterium lactis were greater than the minimum (107 cfu /g), as suggested by Ishibashi and Shimamura (1993), required to produce health benefits claimed for probiotic cheese. The results showed that Damietta cheese can be an effective carrier of probiotic to consumer.

EFFECT OF FREEZE-DRYING ON CHEMICAL COMPOSITION AND DPPH ANTIRADICAL ACTIVITY OF RASPBERRY

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Raspberries are very sensitive to chemical and microbial deterioration during post-harvest storage and handling. Raspberries can be consumed not only fresh, but also in many other forms such as juice, jam, jelly, dried and rehydrated with yogurt and bakery products. Freeze-drying improves the fruit availability, enables preservation of all heat lable compounds, microbiological stability and permanent preservation. The objective of this study is to assess the effect of different freeze-drying conditions on chemical composition and DPPH antiradical activity of Meeker raspberry.

Freeze-drying was performed in Alpha 2-4 LSC Martin Christ freeze-dryer, during 24 h at primary drying temperature -20°C, -30°C or -40°C, and another 24 h at secondary drying temperature +25°C. The content of total phenols, flavonoids and anthocyanins in extracts, obtained from fresh and freeze-dried raspberry, were determined spectrophotometrically. The antioxidant activity of extracts were investigated by measuring 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging capacity (RSC) by spectrophotometric method.

Extracts obtained from fresh and freeze-dried raspberry contain significant amount of polyphenols (36.01–17.06 mg GE/g), flavonoids (20.68–9.34 mg RE/g) and anthocyanins (0.13–0.09 mg CyGE/g). RSC and IC_{50}^{DPPH} values of fresh raspberry extract (IC_{50}^{DPPH} = 0.12 mg/ml) showed slightly higher antioxidant activity compared to freeze-dried raspberry extract (IC_{50}^{DPPH} = 0.18 mg/ml).

Based on the obtained results it can be conclude that freeze-drying causes slight changes in chemical composition and antiradical activity.

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IN VITRO CYTOTOXIC AND APOPTOSIS EFFECTS OF BROWN MARINE ALGA PADINA PAVONIA ON HUMAN CERVIX AND BREAST CANCER CELL LINES

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Introduction:
Seaweeds and their extracts have attracted great interest in food and pharmaceutical industry. They are rich source of carotenoids, pigments, polyphenols, enzymes, diverse functional polysaccharides and also unsaturated fatty acids. Marine algae have been prominent sources of new compounds with diverse biological activities including cytotoxic. Padina pavonia is a representative of brown algae (Phaeophyceae), widely distributed in unpolluted enviroments.

Material and methods:
P. pavonia (Linnaeus) Thivy (fam. Pheophycaea) was collected from Mediterranean Sea in Boka Kotorska, Montenegro. The total phenolic content was estimated by the Folin-Ciocalteu method. Cytotoxic and apoptosis effects were tested against human cervix carcinoma (HeLa) and human breast cancer (MDA-MB-453) cell lines. Nuclear DNA fragmentation was also examined.

Results and conclusion:
P. pavonia methanol extract possesses cytotoxic activity with IC50 values 86.45±0.21μg/mL related to HeLa cell and 74.59±0.79 μg/mL related to MDA-MB-453 cell. Reduction in the number of cells with distorted shapes and condensation of cytoplasm was noticed. An increase in cells containing sub-G1 amounts of DNA was observed, indicating that the tested extracts induced apoptosis. DNA laddering was noted 24h after the HeLa cells were exposed to 2xIC50 concentration of P. pavonia methanol extract. As brown algae represent a rich source of polysaccharides and glycosides, this activity could be connected with those compounds but also with phenolics detected in examined extract (12. 16 ± 0.2 mg GAE/g dw).

CHEMICAL COMPOSITION, ANTIOXIDANT AND ANTI-INFLAMMATORY PROPERTIES OF ALLIUM PANICULATUM L. EXTRACTS

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Members of genus Allium have been used and cultured for thousands of years for their medicinal properties and characteristic flavor. Only two species of genus Allium (A. sativum L. and A. cepa L.) are well researched, while data on chemical composition and biological activities of other species, including Allium paniculatum L. subsp. marginatum (subgen. Allium, sect. Codonoprasum) are very scarce.

In the present study we investigated chemical composition, antioxidative and anti-inflammatory properties of methanolic extract of Allium paniculatum L., wild growing in Serbia. Phytochemical profile was determined by measuring total phenolic, total flavonoid and total anthocyanin contents and by quantitative LC-MS/MS analysis of the extracts and headspace GC/MS analysis of fresh bulbs volatiles. The antioxidant activity of examined extracts was evaluated by measuring their effect on lipid peroxidation (LP) and ability to scavenge 2,2-diphenyl-1-pycrylhydrazile (DPPH) and NO radicals [1]. In addition, the anti-inflammatory activity was observed in human platelets measuring the inhibitory potential of the extracts on COX-1 and LOX-12 activity (production of 12-HETE, 12-HHT, PGE2 and TXB2) [2].

High contents of total phenolics (10.07 mg gallic acid equivalents/g of dry extract), total flavonoids (4.4 mg quercetin equivalents/g of dry extract) and total monomeric anthocyanins (131 μg cyanidine-3-glucoside equivalents/g of dry extract) were found. The dominant phenolic compounds in the herb extract are ferulic and caffeic acids and flavonoids rutine, quercetine-3-O-Glc and kaempferol-3-O-Glc. Dimethyl-disulphide was detected as the dominant volatile compound in fresh bulbs. The extract inhibited production of 12-HETE, 12-HHT and TXB2 in a dose-dependent manner, while inhibition of PGE2 was dose dependant only for extract concentrations lower than 6 mg/ml. That leads to conclusion that extract does not inhibit phospholipase A2 activity, but just the activity of particular enzymes of COX-1 and 12-LOX pathways. Antioxidant activity was weak compared with synthetic antioxidants.

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URINARY LIPID OXIDATION BIOMARKERS ARE INFLUENCED BY FATTY ACID INTAKE AND NOT BY OTHER DIETARY FACTORS

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INTRODUCTION:
Oxidative stress is characterized as imbalance between the content of free radicals and antioxidants in favour of radicals. Dietary nutrients may limit or encourage lipid damage therefore influence urinary oxidative stress biomarker excretion.

OBJECTIVE:
The aim of this study was to evaluate nutrient intake in comparison to reference values (DACH) and to examine the influence of daily nutrient intake, as positive and negative factors, on urinary levels of malondialdehyde (MDA) and 4-hydroxy2nonenal (4HNE) in healthy human.

METHO/DESIGN:
Only one subject participated in this pilot nutritional study, undertaken using the food diary weighing method for 15 consecutive days. Nutrient intake was assessed with Prodi 5.7 Expert plus (Nutri-Science, 2010) computer nutritional programme. Morning urine samples were used for lipid oxidation marker analysis and normalized with creatinine values. MDA and 4HNE were analysed by GC/MS system. Results were statistically evaluated by using PASW Statistics 18 programme.

RESULTS:
The results showed that average daily macronutrient intake in terms of energy caloric profile was sufficient and in compliance with DACH Reference for Nutrient Intake. MDA and 4HNE levels were on average 25,85±9,51 and 0,31±0,30 ng/mg creatinine, respectively. Normalized MDA and 4HNE were correlated (r=0,51), but not statistically significant. Positive factors such as antioxidant vitamins, total dietary fibre and β-carotene showed no influence on MDA, nor 4HNE values. However there was a statistically significant correlation between PUFAs and 4HNE (r=0,534) compared to MDA, where correlation was not found. Moreover there was also significant correlation between linoleic acid, as major precursor for lipid oxidation, and 4HNE urinary excretion (r=0,550).

CONCLUSIONS:
Intake of PUFAs and linoleic acid as a substrate for lipid oxidation had influence on urinary excretion of 4HNE, but not on MDA. None of the expected positive factors showed statistically significant effect on analyzed biomarkers.

CACTUS OPUNTIA MACRORHIZA FRUIT – PROMISING FRUIT

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As many studies indicate a positive relation between consumption of plant foods "rich in phytochemicals and functional properties" and reducing the risks of several degenerative diseases, consumers tended more towards healthy foods rich in bioactive compounds such as phenolic compounds, natural pigments, vitamin C, etc. Opuntia ssp., the largest genus of the Cactaceae, includes manifold species and varieties. But to date, the most known cactus fruits are from Opuntia ficus-indica, which contain many bioactive compounds such as polyphenolic compounds (such as isorhamnetin glycosides), betalains, vitamin C and dietary fibers.

As there are many other species of Opuntia spp. there might be some other promising Opuntia spp fruits. One of these fruits is from Opuntia macrorhiza. In addition to hard seeds, the Opuntia macrorhiya fruit consists of deep red-purple endocarp, thick mesocarp and thin skinny pericarp. Unlike O. ficus-indica, the O. macrorhiza pulp exhibits more desirable technological characteristics such as high vitamin C content, low pH and total soluble solids.

HPLC-DAD analysis showed that the favonol isorhamnetin-3-O-rutinoside found in the O. macrorhiza fruit's peel. Both O. macrorhiza fruit's pulp and peel have high content of phenolic content, 1.21 and 1.09 mg/100 mg of dry weight respectively. With regard to betacyanins, O. macrorhiza fruit's peel and pulp provide a deep red-purple color, whose average impact is higher compared to red beet (B. vulgaris spp.) and about 8 -fold higher than red fruits from O. ficus-indica. Beta vulgaris, as well as O. macrorhiza fruit's pulp and peel and O. ficus-indica fruit's pulp and peel had betacyanin contents of approx. 0.42, 0.42, 0.44, 0.05 and 0.07 mg/100mg (dry weight) in aqueous methanolic extracts respectively. These characteristics give the O. macrorhiza fruits more nutritional features and advantages as promising alternative source of red colorants for foodstuff. Correspondingly, antioxidant activity assays showed a high antioxidant activity of both, O. macrorhiza fruit's peel and pulp.

ANTIOXIDANT POTENTIAL OF MACEDONIAN RED WINES IN RELATION TO THEIR COLOR CHARACTERISTICS, ANTHOCYANINS AND TOTAL POLYPHENOLS

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The intake of antioxidant compounds present in food is an important health-protecting factor. Red wine is recognized as a considerable source of polyphenolic substances, which are well-known antioxidants. They ensure optimal free radical scavenging activity and prevent the oxidative damage of the tissues. As a result, wine has been considered as a product with beneficial health effects, particularly on the cardiovascular system. There are lots of reports that antioxidant properties of wines are associated with the content of flavanols, anthocyaninins, and tannic acid, although it is believed that these properties are rather linked with the concentration of total polyphenols than with the individual polyphenols.

In order to study the relations between antiradical activity and the content of total phenols and anthocyanins in wines, 35 representative samples of single-variety, high-quality red wines, from the vintages of 2004-2008, obtained directly from the local wineries were analyzed. The total polyphenol content was determined using Folin-Ciocalteau reagent. Colour was evaluated according to colour density, hue, % Rd, %Bl, %Ye values and dA measurements. The copigmented, monomeric, polymeric and total anthocyanin content of each wine was measured using spectrophotometric assay according to Boulton. Individual anthocyanin compounds were determined by HPLC with UV-VIS detection. The antioxidant potential of the wines was evaluated using the DPPH method.

The tested wines demonstrated different chromatic profile which was strongly related to the grape variety and the year of production. Higher concentrations of total phenols were confirmed in wines with higher color intensity. Vranec variety wines were the richest in total anthocyanins, followed by Merlot and Cabernet Sauvignon.

The antiradical activity was highly correlated with the total polyphenols content. Vranec wines have shown higher antioxidant potential than Merlot wines, besides their similar polyphenolic content.

LOW COST TECHNOLOGIES AND TRADITIONAL INGREDIENTS FOR THE PRODUCTION OF AFFORDABLE, NUTRITIONALLY CORRECT FOODS IMPROVING HEALTH IN POPULATION GROUPS AT RISK OF POVERTY

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According to 2010 Eurostat statistics, around 81 million European citizens are at risk of poverty, presenting a low purchasing power, limited education and the highest risk of diet-related diseases due to sub-optimal nutrition. The CHANCE project's aim is to address poor nutrition in populations at risk of poverty in Europe by developing attractive, affordable and nutritious food products using low-cost technologies and traditional ingredients. CHANCE has four main objectives: i) identify the most significant population groups at risk of poverty, their nutritional criticalities, and barriers to healthy eating; ii) selection of ingredients and raw materials for the formulation of new food prototypes; iii) develop CHANCE foods using low cost technologies to improve their nutritional value, acceptability and shelf life; iiii) produce CHANCE food prototypes in pilot/industrial scale to optimise the diet of population groups at risk of poverty. The synergic collaboration of nutritionists, food chemists, economists and technologists allow a robust strategy to overcome barriers to healthy nutrition by the lab-scale development of affordable but nutrient-rich food products, new packaging and portioning. CHANCE nutritional and educational strategies will produce guidelines for European Public Health policy dealing with the prevention of malnutrition in the populations at risk of poverty.

EFFECT OF HEAT TREATMENT OF CAMELINA (CAMELINA SATIVA) SEEDS ON THE PHENOLIC PROFILE AND ANTIOXIDANT ACTIVITY OF THEIR EXTRACTS

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In recent years, there has been a growing interest in studying phenolic compounds from oilseeds, one of the latter being camelina (Camelina sativa). Phenolics exist in oilseeds in free, soluble conjugate and insoluble bound forms. The later are not simply extractable by aqueous methanol, but release by the alkali treatment of the samples. The extraction of phenolics from various oilseeds requires the application of thermal pretreatment to make these compounds more extractable. Thermal processing disrupts the cell membranes and cell walls resulting in cleavage of covalently bound phenolic compounds and their release from bound forms. The effect of different heat treatments of camelina seeds on the phenolic profile and antioxidant activity of their hydrolyzed extracts was investigated. The results showed that total phenol contents increased in thermally treated seeds. Heat treatment affected also the quantities of individual fractions of phenolic compounds in extracts. Phenolics in unheated camelina seeds existed in bound rather than in free form. The temperature at 160 °C was required for release of insoluble bound phenolics, whereas lower temperatures were found to be optimal to liberate those present as soluble conjugates. To evaluate the antioxidant potential of these extracts, the reducing power and efficiency in scavenging the alkylperoxyl radical generated in an emulsion system were determined. The results show that the best reducing power and alkyl peroxyl radical scavenging in the emulsion expressed phenolics which were bound to the cell wall. The heat treatment of seeds up to 120 °C increased the reducing power of extracts, but negatively affected their activity in an emulsion against alkyl peroxyl radicals.

Keywords: heated camelina seeds, alkaline hydrolysis, free phenolics, soluble conjugate, insoluble bound phenolics, flavonoids, antioxidant activity

CONJUGATED FATTY ACIDS - BIOLOGICALLY BENEFICIAL LIPID

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Human health and diseases have a known dietary association. Oxidative stress, provoked by reactive oxygen species contribute to the pathologies of disease like Alzheimer's and Parkinson's disease, stroke, harth failure, atheroslerosis, ischemic disease, cancer, ageing and neurodegenerative diseases. Several plant extracts posses antioxidant activity and have shown beneficial therapeutic potentials against various diseases. Long chain polyunsaturated fatty acids (PUFA) especially (n-3) are known to have a protective role in preventing cardiovascualr diseases and some types of cancer. Recently conjugated fatty acids have attracted much attention as a novel type of biologically beneficial lipid.

Conjugated fatty acids refer to a group of isomers of linolic and linolenic conjugated acid that reportedly have anti-carcinogenic, anti-atherogenic and anti-obesity affects.

Naturally occurring conjugated linolic acid (CLA) primarily consists of the cis-9,trans-11 isomer (>80%) present in food, such as beef, milk, and dairy products, while trans-7,cis-9 is the second-most prevalent CLA isomer present in ruminant fat. This isomers originate from biohydrogenation of linoleic acid to stearic acid by rumen bacteria. On the other hand seven different conjugated linolenic acid (CLnA) isomers have been identified. They are not very common in animal fats but are found in various seed oils. For example, a-eleostearic acid (9cis, 11trans, 13trans-18:3) is found in tung seed oil (Aleurites fordi) (68%) in bitter gourd oil (Momordica charantia L.) (56.2%) and in cherry (Prunus avium L.). Mahaleb oil obtained from mahaleb seed (Prunus mahaleb L.), which is virtually unique to Turkey, contains about 35% a-eleostearic acid. Pomegranate (Punica granatum L.) seed contains about 83% punicic acid (9c,11t,13c-18:3), and catalpa seed (Catalpa bignonoides) oil contains about 42.3% catalpic acid (9t,11t,13c-18:3) (1). Oil from the seeds of pot marigold (Calendula officinalis L.) contains approximately 62% calendic acid (8t,10t,12c-18:3). Jacaric acid (8c,10t,12c-18:3) is found in the seeds of Jacaranda mimosifolia.

Because of their unique characteristics to have antitumor properties, conjugated fatty acids may be used as functional food.

CHARACTERISATION OF OILS OBTAINED FROM GRAPE SEEDS FROM CABERNET SAUVIGNON VARIETY USING DIFFERENT EXTRACTION METHODS

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Introduction
Grape seed oil is an alternative to traditionally used edible vegetable oils, particularly in controlled diets. Health benefits ensue from its composition: this oil is rich in unsaturated fatty acids (particularly linoleic) and tocopherols and has low values of cholesterol. Therefore, there is a growing interest to study the possibility to extract grape seed oils from various grape varieties. Another important reason to extract this oil is waste reduction – it can be obtained from grape pomace which is by-product in wine production. In this work, grape seed oil was extracted from Cabernet Sauvignon variety.

Methods and Materials
Grape seeds were taken during the fermentation, washed with called water and kept in refrigerator till the extraction procedure. Just before extraction the seeds were dried and crushed. The oil' samples were obtained using "cold pressure" method and the extraction by n-hexane (Soxhlet method). Third method used was the extraction by n-hexane stimulated by ultra-sound; the duration of treatment was varied.

Results
The yields were determined for all applied methods, the values up to 13% were found. In all obtained samples, the total amounts of polyphenols and tocopherols, as well as fatty acid composition were determined using spectrophotometry, HPLC and gas-chromatography methods, respectively. The obtained values were compared with those obtained for commercial oil (Lesieur, France). Similar fatty acid composition was found for all investigated samples. However, it was found that extraction method influence on oils' yield and total amounts of polyphenols and tocopherols: the longer was the treatment by ultra-sound, higher values of these characteristics were found. Oxidative stability of all investigated oils was estimated by differential scanning calorimetry; the correlation with the amounts of polyphenols was noticed.

Conclusions
The results obtained here show that extraction methods influence on the characteristics of grape seed oils obtained from Cabernet Sauvignon variety.

THE INFLUENCE OF APPLE JUICE ADDED IN BLACKBERRY AND SOUR CHERRY JUICES ON THEIR TOTAL PHENOLS CONTENT AND ANTIOXIDATIVE CAPACITY

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Juices of small fruit can not be consumed in large quantities due to its sensory properties, especially acidity. In order to improve their sensory properties they are mixed with other juices. The main objective of this work was to investigate the influence of apple juice added in blackberry and sour cherry juices on their total phenols content and antioxidative capacity. The other objective was to evaluate the sensory acceptable amount of small fruit juice in the mixture with apple juice with significant level of total phenolics and high antioxidative effect.
Blackberry, sour cherry and apple juices were made from concentrated fruit juices. Apple juice was used for the correction of acidity. The content of the total phenols in fruit juices was determined using the Folin-Ciocalteu reagent while the antioxidant activity was investigated using FRAP reagent.
Blackberry and sour cherry juices were mixtured with 20, 40, 60, 80 or 100 % of apple juice. The total phenols content as well as antioxidative activity were gradually decreased in all tested mixture with the increasing amount of apple juice. The total phenols content ranging from 522 mg GAE / l for 100 % apple juice to 2486 mg GAE / l for 100% sour cherry juice. The antioxidant activity by FRAP assay was ranging from 4776 µmol Fe(II)/ l for 100 % apple juice to 30907 µmol Fe^{2+} / l for 100 % blackberry juice, while it was 25621 µmol Fe^{2+} / l for 100 % sour cherry juice. The obtained values indicated a highly positive correlation (R^2= 0.8649) between the FRAP value and total phenolic content.
However, it was concluded that the mixture of blackberry or sour cherry juice with apple juice was sensory more acceptable than the juices obtained from only one type of small fruit.

Key words: blackberry, sour cherry, apple, juice, total phenols, antioxidative capsity

COMPARISON OF TWO FOOD COMPOSITION DATABASES IN ESTIMATING FOLATE INTAKE AMONG YOUNG WOMEN

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Introduction:
Adequate folate status is considered as a potential public health issue. Consequences of folate insufficiency arising from inadequate intake include increased risk for neural tube defects making folate a critical nutrient among women of reproductive age. Accurate estimation of dietary folate intake depends on limitations of dietary assessment methods, methodological issues related to the biochemical analysis of food folates, adjustment for bioavailability differences between naturally occurring food folate and folic acid from fortified foods and dietary supplements and inaccuracies related to product label declarations. The aim of this study was to compare the application of two different food composition databases (FCDB) in estimating dietary folate intake.
Subjects and Methods:
Previously validated food frequency questionnaire (FFQ) (Int J Food Sci Nutr 60 Suppl 5: 10) was administered to young women (n=709, age range 18-30 years) and the daily folate intake was calculated by using two FCDBs: Kaić-Rak & Antonić (1990) (FCDB1) and Regional FCDB (FCDB2). Folate intake measured by the FFQ was expressed as dietary folate equivalents (DFE) with 1.7 equivalency factor for folic acid from fortified foods and dietary supplements and factor 2 for folic acid from dietary supplements taken on an empty stomach.
Results:
The average folate intake was 247 ± 400 and 252 ± 405 µg DFE using FCDB1 and FCDB2, respectively, and the means didn't differ significantly. The average difference between the folate intake using two FCDBs was 5.7 ± 40.3 µ DFE.
Conclusion:
Folate intake among the studied sample of young women was below recommended 400 µg/day and regarding data for food folate, both FCDBs could be used interchangeably.

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MICRONUTRIENT RECOMMENDATIONS WEB-BASED TOOL USE IN FOOD DEVELOPMENT AND NUTRITION

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Introduction:The EURRECA (EURopean micronutrient RECommendations Aligned) Network of Excellence (www.eurreca.org) collated current micronutrient recommendations. The main objective was to collect and develop a common data base/data source with all recommendations in Europe in order to make them available to different users. The main functions needed to be harmonized and developed in one simple nutritional tool are: monitoring and assessment of dietary intake, assestment of micronutrient inadequacies, comparisment of recomandations for different populations and micronutrient content for food labeling. Methods: Information on current micronutrient recommendations was collated through questionnaires completed by national key informants involved in the development of recommendations. A user-friendly tool, Nutri-RecQuest was developed to allow access to the collated data and to create a database source for use in other nutritional software tools.Results: Recommendations i.e. intakes of micronutrients sufficient to meet the requirements of the majority of healthy individuals of that population from 37 European countries /organizations and eight key non-European countries/regions comprising 29 micronutrients were entered into a database. The following measures and concepts are included: Recommended intake levels: Individual Nutrient Levels (INL97,5) also know as Recommended Daily Allowance, Adequate Intakes (AIs); Adequate ranges; Average Nutrient Requirements (ANRs); Upper limits (ULs). General information on the source of the recommendations as well scientific background information were added. A user friendly web-based interface was developed to provide efficient search, comparison, display, print and export fuctions.Conclusion: Nutri-RecQuest offers valuable and comprehensive data base with an easy access to existing micronutrient recommendations. Having an easy access to this data represent an valuable tool for bodies responsible for setting recommendations as well as for users of recommendations including scientists, policy makers, health professional and food industry for new food development. This is a open data with an ccess via: www.eurreca.org;www.serbianfood.info/eurreca .

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POLYPHENOL PROFILE AND ANTIOXIDANT ACTIVITY OF POLYGONUM AVICULARE L. HERB AND ROOT ETHANOL EXTRACTS

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Common knotgrass (Polygonum aviculare), an annual crop and wasteland weed, is often used as a salad herb, in either raw or cooked form. This plant is used in American, Chinese and Unani traditional medicine because of its diuretic, emollient, expectorant, anti-inflammatory, heart tonifying, vasoconstrictive, fever reducing, wound healing and antiparasitic properties. Therefore, the present study is focused on comparison of antioxidant acitivity and polyphenol profile of herb vs. root ethanol extracts of P. aviculare specimens collected at seven different locations in Serbia.
Polyphenols profile was determined by measuring total phenolic and total flavonoid content and by quantitative LC-MS/MS analysis. The antioxidant activity was evaluated by measuring ferric reducing ability (FRAP) of the extracts and their radical scavenging capacity towards DPPH, OH, NO and O2– radicals [1].
Results showed that ethanol extracts of roots have high total phenolic (257–386 vs. 173–306 mg gallic acid equivalents/1 g d.w., root vs. herb), but low total flavonoid content (2.0-7.7 herb vs. 1.5-7.5 root mg quercetin equivalents /1 g d.w.). The root extracts are rich in gallic acid and catechin, while the herb extracts are characterized by high amount of quincic acid, hiperoside and quercetin-3-O-glucoside. Root extracts showed higher FRAP capacity (302–547 vs 211-346 mg ascorbic acid equivalents /1 g d.w.), as well as DPPH (1.95–15.6 vs 9.30–31.0 μg/ml) and O2– (4.94–10.8 vs. 7.89–21.6 μg/ml) scavenging ability in comparison to herbs extracts. There is no significant difference in scavenging activity towards OH and NO radicals between herbs and roots extracts (103–251 vs. 131–250 μg/ml, and 68.2–198, vs. 64.7–>330 μg/ml, respectively).
The results obtained show that root extracts of P. aviculare possess higher free radical scavenging capacity compared to herb extracts, which indicates that high catehin (3.2-18.0 mg/g) content might be responsible for the activity.

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Reference: [1] Beara, I.N. et al. (2009) J. Agric. Food Chem., 57: 9268–9273

A SIMPLE SPECTROPHOTOMETRIC METHOD FOR DETERMINATION OF TOTAL ANTHRAQUINONES CONTENT IN RUMEX L. SPECIES EXTRACTS

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Rumex L. genus, traditionally known as the sorrels and the docks, is a genus that comprises about 200 species native to Europe and Asia, but introduced almost everywhere. They have use in traditional medicine as antiseptic and antidiuretic cures, whereas the roots of some Rumex species are used for its laxative, depurative and tonic properties. Sorrel is also often used in French cooking. Chemical studies have detected various constituents among which are flavonoids, anthraquinone and tannins. Anthraquinones are found to be responsible for its laxative effects. Total anthraquinones content determination has been monographed in European and Yugoslav Pharmacopoeia, but these procedures are rather time-consuming. Thus, in this study, we propose a quick and simple spectrophotometric method for determination of total anthraquinones content in 80 % ethanolic extracts of Rumex L. species. The method utilizing the Born-Traeger reaction of anhtraquinones, was developed, optimized and partially validated for investigation of roots and herb extracts of six species: R. patientia, R. acetosa, R. acetosella, R. crispus, R. obtusifolius. i R. balcanicus. The linear relationship was obtained for a range of 2,5–240 µmol/L of 1,8-dihydroxyanthraquinone (r2=0,99846). The investigation of matrix effect showed that extract suppressed signal by 29,5 %. Therefore, the standard addition method had to be employed, where the sample was spiked with standard solution of 1,8-dihydroxyanthraquinone. Absorbance at 500 nm of spiked and non-spiked sample was measured after characteristic orange colour developed. The precision is acceptable as revealed by % R.S.D. of less than 8 %. This simple procedure may be used as a convenient screening method for determination of total anthraquinones content in plant extracts, which are in use in pharmaceutical and food industry.

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ANALYSIS OF IN VITRO ANTIMICROBIAL ACTIVITY OF DIFFERENT HUNGARIAN PROPOLIS SAMPLES IN A HUMAN INTESTINAL MODEL

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Propolis has used worldwide as folk medicine for its antimicrobial activity against certain pathogenic microorganisms; however, there is less information about the susceptibility of the intestinal microbiota.
Antimicrobial activity of four propolis samples of different geographical origins was investigated on four lactobacilli, four bifidobacteria and four potentially enteropathogen strains. Each propolis samples were tested by agar diffusion method on Müller-Hinton agar plates twice: after in vitro digestion and without digestion. The agar diffusion test of the not digested propolis samples was performed as follows. The propolis was dissolved in 80% ethanol to get the following concentrations: 0.0625 g/ml, 0.125 g/ml and 0.25 g/ml. The inhibition zones were measured and recorded after proper incubation time.
The influence of digestion on the antimicrobial activity was assessed after in vitro procedure that simulated the digestion processes in a simplified manner by applying physiologically based conditions, i.e. chemical composition of digestive fluids, pH and residence time periods typical in the compartments of the human gastrointestinal tract. During the digestion process the propolis samples did not dissolve in the digestive fluids but remained resinous and aggregated on the wall of the vessel and on the stirrer. The aggregated propolis and the digestive fluids were investigated separately for their antimicrobial activity with agar diffusion method.
Bifidobacteria, Lactobacilli and except the E. coli the pathogenic species were susceptible against the EEP samples. With the raising concentration of propolis, the antimicrobial activity showed directly proportional increase. Bifidobacteria had higher sensibility against propolis than lactobacilli. Antimicrobial activity of propolis was lightly decreased by the digestion process. Physiological role of the propolis can be evaluated only in a complex approach, since this substance is known about its beneficial physiological effects, but much less information is available on the possible side-effects.

DETERMINATION OF NATURAL PHENOLS AFTER MICROWAVE-ASSISTED EXTRACTION

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Natural phenols are synthetized by large group of plants where they play an important role in plant metabolism and protection against pests. These compounds, in addition to being indispensable in plant metabolism, also exhibit complex biological activity in humans for what they are constantly in the focus of scientific interest. The aim of this study was to determine antocyanins, neutral and total polyphenols in different fruit and vegetable samples, as well as in cakes remaining after oil extraction of several oilseeds by implementing a modified spectrophotometric method. For sensitivity improvement a differential spectrophotometric measurement mode was applied. Sample preparation procedure was optimized in order to increase extraction efficiency and to reduce necessary time, and included microwave-assisted extraction, purification of the extracts and fractionation of polyphenols to different classes by using solid phase extraction. Individual acidic and neutral polyphenolic compounds were identified in plant extracts by applying thin layer chromatography.

DEVELOPMENT OF A NOVEL ANALYTICAL TECHNIQUE FOR ANALYSIS OF BIOACTIVE OLIGO-PEPTIDE DERIVATIVES IN FOODSTUFFS

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Small molecular weight peptides represent an important family of bioactive compounds with significant clinical and food industrial implications. The functional properties can include antioxidantm surfactant and antimicrobial activity, moreover these compounds can contribute to characteristic flavors such as sweetness and bitterness. The previously published methods disclose deficiences and shortcomings in terms of the quantitative analysis, the sensitivity and reproducibility, thus development of improved analytical methods appears to be indispenseable.
Our intention was to develop a reliable and sensitive chromatographic method to detect di-, and tripeptides (Aspartame, L-carnosine, L-glutation, Alanyl-glutamine and γ-glutein) in raw and processed foodstuffs. The detection of free peptides was carried out by using evaporative light scattering (ELS) detection, and UV detection with pre-column derivatization with danzyl-chloride.
Pea, rice and garlic samples have been selected for the study, the extraction procedure was optimized with 5 different solvents, and the peptide content was analyzed with the newly developed technique. Antioxidant activity (FRAP) was observed only for the sulphur containing derivatives (γ-glutein, L-glutation). Garlic extracts have shown the highest antioxidant activity (46 ppm in ascorbic acid equivalents), pea samples have exhibited lower activity (23 ppm) and the lowest activity has been measured for rice samples (19 ppm). The peptide content varied in the 10-100 ppm region in all cases. The stability of the sulphur containing derivatives has been found to be low, the stability of these compounds was increased by applying different agents and protection ways such as antioxidants and transition metals and transformation to derivatives (esterification).

BLACK CURRANT MARC – VALUABLE SOURCE OF BIOLOGICALLY ACTIVE COMPOUNDS

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Black currants are widely grown in Latvia. Valuable influence of fresh black currant berries on human health is known very well. However, most of the black currant crop is used for processing. The main processing products till now are juice and jam. But nowadays obtaining of new easily available products of plant origin on the base of by-products is very important. As a result of juice pressing a by-product – marc is left unutilized. Several juice extraction technologies are available, but as a result biochemical composition of juice and marc will be different.

The investigation was carried out at the Latvia State Institute of Fruit-Growing, Research Institute of Food Safety, Animal Health and Environment “BIOR” and Latvia University of Agriculture in 2011.

The aim of the study was to determine biochemical composition: vitamin C, total anthocyans, total phenols and crude fibre of black currant marc.

Two different black currant juice extraction methods: pressing and heating were used.

The marc after juice extraction from berries of the following black currant cultivars: ‘Ojebyn’, ‘Titania’ and ‘Vernisazh’ was tested for the composition of bioactive compounds.

As a result it was ascertained that biochemical composition in the marc, besides cultivar effect, depends also on the juice extraction method. Using juice extraction by heating if compare to pressing the content of vitamin C, total anthocyans and total phenols reduced, but the content of crude fibre increased.

MICROELEMENT ACCUMULATING CAPACITY OF SELECTED MICROALGAE (CHLORELLA VULGARIS AND SPIRULINA PLATENSIS) WITH THE PROSPECTS OS FUNCTIONAL FOOD DEVELOPMENT

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Chlorella vulgaris and Spirulina platensis were in the focus of our research due to the high content of bioactive compounds, favourable growth feature and versatile application aspects with special regard to microelement supplementation.
In our work emphasis was laid on investigation of the extent of bioaccumulation of 4 microelements (Fe(III), Cu(II), Zn(II), Mo(VI)) in cases of the two abovementioned algae species. Bioaccumulating capacity of the algae was studied in a two-week-long experiment by growing them in metal-fortified media.
Both Spirulina platensis and Chlorella vulgaris proved to be efficient in terms of metal accumulation. With the exception of molybdenum the bioaccumulating capacity of Chlorella exceeded that of Spirulina.
Iron (789.7±102.7mg kg-1) and zinc (378.1±5.5mg kg-1) were accumulated to a large extent by Chlorella vulgaris, while bioaccumulation ability of Spirulina platensis proved to be the most significant for iron (676.9±27.6mg kg-1) and molybdenum (5.79±1.1mg kg-1).
Due to the pronounced metal bioaccumulating feature of the two microalgae studied, they are suitable for further application in the production of functional food with enhanced microelement content of high biological availability thanks to the organic forms they are present in the products.
The biomass of Spirulina platensis increased to greater extent than that of Chlorella's after the same incubation time in case of the control media, however metal treatment of the media favoured more pronouncedly the growth of biomass of Chlorella vulgaris. The biomass of Spirulina platensis was diminished when incubated in metal fortified media, with the exception of iron, when definite biomass enhancement was experienced.
As a consequence it might be established that both studied microalgae species can be suggested for involvement in further functional food developments, since they may inevitably contribute to microelement supply of humans, or to the prevention of iron deficiency anaemia.

DEVELOPMENT OF WHITE LUPIN BASED FOOD PRODUCTS

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White Lupin is a leguminous seed with high protein content (about 40% of dry matter) and it is an economically and agriculturally valuable plant. White Lupin is a good source of nutrients, not only proteins but lipids, dietary fiber, minerals and vitamins. The high nutritional value and excellent functional properties make White Lupin a very valuable food ingredient. In our work we developed White Lupin based bakery and dairy products. White Lupin seeds were grinded in a domestic mill to produce lupin flour. We produced sweet biscuits, salty crackers, breads and pastry products by substituting wheat flour at 10, 20, 30 and 40 % with lupin flour. These lupin flour supplemented products scored high on sensory evaluation. Lupin proteins are gluten free, which renders this plant a feasible ingredient for the production of gluten free food products, which are safe to eat for people with wheat allergies or coeliac disease. We manged to produce gluten free biscuits, crackers and pastryproducts by substituting wheat flour with starch and other ingredients. We produced white lupin milk with a method similar to the domestic soy milk preparation. This lupin milk can be used to produce fermented dairy-like products. White lupin yoghurts were made using four different types of starter cultures. These vegetarian yoghurts also scored high on sensory evaluation. In our work we showed that lupin flour is suitable to develop functional food products with high nutritional values and managed to produce gluten free food products by completely omitting wheat flour from our recipes.

Keywords: white lupin, functional food, gluten free, biscuit, yoghurt, pastry

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IDENTIFICATION OF UNHEALTHY DIETARY HABITS SPECIFIC FOR POPULATION AT RISK-OF-POVERTY

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Introduction:
Recent research has confirmed the importance of poor nutrition to major health problems and overall disease burden in Europe. Those with low socioeconomic status (SES) and in risk of poverty (ROP) are likely to eat less healthily and are more prone to nutritional choices associated with unhealthy dietary habits. The objective of this work was to identify unhealthy dietary habits in population at ROP in Europe

Methods and Materials:
Open access (Medline, Web of Science) and grey literature sources were systematically searched for key documents published from 1990 to October 2011 that reported on (unhealthy) dietary habits. In addition, reports from the World Health Organization databases (www.who.int), EFSA (www.efsa.europa.eu), FAO (www.fao.org), Food Standard Agency (FSA) (http://www.food.gov.uk/) were included. Descriptive study results/conclusions were extracted, summarized and reported as unhealthy food group/subgroup/nutrient most commonly consumed per age group per country.

Results:
Results suggested that those on low income and at ROP consume cheap energy from foods such as cheap meat products, full cream milk, fats, sugars, potatoes and little intake of vegetables, fruit, and white bread. The consumption of whole grains, lean meats, fish, low-fat dairy products, and fresh vegetables and fruit (containing considerable amounts of vitamins, minerals and fibre) was consistently associated with higher SES groups, whereas the consumption of fatty meats, refined grains, and added fats was associated with lower SES groups. Low-SES groups had the lowest consumption of vitamin C, vitamin D, carotene, folate, vitamin E, plant-based polyphenols, as well as low intake of minerals iron, calcium and potassium.

Conclusion:
Our study identified the main nutritional criticalities specific for the population at the risk of poverty. These data are of essential value to develop the strategy for achieving optimal nutritional health in vulnerable groups..

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RADICAL SCAVENGING POTENTIAL OF PUMPKIN SEED OIL

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Pumpkin (Cucurbita pepo L.) seed oil is a common salad oil in a northern part of Croatia. Besides the traditional production method (crushing the seeds, roasting and pressing at elevated temperatures), cold production method (crushing the seeds and pressing, at max. 40°C) is recently introduced. As a result, pumpkin seed oils with different organoleptic and chemical characteristics are produced.
In this work, antioxidant activity of several pumpkin seed oil samples, differing in production method, was investigated by electron spin resonance (ESR) and UV-VIS spectroscopy. Galvinoxyl radical (GO) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) were used as scavenging object for the ESR. GO was dissolved in isooctane with the radical concentration of 0.15 mmol/L while DPPH solution with the radical concentration of 0.10 mmol/L was prepared using ethyl acetate as solvent. The freshly prepared radical solution was added to the pumpkin-seed oil samples in order to obtain 3 and 4% (w/v) oil solution. The moment at which the radical solution was put in contact with oil sample was taken as t = 0. ESR measurements were performed at room temperature and the loss of the signal intensity was measured as a function of time.
DPPH was applied as scavenging object for UV-VIS measurements. The absorbance was measured at λ = 515 nm as a function of the time past from the addition of DPPH solution (0.10 mmol/L) to oil samples.
The inhibition of GO, as well as DPPH, in the case of the traditionally produced pumpkin-seed oils was very rapid. Better results are obtained for traditionally produced samples in comparison with those obtained by cold method. Although the reaction of inhibition during the first minute of scavenging reaction was similar between differently produced oil samples, end time point is significantly different. For each oil sample, scavenging mechanisms were similar, comparing ESR scavenging object, as well as, radical-scavenging activity methods.

THE ANTIOXIDANT ACTIVITY OF THE EXTRACT OF SATUREJA KITAIBELII WIERZB. EX HEUFF. AND ITS USE IN THE FORMULATION OF THE ICE TEA

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The antioxidant activity, the total content of phenols and flavonoids have been measured in the ethanol extract of Satureja kitaibelii Wierzb.ex Heuff.herb, as well in the already made ice tea, which contains the extract of this species. The antioxidant activity has been obtained by the use of DPPH (1) and FRAP (2) method, while the content of total phenols and flavonoids has been determined by the spectrophotometric methods with Folin- Cicoltea reagent (3) and aluminum-chloride (4), respectively.
With the aim of making the nutritionally valuable product, with good sensory characteristics and high antioxidant capacity, different concentrations of the extract, used in this process, have been prepared. The antioxidant activity of the final product has been valued and the best formula for its obtaining has been determined.
The capacity of neutralizing of DPPH radicals maximally reaches 91.84 % for the extract and 93.39 % for the ice tea, while the values for EC50, in the extract obtained from the herb were EC50=18.85 ± 0.31 μg/mL, and in the final product were EC50 =26.95±1.31μL/mL, respectively. The normalized value of the antioxidant capacity of the extract (determined by the FRAP assay) was 3.22 ± 0.15 mmol Fe2+/mg, while in the prepared product it was 6.97 ± 0.15 μmol Fe2+/mL.
The content of phenols and flavonoids in the extract is 62.5±7.33 mg GK/g of dry extract and 39.8 ±0.37 mg of rutin/g of dry extract , while in the ice tea is 0.644±0.016 mg GK/ml of drink and 0.235 ±0.002 mg of rutin/ml of drink.
The results show that the extract of the herb S.kitaibelii can be used as a natural antioxidant and a possible additive for the refreshing non-carbonated soft drinks.
Key words: Satureja kitaibelii Wierzb. ex Heuff., antioxidant activity, total phenols, flavonoids.

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ANTIOXIDATIVE RESPONSE OF STEVIA LEAVES TO LOW TEMPERATURE TREATMENT

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Stevia (Stevia rebaudiana (Bert.)) leaves are a very good source of natural antioxidants, especially phenolics and flavonoids that protect the human body from free radicals and many chronic diseases. Moreover, antioxidants present the important link in the complex defence mechanisms against reactive oxygen species (ROS). Low temperatures adversely affect the detoxification of ROS and the resistance of certain varieties to low temperatures is largely based on increased activity of antioxidant enzymes. Being a tropical plant, stevia does not tolerate low temperatures. Nevertheless, regarding its positive effects on human health, it would be useful to expand its breeding area to temperate regions. For that reason, it is necessary to investigate the biochemical mechanisms involved in antioxidative response to the low temperature treatment in stevia leaves. In the present study, plants were exposed to low temperature conditions (4ºC) in the dark at different time points with subsequent 24 h recovery period. Biochemical analyses included spectrophotometric determination of total hydrogen peroxide concentration (HP), total phenols (PHE), guaiacol peroxidase (GPX) and catalase activity (CAT) and lipid peroxidation intensity (LP).

HP concentration in stevia leaves decreased in low temperature treated plants after 24 h of treatment, followed by an increase to maximum value that did not change after the recovery period. Lowering of HP concentration coincided with 64% increase in CAT activity after 3 h of treatment and GPX activity increase by 60% after 6 h of treatment. The significant increase in GPX activity after 36 h of treatment was likely due to the total PHE increase that may be a component of acclimation-induced chilling tolerance.

Our results showed that the short term low temperature treatment could induce better tolerance of stevia due to increased leaf antioxidative enzymes activities.

ANTIOXIDANT ACTIVITY OF SUMAC

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Antioxidant compounds play an important role as a health protecting factor and retarding oxidative degradation of biological compounds by inhibiting formation of free radicals. The use of synthetic antioxidants is common in spite of the studies related with their toxicology and their negative effects on the human health. For this reason the demand for the natural antioxidants has gained interest. Most of the natural antioxidant compounds such as phenolics and polyphenols derived from plant sources. Many of the spices and herbs such as oregano, thyme, sage, sumac, rosemary etc. are used in foods for their desirable flavors as well as for their antimicrobial and antioxidant activity which may help preservation of the food.

Sumac (Rhus Coriaria L.) is one of the traditional spices in Turkey. The use of sumac is mainly for kebabs, grilled meats, stuffed grape leaves and green peppers, salads and sliced onions. Sumac is a rich source of hydrolysable tannins and anthocyanins which are strong antioxidants. The studies related with antioxidant activity of sumac can be studied in two broad groups as; determination of the antioxidant activity in sumac species and in applied food systems.

In the first group, there exist the studies related with determination of the antioxidant activity in different extracts (ethanol, water, methanol and ethyl acetate etc.) of sumac species as wood, branch, berries and leaves. The radical scavenging activities of spray dried sumac extract (with maltodextrin addition) powders was also determined by DPPH method.

The second group involves studies applied food systems; like use of sumac extracts to prevent lipid oxidation in sunflower and peanut oils, to decrease the formation of biogenic amines and thiobarbituric acid reactive substances in sucuk (Turkish fermented sausage).

CONTENTS OF MAIN PHENOLICS AND ANTIOXIDATIVE CAPACITY IN FROZEN RASPBERRY FRUITS (RUBUS IDAEUS L.) FROM ARILJE GROWING AREA

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Raspberries are economically important berry crop that contains numerous bioactive compounds and natural antioxidants with a high free radical scavenging capacity. Berry fruits are extremely perishable and have a short market life. Therefore processing, in particular freezing in commercial cold storages, is necessary in order to provide raspberries to the market and consumers over the entire year.

In Serbia, raspberry are being produced on 13.500 ha, and production is varying between 60.000 and 94.366 t. Arilje growing area is the main production center, with one quarter of total raspberry production in Serbia.

Individually quick frozen (IQF) fruits of the most abundant raspberry cultivars in Serbia (Meeker and Willamette) were randomly taken from the commercial cold storage in Arilje growing area, and analyzed for main phenolics and antioxidative capacity. All samples for freezing were harvested in the full ripening stage in the orchards in close proximity to the commercial cold storage, frozen by conventional freezing, and stored at -18°C. Using high-performance liquid chromatography, high content of ellagic acid (from 13,99 to 27,01 mg/100 g fw for Meeker; from 26,15 to 35,22 mg/100 g fw for Willamette) and cyanidin (from 20,75 to 29,97 mg/100 g fw for Meeker; from 32,97 to 64,68 mg/100 g fw for Willamette) were determined. Significant amounts of pelargonidin (up to 7,08 mg/100 g fw), gallic acid (up to 4,42 mg/100 g fw), quercetin (up to 1.56 mg/100 g fw), and apigenin (up to 0,42 mg/100 g fw) were also detected in all samples. Although the raspberries cv. Willamette contain higher concentration of detected phenolics than raspberries cv. Meeker, nevertheless antioxidative capacity is nearly equal for both cultivars examined.

DETERMINATION OF TOTAL ANTIOXIDANT ACTIVITY OF MILK USING POTENTIOMETRIC TITRATION

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INTRODUCTION:
Although human breast milk is the best dietary choice for a newborn, infant formula is a good enough replacement, so that babies not only survive but thrive on it. There is a constant search for an improved way of monitoring the quality and freshness of infant formula. The aim of this research was to determine the similarity and difference in total antioxidant capacity between formula and breast milk for the purposes of preventing oxidative stress and modifying infant formulas.

METHODS:
Human breast milk, collected from 10 mothers in the 9th week of lactation, 3% skimmed milk UHT, and an infant formula supplemented with prebiotics were used. Milks were diluted in a phosphate buffer solution and total antioxidant activity was potentiometrically measured using iodine/iodide redox couple with a two-electrode cell. The cyclic voltammetry measurements were conducted in a three-electrode cell. All measurements were carried out in an anaerobic environment.

RESULTS:
Potentiometric data of all milks indicate that total antioxidant capacity was high in both human breast milk and infant formula. Plotting the derivative of the oxidant concentration with potential as a function of potential showed that all samples had a double-peak curve, due to the presence of two major oxidizable components that are sequentially oxidized by iodine. Electrochemical behavior of milk and semiquantitative determination of vitamin C were detected by cyclic voltammetry.

CONCLUSION:
Based on our results, it can be concluded that milk is not a well-poised system due to the presence of at least two different oxidazible species, one of which is hydrophobic while the other is hydrophilic. It is observed that total antioxidant capacity of infant formula is similar to the one of breast milk.

ANTIOXIDANT AND ANTIMICROBIAL POTENTIALS OF CHAMPIGNON MUSHROOM

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Fruiting bodies of some wild and cultivatable mushrooms contain medicinal compounds which are being used in traditional medicines and cosmetics. Champignon mushroom (Agaricus bisporus) is the most widely cultivated species of edible mushroom worldwide. This paper focuses on antioxidant and antimicrobial importance of A. bisporus.

Water-soluble polysaccharide-enriched fraction was isolated [1] from the dry carpophores of Agaricus bisporus. Antioxidant activities were investigated using in vitro assay systems: 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging and chelating ability on ferrous ions. Antimicrobial activity was tested in vitro by disk diffusion method in order to determine the zones of inhibition. The following strains of bacteria were used: Gram positive bacteria - Enterococcus faecalis ATCC 49532, Bacillus cereus 10876, Geobacillus stearothermophylus ATCC 7953, and Gram negative bacteria - Pseudomonas aeruginosa ATCC 35032, Proteus hauseri ATCC 13315 Escherichia coli (0157:H7) 35150, Klebsiella pneumoniae ATCC 27736.

EC50 values of the DPPH scavenging activity of the polysaccharides from champignon mushroom was 2.0 mg/ml. At concentrations of 0.1-10.0 mg/ml, the scavenging abilities of A. bisporus ranged between 12.3-75.5 %. The radical scavenging ability of the positive controls -tocopherol and ascorbic acid were between 79.94-78.43 and 80.63-87.64 %, respectively. EC50 values of the chelating ability of ferrous ions was 7.80 mg/ml. Polysaccharide extract from A. bisporus showed steadily increasing chelating ability as concentrations increased to 88.19 % at 20.0 mg/ml. The chelating ability of the citric acid was between 7.19-10.7 %, at the concentrations of 0.1-20.0 mg/ml.

The study of antimicrobial potential of polysaccharide extract showed more potent activity against Gram-positive Enterococcus faecalis ATCC 49532 (26.7 ± 0.2 mm), Bacillus cereus 10876 (27.5 ± 0.4 mm), Geobacillus stearothermophylus ATCC 7953 (22.8 ± 0.3 mm) than Gram-negative bacteria Pseudomonas aeruginosa ATCC 35032 (10.4 ± 0.6 mm), Proteus hauseri ATCC 13315 (12.1 ± 0.1 mm) Escherichia coli (0157:H7) 35150 (12.7 ± 0.4 mm) with exception of Klebsiella pneumoniae ATCC 27736 (22.3 ± 0.2 mm).

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POLYPHENOLS AND ANTIOXIDANT CAPACITY OF MARASCA SOUR CHERRY ECOTYPES (PRUNUS CERASUS VAR. MARASCA)

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Introduction
Sour cherries are rich sources of phenolic compounds, with strong antioxidant and anti–inflammatory activities. Many factors influence on phenolic content (PC) and antioxidant capacity (AC) of fruits. Therefore, the aim of this study was to determine variation in PC and AC of different ecotypes of sour cherry Marasca grown at different locations.

Materials and methods
The PC (anthocyanins [A], flavonol glycosides [FGs], hydroxycinnamates [HCA], flavanols [F], and procyanidins [P]) of three ecotypes of sour cherry Marasca (Recta, Sokoluša and Brač 2) harvested in Zadar and Split growing locations were detected and quantified by HPLC−UV/VIS PDA (Chaovanalikit and Wrolstad, 2004). AC was determined by using DPPH, FRAP and ABTS methods.

Results
Anthocyanin content dominated in total PC of sour cherry Marasca ecotypes, ranging from 2.58 to 8.05 g/kg of dry matter (dm) with cyanidin glycosides being the most abundant. Total HCA of fruits ranged from 29.32 to 64.85 mg/kg dm, with chlorogenic and ferulic acid present in the highest concentration. Total FGs ranged from 159.81 to 338.64 mg/kg dm and the kaempferol glycosides represent the main flavonol in all investigated sour cherry ecotypes. Total F and P ranged from 5.30 to 13.06 mg/kg dm. The (+) catehin and procyanidin 1 were the main F and P, respectively. The data obtained by the three methods showed high AC of all ecotypes.

Conclusions
Generaly, higher PC and AC were in cherries from Zadar growing location. Good correlations were observed between pelargonidin-3-glycoside and AC, regardless to method of determination, while neochlorogenic acid showed good correlation with ABTS. The ANOVA showed significant influences of ecotype and growing location on HCA and FGs amounts.

PREDICTION OF LIPOPHILICITY OF PAPRIKA CAROTENOIDS USING QSRR

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Carotenoids are a class of compounds well known for a long time, being the object of considerable interest, mainly due to characteristic red color, provitamin and antioxidant activity. Liquid chromatography (HPLC) is one of the most powerful analytical tools for organic compound analysis. The advantages of using chromatographic methods include: selectivity, chromatographic integrity and rapid method development. In this context, a liquid chromatography method has been developed and validated for determination of mathematical models for prediction of lipophilicity of paprika carotenoids. The correlation between retention factors, tr (retention time), of several carotenoids, and their physico-chemical and structural properties has been studied by QSRR. The research in this paper is focused on testing the influence of chemical structure on the lipophilicity of isolated free carotenoids from paprika oleoresin.

Retention mechanism has been determined using the mixture of two mobile phases A – acetone : water (75 : 25; v/v) and B – acetone : methanol (75 : 25; v/v), by changing the volume fraction of modifier in the mobile phase. The relationship between lipophilic character of molecules, logP, and chromatographic retention parameters has been determined.

Relationships between these molecular descriptors and retention factors were established, and their predictive and interpretative ability was evaluated. The relationships equation between retention factors and various lipophilicity descriptors of carotenoids are presented in linear and multiple linear forms (QSRR models). The estimated correlation coefficients of relationship equations were very high (more than 0.95), which indicates that retention time (as parameter obtained using HPLC) could successfully be used for prediction of lipophilicity of carotenoids.

RELATIONSHIP BETWEEN PHENOLIC CONTENT AND OXIDATIVE STABILITY IN DALMATIAN VIRGIN OLIVE OILS

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INTRODUCTION

Olive oil is a prominent source of monosaturated fatty acids (MUFAs) due to its high oleic content, as well it's a rich source of natural antioxidants (vitamin E, polyphenols such is oleuropein and tyrosol). Its antioxidant content depends on different factors, such is cultivar, fruit ripening stage, climate conditions and olive growing techniques. Oxidative stability of olive oils is related to the ratio of monounsaturated and polyunsaturated fatty acids, and is also influenced by phenolic fraction. The aim of this work was to determine the fatty acid composition, total phenol content and composition of single phenol compounds and their correlation with oxidative stability of examined oils.

METHODS AND MATERIALS

The monovarietal fruit samples from 5 cultivars were all picked up at the same ripening degree and processed in oil by laboratory plant. Besides basic quality parameters, fatty acid content was determined by GC technique. Total phenol content was measured colorimetrically, while the single phenol composition was determined using HPLC-DAD/MSD system. Oxidative stability of oils was evaluated by OSI instrument.

RESULTS

Fatty acid composition in all samples showed oleic content above 70%. In all samples a stable ratio of oleic and linoleic acid (18:1/18:2) was detected, with values close to or higher than 7. All oils had a total phenol content between 85.59 and 384.33 mg/kg, as well as different composition of individual phenolic compounds, depending on the olive cultivar. Among single phenolics, the most representative was hydroxsityrosol and oleuropein aglycon. Oxidative stability data showed very good storage capacity, depending on fatty acid and phenol composition.

CONCLUSIONS

In all samples in this study very good total phenol content was detected. Oxidative stability of two cultivars was correlated with their oleic/linoleic ratio, while in others it depends also on phenol composition.

KEYWORDS: olive oil, oxidative stability, phenols, fatty acid composition

STUDY OF THE PROBIOTIC POTENTIAL OF LACTOBACILLI NATURAL ISOLATES THROUGH THE ANALYSIS OF ADHESION ABILITY TO CACO-2 INTESTINAL EPITHELIAL CELL LINE

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Lactobacilli strains could be found in fermented products and as a part of gastrointestinal microbiota showing potential beneficial properties for human health. The BG laboratory collection encompasses numerous lactobacilli strains of different origin that exhibit different characteristics like aggregation, production of extracellular or cell-wall associated polysaccharides and production of bacteriocins. All these features present the starting point in the selection of possible new probiotic strains.

The influence of different molecules present on the bacterial cell surface to the adhesion ability of selected lactobacilli (L. paracasei BGSJ2-8, L. paracasei BGGR2-66, L. sucicola BGGO7-28, L. helveticus BGRA43, L. fermentum BGHI14) was evaluated by using Caco-2 epithelial intestinal cell lines as the in vitro test system. The adhesion was calculated as relative ratio of adhered CFU and total CFU number (%). The derivatives of selected isolates lacking genes encoding polysaccharides (CPS- phenotype), aggregation phenotype (Agg-), or bacteriocin (Bac-) were inactivated by single cross-over knock-out using pGhost integration system or by plasmid curing. Additionally, the surface proteins were removed by treatment of cells with proteinase K.

The results revealed that CPS and Agg phenotypes have the positive effect on the adhesion of BGSJ2-8 strain (10% and 7%, respectively), comparing to CPS- (2%) and Agg- derivative (0.5%) or the cells treated with proteinase K (2%). The CPS-Bac- derivative of strain BGGR2-66 exhibit 28% adhesion in comparison to 10% obtained with original strain. The strain BGGO7-28 with S-layer protein exhibit 5% adhesion, while human intestinal isolate BGHI14 and the strain BGRA43, reported previously as potential probiotics, exhibit 12% and 17% adhesion, respectively.

In conclusion, the results indicate that natural isolates are a valuable source in terms of potential probiotic strains and could be interesting to dairy companies for the formulation of functional starter cultures in the production of innovative food.

THE ACID WHEY PREPARATIONS OBTAINED AFTER MEMBRANE SEPARATION PROCESSES - IN VIVO EXPERIMENT ON GASTROINTESTINAL TRACT OF RATS

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Acid whey is a by-product in the manufacture of fresh white cheese, acid curd cheese or acid casein production. The most important differences between sweet and acid whey are the absence of casein, the high calcium content and the higher acidity. Membrane separation processes enable improvements in the quality of existing dairy product and enhancment process efficiency and profitability.
Obtained laboratory concentrates from industrial acid whey have been analysed by in vivo animal model. Concentrates received upon different membrane separation processes (nanofiltration, nanofiltration with diafiltration, ultrafiltration) constituted 20 or 40% of the rats diets, the standard rats diet was used as a control. In the in vivo experiment changes in body weight and metabolism of Ca and P, growth and biochemical or physiological indicators were determined. Biochemical indices in blood, lipid metabolism, enzymatic activity and physiological reaction of caecum and colon were analysed. Compared to the control group the relationship of growth and food intake was better for the experimental diets. The used acid whey had the small impact on transit (excessive accumulation) content in the small intestine. Experimental diets affected positively the parameters of the caecum (wall mass and caecum contents, pH and ammonia content). Also digestibility and utilization of nitrogen was better and high coefficient of digestibility and retention of phosphorus and calcium from the experimental diets was observed. Statistically significant lower glucose level in blood and the reduced level of triacylglicerols in comparison with the control group were noticed. The results obtained in the in vivo experiment did not show significant differences in the physiological effects of investigated concentrates obtained by using the different membrane separation processes.
Research was supported by the National Centre for Research and Development (No N R12 0086 06).

ANTIOXIDANT PROPERTIES OF SELECTED FIG (FICUS CARICA CV.SABZ) FROM IRAN

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Fig has been a typical fruit component of the health-promoting in the middle east for a very long time.Phenolics are an important constituent of fruit quality because of their contribution to the taste,colour and nutritional properties of fruit.In this study,the phenolic antioxidants of fig (ficus carica CV.sabz) pulp from iran,stahban region,were extracted by three diffrent solvents (boil water,ethanol/water (v:v,50:50) and methanol/water (v:v,50:50)) in diffrent concentration by ultrasound-assisted method.The total phenolic compounds were determined according to the Folin-Ciocalteu method.With the HPLC system,we have identified the following phenolics:gallic acid,chlorogenic acid,catechin and rutin.Results showed that the highest phenol is 4768.46 (mg gallic acid equivalent/kg Fig) related to extarcted soloution by boil water solvent with 40%(w:v) concentration.The pulp of fig is rich in gallic acid,chlorogenic acid,catechin and rutin with maximum amounts of 644,1449.3,621.3 and 978 (mg/kg fig).It is a clear relation between concentration of fig pulp and phenolic content.This special cultivar contain highest level of phenolic compounds,compared with common figs from mediterranean region.

THE QUALITY OF A GLUTEN-FREE DIET EVALUATED WITH MEDITERRANEAN DIETARY QUALITY INDEX IN CROATIAN CELIAC PATIENTS

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Introduction:
Strict gluten-free diet, the only treatment for patients with celiac disease, is necessary to prevent malabsorption and to reduce the risk of complications. Such diet excludes all foods and beverages that contain gluten and therefore may result in a nutritionally unbalanced diet. Mediterranean diet is a synonym for healthy and balanced diet. It has been shown that greater adherence to Mediterranean diet is correlated with reduced mortality. Adherence to Mediterranean diet can easily be determined using Mediterranean dietary quality index (MDQI). MDQI is consisted of seven components (saturated fatty acid, cholesterol, meats, olive oil, fish, cereals, fruits + vegetables), whereas each component depending on intake may achieve 0 to 2 points. Total index score might be between 0 and 14 points, where 0 points indicate great adherence to Mediterranean diet. The aim of this study was to evaluate the quality of a gluten-free diet based on a MDQI in Croatian celiac patients.

Subject and Methods:
MDQI was calculated based on a seven day food record from 23 celiac patients from Mediterranean region and 38 celiac patients from continental region.

Results:
Statistical difference was observed only for saturated fatty acid intake among observed regions ($p<0.05$). Celiac patients from Mediterranean region achieved 9.79 points while celiac patients from continental region achieved 10.68 points, however there is no statistical significant difference between these regions.

Conclusions:
In conclusion, celiac patients adhering gluten-free diet, probably duet to specific dietary restriction, as expected have lower diet quality according to MDQI.

NUTRITIONAL QUALITY OF LINSEED AND OIL HEMP VARIETIES

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Oil hemp and linseed can be a complete and balanced source of fatty acids.
Oil hemp has an optimal omega 6 / omega 3 ratio of 3:1, but with limited use in Romania because of the stigma of drug and linseed, due to the oil quality which conteins omega 3 and omega 9 fatty acids and the pleasant taste, in addition to traditional uses, increasingly finds new uses in areas where until recently there were no data on the use of those cultures: food industry (pastry/bakery), medicine and cosmetics.
The biological material used consisted of two monoecious hemp varieties (Zenit and Denise), one dioecious hemp variety (Armanca) and three flax oil varieties (Lirina, Florinda and Iunia 96) authorized in Romania.
The oil content of the studied varietes was determined by Soxhlet method with a Velp block of mineralization. Investigation of fatty acid profile was performed by gas chromatography GC-MS whit Shimadzu GC MS QP 2010.
The compounds separated and identified from the hemp and linseed oil and their concentration were: linoleic acid, omega-6 between 57,57 % - 60,26 % in oil hemp and between 14,39 % - 17,26 % in linseed, alpha-linolenic acid, omega-3 between 14,98 % - 18,67 % in oil hemp and between 50,71 % - 54,30 % in linseed, oleic acid, omega-9 between 8,58 % - 14,02 % in oil hemp and between 19,95 % - 27,40 % in linseed, palmitic acid between 6,64 % - 7,10 % in oil hemp and between 4,65 % - 5,5 % in linseed, stearic acid between 1,21 % - 2,9 % in oil hemp and between 2,82 % - 4,92 % in linseed.
Due to the fatty acid profile, linseed and oil hemp are highly suitable dicotyledonous crops for the human health.

FOLATE INTAKE AND STATUS IN CROATIAN PERI- AND POSTMENOPAUSAL WOMEN

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Introduction:
Folate is attracting the significant scientific interest because of its multiple roles in maintaining health. Impaired folate status has been identified as a risk factor for cardiovascular disease, various types of cancer and neurocognitive disorders.
The aim of the study was to assess the adequacy of folate intake and status among perimenopausal and younger postmenopausal Croatian women.

Subjects and Methods:
Red blood cell (RBC-) and serum (S-) folate concentrations were measured in 174 women aged 45-65 years. All participants completed validated food frequency questionnaire (FFQ) designed to measure dietary folate equivalents (DFE).

Results:
The mean concentration of S-folate was 9.67±3.33 ng/mL (9.17-10.17 ng/mL, 95 % CI), while the mean concentration of RBC-folate was 403.53±141.40 ng/mL (382.31-424.76 ng/mL, 95 % CI). Sub-optimal S-folate levels (<7.2 ng/mL) were found in 25 % of participants, while the RBC-folate levels were inadequate in 12 % of participants. Average daily intake of folate was 292.4 μg DFE. Approximately 82 % of women did not meet the dietary reference intake (DRI) for folate (400 μg/day). A positive statistically significant correlation was found between folate intake with both, S-folate ($p<0.001$) and RBC-folate ($p<0.001$).

Conclusions:
In conclusion, our results provide information about folate status and folate intake on a limited population sample so large scale epidemiological studies should be conducted to assess the prevalence of impaired folate status and folate intake among this population. Folate intake should be encouraged primarily through intake of folate rich foods.

Acknowledgments
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FOLATE AND CALCIUM INTAKE AMONG UNIVERSITY STUDENT POPULATION IN CROATIAN MOUNTAIN REGION

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Introduction:
Inadequate calcium intake may result in weak bones, especially for women who have a greater risk of osteoporosis later in life. This point should be emphasized for young people who need to maximize their peak bone mass, so an ideal time for prevention of osteoporosis may be during the college years. Adequate folate intake in women of childbearing age can reduce the risk of serious birth defects, including neural tube defects. The aim of this study was to determine the average dietary folate and calcium intake among university student population, because these two micronutrients are critical for young people. In the mountain region, milk and dairy products are traditionally present in a daily diet, which is not the case for the consumption of fruits and vegetables.

Subjects and Methods:
The study included 321 university students both gender (50.2% females and 49.8% males), 19-25 years old, from Croatian mountain region. Validated food frequency questionnaires were used to assess an average folate and calcium intake.
Results:

The average dietary folate intake was 239.8 μg DFE i.e. 60.0 % DRI. The average dietary calcium intake was 1062.0 mg i.e. 106.2 % DRI. The average dietary folate and calcium intake was not significantly different ($p<0.05$) according to gender.
Conclusion:

As was expected, the average daily calcium intake was in accordance with the recommended value, while the average daily folate intake was below recommended value. Higher intake of folate rich food should be advised to university students in Croatian mountain region.
Key words: folate, calcium, food frequency questionnaire, student population

DIGESTION AND ABSORPTIONA OF CARNOSINE IN MEAT MODEL USING IN VIVO RAT EXPERIMENT

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The overall goal of DREAM (Design and development of realistic food models with well characterised micro- and macro- structure; FP7-KBBE-2007-2A) is to develop realistic, physical and mathematical models to be used as standards that can be exploited across all major food categories to facilitate development of common approaches to risk assessment and nutritional quality for food research and industry.

Objective of WP6 (our research group was working in this workpackage) to assess the performances of some experimental food models produced in WPs 2-5 in terms of bioavailability of nutrients, phytochemicals and toxicants, and microbial food safety and quality. Our research aim was to assess the release during digestion of carnosine, used as biomarkers for food model (meat) developed in WPs 2-5.

Capillary Zone Electrophoresis method and competitive indirect Enzyme-linked Immunosorbent Assay (ELISA) was developed to determine the carnosine content of meat samples and biological samples (sera, gut fluids).

In vivo rat model was adapted to assess the digestion and absorption of carnosine in meat samples. The rats were given the meat samples by intragastric intubation. Afer 0,15, 30, 60 and 90 minutes the small intestine and stomach were removed and washed out, and the sera were also collected to determine the carnosine content.

Acknowledgement:

This work was supported by DREAM (FP7-KBBE-2007-2A) project

BIFIDOGENIC PROPERTIES OF CEREAL EXTRUDATES

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Popularity of functional food products are increasing. The cereal products of quick-cooking obtained by extruding are the most applicable as dry breakfasts. The benefit of the extruded cereal products consists not only in a high nourishing value, but, in particular, in the prebiotic effect which shows up by strengthening of the bifidobacteria growth.

Application of the extrusion opened new prospects of cereal products enriching by bioactive matters, by which fruits and vegetables are rich having seasonal character, such as carrot, pumpkin, topinambur, roots of celery and parsley.

The aim of our research was investigating the influence of grains and vegetables extrusion on the bifidogenic properties.

Research on the bifidogenic properties of samples was carried out by sowing of museum cultures of Bifidobacterium adolescentis, Bifidobacterium bifidum and Bifidobacterium longum in corn-lactoze nourishing environment (reference). Extracts of vegetables and fine-grinded samples of corn extrudates were brought in the nourishing environment after sterilization. After cultivation during 24-48 hours at temperature of +37°C we conducted subculturing in thioglicol acid semi-fluid nourishing environment for counting the colonies of the bifidobacteria. Reference growing of bifidobacteria cultures was carried out in the standard nourishing environment enriched by a corn extract in the amount of 20 %.

It was determined the content of starch, glucose, dextrins in cereals and cereal extrudates. the count of the bifidobacteria quantity was carried out in the modified environment containing cereal extrudates.

It has been found during the conducted studies that due to extruding of grain and vegetables it is possible to substantially improve bifidogenic properties of dry cereal breakfasts, especially by extruding of corn mixtures with carrot, pumpkin, topinambur and root of celery, and also by extruding of barley and celery.

DEVELOPMENT OF PRODUCTION PRINCIPES OF FUNCTIONAL FOODS

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The analysis of scientific results in the sphere of the functional foods development allowed concluding that many researchers confined themselves to development of new foods leaving unsolved a task of their delivery to consumers resulting in impossibility to achieve the key target: improvement of nutrition and health of population.

Based on the system approach, we developed a model for correction the deficiency of indispensable nutrients by functional products. This process can be divided in the following stages:

• monitoring the actual nutrition and health of people, searching for reasons of appearance and expansion of dietary nutrients deficit;

• argumentation of the selection of foods for fortification and enriching agents;

• development of recipes and technology for manufacturing of new functional product;

• carrying out of a full merchandising examination and confirmation of prophylactic efficiency of the developed product;

• development of the package of measures for promotion of the product to a customer

The system approach stipulates the examination in dynamics of the chosen system. That is why monitoring of nutrition and health of population is a logical finalisation of the model. Such approach allows evaluating the system performance. In case of successful results, some changes should be made, namely the level of the fortification agent should be decreased. If the level of nutrients deficit has not been changed, the level of the enriching agent should be increased or the assortment of functional products should be expanded.

The suggested algorithm for the functional products development based on the system analysis will allow approaching methodologically to the development of new products, thus stimulating high demand of customers for the developed product. In other words their consumption will result in the improvement of nutrition and health of people and improvement of quality of their life.

EVALUATION OF COTTON STALK FOR XYLITOL PRODUCTION

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Xylitol, a five carbon sugar alcohol that is equivalent to sucrose in sweetness. Unlike sucrose, this natural sweetener is anticariogenic and can be consumed by diabetics because it is metabolized by an insulin-independent pathway. Since it has high negative heat of solution, it gives a pleasant cool and fresh sensation. Commercially, xylitol is produced from birch wood tree which is the most expensive source. This has encouraged the development of improved technologies and finding the new sources able to lower the production costs of xylitol. The agricultural waste which is rich in lignocellulosic materials is an ideal source for the production of xylitol. Utilization of these materials for industrial purposes does not only solve the proper disposal of these wastes, but also provide additional income for farmers and generates employment. The hemicellulose content of cotton stalk was found as 17%. The main component of the hemicellulosic fraction of it is xylan, heteropolysaccharide with homopolymeric backbone of xylose units. In the present study, cotton stalk was tested for the economical production of xylitol using by Candida tropicalis. Fort his purpose, cotton stalk was hydrolyzed by acid to produce xylose that was subsequently fermented to xylitol by Candida tropicalis.

NATURAL FOOD COLOR "SPINACIA OLERACEA" THE ENRICHMENT OF DAIRY PRODUCTS

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the use of synthetic and natural colors, in order to produce new food products in the food industry to enhance product acceptance, the day is raising. On the other hand many experts, food fortification as a key option in the prevention and treatment of malnutrition-related diseases are introduced. Or spinach plant Spinacia oleracea, with vast amounts of minerals Fe, Ca, Zn, Na, K, P, fat, protein, fiber and ash, flavonoid and anthocyanin in comparison with other vegetables, has multiple effects in the treatment of various cancers, alzaymer, network eye and nervous system and other application in some disease. Nutritional and therapeutic properties of the present paper contains the pigment chlorophyll extract of spinach to make it suitable as a material for fruit enriched dairy products, especially yogurt containing fruit, green vegetables and fruits such as kiwi, cantaloupe, green and... . Iron, calcium, on the proposal.

APPLICATION OF RESPONSE SURFACE METHODOLOGY FOR EXTRACTION OF PUNGENT RED PEPPER PLACENTA

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The varieties of pungent red pepper have been known for a long time to be utilized as an important source of recognizable phytocompounds for food and pharmaceutical industry. As acknowledge, the most valuable pungent pepper products containing capsaicin and capsantin as a characteristic phytocompounds, are commonly derived from the dried ripe fruit pericarp. Surprisingly, in spite of the assessed content of capsaicin in placenta, it does not appear to be frequently exploited in extraction purpouses and it has been demonstrated to be generally discarded without an application. In line with this fact, the avaliable data of pungent red pepper placenta utilization for extraction purposes are very rare.

The overall goal of this study is to initiate preliminary investigations for extraction of pungent red pepper placenta from domestic origin using ethanol as solvent. Responce surface methodology was employed to study the influence of the time (60-300 min), temperature (20-60 oC) and solid:liquid ratio (from 1:10 to 1:40) on extract yield from placenta.

It has been revealed that the most relevant variables were temperature and solid:liquid ratio. By decreasing of solid:liquid ratio high extract yield was obtained. The verification of the obtained results confirmed good agreement between values calculated using the model equations and experimental value of the responses.

In addition, findings from this research will demonstrate the renew potential of domestic pungent peppers placenta and hopefully to positively impact their wide exploitation and commercial interest in this domestic crop. Taking into account the content of phytocompounds in hot pepper placenta it is reasonable to study it as a potential source of valuable component.

Key words: pungent red pepper placenta, yield of extract, responce surface methodology

CLONING AND EXPRESSION OF A NOVEL CRY1I GENE FROM BACILLUS THURINGIENSIS ISOLATES AND ITS TOXICITY AGAINST MYLLOCERUS UNDECIMPUSTULATUS UNDATUS MARSHALL (COLEOPTERA: CURCULIONIDAE) AND HELICOVERPA ARMIGERA HÜBNER (NOCTUIDAE: LEPIDOPTERA)

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Biocontrol of pests via Bacillus thuringiensis (Bt) δ-endotoxins represents the most successful use of a biological control agent to date. The most notable characteristic of Bacillus thuringiensis is its ability to produce insecticidal proteins. More than 300 different proteins have been described with specific activity against insect species. The six isolates of Bacillus thuringiensis from Andaman and Nicobar Islands which were previously characterized by PCR analysis for the presence of Coleopteran active cry genes were used for Cry1I full length gene amplification. A 2.16-kb DNA fragment of Cry1I gene was PCR amplified, cloned in expression vector pQE 80 L, and then used for transformation of E. coli M15 cells. The optimum expression was obtained with 1 mM IPTG at 370C for 3 h. The sequence of the cloned crystal protein gene showed almost complete homology with a Cry1I toxin gene from Bacillus thuringiensis var. kurstaki, with scattered mutations in the toxic region. The deduced sequence of the protein has homologies of 91.0% with Cry1I and Cry1Ia, and 98.0% with Cry1Ib.Cloning of this gene may help to overcome the increasing resistance of pests to currently used insecticides. Based on the results obtained, the PCR method may be a valuable and reliable tool for specific detection and identification of cry1I genes. The toxicity of Bt recombinant protein was determined against first instar larvae of Myllocerus undecimpustulatus undatus Marshall (Coleoptera: Curculionidae) and Adults; Helicoverpa armigera Hübner (Noctuidae: Lepidoptera) at 310µg/mL and 15.5µg/mL respectively. The novel cry1I gene will be an important resource in constructing genetically engineered bacteria and transgenic plants for biocontrol of insect pests and Bt based biopesticidal formulations, aiming to reduce the use of chemical insecticides.

A RESEARCH ON THE COMPARISON OF FISH CONSUMPTION HABITS OF INDIVIDUALS IN KONYA AND MERSIN PROVINCIAL CENTERS, TURKEY

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The aim of this study was to compare the fish consumption habits of individuals in Konya and Mersin provincial centers, Turkey. The study was conducted on, a total of 1000 randomly chosen people (500 from Konya, 500 from Mersin), aged between 18-75 years. Demographic characteristics and fish consumption habits of the participants were obtained with a face to face interview using a questionnaire.

54.8% of the participants were women and 45.2% were men. The most consumed fish in Konya and Mersin was determined as anchovy. 65.8% of participants from Konya and 90.4% from Mersin consumed the fish as fresh, and type of consumption is preferred to be fried in Konya (43.1%) and Mersin (44.0%). 72.8% of participants in Konya and 84.2% of participants in Mersin answered the question " Do you think that sufficient and balanced fish is consumed in Turkey?" as "No". Those saying "no" gave following reasons in Konya; 25.4% for "its smell", 20.2% for "its expensiveness", 15.4% for "failing to find fish", 15.0% for "dislike of fish" and in Mersin; 46.2% for "its expensiveness", 17.6% failing to find fish", 11.8 % for "dislike of fish", 9.6% for "its smell".

In conclusion, results were obtained related to weekly fish consumption, supply and consumption form of fish, what they regard when choosing fish influence fish consumption of individuals.

Keywords: Fish, fish consumption, consumption habits

THE RELAXATION OF NON-PREGNANT RAT UTERUS BY WINE POLYPHENOL RESVERATROL

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Introduction:
Resveratrol (RSV) is a phytoalexin produced by grapevines. The benefit of resveratrol to health is widely reported. Resveratrol has been found to promote vascular relaxation but its mechanism of action is unclear. The data about influence of RSV on the contractility of smooth muscles of uterus are not available. The aims of our study were to investigate the effects of RSV on the contractility of rat uterus and to investigate the involvement of K+ channels in effect of RSV on the spontaneous contractions (SC) and contractions provoked by oxytocin.
Methods:
Uterine strips were obtained from virgin female Wistar rats in oestrus. Strips were mounted into organ bath for recording isometric tension in Krebs-Ringer solution. Experiments followed a multiple curve design. In order to test the involvement of K+ channels in a mechanism of action of RSV, a selective blocker of KATP channels, glibenclamide (GLB), a selective blocker of inwardly rectifying BaCl2 (1 mM) as well as 4-aminopiridine (4AP), a non-selective blocker of voltage-gated K+ channels and tetraethylamonium (TEA), predominantly blocker BKCa were used.
Results:
RSV induced a concentration-dependent relaxation of SC with EC50=9.52μM and Emax=94% and contractions provoked by oxytocin with EC50=21.88μM and Emax=95% ($P<0.05$). GLB (10 μM), 4AP (1 mM), TEA (1 mM), BaCl2 (1 mM) antagonized the response to RSV in both, oxytocin induced contractions and SRC. Relaxation achieved by concentration of 100 μM RSV was insensitive to K+-channels blockers.
Conclusions:
RSV is uterine relaxant and can be use in tocolysis. The antagonism of RSV effect by different K+-channels blockers suggests that K+-channels are involved in resveratrol action on the contractions of rat uterus. It seems that RSV, when applied in high concentration, may exert an additional mechanism of action.

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II
FOOD ANALYSIS, MICROBIOLOGY AND NUTRITION, FUNCTIONAL FOODS

NOVEL NMR-TECHNOLOGY TO ASSESS FOOD QUALITY AND SAFETY

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Bruker BioSpin GmbH

High Resolution NMR Spectroscopy offers unique screening capabilities for food quality and safety by combining untargeted and targeted screening in one analysis. The objective of this contribution is to demonstrate, that due to its extreme reproducibility NMR can detect smallest changes in concentrations of many components in a mixture, which is best monitored by statistical evaluation however also delivers reliable quantification results.
The methodology typically uses a 400 MHz high resolution instrument under full automation after minimized sample preparation. One analysis in a push button operation takes at maximum 15 minutes and delivers a multitude of results, which are automatically summarized in a PDF report.
The method has been proven on fruit juices, where so far unknown frauds could be detected, be it addition of sugars and amino acids to fake 100% fruit content, be it mixing of different varieties or wrong product labeling like geographical origin and direct juice versus rediluted concentrate as well as on wine. In addition conventional targeted parameters like the quantification of sugars, organic acid, amino acids etc. are obtained in the same analysis. This technology has the advantage that NMR is completely quantitative and concentration calibration only has to be done once for all compounds. Since NMR is so reproducible (based on strict SOP`s), it is also transferable between different instruments of the same field strength and different laboratories.
This technology is currently extended to other food materials as well, like edible oils, honey and milk powder and examples for all food materials mentioned are given. On fruit juices and baby milk powder it could be proven, that food quality and safety can be brought to a new comprehensive level, that allows to answer many more questions than conventional analysis so far could deliver.

CHEMICAL PLATFORM FOR EVALUATION OF PUMPKIN SEED OIL GENUINENESS

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The Štajerska region in Slovenia, the adjacent Styria region in Austria and certain regions of Croatia and Serbia have a long tradition of growing pumpkins (*Cucurbitaceae*, e.g. *Cucurbita pepo* subsp. *pepo* var. *Styriaca* (in Slovenia called the 'Slovenska golica')), as an oil crop. The oil produced – Pumpkin Seed Oil (PSO) is valuable and has a high added nutritional and hedonistic value. New phenomenon in the field of vegetable oils with high nutritional value is the cold pressed type. Cold pressing simply denotes the temperature of the press medium, but due to expansion of extra virgin olive oil benefits the term "cold pressed pumpkin seed oil" should mean the seeds weren't roasted before they were cold pressed. As a consequence exact and accurate tools for evaluating the PSO quality and genuineness and processing history are needed. One set of tools is the platform composed of different chemical analyses.

In the present work the building of a platform to evaluate genuineness of PSO from the Slovene market is summarized. The platform gathers fatty acids, (E)-isomers of fatty acids, sterols and tocopherols composition determinations linked to HPLC triacylglycerol determinations (stereospecific analysis). GC-MS determination of the tocopherol fraction from the 'Slovenska golica' variety PSO revealed the presence of two previously unreported compounds: alpha-tocomonoenol and gamma-tocomonoenol. HPLC monitoring of the various vitamin E compounds during the production steps from unroasted pumpkin seeds to PSO from roasted seeds showed an increase of two tocopherol-like compounds. HPLC analysis of biophenols in cold pressed and roasted PSO showed differences in free biophenols to complex (esterified) ones ratio in both oils, as well.

The proposed platform showed that the partial or summarized chemical determinations can effectively evaluate PSO's genuineness, confirm the cold pressing/roasting history or even discriminate the roasted PSO's from the cold pressed/unroasted ones.

Keywords: cold pressing, fatty acids, genuineness, pumpkin seed oil, triacylglycerols, sterols, vitamin E

FATTY ACID PROFILE AND CHEMICAL COMPOSITION OF SOME WARM WATER FISH SPECIES FROM RETAIL STORES

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The objective of this study was to assess the chemical and fatty acid composition of representative fish (common carp, silver carp, bighead carp, grass carp, tench, catfish and zander) which were collected in retail stores in area of Novi Sad. Chemical analysis and fatty acid determinations were carried out in the Institute of Meat Hygiene and Technology, Belgrade. Statistical analysis was performed using the Statistica 10 program. The amount of protein was the highest in zander fillets (19,21%) and the lowest percentage of protein was found in grass carp fillets (14,8). Percentage of fat ranged from 1,74 in the muscles of zander to 6,85 in the meat of carp. The total cholesterol content was the highest in silver carp fillets (65,90mg/100g) and the lowest in catfish (33mg/100g). The amount of saturated fatty acids (SFA) was the lowest in common carp (24,23%). Tench contained the least amount of monounsaturated fatty acids (MUFA) (34,97%), and the largest percentage was measured in carp (64,34%). Silver carp contained the highest percentage of polyunsaturated fatty acids (PUFA). The lowest percentage of PUFA was detected in common carp, which contained 10,95% and the n3/n6 ratio was 0,14. PUFA/SFA, which is an indicator of the quality of lipids was the most favourable in silver carp. The chemical composition of fish varies greatly from one species and one individual to another. Quantity of n-3 fatty acids varies largely in dependence on the fish species. The ratio of n-3/n-6 varies widely between different fish species. Nutritive value of examined warm water fish species is high since its fatty acid composition is characterized by satisfactory proportion of n-3 and by high proportion of n-6 polyunsaturated fatty acids and favorable content of total cholesterol.

SUNFLOWER (*HELIANTHUS ANNUUS* L.) FRUIT FRACTURE RESISTANCE

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An objective of this study was to evaluate the behavior of six domestic sunflower hybrid fruits on compressive loading considering seed moisture content. Those were Perun, Bačvanin, Krajišnik, NS H111, Pobednik and Šumadinac hybrids. The mean bio yield force, deformation, work and bio yield modulus are presented, as a result of quasi-static fracture measurements of fruits. A sample of 15 seeds was randomly selected from the bulk of each hybrid at four different seeds moisture content range from 5.9 to 36.8 % w.b. The specimens were loaded in horizontal orientation between two parallel rigid plates. The mechanical behaviour of the whole sunflower seed under horizontal loading is a function of its moisture content and arrangement of the pericarp (hull) tissues. The presence of a larger amount of water molecules of pericarp and in the kernel increases its volume. The molecules enter the polymeric chain (both in the hull and kernel) and force it to rearrange, which results in an effect on the compressive behaviour of the whole fruit. The conclusion derivates according to significant differences in bio yield force values among tested hybrids. The fruits of NS H111, Šumadinac, Pobednik and Krajišnik demonstrate low values of bio yield force from 29.3 to 45.2 N at low moisture content of fruit (between 3.7 and 5.9%w.b.). Opposite results were measured for Bačvanin and Perun hybrids (60.6 N and 76.2 N respectively) within the same moisture content of seeds. The machine head displacement has increasing tendency as the seeds moisture content increase for all hybrids. The linear model shows a decreasing trend of bio yield modulus for all hybrids as the moisture content of seeds increased, with high values of the coefficient of regression (CR).

ANTIMICROBIAL ACTIVITY OF POLYSACCHARIDES EXTRACTED FROM MEDICINAL MUSHROOMS ON *CAMPYLOBACTER JEJUNI* AND *STAPHYLOCOCCUS AUREUS*

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Introduction

Modern consumers demand for fresh and minimally treated food products is dictating a trend of reducing the use of man-made chemical preservatives, yet this could increase health risk, caused by foodborne pathogens and spoilage. Therefore the interest in finding new natural antimicrobials and antiooxidants is increasing. We investigated antimicrobial activity of hot water and hot alkali extracted polysaccharides from selected medicinal mushrooms, which are known for their broad spectrum of health promoting activities (Klaus et al., 2011; Kozarski et al., 2011) .

Methods and materials

Minimal inhibitory concentrations (MICs) of different types (crude extract, partially purified and hot alkali extracted polysaccharides) of polysaccharide/phenolic extracts from *Agaricus blazei, Phelinus linteus*, *Laetiporus sulphureus* and *Ganoderma lucidum* were determined with broth microdilution method on model gram-positive (*Staphylococcus aureus*) and gram-negative bacteria (*Campylobacter jejuni*). The kinetics of microbial inhibition was carried out with broth macrodilution method, the extracts were tested in concentration of 2,5 mg/ml. Growth inhibition was checked after 3, 6, 9 and 24 hours of incubation.

Results

The best antimicrobial effect against both tested microorganisms was observed in case of *Phelinus linteus* and *Ganoderma lucidum* extracts. All extracts were composed of a mixture of polysaccharides and phenolic compounds, as well as a small amounts of proteins. Significant antioxidant and antimicrobial properties of tested extracts were in correlation with polysaccharides and phenolic compounds. In concentration 2,5 mg/ml the growth inhibition of *C. jejuni* was better than of *S. aureus*. Crude extract of *G. lucidum* had better effect on *C. jejuni*, while dialized extract had better effect on *S. aureus*.

Conclusions

Polysaccharide/phenolic extracts from selected medicinal mushrooms showed relatively good antimicrobial activity and could be used as antimicrobial and antioxidant food supplements, since they have already demonstrated exceptional radical scavenging activity. Further research is needed to confirm actual bioactive properties in realistic complex environments.

BIOCIDE AND ANTIBIOTIC RESISTANCE IN *CAMPYLOBACTER COLI* AND *CAMPYLOBACTER JEJUNI*

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Introduction:
The increasing antibiotic and biocide resistance among food-borne bacteria represents an emerging public health problem. Active efflux is a common resistance mechanism of toxic compounds extrusion out of the cells. Adaptations to biocides and development of cross-resistance to antibiotics after exposure to sub-lethal concentrations of disinfectants have been recently documented for some bacteria. We examined the prevalence of antibiotic and biocide resistance among *Campylobacter* strains from different sources and the involvement of active efflux to their resistance. Putative adaptive resistance after step-wise exposure to increasing sub-inhibitory concentrations was investigated to identify mechanisms underlying resistance.

Methods and materials:
The biocide resistance and cross-resistance to antibiotics was examined with broth microdilution method. Active efflux was studied on the basis of restored sensitivity in the presence of the efflux pump inhibitors (EPIs) and cmeB, cmeF and cmeR efflux gene mutations. Changes in outer membrane protein (OMP) profiles and morphological changes were studied comparatively in adapted and parent strains.

Results:
Among 42 *Campylobacter* strains studied, different antibiotic and biocide resistance levels were seen. The multidrug resistance was also observed, but no correlation between biocide and antibiotic resistance was confirmed. EPIs partially reversed the resistance to all antimicrobials tested. The minimal inhibitory concentrations of the antimicrobials were reduced in cmeB and cmeF and increased in the cmeR mutant. Repeated exposure to biocides resulted in the partial increased resistance and acquisition of cross-resistance to biocides and antibiotics. Developed resistance was partially stable. More than one type of active efflux was identified in adapted strains, which expressed also different alterations in OMP profiles and morphological changes.

Conclusion:
Active efflux is a crucial mechanism involved in antibiotic and biocide resistance in *C. jejuni* and *C. coli*, wherein more than one type of active efflux is employed, the same is true for adaptation to biocides. However, these adaptations were strains specific, no species specific mechanisms were recognized.

APPLICATION OF LIQUID CHROMATOGRAPHY COUPLED TO MASS SPECTROMETRY FOR THE QUANTIFICATION OF *BACILLUS CEREUS* TOXIN CEREULIDE IN FOOD.

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The emetic toxin of *Bacillus cereus* (cereulide) has been responsible for several documented lethal foodborne intoxications. The toxin is pre-formed in food during the outgrowth of present *B. cereus* and due to its highly resistant profile to heat and extreme pH conditions. It is not destroyed by usual food preparation procedures or degraded upon ingestion of contaminated food.
A newly developed and validated LC-MS/MS method allows the quantification of cereulide in food with great specificity and sensitivity. The method was applied on different complex food matrices involved in cereulide-caused foodborne outbreaks or suspected to contain cereulide (chilli con carne, spices, red beans,…). Although the bacterial counts found in the contaminated foods were low or even absent (< 10 cfu/g), a high percentage of analyzed samples were shown to contain cereulide.
Furthermore, the influence of different parameters (temperature, strains, storage time and inoculation level) on cereulide production in pasta and rice samples was evaluated with LC-MS/MS allowing determination of critical conditions for cereulide production.
The method was also used to perform a limited-scale baseline survey in 50 restaurants in Belgium on cereulide prevalence in rice-based foods..White cooked and fried rice were taken away and directly analyzed for microbiological determination of *B. cereus* and for cereulide quantification with LC-MS/MS. In total,13% of the collected rice dishes contained low amounts of the toxin.
Among the key findings of this research are the confirmed fact that *B. cereus* counts are not reliable indicator of toxin presence in food, whereas direct measurement of the toxin concentration in food is primordial for risk assessment. The developed LC-MS/MS method is a cereulide-specific tool, easily performed, offering a high sensitivity in the quantification of cereulide that can serve both research and routine analyses.

PROBABLE HEAVY METAL POLLUTION IN SEEDS AND POULTRY IN THE ENVIRONMENT OF CEMENT INDUSTRY OF ÇANAKKALE

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This study was carried out 18 villages and towns fronting to a cement factory in Mahmudiye village of Çanakkale district. 4 poultry houses from each location was selected and 4 chickens, 4 eggs and the samples of seed wheat from each poultry houses were taken in Winter, Spring, Summer and Autumn seasons (January, April, July, October) of 2009 and 2010 years.One of the main aims of the study is to determine the level of some heavy metals (Pb, Cd, Cu, Cr, Co, Mo and Ni) in the livers, legs and chests of the chickens fed near the places of cement factory. In the experimental period, 2304 chickens, the samples of chicken liver, legs and chests, 2304 eggs and 576 seeds of wheat were collected. Heavy metal levels analyzed in the livers of the samples were found higher than the ones in the legs and chest samples ($P<0,01$) and the heavy metal levels of the seed wheat collected in the poultry houses were found higher than the egg samples in the same poultry houses ($P<0.01$).

It has found that none of the heavy metals exceeded the limits determined by Turkish Food Codex and European Union. The results of the study have shown that heavy metal levels of the samples gathered from the villages and towns located in the north and south sides of the cement factory and the sample groups were statistically different in terms of location ($P=0.000$) and seed-egg ($P=0.000$).

DETERMINATION OF LIPOSOLUBLE VITAMINS CONTENT IN DIETETIC PRODUCTS

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A large number of dietary products contains high content of vitamins A, E and D. Depending on usage, the amount of entered vitamins can significantly surpass the recommended daily intake. Also, if the content does not match the declared, this can lead to consumers misleading. In our market, there is a large offer of dietary products in pharmaceutical forms, as well as enriched foods with these vitamins content declared. By proper use of these foods, it is possible to largely meet the daily requirements for vitamins.
Our goal was by using HPLC and UPLC methods with spectral and fluorescent detector to determine liposoluble vitamin content in products where their content is declared.
For successful determination of the content of vitamins A, E and D in the complex composition of foods multiple purification of samples is necessary, while for the determination of the synthetic products it is enough to apply the extraction. We apply the extraction with n-hexane, extract steaming and reconstitution in methanol, with membrane filtration. Separation was performed with RP-HPLC method with fluorescent detector with variable wavelengths, and UPLC method with the spectral detector.
The dietary products of different backgrounds, forms and methods of production (total 48) were analyzed, of which 8.3% had lower, and 2.1% higher content than declared.

Keywords: vitamin A, vitamin E, vitamin D, HPLC, UPLC, dietary products;

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APPLICATION OF PROTEOMICS FOR THE PROCESS DEVELOPMENT, QUALITY CONTROL, AUTHENTICITY AND PRODUCT SAFETY IN FOOD TECHNOLOGY

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Human food is a very complex biological mixture and food processing, quality control and assurance and food safety are very important and essential disciplines. In proteomics, glycomics and metabolomics, high-performance and high-resolution analytical techniques such as SDS-PAGE, two-dimensional gel electrophoresis, one dimensional and multidimensional chromatography as sample preparation methods, combined with different mass spectrometric methods are used to monitor the protein composition of foods and their qualitative and quantitative changes during the production process and storage. An overview about the use of proteomcs, glycomics and metabolomics in food technology and biotechnology is presented. These techniques are used for characterization and standardization of row materials, process development, detection of batch-to-batch variations and quality control of the final product of both foods of animal and plant origin. Very important is also their application in food safety control and assessment of originality and authenticity, especially regarding biological and microbial safety, and the detection of manipulated and genetically modified food, as well as authenticity of organic and characteristic local food.

FOUR STEPS TO RISK ASSESSMENT OF *CAMPYLOBACTER* CONTAMINATION

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The purpose of the work was to develop a qualitative risk assessment that attempts to understand how the incidence of human campylobacteriosis is influenced by various factors during animal briding. In the estimation of risks, these steps were involved: Hazard identification: termophilic *Campylobacter* spp (*C. jejuni* and *C. coli*) are the leading cause of zoonotic enteric illness. Hazard characterization: it is assumed to be dose-independent based on some studies on healthy human volunteers.Exposure assessment: Incidence of *Campylobacter* spp at Serbian poultry farms varies from 20 to 80%. Inoculation of chickens with 6.77 log cfu *C. jejuni* ATCC 29428 per chicken in 21st day of life leads to 5.26 log cfu/g feces after only 5 days, this number has trend to decrease in next two weeks when 3.02 log cfu/g feces was found. The prevalence of campylobacter-contaminated chickens from positive flock appears to drop from 100% live birds (with 3.02 log cfu/g feces) to 50% of chicken carcasses according to our experimental results. The influence of production management is great, since in poultry abattoris the prevalence varies from 11.43 to 90.00% carcasses and in pig abattoirs from 1.83 to 22.22%. Incidence of human campyloabacteriosis was 5.39 in 2009. Risk characterization: *Campylobacter* spp. is frequently found in feces of live animals in Serbian farms. But even high exposure of population to *Campylobacter* spp in Serbia, the incidence of human campilobacteriosis from raw meat is low, manily becaise there is lack of evidence and confirmation of human campylobacteriosis. In order to significantly reduce the bacterial load on processed carcasses, interventions would required addressing the bacterial load, both internally and externally.

TARGETED SCREENING OF SUGAR DEHYDRATION PRODUCTS IN FRYING OILS BY HIGH RESOLUTION MASS SPECTROMETRY

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Frying is a widely used process in the world as it produces palatable and consumer-charming foods in a very short time. During frying, a series of chemical reactions take part both in frying oil and frying material as they are subjected to high temperatures (180-200°C). Compounds occurring in the frying material may be transferred to the oil and in case of repeated use of it, accumulation of these compounds become unavoidable. After a number of frying, frying oil will be a pool of transferred compounds and behave like a contaminant for new frying materials. In order to determine accumulation of sugar dehydration products with a focus of 5-Hydroxymethylfurfural (HMF), 50 frying cycle were performed without replacement of frying oil. In every frying cycle 20 g of potatoes were introduced to the 1 L frying oil at 180°C. 5 mL of frying oil is collected every five cycle and extracted twice with methanol-water (75:25, v/v). Analyses were performed with Thermo Scientific Exactive Orbitrap high resolution mass spectrometry in electrospray ionization positive mode. m/z of 50-300 was scanned at high resolving power (R=50.000). Sugar with theoretical mass of [M+H]+ of 180.08665, and its dehydration product with theoretical mass of [M+H]+ of 163.06010 couldn't be detected in frying oil after 50 frying cycle as they are highly hydrophilic. On the other hand, dehydration product of glucose, that lost two moles of water, with theoretical mass of [M+H]+ of 145.04954 and HMF with theoretical mass of [M+H]+ 127.03897 was detected with very high mass accuracy as they are more hydrophobic and easily transferred to frying oil (Δ<0.5 ppm). HMF may be formed in the frying material and then transferred to the frying oil or sugar dehydration product [M+H]+ of 145.04954 may turn into HMF in the frying oil during repeated use.

DESIGN AND IMPLEMENTATION OF A TOOL TO PERFORM THE HYGIENIC ASSESSMENT OF VENDING MACHINES

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Vending machines are more and more present in our everyday life, being an effective method to get “the” items that allow us to satisfy hunger or thirst quickly and directly. In this study, a survey was designed to assess the hygienic-sanitary conditions of the vending machines for cold drinks, hot drinks, solids and solids that require refrigeration. This survey consists of a part common to all types of machines mentioned in the maximum score is 100 and one other part in accordance with the specific type of machine to be evaluated at the maximum score is 60. Another survey was also designed to evaluate the distribution of food products from the moment they leave the company responsible for vending machines to the vending machine, with a maximum score of 100. These surveys were administered to 45 vending machines located in the island of Gran Canaria during the first semester of 2011.The cold drinks machines evaluated obtained an overall score of 88,4 and 50,9 in specific items, hot drinks machines registered an overall score of 89,6 and a score on their specific items of 52,2. The solid’s machines obtained an overall score of 92,7 and 54,7 in specific items and the machines that contain solids in refrigeration recorded an overall score of 88,5 and a score on their specific items of 53,2. Regarding to the survey on the evaluation of the food distribution, the score was 87,5. As shown by the results obtained, the hygienic-sanitary conditions of the vending machines are high. The shipping and handling of foods is also very positive. After several meetings with the leaders of the vending company that allowed this study we believe we have designed a useful tool in assessing the conditions of hygiene and food safety of foods marketed by these devices.

MICROBIAL IMMOBILISATION TREATMENTS OF CATTLE HIDES - A NOVEL APPROACH TO HIDE INTERVENTION STRATEGY

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Cattle hide decontamination treatments have been recognized as an effective way to reduce microbial contamination of beef carcasses during slaughter and dressing in abattoirs. A range of related techniques – aimed at killing and/or removing pathogens on hides – have been considered in previously published studies. However, reported microbial reductions achievable were relatively limited: around 2-3 logs on decontaminated hides or about 1 log on resulting dressed carcasses. Consequently, to improve the effectiveness of hide treatments, a new approach – treatment to immobilize microbiota on cattle hide rather than to kill it – has been recently proposed.

An insect-produced, natural, food-grade resin (Shellac) was evaluated as an on-hide microbiota-immobilizing agent in a laboratory models system using a sponge-swabbing microbiological sampling method. On hides spray-treated with a Shellac-in-ethanol solution, recoveries of general microflora (total viable count of bacteria-TVC, *Enterobacteriaceae* counts and generic *E. coli* counts) were greatly reduced: up to 6.6 log10 CFU/cm2 reductions. The effects of the Shellac treatment were mainly due to immobilization of bacteria on hair by the resin, and to lesser extent due to bactericidal action of the ethanol.

In the hide-to-beef direct contact laboratory experiments, hide treatment (of varying visual cleanliness) with the Shellac solution significantly reduced (up to 3.6 log reductions) general microflora transferred from hide onto meat.

Furthermore, post-slaughter but pre-skinning treatment of hides with Shellac-in-ethanol solution, under practical conditions of small commercial abattoir operation, significantly reduced (up to 1.7 log) levels of general microflora found on final beef carcasses.

Overall, in both laboratory- and abattoir-based experiments, microbial reductions achievable by the Shellac-treatment of hides were superior - on both hides and beef - to those achievable by a control hide treatment using rinse-vacuum with sanitizer. Therefore, the Shellac treatment of hides can be considered as an effective alternative approach to hide decontamination strategies to improve beef safety.

THE EFFECT OF HULLS ON *ALTERNARIA* SPP. INFECTION OF SPELT WHEAT KERNEL

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The genus *Alternaria* includes plant pathogenic and saprophytic species that may demage crops in the field and cause post-harvest decay. Many *Alternaria* species are allergens and mycotoxin producers harmful for human and animal health. *Triticum aestivum* ssp. *spelta* L. is a hulled grain with high nutrient value. There is a growing demand on the market for such alternative crop. It has been proved to be rich source of useful genes for tolerance to biotic and abiotic stress and grain quality, which make spelt suitable for organic farming system. The aim of this work was to investigate the effect of hulls in protection of spelt kernel against penetration of *Alternaria* spp. Field experiment was carried out in the 2010/2011 in the region of Vojvodina on three spelt wheat genotypes. At the full flowering stage inoculation was performed with an aqueous suspension of *A.alternata* conidia (at a concentration of $0{,}2475 \times 10^6$ infective particles/ml) and two isolates of *A.tenuissima* (at a concentrations of $0{,}605 \times 10^6$ and $0{,}497 \times 10^6$ infective particles/ml) obtained from 14-day old cultures grown on a PDA medium. Inoculated spikes were immediately covered with polyethylene bags for 24 h. Spikes treated with fungicide and distilled water treatments were used as two control objects. In the full ripeness stage spikes from each plot were cut by hands and used for next analysis. It was found a significant difference of infection level between hulled (92-100%) and dehulled (4-72%) spelt samples, with exception of fungicide treatment. Yield components, length of spike and weight of spike have shown significant difference between fungicide treatment (16,2 cm; 1,82g) and infected kernels by *Alternaria* spp. (10,7cm; 1,03g) respectively. This is a good evidence that hulls protect kernels against fungal colonization and therefore increase the fitness of spelt under unfavorable conditions.

EFFECT OF PESTICIDES IN HONEY AND OTHER BEE PRODUCTS ON HUMAN HEALTH AND ENVIRON

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Honey is regarded as a natural and safe product for human that free of any chemical contaminants. However, today some of honey is produced in an polluted environment by different sources of contamitants. These are present in air, water, soil and plants and are transported to beehives and bee products by bees. Nectar and pollen collected from pesticide-treated flowers can result in contaminated honey.

The residues of pesticides detected in beehive products are classified in the groups of insecticides (organochlorines, organophosphates, carbamates and neonicotinoids), acaricides, fungicides and herbicides. Plant-derived pesticides, called botanicals, have also been developing quickly. Systemic insecticides, which poison pollen and nectar in the flowers, may kill bees and other needed pollinators. Organophosphorus and carbamates causes bees that have been fed on contaminated blossom to transfer pesticide residues into honey and finally to the consumer.

Consumers in Europe are concerned about pesticide residues in food.The small amounts of pesticide residues remain in the honey and other products constituting a potential risk for the human health. Pesticides may cause acute and delayed health effects in those who are exposed. These effects can range from simple irritation of the skin and eyes to more severe effects such as affecting the nervous system, birth defects, fetal death, reproductive problems, and also causing cancer.

Pesticide use also raises a number of environmental concerns. Over 95% of sprayed insecticides and herbicides reach air, water and soil other than their target species. In addition, pesticide use reduces biodiversity, reduces nitrogen fixation, contributes to pollinator decline, destroys habitat, and threatens endangered species. Pests also can develop a pesticide resistance. Some pesticides contribute to global warming and the depletion of the ozone layer.

The beekeepers, farmers and applicators must take into account the perecautions for pesticide application to prevent residue risk in honey.

CHARACTERISTIC OF COMMON WINTER WHEAT VARIETIES BASED ON GRAIN HARDNESS

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Introduction
Grain hardness is a basic differentiating element of wheat standard classifications. The hardness of the wheat endosperm is genetically determined. That is being considered a stable variety' index. The attention that is being paid to the hardness as an indicator of the quality is due to the different technological relation of the wheat.

Methods and materials
Twenty four Bulgarian varieties of common winter wheat developed over a very long period of time-for 60 years at Institute of IRGP-Sadovo were studied.
Using Inframat 8600-H, grain hardness, vitreousness and content of crude protein, were determined during 3 crop years.

Results and conclusions
Statistically it has been proven that old varieties like Jubilarian 3 and No. 301, as well as Katya, Lada, Murgavets and Guinness, are wheat with hard endosperm and high vitreousness ; but the old variety Okerman and varieties like Sadovo super, Mustang, Prelom and Diamond have soft endosperm and therefore are low vitreous. The rest of the studied varieties have medium hard to hard endosperm.
By using analysis of variance it has been proven that under certain agro climatic conditions the index varies during 3 years of study: F exp.= 7.76 > F crit.=3.12

Key words: wheat variety, grain hardness, vitreousness, protein

COMPOSITION OF 7S AND 11S PROTEIN FRACTIONS IN SOYBEAN OKARA

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Among various soy foods soymilk and tofu are becoming more popular as low cost substitutes of traditional dairy products for consumers and an ideal nutritional supplement for lactose intolerants. Okara is a byproduct obtained during processing of soybean for soymilk, which is either under utilized or unutilized.

Protein quality, based on its subunit composition, in okara obtained as a by-product during hydrothermal cooking (HTC) of soymilk was assessed. Okara proteins, from six investigated soybean varieties, were localized mainly in one region of bands with MW < 40 000 on the SDS-PAGE gels.

The basic 7S globulin (Bg7S) was the main protein of 7S protein fraction in okara, representing 24.61-28.37% of okara extractable protein. Okara Bg7S subunits, “heavy” (HI,II) and “light” (LI,II) subunit represented 4.81-7.83 % and 18.30-21.57%, respectively. Such a high content of Bg7S in okara is desirable because of its nutritional value as it is a cysteine-rich glycoprotein. Participation of Bg7S in extractable protein of soybean and soymilk was significantly less than in okara (5.18-7.80% and 7.79-11.14%, respectively). Investigated soybean genotypes produced okara with mainly acidic A5 (5.32-17.31%) and basic B1,2,4 (9.83-16.52%) polypeptides of 11S proteins.

Content of Bg7S in soybeans significantly indicated ($r=0.90$; $p<0.05$) total protein content in okara (31.81-40.36%). Soybeans 11S content didn’t indicate okara protein recovery (27.28-36.16%) or extractability (79.29-90.45%). From all tested relationships extractable soluble protein content of okara (27.83-32.53%) was influenced only by soybeans Bg7S ($r=0.86$; $p<0.05$) and its “light” subunit contents ($r=0.93$; $p<0.05$). Okara protein recovery depended on Bg7S “heavy” subunit content in soybeans ($r=0.81$; $p<0.05$). The high quantity of vegetable protein in okara (around 35%) and very high protein extractability (around 85%) qualify this by-product for potential application in food fortification as functional ingredient.

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EVALUATION OF BROWNING RATE OF QUINCE AT AMBIENT EXPOSURE

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The Quince (*Cydonia oblonga*) is a relatively small tree, the only member of the gender *Cydonia*, from the *Rosaceae* family. The fruit is called quince, and resembles a cross between an apple and a pear. Quince is rich in dietary fibre, vitamins, like vitamin C, and minerals, such as copper or potassium, while being low in saturated fat, cholesterol and sodium. Since this fruit is relatively susceptible to browning, it was evaluated the colour of the quince over time of exposure to the atmospheric air.

The colour of the fresh pulp was assessed using a handheld tristimulus colorimeter (Chroma Meter - CR-400, Konica Minolta) calibrated with a white standard tile, using the CIELab colour coordinates: L*a*b*. A CIE standard illuminant D65 was used. These cartesian coordinates were then used to calculate the polar or cylindrical coordinates: value, hue angle (Hº) and chroma (C). At each instant, ten measurements of colour were made, and to evaluate the colour change, measurements were repeated in the same samples after every 5 minutes, over a period of two hours.

The results obtained for the medium values of the cylindrical coordinates in the freshly cut quince were found to be: value = 7.80, chroma = 31.78 and Hue = 92.28 º, being these values determined right after cutting.

Total colour difference was calculated having the values of the cartesiaan coordinates of the freshly cut quince as reference. In relation to the colour change, the values for ΔE were 0.00, 26.35, 30.41, 31.81 and 32.39, respectively for times 0, 30, 60, 90 and 120 minutes, indicating a faster rate initially and a tendency for stabilization towards the end of the period analyzed.

EVALUATION OF BROWN SUGAR QUALITY FROM SUGAR BEET PROCESSING

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In the present study the quality of brown sugar from domestic sugar beet processing were investigated. It is either an unrefined or partially refined sugar consisting of sugar crystal with some residual molasses content, or it is produced by the addition of molasses to refined white sugar. At gobal sugar market various types of brown sugar are present. It can be produced from sugar cane or sugar beet, in principle according to three manufacturing processes. Depending on the region brown sugar have different names. In the dependence of origin and manufacturing processes it differs according to chemical composition, nutritive value, color, taste and grain size.
Their popularity is due to the idea of consumers that brown-colored products are more natural, healthier and more valuable. Their employment in the food manufacture is based on aroma, color characteristics and nutritive value.
The aim of this paper was evaluation quality of brown sugar, produced in domestic sugar industry, from the aspect of food safety and nutritive value.

PROCESSING QUALITY OF SUGAR BEET, ROOT AND SUGAR YIELD IN RELATION TO CULTIVAR, YEAR AND LOCALITY

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Production of sugar beet and granulated sugar in environmental conditions of the Province of Vojvodina is possible but to have a successful production optimal technology must be applied. Production of sugar beet and granulated sugar is virtually imposible without the use of modern cultivars with triple tolerance to the most imortant diseases: Cercospora beticola, rhizomania and Rhizoctonia solani. Field microtrials involving cultivars with various levels of tolerance towards the most important diseases of sugar beet were set in 2009, 2010 and 2011, in four replicates. The root yields were determined on the site whereas the chemical analyses were conducted in the laboratory of the Institute of Food Technology in Novi Sad. In 2009, sugar beet showed the best processing quality, followed by those harvested in 2011 and 2010. All seven indicators of processing features were best in sugar beet harvested in 2009. But, the mean root yield was the highest in 2011, reaching the value of 100.02 t/ha whereas it was the lowest in 2009, 88.77 t/ha. The yields of granulated sugar were significantly dependent on cultivar, year and locality. The highest yield of granulated sugar, averaged over cultivars and years, was obtained in 2011 (14.246 t/ha) with Prestige as the best performing cultivar. In contrast, the lowest granulated sugar yield was registered in 2010 with a mean value of 10.566 t/ha, averaged over cultivars and localities. The poorest performance regarding this parameter was shown by cultivar Kontrola I (9.539 t/ha). This confirmed that it is possible to achieve outstanding yields of granulated sugar under our environmental conditions which are comparable to those reported in the countries of Western Europe.

DETERMINATION OF FATTY ACID COMPOSITION OF *ROSMARINUS OFFICINALIS* L. BY GAS CHROMATOGRAPHY-MASS SPECTROMETRY

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Since ancient times, aromatic herbs and spices have been added to different types of foods to improve the flavour and sensory properties. *Rosmarinus officinalis* L. is a perennial herb that belongs to *Lamiaceae* family. It is used as a food flavouring agent and is also well known medicinally for its powerful antimutagenic, antibacterial and chemopreventive properties. It has been demonstrated that exhibits plant antioxidant activity. The leaves of rosemary as well as other wild edible plants used for culinary purposes give low yields of oil, but are rich sources of essential fatty acids, such as α-linolenic acid (18:3n3) and linoleic acid (18:2n6). Linolenic acid and unusual fatty acids of n3 and n6 series play an important role in the modulation of human metabolism. In this study, the qualitative and quantitative composition of leaf lipids rosemary (*Rosmarinus officinalis* L.) grown in Serbia has been investigated. Gas chromatography – mass spectrometric analyses showed major fatty acids to be α-linolenic, linoleic and palmitic acids. The content of 18:3n3, 18:2n6 and palmitic acid were within the ranges of 32.4-42.0; 21.3-27.9 and represented 12.5-17.1% of the total fatty acids, respectively. Results showed that the rosemary is rich source of essential fatty acids (18:3n3 and 18:2n6), with favourable n3/n6 ratio.

DETERMINATION OF POLYCHLORINATED BIPHENYLS IN HUMAN COLOSTRUM AND INFANT FORMULAS

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Monitoring of PCBs in human colostrum in South Bačka started in 1982. The objective of this study was to determine concentrations of eight EPA PCB congeners (28, 52, 101, 118, 138, 153, 180, 209) as typical representatives of persistent pollutants, in early human milk and commercial infant formulas, as a measure of exposure of breast fed newborn babies. Samples of 3rd day colostrum were collected in 2006 from mothers living in the region of Novi Sad, who had no known occupational or dietary exposure to chemicals, and analyzed on GC-ECD (HP 5890 supplied with a Quadrex fused silica column 5% Ph for PCBs).

The age of mothers, donors of colostrum, was 28.73±2.45 (25–32) years - nine were primiparous and thirteen multiparous. The weight of mothers before pregnancy was 61.5±10.2 kg (median 62, range 51–87) and before delivery 77.9±10.9 kg (median 80, range 67–102).

The sum of 8 PCB congeners was 1.06 ± 1.41 μg/kg wet weight (range 0.15 – 5.60). The highest values were of PCB 101. PCB congeners 28 and 118 were not detected in any of the samples analyzed. No correlation was found between PCBs concentrations and age of mothers. Birth weights also did not influence PCBs concentrations.

Concentrations of PCBs in infant formulas were below average values in human colostrum. Formula manufactured in Serbia did not contain any of PCB congeners. In other four imported formulas, PCB congeners 153, 138 and 180 were detected in a concentration ranging from 0.05 to 0.07 ng/g wet weight.

Although breast fed babies babies were more exposed to PCBs than formula fed babies, breastfeeding should be encouraged, since human milk is undoubtedly the best food for development and growth of infants.

EXPERIMENTAL MODELS TO STUDY THE IMPACT OF FOOD-RELATED CONDITIONS ON VIRULENCE PROPERTIES OF POULTRY MEAT ISOLATE *CAMPYLOBACTER JEJUNI*

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Introduction:
Campylobacter jejuni has become the leading cause of human inflammatory enteritis and of the most important zoonosis worldwide. Despite of high prevalence of human campylobacteriosis, mainly transmitted by food, extraintestinal survival and virulence properties of thermotolerant campylobacters are still poorly understood, also due to the lack of useful models for such studies.
Methods and materials:
We confirmed previously bacterial environmental stresses to be implicated in the adhesion, invasion and intraepithelial survival of *C. jejuni* in Caco-2 cells, J774 murine macrophages and PSI cell lines in *in vitro* cell models (Rubeša Mihaljević et al., 2007; Šikić Pogačar et al., 2009; 2010). In this work BALB/c mice were experimentally infected with stressed *C. jejuni* cells to mimic the infection *in vivo*. After bacterial spreading and tissue invasion we followed the survival of stressed campylobacters (exposed to starvation or short-term oxidative stress) at 1, 3 and 8 days post infection in the organs (liver, spleen) of infected animals.
Results:
Colonization of untreated as well as stressed campylobacters occured in the livers and spleens of BALB/c mice. Starvation impaired the ability of *Campylobacter* to persist in organs, however, short term exposure to oxygen enhanced its survival and therefore also the duration of infection with *Campylobacter* pre-exposed to short-term oxidative stress.
Conclusions:
C. jejuni can adapt to environmental oxidative stress and modulate its intestinal epithelial cell interactions, such as adherence, invasion, and intraepithelial survival. Adaptive stress response in food or in food processing environment is thus crucial not only for extra-intestinal survival of *Campylobacter* cells, but also during host-pathogen interaction and thus for its pathogenicity. *In vivo* studies have confirmed our current knowledge about virulence properties of *C. jejuni* 49/4 isolate from *in vitro* tests in conventional and also new functional model of the intestinal epithelium, e.g. noncarcinogenic small intestinal epithelial cells (PSI).

EFFECT OF ALUMINUM SALTS, COPPER SALTS AND POLYELECTROLYTES ON CHARGE NEUTRALIZATION OF PECTIN MACROMOLECULES

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In sugar industry, there is a problem of the presence of undesirable macromolecules compounds such as pectins and proteins in sugar beet juice. Separation of these compounds is done mostly by compounds with calcium ion. Affinity of calcium binding with undesirable macromolecules from sugar beet juice is not significant. The aim of this study is application of alternative coagulants with divalent and trivalent cations, CuSO4 and Al2(SO4)3 with or without the addition of polyelectrolyte which cause the process of charge neutralization macromolecules by adsorption mechanism followed by polymeric bridging effect. Mechanism of discharge of macromolecules compounds using a model of double electric layer surrounding colloidal particles are suggested.

Volume 50 cm3 model solution of pectin (0.1 % w/w) was treated with seven volumes of CuSO4 solution, ranging of 0.47 - 3.29 cm3 and seven volumes of Al2(SO4)3 solution, ranging of 0.59 - 4.15 cm3. Optimal quantities of the applied coagulants, determined by measuring the Zeta potential values, where estimated as follows: 0.24 % (w/w) CuSO4 and 0.45 % (w/w) Al2(SO4)3 & Na2CO3 on sugar beet. This is much lower than 1 – 3 % (w/w) CaO commonly used in sugar production.

Adding different concentrations of cationic polyelectrolytes in CuSO4 and Al2(SO4)3 solution, the highest efficiency of clarification was noticed by applying cationic polyelectrolytes of concentration 3 mg/dm3. It was shown that this type of polyelectrolytes further reduced the value of Zeta potential of sugar beet pectin macromolecules. Zeta potential was determined by electrophoretic method.

Analyzing the experimental results, based on tracking the changes in Zeta potential, mechanism of charge neutralisation of pectin macromolecules by Al+++, Cu++ ions and cationic polyelectrolyte was determined.

CHEMICAL CHARACTERIZATION OF HULL-LESS PUMPKIN SEED OIL PRESS-CAKE

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The utilization of agricultural waste products to produce food has recently received increased attention, not only to minimize waste disposal problems, but to help maximize potential resources and production of new and novel food products. The objective of this study was to characterise the pumpkin oil press-cake, a by-product of the pumpkin seed oil pressing process. The cakes were obtained by pressing the domestic variety of hull-less pumpkin seeds (*Cucurbita pepo* L.) „Olinka“. Two pressing processes were applied: using a continual screw press in cold-pressed oil manufacturing and hydraulic press in the virgin pumpkin oil pressing process. In order to assess the suitability of this by-product, proximate analysis of the samples were conducted to determine the residual oil and water contents, as well as proteins, carbohydrates, crude fibers and ash using official methods of analysis. The residual oil was also analyzed in order to determine its nutritive quality. The obtained results showed that two kinds of oil press-cakes were significantly different in terms of oil and water contents. Press-cake obtained using a screw press had a higher water content (8,30±0,40%) and a lower residual oil content (13,41±1,48%), compared to the press-cake obtained using a hydraulic press (3,94±0,65% water content and 18,18±9,44% residual oil). In addition, the pumpkin press-cakes had a substantial amount of high quality proteins. The protein content of the press-cake obtained using a screw press was 67,09±3,08 % d.m., while in the cake obtained using a hydraulic press was 59,20±5,13 % d.m. Results also have confirmed that the residual oil, regardless of the pressing method used, was of high quality, especially in terms of the high content of the essential omega-6 (linoleic fatty acid) and gamma tocopherols. The obtained results confirmed that both press-cakes can be used in different applications as value-added, functional ingredients for food manufacture.

THE EFFECT OF BROWNING INHIBITORS TREATMENT ON THE MICROBIOLOGY OF FRESH-CUT APPLE SALAD

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Apple is widely used fruit; they contain fibre, sugars and biologically active compounds – polyphenols. They are suitable for fresh-cut fruit salad production. One of basic problems which have to be solved in fruit processing industry is fresh cut fruit browning. The surface browning of fresh-cut apple is caused by interaction of polyphenol oxidase (PPO) and substrate of polyphenol compounds in the presence of oxygen. Nowadays consumers focus not only on appearance and shelf-life of fresh-cut fruits but also are beware of synthetic additives used for colour improvement and consistency retention. There are limited data about use of natural juices to prevent this undesirable process in fresh-cut apples. Furthermore, in the process of production during peeling or cutting microorganisms can be transferred from fruit skin to a surface of flesh, which contains nutrients and is a good medium for development of microorganisms.
The experiments were carried out at the Latvia State Institute of Fruit Growing year 2010. The aim of the research was to evaluate sea buckthorn (*Hippophae rhamnoides* L.), quince (*Chaenomeles japonica* (Thunb.) Lindl. ex Spach), white currant (*Ribes rubrum* L.) juice and antioxidant Natureseal® AS1 impact on quality of apple pieces. The microbiological quality was characterized by total bacteria colony count, *Pseudomonas*, lactic acid, yeasts and moulds colony forming units (CFU).
The least amount of yeast and lactic acid CFU was established in samples treated with juice of Japanese quince while the largest amount in samples treated with sea buckthorn juice. Inhibitor Natureseal ® AS1 solution (4% and 5%) reduced the development of lactic acid bacteria CFU on the surface of fresh cut apples during the first 3 days of storage.

COMPARISON OF LOW MOLECULAR WEIGHT GLUTENIN AND GLIADIN SUBUNITS IN SELECTED WHEAT VARIETIES

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The most important role in wheat protein complex belongs to gluten with its components: glutenin and gliadin. Majority of conducted and published research related to investigation of glutenin and gliadin fractions composition is directed to high molecular weight subunits and their relation to expressed technological properties of wheat varieties.
Differentiation of wheat varieties in relation to low molecular weight subunits composition with molecular weight of up to 30 kDa gains in importance under the fact that some of low molecular protein fractions found in wheat express bioactive properties with confirmed curative and preventive properties proven in vivo or/and in vitro in relation to cardiovascular diseases, cancer, immune and other disorders.
Determination of glutenins and gliadins of wheat varieties from different regions was conducted by LoaC (Lab-on-a-chip capillary electrophoresis) method with previous separation of glutenin and gliadin fractions. PCA was utilized to identify the varieties which are characterized with the most expressed differentiation in the low molecular weght glutenins and gliadins composition.
Ten wheat varieties, including these wide spread in production but also these with high differentiation of composition and shares of protein fractions in the interval from 13 to 28 kDa were compared, and the significance of differences was analysed with ANOVA test.

SIGNIFICANCE OF INTERNAL AMPLIFICATION CONTROL FOR THE DETECTION OF HUMAN NOROVIRUSES BY REAL-TIME RT-PCR FROM DIFFERENT FOOD SAMPLES

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Among human enteric viruses, the noroviruses (NoVs) are of a major epidemiological significance as a common cause of both epidemic and sporadic non-bacterial gastroenteritis in humans. According to the very recent Centers for Disease Control and Prevention data, from all episodes of foodborne illnesses each year, NoVs caused most illnesses (58%) through consumed contaminated food. Soft fruits or vegetables and RTE foods are increasingly identified as vehicles in foodborne viral illnesses. Since molecular methods have been progressively more applied to detect, quantify and study pathogens in food, the most effective methods for virus detection in food samples are those based on nucleic acid amplification. However, two major obstacles that influence routine virus detection in foods include the low efficiency of concentration and nucleic acid extraction procedures and the presence of inhibitors from food matrix to the molecular reactions. Most false negatives are consequence of inefficient virus and/or nucleic acid extraction and of inhibition of the RT-PCR reaction. To overcome and verify whether amplification reactions have functioned correctly, implementation of internal amplification controls (IACs) is essential. For this purpose, previously constructed IACs for application with two sets of highly reactive degenerate primers (MON and COG) for the detection of human NoVs genogroups GI and GII by real-time RT-PCR were tested. Twenty-five grams of raspberries, lettuce, tomatoes, green onions and deli meat have been artificially inoculated with norovirus GI and GII positive stool samples. IACs were incorporated in all real-time RT-PCR assays, and simultaneous amplification of both target and RNA IAC was achieved but without decreasing of detection levels of target virus. These IACs facilitated the distinguishing between negative and false negative results, since melting curves allowed the differentiation between the internal control and NoV amplicons and could clearly be distinguished in agarose gels, by the difference in their product sizes.

BASELINE CONCENTRATIONS OF LESSER ELEMENTS IN PORTUGUESE CEREALS

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Cereals are by far the most significant agricultural crops, not only on a gross-tonnage basis, but also by what they really represent in terms of energy supply and dietary intake for human nutrition worldwide. One of the drawbacks of human diets based mostly on cereals is that the intake of essential elements may be inadequate regarding their average daily requirements -- when cultivation soils become exhausted or are already poor in such elements -- while, in turn, others can be present in levels that may be questionable for human ingestion on a daily basis. Within the framework of a research contract by the Portuguese Foundation for the Science and the Technology (PTDC/QUI/65618/2006; FCT, Lisboa), an extensive investigation of elemental concentrations in home-grown cereals and their cultivation soils has been carried out across the main production areas of mainland Portugal, for baseline-data purposes and with a view to an eventual improvement (biofortification) of major cereal cultivars as well. The present paper deals with maize (or corn; *Zea mays* L.), rice (*Oryza sativa* L.) and barley (*Hordeum vulgare* L.) from the 2009 campaign. Cereal and soil samples from distinct areas that feature significant productions for each cereal were collected through the summer of 2009. Elemental levels in all samples were determined by k0-standardized, instrumental neutron activation analysis (k0-INAA), in the Portuguese Research Reactor of the Technological and Nuclear Institute (RPI-ITN, Sacavém; pool-type reactor; maximum nominal power: 1 MW). Quality control of the instrumental procedure has been asserted with concurrent analyses of NIST-SRM 1567a (Wheat Flour), NIST-SRM 1568a (Rice Flour) and GBW 07404 (Limy-yellow Soil). Concentrations of As, Br, Cr, Co, Fe, K, Na, Rb and Zn -- all within their safe intervals for human consumption -- are reported and discussed with respect to corresponding data from major producing areas around the globe.

DOMESTIC BALKAN DONKEY'S MILK: MICROBIOLOGICAL, CHEMICAL AND SENSORY PROPERTIES

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The aim of this study was to investigate microbiological, chemical and sensory properties of raw donkey's milk from an autochthonous breed originated from Serbia. Changes in microbial flora during the six days of storage at 4 °C were monitored by enumeration of total count of bacteria, yeasts and moulds, Enterobacteriaceae, coliforms, lactic acid bacteria, bacterial endospores, coagulase positive staphylococci, E.coli, C. perfringens and Salmonella spp. Descriptive method was used for determination of sensory properties. Descriptive terms were developed to describe appearance (colour), flavour, taste and aftertaste. Chemical analyses included determination of protein, milk fat, dry matter, lactose and vitamin C content. After five days of storage at 4 °C microbiological quality of the raw Domestic Balkan donkey's milk was in accordance with the requirements of European Regulation. The obtained results indicate strong antimicrobial activity of the tested milk and longer shelf-life in comparison to other raw milk sources. Sensory properties of the tested milk were in accordance with changes in microbial flora. High vitamin C content, low protein and milk fat content make the tested milk a valuable potential component of functional food.

INFLUENCE OF INGREDIENTS ON RHEOLOGICAL PROPERTIES OF HAZELNUT BUTTER

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Summary: Rheological properties of the most important factors are the quality of sweet hazelnut butter. The share of solid particles, the oil phase, the presence of stabilizers and emulsifiers determine the rheological properties of the hazelnut butter. The aim of this study was to search the influence of the share of nuts, the type of carbohydrate and milk components on the rheological properties of hazelnut butter. Measuring the rheological properties of hazelnut butter was conducted on a rotational viscosimeter with concentric cylinders at a temperature of 25 °C per day production. From the obtained data to calculate the rheological parameters consistency coefficient, flow index and apparent viscosity of hazelnut butter. Based on the results of research on the impact of ingredients on the rheological properties of hazelnut butter that comes with hazelnut butters examined showed non-Newtonian pseudoplastic properties and to increase the share of nuts is a change of rheological properties. Thus, the addition of a larger share of kernels increases the apparent viscosity and consistency of the hazelnut butter. Also types of carbohydrates and milk components affect the change in rheological properties. Increased viscosity and consistency of butter was using the definition of inulin HD , acacia honey and soy milk powder.

Key words: Hazelnut butter, rheological properties, carbohydrates, milk components

NUTRIENTS AND MINERALS IN GRAINS AND MILLING PRODUCTS AFTER SELECTIVE ABRASIVE SCOURING OF SOFT WINTER WHEAT

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Cereal grains contribute most significantly as a source of carbohydrate and to a less extent of protein. Their potential contribution of minor nutrients, including the trace elements, is frequently overlooked. These valuable nutrients are partly located in peripheral parts of the grain and are lost during flour production. However a high varietal variability in the mechanical properties of the aleurone layer, the adhesion forces between the aleurone layer and endosperm, the structural irregularity of aleurone layer-endosperm interface, and mechanical properties of the grain peripheral layers might influence the effect of wheat grain abrasive scouring

The objective of this study was to investigate how selective removal of the surface layers of whole wheat grains by abrasive scouring affects the distribution of macronutrients, micronutrients and trace elements in a soft winter wheat variety Partizanka and its milling products.

The investigated minerals were: P, Ca, Fe and Mg. The concentrations of minerals in scoured wheat grains were significantly reduced, dropping on average to 65% of the initial values for macroelements. On the other hand, the levels of protein, sugars, oils and starch were mostly maintained. The change of concentrations with the duration of applied scouring treatment followed different patterns for different nutrients and elements.

Therefore better understanding of how selective removal of pheripherial parts affects nutrients in whole wheat grain, coupled to the measurement of contaminants, would allow optimizing surface processing and utilizing it for enhancing the nutritive as well as the bioprotective value of whole-wheat food products.

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AMINO ACID COMPOSITION IN FISH SPECIES FROM ATATURK DAM LAKE (EUPHRATES, TURKEY)

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Introduction

Freshwater fish species are very rich sources of low-fat, excellent protein and mineral components. Silurus triostegus, Acanthobrama marmid, Aspius vorax, Capoeta trutta, Carasobarbus luteus, Chalcalburnus mossulens and Cyprinus carpio which are widespread in Fırat river and consumed by people in Turkey, Iraq and Syria. Different species has variety of amino acid compositions although they live in the same environmental conditions. Animal origin amino acids are very important in human nutrition and metabolism. Recently very valuable data have been published concerning the fatty acid composition assessment of commercially important seawater and freshwater fish species of Turkey (Özoğul et al., 2007). On the other hand, there has been no data available documenting the amino acid of economically fish species caught in Atatürk Dam Lake, Turkey.

Materials and methods

A total of 7 freshwater fish species of commercial importance were chosen from the Atatürk Dam Lake, Turkey. Edible muscle of each species was minced for analyses. In this study, it was determined with HPLC that from contained lysine, methionine, threonine, isoleucine, leucine, phenylalanine, valine, histidine, serine, arginine, cysteine, tyrosine, alanine, aspartic acid, glutamic acid, glycine, and proline.

Results and conclusions

These results show that, freshwater fishes are as valuable as other seafood and animal products with their rich amino acid compositions. The essential, semi–essential, and non-essential amino acid contents were found to be significant level for all Atatürk Dam Lake in commonly consumed fish species. Amino acids amounts differed between the species even they were living in similar habitats. Amino acids contents, the samples were important for human consumption.

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CHARACTERIZATION OF BREAD WHEAT CULTIVARS BY SEED STORAGE PROTEINS

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Gluten proteins are the major storage protein fraction in the wheat grain. Protein content and composition are of particular interest because the gluten proteins play a major role in determining the grain processing quality. When flour is mixed with water, the gluten proteins swells and form a continuous elastic network which confers viscosity and elasticity to the dough, enabling the production of yeast leavened products. Sixteen Croatian and sixteen Serbian winter wheat cultivars differing in processing quality were analyzed and compared. Samples were collected at the experimental fields of the Agricultural Institute Osijek and Institute of the Field and Vegetable Crops Novi Sad in 2009. The gluten proteins have been examined by RP-HPLC and SDS-PAGE. The proportion of albumins and gliadins in total extractible proteins were range from 10.14 to 23.44%, while the proportion of total gliadins and glutenins varied between 42.19 and 58.91% and 28.23 and 38.46%, respectively. Regarding the high-molecular-weight-glutenin subunits (HMW-GS), their proportion varied between 5.49 and 12.89%. Observing the HMW-GS composition, the dominant subunits at the Glu-A1 locus were N and 2*, at the Glu-B1 locus 7+8 and 7+9, while at the Glu-D1 locus the subunits 5+10 were the most frequent. The results showed the significant differences between two cultivars group in the proportions of total albumin and globulins, total glutenins and gliadins as well as in γ-gliadins and low-molecular-weight-glutenin subunits (LMW-GS).

EXAMINATION OF RHEOLOGICAL PROPERTIES WHEAT SAMPLES BY NEAR INFRARED SPECTROSCOPY

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Owing to its several advantages near infrared (NIR) spectroscopy is a widespread analitical method being used in agriculture and food industry as well. It is suitable for identification, qualification and quantitative analysis too. In wheat quality control rheological characteristics of dough made from wheat flour are as important as physical and chemical properties too. Rheological properties like farinograph, alveograph, extensigraph parameters are influenced by many factors. For these parameters developing NIR calibration equations with good accuracy is complex problem, prediction of these parameters is more difficult than the chemical composition. In this study we examined wheat samples from different growing area by alveograph and spectral data were collected by FOSS Infratec 1241 instrument. Our first objective was whether it is any effect of the growing area on NIR spectra. Principal Component Analysis (PCA) was developed to examine this effect. We have found that samples from same growing area are close to each other, but there is not any separation in the whole population. According to these PCA results no need to separate the population, we could develop calibration equations on the whole sample set. After qualitative analysis modified partial least squares analyses on NIR spectra were developed for two alveograph parameter (P/L és W) to get calibration equations.

THE FATTY ACIDS AND ACYLGLYCEROLS CONTENT AND COMPOSITION OF CHICKPEA FLOUR

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The chickpea (*Cicer arietinum* L.) is a legume plant of the family *Fabaceae*. It has high protein content and content of fat up to 5%. The chickpea also has high dietary fibres content and hence it is healthy source of carbohydrates. In this paper composition and content of fatty acids and acylglycerols of lipids from chickpea flour were examined. The chickpea flour was obtained by milling seeds to average particle size of 0.3 mm. The lipids are obtained by trichlorethylene duplicate extraction and by using reflux (1:20 w/v at solvent boiling temperature, 45 minutes). The extracts were combined and dried under vacuum. In order to investigate the content and composition of chick pea flour fatty acids and acylglycerols, GC (5890 Series HP Chromatograph) and HPLC (Agilent 1100 Chromatograph) method respectively, were performed. In order to obtained fatty acids methyl esters for GC analysis, the lipids were alkaline hydrolyzed and methylated by methanol and BF3 as catalysts. The content of lipid was 3,11 g per 100 g of chick pea flour and fatty acids content was: palmitic 12.18%, stearic 2.47%, arachidonic 1.10% , behenic 0.52, oleic 37.77% and linoleic 42.14%. It can be seen the chick pea flour contained 20.48 g per 100 g of lipids of total saturated fatty acids composed of palmitic, stearic and arachidonic acid, 17.16 g per 100 g of monounsaturated fatty acids composed of oleic acid and 58.52 g per 100 g of polyunsaturated fatty acids composed of linoleic acid. So, in total sum, the content of unsaturated fatty acids was 75.68% g per 100 g of lipids. By HPLC analysis it was obtained the lipids contained the highest content of triacylglycerols (57.48%), while the content of diacylglycerols was 36.66% and monoacylglycerols, 5.51%.

SUITABILITY OF THIOBARBITURIC ACID METHOD FOR ASSESSING LIPID OXIDATION IN PORK, OSMOTICALLY DEHYDRATED IN SUGAR BEET MOLASSE

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Thiobarbituric acid (TBA) reaction for measuring secondary lipid oxidation products in meat was evaluated for interference by ingredients of sugar beet molasse (presumably sugars and sugar degradation products). Pork meat was osmotically dehydrated in sugar beet molasse solution and stored for 4 months, at 4oC, under the modified atmosphere conditions. The effectiveness of different TBA tests in minimazing the interferences of sugar molasse ingredients was measured by aqueous acid extraction method (EM) under different conditions of incubation: 1) boiling or 2) room temperature, with 20 mM TBA, and 3) at 40oC, with 80 mM TBA. The distilation TBA method (DM) was employed to evaluate the interferences found in EM, and low TBA values were obtained in all TBA method procedures. Primary lipid oxidation products were, also, low (peroxide value = 0), except for microbiologically contaminated samples with increased water activity value, where elevated peroxide values, but low TBA values were obtained. The data are suggestive of oxidative stability of osmotically dehydrated pork meat under storage in modified atmosphere and refrigerated conditions. TBA EM may be the inadequate method for the analysis of oxidative deterioration of meat samples dehydrated in sugar beet molasse, due to interferences which cause erroneously high value of TBA, detected as absorption at: max. 350 nm and 450-460 nm, present in dehydrated meat and sugar beet molasse itself, which are overlapping the pink peak (max. 532 nm), characteristic for malondialdehyde. TBA EM procedure at low incubation temperature (40oC), with meat extracts reacting with elevated TBA concentration (80 mM), was the most sensitive of analyzed TBA methods.

DETERMINATION OF TOTAL PHOSPHORUS IN MEAT PRODUCTS

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Phosphate and polyphosphate additives are added to meat and other food products because thay serve as an emulsifier of fat, water and protein, and effect on water binding. Phosphates affect the texture of the product, prevent discoloration, improve emulgation of fat and improve flavor, prevent oxidation of unsaturated fatty acids affect the pH value.
Existing legislation defines the maximum amount of phosphorus (expressed as P2O5), which can be added to meat products and in amount of 5 g/kg. In the Sanitary Chemistry department of Public Health Institute, the content of phosphorus in these products in the samples presented for analysis is determined on a daily basis.
In the period from May 2010 to November 2011 there were 85 samples of meat products of ungulates and poultry meat to analised for content of total phosphorus. The content of total phosphorus, g/kg, expressed as P2O5 was determined using the standard method "Meat and meat products – Determination of total phosphorus content – spectrophotometric method," JUS ISO 13730, 1999.
The principle of the method is based on dry incineration ash and acid hydrolysis using nitric acid, followed by addition of ammonium and ammoniummonovanadate heptamolydate causing the creation of yellow colored compounds, whose intensity is measured spectrophotometrically at 430 nm.
Providing assurance in the results of laboratory provides through internal quality control (using the control map; Nordtest method) and frequent participation in inter-laboratory comparative tests.
Of the total number of samples tested 24 samples or 28.2% had a phosphorus content (expressed as P2O5) greater than 5 g /kg, while in 47 samples or 55.3% phosphorus content ranged from 4 g/kg to 5 g/kg.

DETERMINATION OF THE AMOUNT OF FREE AMINO GROUPS AS AN INDICATOR OF WHEAT FLOUR PROTEIN COMPLEX QUALITY

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The quality of wheat-based products is highly dependent on the quality of the used flour, where the quality of starch and protein fractions has the most dominant role. The degree of protein hydrolysis, which indicates the level of protein quality as well as the end-use flour quality, is determined by different methods (chemical, physical and rheological). The aim of this study was to determine the biochemical status of freshly harvested wheat in terms of the amount of free amino groups as an indicator of the protein hydrolysis degree. Determination of free amino groups was carried out from wet gluten by using modified method of Nielsen at al. (2001), where each sample was beforehand tempered at two different temperatures (30° and 37°C). The temperature of 30°C corresponds to the real baking conditions as well as it is commonly used in rheological measurements. Moreover, the temperature of 37 °C provides optimal conditions for the activity of hydrolytic enzymes present. Three wheat varieties were collected from two localities in northern Serbia in 2010/2011 production year. The selected localities were characterized with different micro-climatic conditions during grain filling and maturing.
The obtained results indicated that the amount of free amino groups from the samples tempered at 30 °C to a greater extent depends on the locality, whilst the amount of free amino groups from the samples tempered at 37 °C to a greater extent depends on the variety.
The further research should be carried out in different stages of post-harvest maturation of wheat as well as in optimal stage of flour maturation.

Key words: wheat, quality, gluten, free amino groups, micro-climatic conditions

RESEARCH OF PATULIN IN FROZEN RASPBERRIES CONTAMINATED WITH FIELD FUNGI

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Fresh fruit is susceptible to contamination with filamentous fungi during growing, harvesting, transport, storage and sales. For these reasons it is important to identify and take appropriate measures not only about microbiological contamination but also concerning possible presence of mycotoxins. Due to soft tissue structures berries are very susceptible to mold contamination of different mold genera including toxigenic ones (*Penicillium*, *Aspergillus* and *Byssochlamys*). The aim of the research was to investigate the presence of patulin in frozen raspberries harvested under rainy and wet conditions convenient for production of this secondary metabolite of molds in fresh raspberries. Frozen raspberry samples which were visually rated as products with intensive mold attack were taken from the most important cooling warehouses in raspberry growing region in Serbia. The method developed by Arranz et al (2005) widely represented in the EU for the determination of patulin using high-performance liquid chromatography (HPLC) with UV detection (λ = 276 nm) was used for determination of presence of patulin in the raspberry samples. Determined contents of patulin in the samples ranged from 1.07 to 15.33 µg/kg. Obtained results were significantly bellow the contents of patulin obtained by Demirci et al (2003) for mold contaminated raspberries from other raspberry growing region (48 to 746 µg/kg, with an average content 325.73µg/kg), indicating lower patulin production by molds which contaminate raspberries from Serbia. Patulin content of fresh fruits as raw material for further processing is not regulated by laws in Serbia or in the European Union, but the Joint Food and Agriculture Organization-World Health Organization (WHO) Expert Committee on Food Additives has established a provisional maximum tolerable daily intake for patulin of 0.4 µg/kg of body weight per day (WHO, 1995).

Keywords: raspberry, patulin, HPLC-UV

INSIGHT INTO THE LEVEL OF PESTICIDE RESIDUES AND THE PRESENCE OF PATULIN AND HEAVY METALS IN BABY FOOD PRODUCED BY DOMESTIC MANUFACTURERS

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Babies and small children are especially sensitive to the exposure to environmental contaminants. This paper deals with the analysis of 50 baby food samples, based on fruit and vegetables, of domestic manufacturers, concerning the residues of pesticides, patulin and heavy metals.
A LC–MS/MS with ESI was applied for the detection of aldicarb sulphone, aldicarb sulphoxide, carbendazim, methomyl, 3-hydroxycarbofuran, aldicarb, bendiocarb, carbaryl, carbofuran, ethiophen-carb, metiocarb, propoxur, oxamyl, maloxon, azoxystrobin, malathion, triadimefon, quintozene, triadimenol, prochloraz, metalaxyl, azinphos-ethyl, myclobutanyl, propyzamide, bitertanol, hexaconazole, kreoxim-methyl, pirimifos-methyl, prochloraz and resmethrin in baby food, extracted with QuEChERS. The average recoveries for all analites were 82.3-101.4% (RSDs 2.63-16.29%). The extraction of patulin was carried out by SPE with the clean-up of extracts on the Oasis® HLB cartridge. For the patulin analysis, an Agilent 1260 HPLC-VWD and Zorbax Eclipse Plus C18 column were used. The recovery rates and the RSD of variations were 91.2-111.5% and 2.1–9.3%, respectively, the minimum detectable level was 1 μg/kg. For the determination of heavy metal content AAS SpectarAA 220 the following techniques were used: flame detection for Pb and Cd, hydride VGA 77 for As and cold vapours for Hg.
The results showed that the concentration of pesticide residues in all the samples was below the MRLs regulated in the Republic of Serbia. By analyzing the apple-based formulas, the method of patulin analysis demonstrated that 100% were in compliance with current regulations, although one of the samples contained patulin at the limit of quantification. The detected heavy metal content in all formulas was below the MRLs.
In accordance with the obtained results it can be stated that the baby food of domestic manufacturers is safe concerning the residues of pesticides, patulin and heavy metals.
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PESTICIDE RESIDUES IN APPLE SAMPLES ON THE MARKET OF THE REPUBLIC OF SERBIA IN 2011

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Apple is one of the most widely cultivated fruit trees in the world. Apple is attacked by many pests and diseases, and at present, the pesticides are widely used for apple protection. In the Republic of Serbia, during 2011, there were 87 insecticides, 30 acaricides, 87 fungicides and two plant-growth regulators used in apple protection. Apples in orchards are usually treated with pesticides more than 20 times. The inappropriate use of pesticides and the disregard of the PHI results in the increased pesticide residue content. It needs to be emphasized that fresh apple consumption entails a certain risk of beeing exposed to the pesticide residues, so the content of their residues must be checked on. Our study comprised the determination of the pesticide residue content in samples of apples from the markets of Novi Sad taken during 2011. The extraction of pesticides was carried out by QuEChERS. The Thermo Scientific DSQ II Focus GC-MS was applied for the detection of 22 pesticides in apple samples. The investigated pesticides were: dodin, chlorpyrifos, thiofanate methyl, bupirimat, fenarymol, krezoxim-methyl, flutriafol, dithianon, dimethoate, flusilazole, penconazol, difenoconazole, acetamiprid, fenoxycarb, chlorothalonil, pyrimethanil, dinocap, trifloxystrobin, azinphos-methyl, captan, cypermethrin and methyram, with carbofuran as an internal standard.
The linearity was studied in the range of 0.1–2.0 µg/ml with the R2 higher than 0.99. The recovery data were obtained by spiking blank samples at concentration levels 0.1, 0.2 and 0.5 mg/kg, yielding recoveries in the range of 80–110%. The precision values expressed as RSD were lower than 18% for the intraday precision. The LODs and LOQs were established as 5 and 10 µg/kg, respectively. The pesticide residues were below the MRLs values as regulated in the Republic of Serbia.
The obtained results show that the apples from the market of Novi Sad are safe for consumption.

INFLUENCE OF DIFFERENT STORAGE TEMPERATURES ON SAFETY OF DIARY PRODUCTS

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It is well known that, depending of numerous internal and external factors, microorganisms growth occurs during storage of diary products, resulting in sensoric changes i.e. spoilage. Storage and transport temperature is an important factor, largely influencing on product safety and shelf-life.
The experiment was designed in order to monitor durability of certain diary products (sterilised milk, white cheese, yogurt and cream) within their shelf-life, that were stored at proper temperatures (6 – 8 ^{0}C) and elevated temperatures (14 ^{0}C).
Samples were taken from each group of products, in original packaging units immedeiately after production and kept at predefined temperatures (8 and 14 ^{0}C).
Samples were tested at preset time intervals. Testing consisted of microbiological analysis, physico-chemical analysis (pH value), as well as sensory analysis (odour, taste, colour, consistency).
Microbiological analysis was carried out in accordance with national legislative using validated ISO methods.
The results showed that storing at elevated temperatures results in increase of aerobic mesophilic bacteria, as well as lactic acid bacteria, which led to alterations in sensory properties i.e. spoilage of diary products. pH value also decreased due to the increase of lactic acid bacteria count.
Proper storing temperature control, as the important element influencing food safety is one of the most frequent (and often the hardest to achieve) activity in production and distribution chain of diary products.

THE AMOUNT OF THIOL (SH) GROUPS AS A QUALITY INDICATOR OF THE WHEAT FLOUR PROTEIN COMPLEX

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Since the technological quality of flour is directly influenced by protein content and quality, a great attention is paid to determination of its properties. For this purpose, a wide range of chemical, physical and rheological tests are commonly employed. The rheological properties of dough during baking processing and ultimately the quality of final product are influenced by the changes of the thiaol/disulphide structure of gluten proteins. The aim of this study was to monitor the changes in the amount of thiol groups as a quality indicator of protein complex of three freshly harvested wheat samples from two localities characterized by different micro-climatic conditions in 2010/2011 production year. By modifying the method of Pérez et al. (2005), the content of thiol groups was spectrophotometrically determined in wet gluten of selected samples (λ = 412nm). Each sample was beforehand tempered at two different temperatures (30° and 37°C) in order to imitate the flour processing conditions as well as to determine the impact of hydrolytic enzymes present. On the basis of obtained results, it was noticed that each variety manifested different trend in the amount of thiol groups over time when tempering at 30 °C, whilst tempering at 37 °C highlighted the dominant impact of selected localities on the amount of thiol groups.

RESIDUE ANALYSES OF NITROFURAN METABOLITES IN ANIMAL PLASMA BY UHPLC-MS/MS

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The use of nitrofuran based veterinary drugs in food-producing animals has been banned in the EU since mid 90s. Monitoring programs in the EU are based on the detection of protein-bound metabolites, usually in liver and tissue after slaughtering. UHPLC-MS/MS method was developed and validated in-house, for the determination of four nitrofuran residues (AHD, AOZ, SEM and AMOZ) in animal plasma (bovine, ovine, porcine and equine). Plasma samples were derivatised with 2-nitrobenzaldehyde and subsequently extracted with organic solvent. Extracts were concentrated and analysed by UHPLC-MS/MS. The performance of the method has been additionally evaluated through application to routine samples collected on-farm in Republic of Ireland, as well as blood plasma samples taken from animals in Republic of Serbia. Decision limits (CCα) were calculated following guidelines from 2002/657/EC, to be 0.07, 0.06, 0.07 and 0.05 µg kg-1 for AHD, AOZ, SEM and AMOZ respectively.

EVALUATION OF ANTIFUNGAL ACTIVITY OF *OREGANUM HERACLEOTICUM* L. ESSENTIAL OIL AGAINST SOME FOODBORNE FUNGI

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Oreganum heracleoticum L. plant parts and biochemical extracts are commonly used in the food and medicine. The most important component of oregano is essential oil (EO), which has been reported to posses antiseptic, analgesic, antioxidant, germicidal, cytotoxic and other pharmacological properties. Besides, oregano EO can be considered as a natural food preservative, since it shows strong antimicrobial effects, due to its high content of phenolic compounds, particularly carvacrol.

In this work, antifungal properties of *Oreganum heracleoticum* L. EO have been tested, using broth micro-dilution method. The microorganisms used in investigation are fungal species isolated from food: *Penicillium aurantiogriseum*, *P.brevicompactum*, *P.chrysogenum*, *Aspergillus niger*, *A.flavus* and *Rhodotorula glutinis*, and some species from ATCC collection – *Aspergillus brasiliensis* ATCC® 16404TM, *Saccharomyces cerevisiae* ATCC® 2601TM and *Candida albicans* ATCC® 10231TM. Concentrations of 7-day culture suspensions were in range 105-106 cfu/ml, and concentrations of oregano EO applied on fungal suspension were: 0.15µl/ml, 0.31µl/ml, 0.62µl/ml, 1.25µl/ml, 2.5µl/ml and 5µl/ml. Inoculums were grown in microtitar plates for 48 h, and then they were subcultured into Petri dishes, poured with Sabouraud-maltose agar and incubated for 7 days at 25°C.

Oregano EO showed different level of antimicrobial properties on different fungal species. The highest inhibition oregano EO demonstrated against *P. chrysogenum*, which was completely inhibited by all tested concentrations, so the minimum fungicidal concentration (MFC) was <0.15 µl/ml. The MFC value for *S.cerevisiae* and *R.glutinis* was 0.31 µl/ml, while the total inhibition of *A.flavus*, *A.niger* and *C.albicans* were observed at the concentration 0.62 µl/ml of EO. The most resistant species were *P. aurantiogriseum* and *P.brevicompactum*, whose MFC was 1.25 µl/ml. In the case of *P.aurantiogriseum*, a lack of sporulation was also observed at all tested concentration lower than MFC.

The oregano essential oil, besides its importance for flavoring, has also demonstrated high antifungal properties, in concentration applicable to food.

SHEEP MILK QUALITY/QUANTITY AND SUBCLINICAL MASTITIS

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Brief introduction: Dairy sheep farming is an important economic activity, especially for countries in the Mediterranean basin. In such systems subclinical mastitis is quite important impairing milk quantity, quality and safety. Our study investigates the correlation between the presence of subclinical mastitis on milk yield and quality parameters. Methods and materials: The study was conducted on Crete, Greece enrolling Sfakion breed ewes; the major sheep population on the island. Altogether 400 ewes belonging to 10 extensive and 10 semi-intensive sheep flocks (20 animals from each farm equally allocated to early and late lambing periods) were monitored for two consecutive milking periods. Individual milk samples were collected monthly from those animals recording in the same time all management interventions by each farmer. Chemical composition of milk samples, Colony Forming Units(CFU) and Somatic Cell Counts(SCC) were assessed by infrared methods and Fatty Acid(FA) profile by gas chromatography, for one month's samples. Samples with SCC above 500,000 were cultured for mastitis-related pathogens. Results: Analyses of the results showed that there is a high prevalence of subclinical mastitis, 19.3% of animals, with ewes from semi-intensive system and from late lambing being more susceptible (p-value <0.001). The most commonly identified pathogens were Staphylococcus spp. Animals identified as having sub-clinical mastitis had lower milk lactose and Solids Non Fat (SNF) (p-value <0.001), independently of management system or lambing period. No statistical differences, respectively to the above, were recorded when milk yield records analysed. Furthermore, ewes with subclinical mastitis had a higher milk pH and CFU (p-value <0.001). When the FA profile was examined there were no clear differences for specific FA, but ewes with mastitis had a higher Δ9-Desaturase activity index (p-value<0.001), especially the late lambing. Conclusions: Sub-clinical mastitis can affect milk quality while a possible effect on milk FA synthesis needs to be further investigated.

PESTICIDE DETECTION IN WATER AND SEDIMENT

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Chlorotriazine herbicide atrazine (IUPAC: 6-chloro-N2-ethyl-N4-isopropyl-1,3,5-triazine-2,4-diamine) was excessively used on crop fields to control broadleaf weeds in the production of corn, sugar cane and sorghum. Due to its heavy use, the toxicological profile of this herbicide has been investigated over the years. Intensive use of pesticides has resulted in their presence in water, soil and air. Number of these chemicals can act as endocrine disrupting compounds. Endocrine disrupting chemicals are substances in our environment, food and consumer products that interfere with hormone biosynthesis and metabolism resulting in an alternation from normal homeostatic control or reproduction. What makes endocrine disruptors so significant is that they are not bound by the classic toxicological assumption that supports threshold-based system of determining chemical toxicity, they are often more active at lower doses, far beneath of those, which are traditional concern to toxicologists. The results gained by The Joint Danube Survey target analysis of water and soil show no presence of atrazine in Novi Sad region. The most likely reasons for no detection of this substance could be target sampling method, which might be inappropriate in this case, as well as short half-life of atrazine. Prior research in this field show the adverse effect of atrazine in lower doses than limit of detection in used method, which is why a different sampling and detection methods should be used for more valid results.

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CONTENT OF MERCURY IN MARINE FISH AVAILABLE AT SERBIAN MARKET

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Fish has an important role in a healthy diet. Fish contains high-quality protein and other essential nutrients. However, increased fish consumption may simultaneously increase the contaminants intake to the levels of toxicological concern, especially mercury. Exposure to high levels of mercury (Hg) can cause permanent damage to the brain, kidneys, and developing fetus.
The aim of this work is to determine mercury content in marine fish, estimate the intake of mercury through fish consumption and compare it to the recommended safe limit.
Concentrations of total Hg were measured in 572 samples of marine fish (hake, mackerel, sprat, scorpanea, gilthead, european seabass) during 2010 and 2011. Analyses were carried out on atomic absorption spectrometer Varian "SpectrAA 220" with VGA 77 hydride system. Analytical quality control was achieved by using certified reference material BCR 186.
For the purpose of intake assessment, we used the data obtained from the FAO/WHO diets database.
All samples contained mercury below the maximum level fixed by the European Commission and Serbian national regulation wich sets the maximum of mercury level at 0,5 μgg-1. Mean mercury content in examined species is 0,048 μgg-1. The highest average mercury concentration was found in scorpanea - 0,080 μgg-1 and the lowest in sprat - 0.016 μgg-1. The estimated weekly intake for mercury, based on average body mass of 70 kg and mean mercury value found in fish was 0.073 mg/kg b.w./week. The same value calculated using maximum mercury content (0.495 μgg-1) was 0.752 mg/kg b.w./week. In both consumption scenarios, weekly intake of mercury through marine fish consumption is lower than the recommended provisional tolerable weekly intake of 5μg/kg b.w./week.
Based on FAO/WHO recommendation and on obtained results, we can conclude that the intake of mercury in the case of consuming marine fish does not pose health risk to Serbian population.

PRESENCE OF *LISTERIA MONOCYTOGENES* IN MEAT AND MINCED MEAT PRODUCTS

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Listeria monocytogenes is an important foodborne pathogen which causes listeriosis, a serious invasive illness in humans, and it occurs not even in food but also in food industry equipment and premises, notably at low temperatures. So far scientific studies have focused on adhesion potential, biofilm forming ability, resistance to desiccation, acidity and heat treatments, tolerance to increased sublethal concentration of disinfectants or resistance to lethal concentrations. According to mentioned the goal of this study is to evaluate difference in presence of *Listeria monocytogenes* in meat and minced meat products. Analyses were performed on meat samples from 5 butchery during the period of 6 months (from June until December 2011.). Once a week samples of meat were sampled in butchery and microbiologically analyzed at *Listeria monocytogenes* presence. Of 523 analyzed samples, 54 (9,68%) minced meat product samples were positive at *Listeria monocytogenes* presence but neither one meat sample was positive. The growth of *Listeria monocytogenes* was analyzed according to the SRPS EN ISO 11290-1: 2010 methodology.
Comparison of the results indicate conclusion that *Listeria monocytogenes* is secondary contaminant and it is present only in meat which is technologically processed due to its ability to form biofilms. Biofilms are formed especially on stainless steel equipment, which strengthen *Listeria monocytogenes* resistance to disinfectants.

DETERMINATION OF CARBON, HYDROGEN, OXYGEN AND NITROGEN STABLE ISOTOPE RATIOS IN FOOD BY IRMS

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Isotopic analyses of food have become a widespread tool to evaluate the quality, authenticity and origin of labeled products. In SP Laboratory determination of 13C/12C, 2H/1H, 18O/16O, 15N/14N isotope ratios were used for checking the botanical and geographical origin of wines, alcoholic drinks and honey, and for the detection of eventually exogenous sugar or water addition.
The analysis was carried out using Elemental Analyzer (Flash EA 1112HT) and GasBanch II which was connected to an Isotope Ratio Mass Spectrometer (ThermoFinnigan DELTA V Advantage).
Comparing δ13C in protein and raw honey (δ13Choney, δ13Cprotein), which should be the same, if they come from the same floral sources, it is determined if the honey is adulterated with sugar. The % of adulteration can be estimated by the difference in δ13C between the raw honey and its protein. δ15N in honey is influenced by various, agricultural practices and natural nitrogen cycles.
Combined results of δD and δ13C values gives important information about botanical origin of ethanol in wine and alcoholic drink and possibility of distinguishing between fruit spirits and spirits with non-fruit origin (made from beet sugar, maize, cane sugar). The values of δD and δ18O can provide information about climatic conditions and geographical location.
The obtained results allow establishment of a database and classification of products based on botanical and geographical origin. This method is successfully applied to prevent fraud in the food products industry.

IMPORTANCE AND METHODS FOR FRUIT JUICE EVALUATION IN FRUIT JUICES, NECTARS AND RELATED PRODUCTS

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Fruit content is one of the essential quality elements of fruit juices, nectars and related products.
Its authentication comprehend several analysis which results are compared to the ones regulated in domestic (Regulations on quality of fruit juices, concentrated fruit juices, fruit juice powder, fruit juices and related products (Official Gazette RS no. 27/10, 67/10, 70/10, 44/11 and 77/11)) and foreign regulatives (Code of practice for evaluation of fruit and vegetable juices A.I.J.N. of European Union, Schweiz. Lebensmittelbuch, Kapital 28A, Frucht und Gemusesafte, Fruchtnektare, Fruchtsirupe, Konzentrate und Pulver, (SLMB, Juli 2000)).
The mane cases of common adulteration were: lower fruit content (especially in nectars), substitution of fruit ingredient with cheaper (sour cherry instead of blueberry) massive addition of sugars masked with addition of citric acid, undeclared addition of sugar and similar, as on our as on world market.
Elaboration of results of control of domestic and imported concentrated fruit juices, fruit juices, nectars, soft drinks with fruit juices, ran by SP Laboratorija during 2010. and 2011. according actual domestic and foreign regulations is represented in this work.
Checking the selected parameters using standard methods, and comparation of results with values implemented in domestic Regulation from internationaly authorised data bases are achieved to reliability and rationality during the authentication of examined products.
According to results of analysis done at SP Laboratorija conclusion is that the approach of producers to the quality and authenticity of juices developed during the past few years. Producers requests for checking of raw material (concentrated fruit juices) are more and more often, and contribute to lower number of unacceptable products.

ANALYTICAL RESULTS OVERVIEW OF FRUITS AND VEGETABLES PRODUCED IN SERBIA

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SP Laboratory had analysed residual active substances of pesticides in fruits and vegetables, which were produced in Serbia, from Janury 2010 until December 2011.
Different techniques were used for determination of pesticide residues such as gas chromatography with mass spectrometer (GC6890N/MS5975, RTL PEST3 by Agilent, USA), gas chromatography with electron capture detector (GC6890N/ECD, by Agilent,USA), gas chromatography with electron capture detector and head-space injection system (GC7890N/ECD/HSS by Agilent, USA) and liquid chromatography with mass spectrometer (Ultimate 3000/MSQ by Dionex, USA). Sample preparation has been done by QuEChERS method (EN 15662:2008).
Processed results are related to the 532 samples, on presence of 426 residues of pesticide.
About 50% of the analyzed samples contained pesticide residues. 36% of samples had only one active substance of pesticide, while all other samples contained two or more active substances of pesticides. The concentration of active substances of pesticides, that were determined in samples, were in line with our and EU legislation except for 53 samples (18 samples had Carbendazime, or Dithiocarbamates (expressed as CS2), 4 had Pyrimethanil, 3 had Captan, 2 had Procymidone, 1 sample had Famoxadone, or Metalaxyl, or Chlorpyriphos, or Vinclozoline, or Fenitrothion, or Fenamidone, or Methiocarb, or Imidaclopride).
Based on the processed results, it can be concluded that 90.03% of the analyzed fruits and vegetables are in corresponding to the Serbian legislation („Pravilnik o maksimalno dozvoljenim količinama ostataka sredstava za zaštitu bilja u hrani i hrani za životinje i o hrani i hrani za životinje za koju se utvrđuju maksimalno dozvoljene količine ostataka sredstava za zaštitu bilja (Sl.Glasnik RS 25/2010, 28/2011“) and EU Regulation (EC) No. 396/2005. The concentration of residual active substances of pesticides in the analyzed fruits and vegetables, produced in Serbia, do not exceed the maximum permissible concentration as defined in Serbian and EU legislation.

STUDY OF THE MICROBIOLOGICAL PROFILE OF THE FRESH FRUITS GAINED FROM SMALL RETAIL ESTABLISHMENTS, AND THE EFFECTS OF THEIR WASHING

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Introduction

Fresh fruits are essential component of the human diet, but they are widely exposed to microbial contamination throughout the harvest, and after it during their`s handling until the consuming. The purpose of our survey was to determine the microbiological quality of the fresh fruit before and after washing with tap water, as it is usually consumed.

Materials and methods

We examined total of 72 samples of fresh fruit from few small retail establishments in Skopje in the period of 2 months, 18 samples from each of the following fruits: grapes, plums, peaches and apples. The samples were tested before and after their washing with tap water, according the appropriate ISO methods, for the presence of *Salmonella* spp., *Listeria* spp., *E. coli*, *Staphylococcus aureus*, *Bacillus* spp., *Enterobacteriaceae* and enumeration of total viable count (TVC), and total number of present yeast and moulds.

Results

We determined the presence of several strains from fam.*Enterobacteriaceae* : *Klebsiella pneumoniae* spp. *pneumoniae*, *Klebsiella oxytoca*, *Serratia ficaria*, *Pantoea agglomerans*, *Enterobacter cloacae*, *Pseudomonas oryzihabitans*. In one sample we determined the presence of *Listeria innocua*, but none of the samples have given positive result for the presence of *Salmonella* spp. We also determined presence of *Bacillus cereus* in 45 samples, *Staph. aureus* and *E.coli* in 6 samples. The grape samples had TVC in range of 600 to 7600 cfu/gr. before washing, and after washing 40 to 6240 cfu/gr., the plum samples had TVC in the range of 40-1080 cfu/gr. and 0-500 cfu/gr. appropriately, the peach samples had TVC in the range of 500-51.000 cfu/gr. and 100-49.000 cfu/gr. appropriately; and the apple samples had TVC in the range of 60-2200 cfu/gr. and 20-220 cfu/gr. appropriately. The total count of yeast and moulds was the greatest in the peach samples, and the smallest in the plum samples.

Conclusion

From the gained results we determined that the washing of the fruits with tap water, reduces only one part of the present bacteria, yeast and moulds. In the examined samples wasn`t determined any significant presence of the food borne pathogens.

INVESTIGATION ON CHANGES OF TOTAL WHEAT QUALITY CAUSED BY MOLD CONTAMINATION

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INTRODUCTION

Cereals represent important strategic row material from the aspect of the importance for the nutrition of the nation. Various products which are using in the human nutrition, can be contaminated by molds at the all phases of the production cycle. Many of those molds are toxigen and are potential producers of various mycotoxins. The aim of this study was to investigate the presence of molds in the wheat kernel and flour with identification of the species from the isolated micropopulations, as well as their influence on the usability and the hygyenic accurance of the wheat kerenel to be determined.

MATERIAL AND METHODS

In order the attack of *Fuzarium* spp. and *Alternarie* on wheat kermels to be recorded, kernel fractionation was performed on the basis of the sensorial evaluation, as well as of mycological and toxycolocycal check. The contaminated kernels are devided into three fractions: darkgerm kernels, little fuzarious kernels and strong fuzarious kernels Biologycal and technologycal quality on wheat kernels and flour was determined by ICC methods.

RESULTS AND CONCLUSION

Average content of mold number per kernel of wheat fraction pattern was investigated. The most infected were the strong fuzarious fractions. Investigation on AB1, AG1, OA and ZEA was included. CA was present in slightly and strong fuzarious fractions, and ZEA which was found even in the 87% of the patterns its concentrations were too high.

It was showed that the energy values of sprouting significantly decreased at the fuzarious fractions, the high fungus contamination influences. Chemical analyses clear pointed out to the disturbances which happen in the wheat conglomerate of gluten and starch provoked by the contamination of molds. The wet gluten content of the all analysed varieties has shown considerable variations in the analysed fractions.

It can be concluded that the field molds decrease or lead to unusage of the biologycal and processing quality of wheat and its hygienic accuarance.

ISOLATION AND BIOCHEMICAL PROPERTIES OF *AEROMONAS HYDROPHILA* IN RAINBOW TROUT

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Aeromonas spp. is commonly present in water and in certain incidences they might cause diseases in fish and amphibians. Humans are infected by ingestion of these bacteria with contaminated food or water. *Aeromonas* spp. might cause gastro-intestinal disorders and poisoning in humans. One of the major issues associated with *Aeromonas* and incidence of gastro-intestinal diseases is accurate identification of aeromonades at the species level. Therefore, there is a need for a clear phenotypic scheme and biochemical characterization of the mentioned species.

Objective of this paper was to study the presence of *Aeromas hydrophila* in trout samples and to test biochemical characteristics of isolated strains.

For isolation of *Aeromonas* species, 120 samples of rainbow trout, commercially available, were studied. *Aeromonas hydrophila* was isolated from fish muscle tissue and skin according to "Microbiological Methods for the Meat Industry", second edition (1991) Biochemical studies were performed on *Aeromonas hydrophila* medium, followed by oxidase test (+), catalase test (+), staining according to Gram (-) and vibriostat test agar (0/129, vibriostatic), as well as biochemical tests API 20E and API 20NE.

From the 120 studied rainbow trout samples, 12 strains of *Aeromonas hydrophila* were isolated, out of which seven strains (58,3 %) of *A. hydrophila* belonged to group 1, whereas five strains (41,6 %) belonged to A.hydrophila group 2. Out of 12 isolated strains, 11 (91.7 %) had β-galactosidase. They were citrate and indol positive, sorbitol negative, arabinose positive, NO2 - producing and reducing it to N2. Then (83.3 %) of 12 twelve isolated strains were Voges-Proskauer positive and melibiose negative, whereas eight (66.7 %) were amigdalin and lysine-decarboxylase positive. It was established that seven of 12 twelve strains (58.3 %) ferment glucose.

The obtained results demonstrate the need to supplement phenotypic schemes for identification of *Aeromonas* strains originating from fish at the species level.

Comment: Results were obtained during realization of the project No. TR31011, financed by the Ministry of Education and Science.

PESTICIDE RESIDUES IN ORGANIC AND CONVENTIONAL FRUIT AND VEGETABLES ON THE MARKET OF VOJVODINA

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Presence of pesticide residues in fruit and vegetables is considered as a major issue in food safety, and use of pesticides is becoming widely unpopular. For that reason, there is a growing interest for organic products.
The present survey included 33 samples of fruits and vegetables provided by organic farms in Vojvodina, the major agricultural area in Serbia, and 92 samples of imported, conventional fruit and vegetables, collected during year 2010.
Pesticide resides were analysed by gas chromatography/mass spectrometry, following QuEChERS extraction. With the aim of identification of potential traces of various pesticides, automated screening method was performed by using deconvolution of full-scan spectrum acquired under a RTL method. Quantification method for 54 pesticide residues was formed in SIM mode, and validated according to the requirements of DG SANCO 10684/2009.
In organic samples no residues were found. Of 92 conventional samples analyzed, pesticide residues were detected in 48.9%. Most frequently found pesticides were imazalil and chlorpyrifos (found in 35.5% and 20.0% of contaminated samples, respectively), followed by benzophenon, bifenthrin, dichlorvos, thiabendazole, myclobutanil, pyrimethanil, chlorpyrifos-methyl, pirimicarb, cyprodinil and diuron metabolite. Chlorpyrifos was quantified in 20.6% of collected samples in concentration range 0.02–0.1mg/kg. These values are below the MRLs established for analysed commodities. In terms of commodity, banana, mandarin and grapefruit had the highest rate of contaminated samples (around 60%), followed by orange, lemon and apple. 28.9% of contaminated samples contained multiple pesticide residues: 10 samples contained two, 2 samples three and 1 sample five pesticide residues.
Absence of pesticide residues in samples of organic fruit and vegetables indicate judicious use of resources in organic farming in Vojvodina. Findings of pesticide residues in a significant number of samples of conventional fruit and vegetables demonstrate the need to include more pesticides in routine residue analysis, in order to protect health of consumers.

DETERMINATION WITH GAS CHROMATOGRAPHIC METHOD OF METHANOL AND ETHANOL AMOUNT IN JUICE OF SOME GRAPE VARIETIES GROWN IN TURKEY

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In this Research, At the time of grape varieties used in making wine, some of which are harmful to human health of pollution from the use of methyl alcohol is intended. For this purpose, people consume large amounts of methyl alcohol level in grape juice was investigated. Four different grape varieties grown in Konya province are used in the research. Filtered using a filter paper sample of 5 ml of grape juice mixed with 5 ml n-propanol. Until 800C heated, manual headspace was injected into the GC-FID system. Calibration graph was created using n-propanol as an internal standard. Methyl alcohol was determined in one of the samples with gas chromatograhy analysis.

Keywords: Vitis vinifera L., grape juice, metil alkol, etil alkol.

DETERMINATION OF THE MIGRATION OF PRIMARY AROMATIC AMINES FROM POLYAMIDE KITCHENWARE USING LIQUID CHROMATOGRAPHY - TANDEM MASS SPECTROMETRY

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In recent years, the use of plastic utensils, such as turners, whisks and spoons for cooking and frying has increased because they are cheap, unbreakable, resistant to high temperature and do not scratch other surfaces. Most of these materials are made of polyamide which could incorporate synthetic organic colorants such as azodyes. Since primary aromatic amines (PAAs) are the starting substances of these azodyes, they could be present in the kitchen utensil as an impurity or as a breakdown product.
Due to the potential risk of primary aromatic amines to consumer health, the use of these chemicals is extensively regulated. According to Commission Regulation 10/2011, food contact materials may not release PAAs (expressed as the sum of PAAs) in a detectable quantity using an analytical method with a detection limit of 10 µg/kg food or food simulant.
In this contribution, a method for the quantitative determination of the migration of 26 PAAs from polyamide kitchenware is presented. The migration has been carried according to the 'Technical guidelines on testing the migration of primary aromatic amines from polyamide kitchenware and of formaldehyde from melamine kitchenware.' The simulant, used for the migration is 3% acetic acid in water and the migration conditions are 2 hours at 100°C. Three successive migration tests are carried out. Afterwards, the simulant of the last migration test is analysed by liquid chromatography coupled to tandem mass spectrometry. Quantification is carried out using an external calibration curve. The method is validated in-house and has also been used for the analysis of real samples.
It can be concluded that a fast and reliable method has been developed, that is able to confirm and quantify the presence of carcinogenic PAAs in polyamide kitchenware, showing its suitability for routine analysis and monitoring for compliance with EU Regulations of polyamide kitchenware.

PRESENCE OF *L. MONOCYTOGENES* AND *LISTERIA* SPP. IN READY TO EAT VEGETABLES SOLD IN SUPERMARKETS IN OSIJEK, CROATIA

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Introduction
Minimally processed and refrigerated vegetables have high potential for contamination with bacterium *Listeria monocytogenes*. The aim of this research was to investigate presence of *L. monocytogenes* and *Listeria* spp. and to assess microbiological quality of ready to eat vegetables sold in Osijek, Croatia.

Material and Methods
In period form March 2008 till April 2009, 100 samples of minimally processed and refrigerated vegetables from supermarkets in Osijek were analysed for presence of *Listeria* spp. Lettuce, delicates and cabbage salads, mixed, leafy and rooty vegetables were investigated.

Results
Listeria spp. was determined in 20% of the samples, and *L. monocytogenes* in 1% of the samples in amount of 60 cfu/g. Microbiological quality of investigated minimally processed and refrigerated vegetables from supermarkets in Osijek was satisfactory with regard to Croatian and EU regulations on *L. monocytogenes*.

Conclusions
Presence of *L. monocytogenes*, although in tolerable amount, and other *Listeria* spp. is an indicator of unsatisfactory listericide treatment and suggests that risks of consumption and possibility of harmful effect on people's health are not completely eliminated.

SURVIVAL AND GROWTH OF *LISTERIA MONOCYTOGENES* IN READY-TO-EAT VEGETABLES

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Introduction
Listeria monocytogenes is important for its resistance and ability to colonize, survive and grow at refrigeration temperatures. Incidence of listeriosis depends on amount of bacterium consumed. The aim of research was to investigate survival and growth of *L. monocytogenes* on ready-to-eat vegetables.

Material and methods
Fifty samples of lettuce, cabbage and delicate salads, mixed and rooty ready-to-eat vegetables were inoculated with referral strain of *L. monocytogenes* ATCC 35152. Survival and growth were investigated during shelf life and storage at refrigeration temperature using following methods: HRN EN ISO 11290-1 Horizontal method for the detection and enumeration of *Listeria monocytogenes* – Part 1: Detection method (ISO11290-1: 1996; EN ISO 11290-1:1996) and HRN EN ISO 11290-2 Horizontal method for the detection and enumeration of *Listeria monocytogenes* – Part 2: Enumeration method (ISO 11290-2:1998; EN ISO 11290-2:1998)

Results
Survival of inoculated strain was determined in all groups of investigated vegetables. Incomplete inhibition of bacterial growth was determined in inoculated mixed vegetables, while complete inhibition of bacterial growth was determined in rooty vegetables. Population growth was weak in all inoculated samples stored at adequate refrigeration temperature.

Conclusions
The research confirmed that this kind of ready-to-eat food can be considered a potential source of *L. monocytogenes* infection and that different vegetables have different potential for support of *L. monocytogenes* growth. Results indicated that temperature level was the most important factor for control of the bacterial growth, so it is necessary to maintain cold chain continuity. Results also show the need for monitoring *L. monocytogenes* presence in production, storage and sale, in order to minimize its potential presence at the moment of consummation in amounts harmful for people's health. Further research of survival and growth of *L. monocytogenes* in production environment and in different combinations of vegetables are necessary in order to ensure microbiological safety for the consumers.

INHIBITORY ACTIVITY OF THE BASIL EXTRACT (*OCIMMUM BASILICUM* L.) ON *PENICILLIUM* SPECIES ISOLATED FROM FOOD

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Introduction.
Natural antimicrobial agents extracted from herbs have been intensively investigated for their potential role in the protection of food from microorganisms especially that with short shelf-life which are the most susceptible to microbial spoilage such as bread, bakery products, cakes, salads, fresh fruits and vegetable, fish, etc. This study was aimed at investigating the antifungal potential of basil extract (*Ocimmum basilicum* L.) against *Penicillium* spp. [*P. aurantiogriseum* Dierckx, *P. glabrum* (Wehmer) Westling, *P. chrysogenum* Thom, and *P. brevicompactum* Dierckx] isolated from food.
Materials and Methods.
The composition of basil extract was determined by GC-MS analysis. Antifungal investigations were done by agar plate method using a PDA medium. Inhibition of fungal growth was determined by daily measurement of the diameter of radial colony growth during 14 days of incubation at 25±2ºC. Tests were carried out in 6 replications.
Results.
The major component identified in basil extract was estragole (86.72%). At all applied concentrations basil extract reduced the growth of *Penicillium* spp. with colony growth inhibition from 3.6% (for *P. glabrum*) to 100% (for *P. chrysogenum*).
The highest sensitivity was observed in *P. chrysogenum* which growth was completely inhibited at basil extract concentration of 1.5mL/100mL. The growth of other determined *Penicillium* spp. was partially inhibited with colony growth inhibition of 63.4% (*P. brevicompactum*), 67.5% (*P. aurantiogriseum*), and 71.7% (*P. glabrum*). Higher concentrations (0.70 and 1.5mL/100mL) reduced growth of aerial mycelium in all tested *Penicillium* species. In addition, at the same extract concentrations, examination of microscopic preparation showed deformation of hyphae with frequent occurrence of fragmentations and thickenings, occurrence of irregular vesicle frequently without metulae and phialides, enlarged metulae.
Conclusions.
This study proved that the tested basil extract could potentially be used as a protective agent against *Penicillium* spp., frequent contaminants of food.

QUALITY CONTROL OF THE CROISSANT (A PASTRY BAKERY PRODUCT)

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Bakery products are widely consumed and therefore particular requirements for their quality and safety characteristics should be established. Carossan (a pastry new product) is produced under various conditions of processing starting by mixing the ingredients until baking. The main problem in this product is the variation in the final product in terms of quality (shape, texture). This variation could be due to many factors such as the fermentation time, Oven temperature and production stage. Our main goal in this project is to study the causes and finding solutions for the variation in the Croissant quality. Five different treatments were selected to achieve our goal according to the above mentioned variations. Chemical and Sensory evaluations were done to study the quality of the Croissant. It was found that the lowest pH value was for the treatment that had significantly the highest fermentation time (12 hr). Also, it was found that the highest water activity was obtained for the treatments that had the lowest oven temperatures at stage three of baking. The highest overall acceptability scores indicated that the best Croissant type was produced under 7 hr. fermentation combined with 60-220 C Oven temperature. These results may help producers in selecting the best processing conditions to produce this type of Croissant. More studies are needed to achieve the highest quality Croissant especially the mixing stage.

INFLUENCE OF THE HERB EXTRACT ON INHIBITION OF BEEF MEAT SPOILAGE - POTENTIAL SOURCE OF NATURAL PRESERVATIVE

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Raw beef can be contaminated by microorganisms and support the growth of pathogens, and may lead to serious food-borne diseases. In many cases, plant extracts exibit antimicrobial and antioxidant activity, and they are added to various products to retard their spoilage, discoloration or contamination by micro organisms. In the past, herb extracts have been in meats as flavoring agents. We investigated the inhibitory activity of 2.5% ethanolic extract of Serbian herb Kitaibelia vitifolia against ATCC strains: *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, *Proteus hauseri*, *Proteus mirabilis*, Bacillus subtilisand fungi *Candida albicans* and *Aspergillus niger*,in a lean beef meat. We prepared samples (48 pieces per 25g) by cutting with knife, according the sterility demands, from one piece of beef (2 kg). We organized 3 experimental group: samples from first (I - control) group are non-treated; II - samples immersed in sterile water and III - samples immersed in above mentioned herb extract. Analysis was carried out during storage at 40C and 250C (0. day, after 2, 4 and 7 days). Longest sustainability shows samples from experimental groupIII, on both temperature of storage, determined by method for proving spoilage, described by Nessler. Antimicrobial activity evaluated by their minimum inhibitory concentrations (MIC), were determined using the micro-dilution method. We found that the above mentioned extract had strong inhibitory activity against *E.coli* (7.820 mg/ml), *S. aureus*, *P. mirabilis* and *K. pneumoniae*(15.625 mg/ml). Moderate sensibility on applyed herb extract shown *P. hauseri* (31.250 mg/ml).Extract shown minimum of inhibitory activity against B. subtilis (62.500 mg/ml). Among fungi, *A.nigeris* very susceptible (7.820 mg/ml), unlike the *C. albicans* (62.500 mg/ml). This extract may be further investigated as a natural preservative to the food industry by creating an additional antimicrobial factor (pH value) to increase effectiveness of inhibition of the micro-organisms growth.

Key word: beef, spoilage, antimicrobial activity, herb extract, *Kitaibelia vitifolia*

CADMIUM CONTENTS IN THE LIVER AND KIDNEY FOR FIVE PUREBRED PIGS FROM VOJVODINA

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The content of cadmium (Cd) was investigated in liver and kidney for five purebred pigs (Large White – LW, n = 48; Landrace – L, n = 48; Duroc – D, n = 48; Hampshire – H, n = 48 and Pietrain – P, n = 48), produced in Vojvodina. This element was determined by flame atomic absorption spectrometry after mineralization by dry ashing. The difference in the Cd content among the five purebred pigs, reared under the same conditions, was not significant in the analysed liver ($F = 1.191$; $P = 0.315$) and kidney ($F = 0.867$; $P = 0.484$) tissues. Pigs kidney Cd content was significantly higher ($F = 461.650$; $P < 0.00001$) than liver. The order of the purebred pigs regarding Cd content in the liver samples in mg/kg was: H (0.057–0.261, on average 0.146) > LW (0.052–0.268, on average 0.138) > D (0.031–0.252, on average 0.133) > L and P (0.029–0.270 and 0.039–0.227, on average 0.124). The average Cd content in all investigated liver samples was 0.133 mg/kg. The order of the purebred pigs regarding Cd content in the kidney samples in mg/kg was L (0.173–1.160, on average 0.412) > D (0.178–1.060, on average 0.398) > P (0.180–1.012, on average 0.367) > H (0.203–0.649, on average 0.366) > LW (0.168–0.654, on average 0.361). The average Cd content in all investigated kidney samples was 0.381 mg/kg. The maximum Cd content found in the liver samples was significantly below maximum level (0.500 mg/kg), while only 2.08% (n = 5) of kidney samples slightly exceeded the maximum level (1.000 mg/kg) set by EU and Serbian legislation. Obtained Cd contents in analysed liver and kidney tissues indicate Cd availability in the local agricultural environment in Vojvodina.

IRON CONTENTS IN THE *LONGISSIMUS DORSI* AND *SEMIMEMBRANOSUS* MUSCLES FOR FIVE PUREBRED PIGS FROM VOJVODINA

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The content of iron (Fe) was investigated in *M. longissimus dorsi* and *M. semimembranosus* for five purebred pigs (Large White – LW, n = 6; Landrace – L, n = 6; Duroc – D, n = 6; Hampshire – H, n = 6 and Pietrain – P, n = 6), produced in Vojvodina. Fe was determined by flame atomic absorption spectrometry after mineralization by dry ashing. The difference in the Fe content among the five purebred pigs, reared under the same conditions, was not significant in the analysed *longissimus dorsi* (F = 1.517; P = 0.228) and *semimembranosus* (F = 0.480; P = 0.750) muscles tissues. Muscles had no significant effect on the Fe content (F = 2.839; P = 0.097). The order of the purebred pigs regarding Fe content in the *longissimus dorsi* muscle samples in mg/100g was: LW (1.41–1.81, on average 1.55) > P (1.16–1.77, on average 1.37) > H (1.06–1.62, on average 1.31) > L (1.04–1.65, on average 1.29) > D (1.07–1.57, on average 1.28). The average Fe content in all investigated *longissimus dorsi* muscle samples was 1.36 mg/100g. The order of the purebred pigs regarding Fe content in the *semimembranosus* muscle samples in mg/100g was LW (1.00–2.79, on average 1.57) > P (1.17–1.93, on average 1.52) > D (1.13–1.83, on average 1.47) > L (1.16–1.99, on average 1.46) > H (1.19–1.60, on average 1.37). The average Fe content in all investigated *semimembranosus* muscle samples was 1.48 mg/100g. The Vojvodian pig meat analysed in this study, showed slightly higher Fe content compared with the values found in other countries.

ANALYTICAL METHODS FOR BIOTIN DETERMINATION

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This paper gives a rewiew of analytical methods for biotin determination in various mediums. Contemporary analytical methods provide fast biotin determination with low detection limits. Results of quantitative determination of biotin in sugar beet molasses obtained by various methods are presented.The following methods were applied: HPLC (High Pressure Liquid Chromatography), TLC (Thin Layer Chromatography) and microbiological methods by Danielsen and Eriksen (1968) for biotin activity determination in the raw materials for fermentation with active microorganisms Lactobacillus plantarum and Saccharomyces cerevisiae. Microbiological method by the mentioned authors with active microorganism Saccharomyces cerevisiae for biotin determination in sugar beet molasses came out accurate, precise, with the detection limit of 0.0100 µg/cm3 or 1 ppb, because it is the lowest concentacion of biotin which still shows linear response and fits into linear dependence of biotin concentrations - growth area of the yeast.
For these reasons this method was accepted as the standard method for determination of biotin in sugar beet molasses by the Institute for Standardization of Serbia.

MICROBIOLOGICAL QUALITY OF SOFT WHITE CHEESES IN THE BELGRADE MARKET

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Introduction
Our area is characterized by widespread production of soft white cheeses, whose main characteristics are nonstandardized production and quality as a consequence of technological processes diversity. It prepares from skimmed or partially skimmed cow's, sheep, goat and mixed milk, which may or may not be thermic treated.

Material and methods
In this paper it was examined the hygiene of traditionally made soft white cheeses in the Belgrade market, which comes from home-made production. Sampling was done according to prescribed methods. In the laboratory, cheese samples were prepared and subsequently inoculated on culture medium in accordance with SRPS EN ISO standards under the Regulation on the general and special conditions of food hygiene at any stage of production, processing and transport (Official Gazette 72/10). Cheese samples were examined on the presence of coagulase-positive *staphylococci* (SRPS EN ISO 6888-2), *Eschercihia coli* (SRPS EN ISO 16649-2) and *Listeria monocytogenes* (SRPS EN ISO 11290-2.)

Results and discussion
It was examined a total of 729 samples of soft white cheeses, of which 7 samples (0.96%) were positive for coagulase-positive staphylococci, and 12 samples (1.65%) on *Escherichia coli*. No *Listeria monocytogenes* was found in any samples. In fact, inadequate conditions for production, poor hygiene of equipment and processing area, are main reasons for poor hygiene of cheese, together with existing significant problem with microbiological quality of water used in the manufacture of soft white cheese.

Conclusion
Results in this paper indicate that it is necessary to improve hygiene measures in production and processing of milk, in order to eliminate undesirable microorganisms in the soft white cheeses.

Keywords: soft white cheese, hygiene, the Belgrade market

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EVALUATION OF PESTICIDE RESIDUES IN BABY FOOD, 2009 -2011

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In the present of agricultural practice, pesticides provide an unquestionable benefit for crop protection; however, the presence of pesticide residues in food can negatively affect human health. Special attention is paid to the safety of children and infants, as they represent a vulnerable risk group of population. The toxicity of pesticides is in infants and children may differ quantitatively and qualitatively from in adults. Considering the multitude of risks associated with pesticide intake by infants, the European Union has set a very low limit for pesticide in infant food. According to this regulation infant formulae must not contain residues of individual pesticides at levels exceeding 0.01 mg/kg (MRL).
The authors present the results obtained in 2009 - 2011 in the research of some chemical pollutants with cancer risk (organochlorine and organophosphorus pesticides residues) in baby food products from Romania.
We analyzed different baby food products samples (processed cereal-based foods) from Romania, so: 307 samples in 2009; 183 samples in 2010 and 80 samples in 2011. The analysis of the organochlorine pesticides was performed by gas chromatography with an electron capture detector (EC) and the organophosphorus pesticides with a phosphorous nitrogen detector (NP) (Shimadzu A 2010 model), after the acetonitrile extraction of the pesticide residues from samples and the clean –up with SPE (we tested 55 pesticides).
The GC/ECD and GC/NPD analysis of pesticides in all researched samples showed that most of the detected and quantified residues were below 0.01 mg/kg which corresponds to the maximum residual limit for pesticide residues in baby food.

Keywords: pesticide residues, baby food analysis, GC/ECD, GC/NPD, Romania

ORGANOCHLORINE PESTICIDES RESIDUES AND HEAVY METALS IN SOIL AND VEGETABLES IN DIFFERENT GROWING SYSTEMS

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In this paper are presented the research results obtained in 2011, in SIECOLEG Project regarding the assessment of some organochlorine pesticide residues (20 active substances) and the assessment of the heavy metals (lead, cadmium, copper, manganese) from 80 soils samples and 25 vegetables samples (tomatoes, cucumber, peppers, eggplant) from different growing systems (ecological and conventional).

1. Organochlorine pesticides residues: Determination of the organochlorine pesticide residues in soil and vegetables samples were performed by Gas chromatograph (GC Shimadzu, model 2100), equipped with an electron capture detector.

In soil samples harvest from conventional ferm on Roman Farm and Tg.Frumos Farm were detected Endosulfan I (range 0.002 – 0.015mg/kg); Endrin aldehide (range 0.004 – 0.01 mg/kg) and Endosulfan sulfate (0.001 mg/kg)

In vegetable samples from conventional farm, the content of organochlorine pesticide residues in some samples analysed were none detectable. In others samples, tomatoes, papper were detected heptachlor epoxid residues (range 0.001 – 0.006 mg/kg); endosulfan I residues (range 0.001 – 0.003 mg/kg) and endrin aldehide residues, but in admissible limits (< 0.01 mg/kg).

In all samples analysed the organochlorine pesticide residues were included in admissible limits (Regulation (EC) 396/2005).

2. Heavy metals: Determination of the heavy metals in soil and vegetables samples was performed by atomic absorption spectrometry (AAS) - Schimadzu 6300, graphite furnace and autosampler.

In soil: lead and cadmium concentrations ranged from 4.51 to 6.58 mg/kg and from 0.14 to 0.4 mg/kg, respectively. Cooper and manganese concentrations ranged from 20.73 to 31.59 mg/kg and from 218.1 to 298.3 mg/kg, respectively.

In vegetables (tomatoes, cucumber, peppers, eggplant): lead concentrations ranged from 0.0 (tomatoes) to 4.35 mg/kg(cabbage); cooper concentrations ranged from 0.2 mg/kg (cucumber) to 0.80 mg/kg(eggplant); manganese concentrations ranged from 0.0 mg/kg (tomatoes) to 0.60 mg/kg(eggplant).The cadmium concentrations not detected in no vegetable samples.

Heavy metals concentrations in the samples analyzed were within the maximum limits.

THE PRESENCE OF INDICATORS OF MICROBIOLOGICAL CONTAMINATION IN CONFECTIONERY PRODUCTS

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The aim of this study was testing of groups of bacteria that are represent the indicators of microbial contamination or of potentional spoilage of particular food types. In a total of twenty samples of various confectionery products were determined the total colony counts, total count of aerobic spore-forming bacteria, the total number of yeasts and molds and total number of *Enterobacteriaceae*. Relevant ISO methods were used to determine these bacterial groups. The results indicate the hygienic conditions during the manufacture of confectionery products. In addition, the number of individual groups of bacteria were used to calculate the measurement uncertainty of quantitative microbiological methods. Measurement uncertainty is an indication of the reliability of the results obtained in the laboratory for microbiological testing. Tested confectionery products have shown satisfactory microbiological quality. Total number of *Enterobacteriaceae* in nineteen samples was below the detection limit (<10 cfu/g). Only one sample was the number of total *Enterobacteriaceae* about 250 cfu/g, which is above the limit prescribed by the appropriate guidelines for food safety.

Key words: food safety, confectionery, *Enterobacteriaceae*.

DETECTION OF SUS DOMESTICUS SPECIFIC DNA FRAGMENTS IN FOOD PRODUCTS

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In the current era where free trade and mass market globalization is dominating, certain food producers take advantage of every opportunity to increase profits and neglect proper food safety protocols with respect to religious or cultural beliefs. The main target of the work was to develop a fast, cheap and reliable molecular technique in foods and to check foods for porcine contamination. We developed PCR methodology to safely and reliably detect Sus domesticus specific DNA fragments in food products.

CONTENT OF HEAVY METALS IN STONE FUNGUS (*BOLETUS EDULIS*) FROM SOUTH-WEST SERBIAN FORESTS

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Boletus edulis is among the most popular and widely consumed wild macromycetes, being rich in minerals, dietary fiber, vitamins and having medical properties they have been used as antibacterial, anti-tumor, anti-cholesterol and antiviral agents

This research was conducted on 9 areas of SouthWest Serbia covering forests. The main soil characteristics (humus, pH values and organic C) have been analyzed using standard methods (electrochemicaly by nKCl, Kotzman method and CNS-analyzer), and the content of heavy metals As,Cd, Pb, were determined using ICP technique. Atomic absorption spectroscopy (AAS) employing hydrid metod was used to determine the content of Hg in the examined soils. In order to analyze the content of heavy metals in stone fungus, there have been used various AAS techniques relying on different proposed methods, i.e. EPA 7473 method for Hg, BMK 016:2005 for As and method BMK 017/2005 for Pb and Cd.

Results of the research showed the main soil characteristics to be as follows: pH values ranging from 3.5 to 6.75, total organic carbon - 1,65-6,84%; and total humus range - 2,83-10,75%. Total content of heavy metals detected in all examined soil samples was under the permitted values, as well as in all the examined stone fungus samples, with the difference in Cd content ranging from 0.08-1.3 mg/kg. One of the tested localitites had exceeding permitted values of Cd content (>1mg/kg), as well as Hg content showing to be above the permitted values on 3 localities (0,58-0,71 mg/kg).

These results indicate the absorption capacity of the wild mushroom to be higher for As and Pb,comparing to the present Cd from the soil. It is also interesting for Hg to be detectable in the mushroom samples deriving from the soils without Hg content, which indicates further invastigations regarding potential pollution sources.

Key words: stone fungus, heavy metals, absorption capcity

QUALITY OF BARLEY CULTIVARS IN RELATION TO HORDEIN PROTEINS

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Both spring and winter barley cultivars grown in region of eastern Croatia were studied for malting quality in relation to hordein proteins. The micromalting of analyzed barley cultivars and malt analyses were done according to the EBC official methods. The analysis of hordein proteins was carried out by reversed-phase high-performance liquid chromatography (RP-HPLC). The quantitative analysis of hordein proteins has showed that B-hordein was major component, followed by C- and D-hordeins. Among investigated cultivars the malt extract content varied from 76.8% (cv. Angora) to 82.6% (cv. Scarlett). Spring barley cultivars had on the average higher malt extract yield in contrast to winter barleys. The significant negative correlation between the total hordein content and malt extract content was found. Among hordein fractions the B-hordein and D-hordein significantly contributed to lower malt extract yield. RP-HPLC analysis of malt hordeins revealed that the amount of hordein degraded during malting significantly correlated with Kolbach index.

COMPARATIVE STUDIES OF PROTEIN FRACTIONS OF DIFFERENT TYPES OF MILK BY SDS-PAGE GELELECTROFORESIS WITH THE AIM OF AUTHENTICATION

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Recently increasing interest can be observed in the use of mare's milk for human nutrition as functional food especially for children intolerant to cow's milk, or suffering from neurodermitis, allergies and similar disorders. Adequate control methods are required to verify milk authenticity because of the expensive production of mare's milk. Our major aim was to develop a protein-based method for species identification.

Equine (*Equus caballus*) milk samples were compared with the milk of sheep (Ovis aries), goat (*Capra hircus*) and bovine (*Bos Taurus*). Variations in the milk protein profile between breeds and the effect of lactation stage were studied as well. Individual mare milk samples, taken from animals of different breeds (Nonius, Lipizzaner, Furioso-North Star) were studied by SDS-PAGE gelelectroforesis. Comparison was made between goat milk from breeds Alpine and Hungarian Parlagi. Individual ewe milk samples, taken from international breeds (Lacaune, Ile de France, Awassi, Merino, Tsigai) were also studied regarding the qualitative and quantitative characteristics of their proteins.

Analysis of protein profile of SDS–PAGE was performed by using omniPAGE mini apparatus (Cleaver Scientific, Rugby, UK), with a 12.5% (w/v) separating gel in 370 mM Tris-HCl buffer, pH 8.8, and a 7.5% (w/v) stacking gel in 125 mM Tris-HCl buffer, pH 6.8 containing 0.1% (w/v) SDS. Milk samples were defatted by hexane before the investigations.

Wide range molecular weight markers (10-200k Da, Lonza, Basel, Switzerland) were used. Protein bands were detected after colloidal Coomasie staining (Pro Sieve Blue, Lonza, Basel, Switzerland) applying BioDocAnalyze (Biometra, Gottingen, Germany) gel documentation system.

From the obtained results it can be concluded that the described SDS-PAGE procedure is suitable for unequivocal identification of mare milk, and capable of distinguishing between species and in special cases between different breeds of the same species as well.

INVESTIGATION OF RELATIONS BETWEEN HMW GLUTENIN COMPOSITION AND RHEOLOGICAL PROPETIES OF CONTEMPORARY WHEAT VARIETIES

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Among cereal scientists it is widely accepted that rheological properties of dough, examined by different types of equipment, but also the structure of high molecular weight (HMW) glutenin subunits are highly related to wheat baking properties.
Farinograph, Extensigraph and Amilograph properties and lab-on-a-chip (LoaC) electrophoresis analysed composition of HMW glutenins of twenty different wheat varieties grown in three different years (2008, 2009 and 2010) were determined. Based on occurrence of HMW glutetnin fraction of identified molecular weights (131, 133, 139, 148, 186 and 218 kDa) analyzed wheat varieties were, independently of the growing season divided in four groups under which varieties with the same HMW compositions were comprised. Rheological properties were compared among the groups of varieties with the same HMW glutenin compositions.
The group which differentiated in comparison to the other groups on the basis of presence of the fraction of HMW glutenin with the highest molecular weight of 218 kDa had statistically higher farinograph quality number than other groups. The group in which both HMW glutenin fractions with the lowest molecular weights of 131 and 133 kDa were present was characterized in comparison to other groups with statistically lower farinograph quality number and extensograph energy, and statistically higher farinograph softening degree. In the group which differentiated from the other groups based on presence of HMW fraction of 139 kDa amilograph peak viscosity was statistically higher than in other groups.

Key words: wheat quality, rheology, HMW glutenin subunnits

SALT CONTENT IN RETAILED FOOD IN NOVI SAD

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Epidemiological and clinical investigations brought evidence that sodium intake above 5g/person/day was a strong independent etiological risk factor for hypertension, stroke, cardiovascular and renal diseases. Population-based intervention studies showed that modest reduction of sodium intake was followed by significant reduction of blood pressure, cardiovascular diseases, stroke and all causes of deaths. Worldwide investigations indicated that the main source of salt/sodium was processed food which accounted 65-85% of total sodium intake. Countries that achieved reduction of population salt intake performed it trough a combination of regulatory measures (food reformulation and labelling) and population awareness and education together with food industry. In the Republic of Serbia cardiovascular diseases are leading cause of death participating with 55.2% in the total death cases. Elevated blood pressure was detected in 46.5% among adults. Population based investigation on salt intake and salt content in food has not been performed yet.
The aim of our investigation was to determine salt content in different food items retailed in Novi Sad. A study was performed from 2005-2009. Retailed food items were taken randomly by educated samplers from IPHV. Titrimetric method with AgNO3, and K2CrO4 as indicator, was applied to determinate chloride ion. NaCl content was calculated.
Obtained results are expressed as a number of controlled food samples, average NaCl content (in g) in 100g of food and rang: (116) bread and bakeries 1.36 (0,12-6.23); (202) burek pie and pastry 1.70 (0,18-3.80); (89) cheese 1.58 (0.15-5.20); (76) canned vegetable 1.57 (004-2.95); (12) dry pasta 0.26 (0.04-1.00); (16) sausages 2.41 (1.60-3.16); (20) canned fish 1.51 (0.43-2.57).

Key words: Table salt, Food, Novi Sad

ANTIMICROBIAL PROPERTIES OF *LACTOBACILLUS PLANTARUM* IN PORK MEAT OSMOTICALLY DEHYDRATED IN SUGAR BEET MOLASSE

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Despite all the advances in modern technology and science, foodborne pathogens are still one of the major problems in less developed countries, causing illness and death of approximately 1.8 million people annually. *Listeria monocytogenes* is the major human pathogen in the *Listeria* genus. In the past decade, increasing attention has been directed to the use of natural antimicrobial agents generated by metabolic actions of lactic acid bacteria (LAB). LAB can secrete many antimicrobial substances with presumptive antimicrobial effect in foods that could be exploited in preventing many foodborne pathogens and spoilage organisms. This study was conducted to examine the antimicrobial activity of the probiotic organism *Lactobacillus plantarum* and its effect on non-pathogenic type of *Listeria* with very similar genome, *Listeria innocua*. In meat, osmotically dehydrated in sugar beet molasse, *L. innocua* and *L. plantarum* was inoculated with aim to determine the *L. plantarum* antimicrobial activity. The growth of *L. innocua* and *L. plantarum* was monitored 28 days, and the growth inhibition of *L. innocua* in the presence of *L. plantarum* was observed.
Also, to determine the *L. plantarum* antimicrobial activity well diffusion method has been performed. The overnight culture and concentrated filtrate of *L. plantarum* has been used in separate wells. After 24 hours incubation at 37°C the antimicrobial activity was examined and found to be effective against *L. innocua*. This test has showed some inhibitory effects of *L. plantarum* and its metabolites on non-pathogenic strain *L. innocua*.

COMPARISON OF METHODS OF DIRECT MICROSCOPY AND DELAVAL CELL COUNTER IN DETERMINING THE NUMBER OF SOMATIC CELLS IN MILK SAMPLES

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Introduction

A number of somatic cells in milk indicates the presence of an inflammable process in mammary glands and serves as an indicator of milk hygienic suitability and milk quality. Somatic cells are mostly leukocytes which reflect the condition of the body in view of physiological and pathological changes and a possible incidence of mastitis. Apart from mastitis, a number of somatic cells in milk is also affected by the following factors: physiological-pharmacological (the phase of lactation, race, veterinarian drugs) and stress-related ones (method of feeding, transport, keeping conditions, way of milking, technical validity of milking machines). An increased number of somatic cells has a negative effect on the activity of starter cultures and thermal stability of milk. Determination of the number of somatic cells in milk is a key factor in evaluation of milk quality and therefore it is necessary to conduct an adequate milk control for presence of somatic cells.

The aim of this work is a statistical evaluation of the results obtained by comparing the reference ISO 13366-1 method for determination of the number of somatic cells and the DeLaval equipment.

Materials and methods

Checking the number of somatic cells in cow milk is a well-established method for timely detection of subclinical mastitis in cows. Because of high frequency of subclinical mastitis and enormous material losses in dairy herds caused by it, it is a common practice to conduct routine scanning of cow milk for the number of somatic cells.

Testing was done on the Holstein-Friesian cow farm, which used a tying system and where milking was performed in split shifts in the cowshed, on the bedding. The experiment was carried on 2.5 – 3.5- year-aged cows, in the first and second lactation phases, which average milk yield for 305 days of lactation amounted about 7500 liters of milk. In total, 40 samples were analysed, in three repeats.

To find out a total number of somatic cells, the following methods were used: reference method of direct microscopy (ISO 13366-1) and DeLaval counter, the equipment for fast and operative monitoring.

Results and discussion

A method of direct microscopy can detect a high number of somatic cells 106 - 107 cell/ml. A DeLaval counter is much faster operatively and requires a smaller sample volume for the analysis. The number of somatic cells ≤ 400.000/ml meets the requirements for the hygienic suitability and quality of milk, Out of 40 samples, 31 sample was correct.

Conclusion

A DeLaval counter is an alternative method in detection of somatic cells, which, due to its transferability, is suitable for fast and operative monitoring. A reference method of direct microscopy is surely a reliable method for adequate and precise sample analyzing.

CONTROL OF *PENICILLIUM VERRUCOSUM* VAR. *CYCLOPIUM* IN CREAM CHEESE BY *AGARICUS BOHUSII* EXTRACT

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Food processors, food safety researchers, and regulatory agencies have been increasingly concerned with the growing number of food-borne illness outbreaks caused by different fungal pathogens. Mushrooms could be a potentially useful sources of antimicrobial compounds. *Agaricus bohusii* is edible, taste and prized mushroom from *Agraicaceae* family. We tested ethanol extract of this mushroom as a natural food preservative. Extract was added in cream cheese infected with food contaminating microfungi *P. verucosum* var. *cyclopium* (previously isolated from cheese) in different concentration (10-100 mg/mL). Solutions were kept at room temperature and at +4°C and daily observed during 7 days. Growth inhibition of *P. verucosum* var. *cyclopium* by ethanol extract of *A. bohusii* is calculated as a percent of inhibition. There is no growth of microfungi at second day after the incubation at the samples kept at +4°C, samples at 25°C showed different growth inhibition depending on extract concentration. Growth inhibition percentage of extract toward microfungi at 4th day can be presented as following: 13.3-53.3 % at +4°C and 100 % on all concentration at room temperature. The growth inhibition of microfungi was also observed at 7th day but on higher level, 83.3-90.0 % in refrigerator, while dose depending factor was not observed at the samples kept at room temperature. On all concentration tested the growth inhibition was 100 %. It looks that the lowest concentration (10 mg) of mushroom extract was either strongly effective as the highest one (100 mg) at room temperature. Because of increasing pressure of consumers and legal authorities, the food industry has tended to reduce the use of chemical preservatives in their products to either completely nil or to adopt more natural alternatives for the maintenance or extension of product shelf life. In this manner mushroom extracts may replace conventional chemical antimicrobials.

PRELIMINARY STUDY ON PCB DEGRADATION IN MEAT EMULSIONS BY USING MEAT STARTER CULTURES

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The effects of meat starter, isolated enzymes and thermal treatment on probability of polychlorinated biphenyls (PCBs) degradation in meat emulsions were investigated. Three different groups of meat emulsions were tested; (I) containing PCB congeners (PCBs 10, 28, 52, 138, 153, and 180), (II) PCBs and commercial meat starter (Texel DCM-1, Danisco Texel) and (III) PCBs and enzymes isolated from commercial meat starter. Prior to analysis all samples were incubated at 4 °C for 72 h. All tested meat emulsions were analysed both raw and after thermal treatment to internal temperature of 78 °C and 100 °C. Hexane was used for PCBs residues extraction, according to EPA 608 method, with some modifications. Results indicate that meat starter as well as isolated enzymes addition into the meat emulsion affects the tested PCBs degradation. Also the effect of thermal treatment (both temperatures, 78 °C and 100 °C) has been established - it reduced the PCBs content. Generally, an increase in internal temperature of meat emulsion decreased the PCBs concentration in most of the experiments. Also the meat starter/or isolated enzymes addition assisted in PCBs degradation, in raw emulsions was successfully isolated enzymes and at higher temperature (100 °C) of thermal treatment meat starter.

ANTIFUNGAL EFFECT OF ESSENTIAL OILS ON *ASPERGILLUS WESTERDIJKIAE*, *A. OCHRACEUS*, *A. FLAVUS* AND *PENICILLIUM NORDICUM*

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Introduction:
Fungi are natural food contaminants, but mycotoxin-producing fungi are harmful to humans and animals. Ochratoxin A (OTA) and aflatoxin B1 are among the most important and frequent ones. The consumers demand less use of synthetic preservatives but still they expect food to be free from microbial growth, toxins and other quality deteriorating factors. Essential oils are well known antimicrobials that may fulfil these requirements. The objective of this study was to evaluate the efficacy of different essential oils and their components on fungal growth and mycotoxins production.
Methods and materials:
Fungal spores from 10- to 14-d old cultures (*Aspergillus westerdijkiae* ŽMJ26, *A. ochraceus* ŽMJ28, *A. flavus* ŽMJ30 and *Penicillium nordicum* ŽMJ31) in concentrations of 10^4 and 10^6 spores ml^{-1} were used for growth and putative mycotoxin synthesis inhibition. Minimal inhibitory concentrations (MICs) of essential oils of oregano, thyme, mint, fennel, pine needles and pinecones, and carvacrol, thymol, menthol and anisaldehyde were determined with broth microdilution method. The kinetics of growth inhibition was followed for selected most efficient oils with radial growth rates on CYA (Czapek Yeast Autolysate Agar) and gravimetric measurement in broth macrodilution test. Mycotoxins production was checked after 7, 14, 17 and 21 days of growth.
Results:
Thymol, carvacrol and oregano and thyme essential oils were most efficient antifungals with growth inhibition of all strains on agar already at ¼ MICs from broth microdilution test and also in the liquid medium. Among tested fungi only *A. westerdijkiae* produced OTA in experimental conditions used and it was not inhibited by the essential oils addition.
Conclusions:
The study provides useful information of the potential risk of mycotoxin accumulation irrespective to fungal growth inhibition. Effective natural alternatives need to be evaluated as the inhibitors of growth and microbial secondary metabolite synthesis, before they can be effectively used in foods.

PREVALENCE OF *LISTERIA MONOCYTOGENES* IN READY-TO-EAT FOOD PRODUCTS IN VOJVODINA PROVENCE

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INTRODUCTION

Diseases caused by contaminated food are important public health problem today. *Listeria monocytogenes* is pathogenic bacteria that can contaminate food products during and after processing, whereas ready-to-eat food does not undergo any treatment to ensure its safety before consumption, risk of foodborne disease must be considered if this pathogen is present in the food.
The aim of this study was to determine the prevalence of *Listeria monocytogenes* in different ready-to-eat food products.

METHODS AND MATERIALS

In the 6-month period from Jun 1st to December 31st, 2011 a total of 1380 food samples were examined in the Department of Sanitary Bacteriology, Center for Microbiology, Institute of Public Health of Vojvodina in Novi Sad. The total of 912 samples were analyzed for the presence of *Listeria monocytogenes* according to the techniques recommended by the International Organization for Standardization (ISO 11290-2). The identity of suspected *Listeria monocytogenes* were confirmed using VITEK 2 Compact system, BioMerieux, France

RESULTS

Listeria monocytogenes was detected in 1.97% (18/912) of the samples. The highest prevalence of *Listeria monocytogenes* was found in cooked meals (33.3%), sandwiches (22.2%) and unexpectedly high in frozen food, like ice-cream and frozen vegetables (22.2%). It was also found in bread spreads (16.7%) and cakes (5.6%).

CONCLUSIONS

Because of the high mortality rate associated with listeriosis and the widespread nature of the organism, the presence of *Listeria monocytogenes* in some ready-to-eat food items could pose public health hazard, particulary to the high-risk group of the population. Surveilance of listeriosis is essential to prevent foodborne outbreaks, assessing the human health risk arising from ready-to-eat food.

KEY WORDS *Listeria monocytogenes* , ready-to-eat food

EVALUATION OF THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF OILS OF COTTON SEEDS SPECIES CULTURED IN SYRIA

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This study was done to evaluate physical and chemical characteristics of six types of oils obtained from cotton seeds which were cultured in Syria (Aleppo 1/33, Aleppo 40, Aleppo 90, Aleppo 118, Rakka 5, and Dair Ezzour 22). After evaluation, the following results were obtained:

Oil percentage in whole cotton seed after HLJ ranged between 17,10 – 20,26%, in whole cotton seeds without lint was 21,36 – 25,50%, in pulp was 36,38 – 39,91%. Refracto index at 40 degrees Celsius was 1,4635 – 1,4669. Percentge of unsaponifiable components were 0,69 – 0,84%. Iodine value was 99,01 – 104,10 gram iodine/100g. Saponification value was 185 - 192 mg KOH/g. Total tocopherols were 82,80 – 122,70 mg/100g , individual tocopherols were α=34,20 – 90,10 mg/100g, γ= 29,02 – 52,73 mg/100g and δ= 1,25 – 23,96 mg/100g.

Gas chromatography analysis revealed that oil contained 76,96% of saturated fatty acids, and 31,74% of unsaturated fatty acids.

Key words**:** Cotton seeds oil, Total and individual tocopherols, Fatty acids.

EFFECTS OF DIATOMACEOUS EARTH AGAINST *TRIBOLIUM CASTANEUM* (HERBST) POPULATIONS WITH DIFFERENT SUSCEPTIBILITY TO CONTACT INSECTICIDES

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To overcome the problem of resistance of storage insects to contact insecticides the aim of the paper was to test effects of two diatomaceous earth (DEs) from Serbia (DE S-1 and DE S-2) and the product Protect-It, at rates of 0.25, 0.5, 0.75 and 1 g/kg of wheat grain (<12% humidity), against three populations of T. castaneum with different susceptibility to contact insecticides: one laboratory and two with altered susceptibility to malathion: Nikinci and Kikinda (Serbia). The trials were conducted at 25±1ºC and 60-70% r.h. Insect mortality was evaluated after 7, 14 and 21 days of exposure, and effects on progeny production were assessed after 12 weeks.

After 7 days of exposure, only Protect-It at rate of 1 g/kg caused high mortality (90-100%) in all populations, and at rates of 0.75 and 1 g/kg after 14 days of exposure to treated wheat. After 21 days of exposure mortality >95% was observed in all populations in wheat treated with 0.5-1 g/kg of dust Protect-It and 1 g/kg of DE S-1 and DE S-2. Regarding all treatments, the highest level of progeny reduction in all populations was observed after 21 days of exposure. The product Protect-It applied at range of 0.5-1 g/kg caused high progeny reduction (97-100%), the dust DE S-1 caused high progeny reduction in laboratory population, and population from Nikinci (98-100%) at rates of 0.75 and 1 g/kg, and in population from Kikinda at 1 g/kg, about 92%. The dust DE S-2 at rate of 1 g/kg caused the highest progeny reduction in laboratory population - 94%, and in populations from Kikinda and Nikinci, 86 and 91%, respectively. Investigation results showed that DEs can be successfully used against *T. castaneum* populations resistant to malathion and/or populations with altered susceptibility to contact insecticides.

DEVELOPMENT OF HPLC METHODS FOR DETERMINATION OF SYNTHETIC DYES IN BEVERAGES

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Synthetic colours are added to foods to replace natural colour lost during processing, to reduce batch - to - batch variation and to make the foodstuff more attractive for the consumers. Monitoring of levels of synthetic dyes in high consumption products such as beverages is very important and is strictly controlled by formulating the directive 94/36/EC, 1994. Consequently accurate and reliable methods for determination of synthetic colorants are required for the assurance of food safety. High performance liquid chromatography with UV-DAD detection was employed. For development of the chromatographic methods were employed an LiChrosorb RP -18 (250mm x 4mm, 5 μm), Purospher STAR RP -18e (125mm x 4mm, 5μm), Chromolith Performance RP -18e (100 - 4,6 mm) and Chromolith RPe (50-4.6) columns using Reversed Phase and Ion - Pair Reversed Phase HPLC with tetrabutylammonium hydrogensulfate as an ion pair reagent. In the absence of an ion pair reagent many food dyes (E102, E123, E124) are eluted close to dead volume. But with optimal gradient eluation program 10 synthetic dyes (E102, E110, E122, E123, E124, E127, E129, E131, E133, E151) were simulyanosly determinate for 8 min run time under reversed phase mode. Under this conditions, determination was possible for the most hydrophobic dyes such as E122 and E127, and also for less hydrophobic dyes. It was impossible to determine dye E127 with neutral molecule with Ion - Pair Reversed Phase HPLC since there no tendency to form ion pais. So, as the type for better separation of food dyes was choose Reversed Phase condition without ion - pair reagent and short monolith column Chromolith RPe (50-4.6).

QUALITY OF ALTERNATIVE OIL AND PROTEIN CROPS

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The most important oil and protein plant crops belong to different famillies. Constant increase in demand for plant oils used as food or for processing industry inspired evaluation of other, insufficiently used plant species for breeding and commercial production. Fifteen plant species were grown during 2010 on a quarantine plot of the Institute of Field and Vegetable Crops in Novi Sad. Oil and protein content was determined in the seeds and tubers accordingly. The highest oil content was found in castor oil plant (52.28%), and the lowest in chard (4.58%). Protein content was highest in white mustard (39.54%), and lowest in castor (13.12%), while the largest total content of oil and protein was found in oil gourd (82.62%), and the lowest in chard (21.94%). Selected species will be included in further research as a source of oil and protein for various purposes.

EFFECTS OF 50°C TEMPERATURE ON POPULATIONS OF *SITOPHILUS GRANARIUS* (L.) AND *TRIBOLIUM CASTANEUM* (HERBST) WITH DIFFERENT SUSCEPTIBILITY TO CONTACT INSECTICIDES

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The application of extremely (high and low) temperatures may be a good alternative measure to resolve problems of storage insects resistance to insecticides. The aim of the paper was to investigate effects of temperature of 50°C on five *S. granarius*, and eight *T. castaneum* populations with different susceptibility to contact insecticides. In a thermostat, adults were exposed to 50±1°C at 6-10 intervals, *S. granarius* in empty glass containers, and *T. castaneum* in plastic containers with 1.25 g of wheat. Assessment of effects was done after 24 h of recovery at 24±1°C and 65±5% r.h.
Determined lethal parameters (LT50, LT95 and LT99) showed that for 50% mortality of *S. granarius* adults from all populations it takes about 60 minutes, and for 95% mortality about 90 minutes. Time needed for lethal effects to occur on half of the exposed adults of *T. castaneum* from all populations was about 33 minutes, and for lethal effects at 99% level about 65 minutes. Investigation results showed that there is no difference in susceptibility of *S. granarius* and *T. castaneum* populations to 50°C, which indicates that this temperature can be successfully used for control of resistant populations of storage insects.

DEPENDENCE BETWEEN QUALITY PARAMETERS OF WINTER WHEAT AND G × E INTERACTION

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Development of new production technologies and quality improvement of traditional wheat products, are of great importance for improving the competitiveness and food safety, both on domestic and international markets. The aspects of wheat quality may be very different for the manufacturer or the user. The creation of new genotypes, high-adaptable in different agro-ecological conditions, is crucial for obtaining high-quality products. The aim of this study was to analyze the genotype-environment interaction (GEI) for two wheat quality parameters, quality number and backing score. These parameters serve as indicators of the dough softening degree and elasticity and fineness of the bread pores, as the end product. Twenty wheat genotypes, with different high molecular glutenin subunits (HMW SB), were studied at five locations during three years. The average value of quality number ranged from 43.6 to 72.1, while for baking score the values varied from 2.8 to 5.5. Analysis of variance of the studied genotypes in the 15 environments showed that the effects of genotype, environment and GEI were highly significant for the both analyzed traits. The genotypes with a high quality number were more stabile in relation to the genotypes that had high average values for baking score. Between groups of genotypes with different HMW SB, there was no significant difference in average values for quality number. However, a significant difference in baking score between the genotypes with different HMW SB, indicating that the final quality is influenced by numerous factors. These factors must be carefully analyzed in order to offer consumers high quality products as the basic condition for long-term market positioning.

ASSOCIATIONS BETWEEN MICROSATELLITE MARKERS

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Wheat quality is a complex collection of traits affected by various loci on multiple chromosomes. This study was conducted in order to identify quantitative trait loci (QTLs) related to most commonly used quality parameters, protein content (PC) and sedimentation value (SED). For this purpose association analysis between SSR molecular markers and quality traits was performed on a selected sample of 94 diverse wheat genotypes. Quality parameters were determined during five years (2007-2011). Microsatellite markers located near targeted QTLs were carefully chosen in accordance with existing literature data. Genomic DNA was extracted from seedlings using CTAB method and PCR products were separated by capillary electrophoresis. The population structure was estimated in Structure v.2.0. software, while association analysis was performed in the program Tassel. Significant marker-trait associations (MTAs) were found for the both quality parameters. The markers WMC31 and GWM18 showed significant and stabile associations with QTLs for PC and SED, respectively. Our results demonstrated that association analysis could complement and enhance previous QTL information and provide very useful information for marker-assisted selection.

CHARACTERIZATION OF LACTOBACILLI AND YEASTS MICROBIOTA IN KEFIR GRAINS BY PCR-DGGE AND RDNA SEQUENCING

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Characterization and stability of lactobacilli and yeasts from kefir grains using culture-dependent and culture-independent methods were investigated. Using a combination of conventional microbiological cultivation with subsequent sequencing of 16S rDNA for bacteria and 26S rRNA for yeasts revealed 3 lactobacilli and 3 yeasts species in kefir grains as prevailing lactobacilli and yeast microbiota. *Lactobacillus kefiranofaciens* subsp. *kefirgranum*, *Lactobacillus kefiri*, Lactobacillus parakefiri were found in kefir grains with 51, 33 and 15 % distribution, respectively. The most frequently isolated yeasts were *Kluyveromyces marxianus*, *Kazachstania exigua* and *Rhodosporidium kratochvilovae*, with 64, 29 and 7 % distribution, respectively. This study is first to report on the presence of *Rhodosporidium kratochvilovae* in kefir grains. On the other hand PCR-DGGE as culture-independent method showed that dominant microorganisms were *Lactobacillus kefiranofaciens* subsp. *kefirgranum*, *Kluyveromyces marxianus* and *Kazachstania exigua*. Using this approach, *Lb. kefiri*, *Lb. parakefiri* and *Rhodosporidium kratochvilovae* were not identified. This result confirms that only predominant lactobacilli and yeast populations in kefir grains could be identified. Therefore the combination of both techniques is necessary for detailed and reliable study of microbial communities in kefir grains. Another interesting finding was to confirm the microbiota of kefir grains as very stable which did not change over time. This finding is important to ensure constant product quality. Thus kefir grains represent a good material to develop food supplements, since it is known that kefir grains have health beneficial properties.

CHEMICAL CHANGES DURING THE MANUFACTURE OF BEVERAGES MADE FROM MILK, WHEY AND SOYMILK USING KEFIR STARTER CULTURE

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Kefir, a traditional popular middle eastern drink originates from the Caucasus in central Asia. In this study kefir starter culture were used for production of beverage. Some chemical parameters (Carbohydrate, Ethanol, Dry matter, Fat and pH) were determined during 48 h of fermentation in 3 beverages. Alcoholic beverages made from milk, whey and soymilk using kefir starter culture. The incubation time (24h) and temperature (25 ºC) inoculation rate (5%) and mixing rate (90 rpm) were the same for the all products. During the fermentation carbohydrate content (w/w) and pH decreased markedly, but dry matter and fat content of the beverages were not significantly different from dry matter and fat content of the substrates. Ethanol content in 3 beverages increased significantly during the fermentation

CHEMICAL COMPOSITION OF MULTIFLORAL BEE POLLEN FROM BULGARIA

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Institute of Animal Science

Bee pollen is promoted as a healthy food with a wide range of nutritional and therapeutic properties. The objective of the present study is to determine the chemical composition of multifloral bee pollen produced in Bulgaria. The study was carried out totally on fourteen bee pollen samples. The following parameters were determined: Moisture content – until constant weight, using oven at 105 ºC for two days; proteins by Kjeldahl method; lipids by Soxhlet procedure using diethyl ether as solvent; ash content – gravimetry using oven at 550 oC. Before testing the samples are stored in a refrigerator at -18 ºC. Ten commercial bee pollen samples were purchased from the market. It was found that bee pollen contains: moisture (8.92 – 14.60%), proteins (22.05 – 25.96%), lipids (3.81 – 9.32%) ash (2.30 – 2.80%). Four samples came from the experimental apiaries of Institute of Animal Science (IAS), Kostinbrod. For these samples the following results were obtained: moisture (11.39 – 16.48%), proteins (18.45 – 22.42 %), lipids (6.30 – 8.71%), ash (1.56 – 2.22%). The average values of moisture (13.81% ± 1.06), protein (19.80% ± 0.89), lipid (7.15% ± 0.54) and ash content (1.81% ± 0.14) of bee pollen samples collected at IAS are comparable with those of commercial samples – 11.51% ± 0.55; 23.48% ± 0.44; 6.38% ± 0.54; 2.58% ± 0.06, respectively. The variation between the samples can be explained by multifloral origin.

Key words: pollen, chemical composition, moisture, proteins, lipids, ash.

NATURAL CONTAMINATION AND CO-OCCURRENCE OF FUMONISINS AND DEOXYNIVALENOL IN WHEAT AND CORN SAMPLES

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Among mycotoxins produced by *Fusarium* spp., fumonisins (FUMs) are usually present in corn, while deoxynivalenol (DON) is a common contaminant of wheat. A survey was carried out to determine FUMs and DON contamination in 75 wheat and 24 corn samples. Different varieties of wheat collected during the 2010 harvest season from three localities in north Serbia (Banat, Bačka and Srem), and corn from the same harvest season was sampled from the silos in Bačka. Content of total FUMs in corn and wheat samples and DON in corn were determined by the enzymatic immunoaffinity method, while DON in wheat was determined by the HPLC method. Out of 75 wheat samples investigated, 50.7% contained FUM in the range of 27-614 ng/g, with an average value of 241 ng/g, while the content of DON in 65.3% samples was 64-1604 ng/g (average 370 ng/g). In all tested corn samples, FUM contamination was above the limit of detection, but only in one above the maximal limit for humans (4000 ng/g). In two of tested corn samples DON was not detected, and in three out of 24 the content was above the maximal allowed limit (1750 ng/g). Statistical analysis showed a significant negative correlation ($p < 0.05$) only between the average FUMs and DON contamination for three locations (-0.46). This is the one of rare reports of the co-occurrence of natural FUM and DON in wheat and corn samples and the first report of correlation in FUM and DON in different wheat cultivars in Serbia.

This work was financially supported by SEE-ERA.NET PLUS, Project entitled "Systems to reduce mycotoxins contamination of cereals and medicinal plants in order to preservation native species and traditional products in Romania-Serbia-Croatia area", No. 139 "CROSSMICOTOX" and by the Ministry of Education and Science, Republic of Serbia (Project No 172042).

SAFETY OF MEAT PRODUCTS

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The quality of the finished meat product depends on the composition and properties of both materials used and of conditions of processing. Quality of derived meat can vary under the influence of environmental factors, conditions of cultivation and transportation, ante livestock slaughter conditions and initial processing, refrigeration storage options as well.
Therefore a united approach comprising consistent standards robust controls is required to ensure consumers' health and to maintain consumers' confidence and satisfaction. Chemical analysis along the whole food chain downstream (tracking) from primary production to the consumer and upstream (tracing) from the consumer to primary production is an important prerequisite to ensure food safety and quality. In this frame the focus of the following paper is on the "chemical safety of meat and meat products". It should be taken into account inorganic and organic residues and contaminants, the use of nitrite in meat products, the incidence of veterinary drugs, as well as a Failure Mode and Effect Analysis (FMEA) system assessing (prioritizing) vulnerable food chain steps to decrease or eliminate vulnerability.
Study of animals on the farm was performed during 2010-2011. 2,000 animals were tested and investigated their feeding rations and living conditions. After that products of slaughter was investigated: meat, animal blood, liver, intestine.
Quality forage and balance. Sanitary condition and biochemical composition of the animals were determined by organoleptic, visual and chemical methods.
The following factors affect the quality of meat and its safety: Breeding: breed, age, species, sex; growing conditions; ante maintenance; technology slaughter.
Diet affects feeding. Lack of food and lack of balance in their composition reduces the content of protein and fat, increased rigidity of meat.
Genetics. Heredity influences the tenderness of meat, its pH, the degree of muscle fibers, susceptibility to stress.

STORAGE DURATION EFFECT ON SEDIMENTATION VALUE (ZELENY TEST) IN WHEAT

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Specific information on wheat quality can be inferred from sedimentation value (SV) obtained by Zeleny test (ml). A problem with this method is experienced due to reduction of SV during wheat storage. We studied the dynamics of SV reduction in 15 NS wheat cultivars differing in technological quality. A series of experiments was performed to establish changes in SV depending on the length of wheat storage at room temperature in laboratory. Wheat samples were tested for SV for a year, at one-month intervals. The average SVs ranged from 20 to 40 ml. The samples with high initial SV generally had a high intensity of SV decline, especially during the first three months after harvest. Linear regression showed a significant linear decrease in SV of 0.7 ml per month during the one-year storage.

Key words: Wheat, sedimentation value, Zeleny test.

THE OFFICIAL DEVELOPMENT SUPPORT PROGRAMME IN FOOD COMPOSITION AREA IN 2011

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Introduction:
The Slovak Republic has created specialized workplace Slovak Food composition databank (SFCDB) in Food Research Institute. SFCDB has been working on collecting of food composition data and building up the food composition databases. Most of Eastern European Countries (CEE) have not built yet similar databases and therefore SFCDB in the frame of the Official Development Support Programme enhances and strengthens knowledge of potential food composition data producers and compilers and thus helps to enhance creation of the national food composition databases in CEE area. In 2011 the support was addressed particularly to Ukraine, which was selected from the CEE.

Materials and methods:
SFCDB provided Ukraine within this Programme: grant, training, capacity building activity and data management programme named Daris, which is developing in cooperation with programmers in the SFCDB in compliance with EuroFIR project requirements. Currently Daris allows detailed storage of original food composition data with no further operations (e.g. aggregation, printing or reporting).

Results and conclusions:
In 2011 SFCDB realized the training course about documentation of food composition data in Ukraine for 18 participants working in the area of medicine, nutrition, education and food technology. One person from Ukraine gave grant to participate on the 10th International Graduate Course on Production and Use of Food Composition Data in Nutrition. After that, Daris was distributed to Ukraine organisations as a basic toll for gathering of food composition data. The target country is expected to actively nurture and implement gained knowledge and experience to the local situation, which is a challenge in the CEE region.

Activities of Development Support Programme have also contributed to fulfil one task from the Work package 4: Training and spreading of excellence, EuroFIR Nexus project.

This work was realized with financial support of the Ministry of Agriculture and Rural Development of the Slovak Republic.

FINGERPRINTING OF FOOD AND FOOD PROCESSES BY 1H NUCLEAR MAGNETIC RESONANCE AND CHEMOMETRICS (BROMATONOMICS): APPLICATION TO WINE PRODUCTION AND TERROIR

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Fingerprinting by 1H Nuclear Magnetic Resonance and chemometrics (bromatonomics) is a powerful method for studying food and food processes.
This paper describes the use of NMR bromatonomics to wine analysis in general [1] and in particular to the wine production and terroir in La Rioja district [2]. Rioja is a small wine region in central northern Spain which can geographically be divided into three sub-areas (Rioja Alta, Rioja Baja and Rioja Alavesa). The winemaking process from must, through the alcoholic and malolactic fermentation was monitored by NMR spectroscopy at nine wineries in the Rioja sub-areas (terroirs). The bromatonomic approach allowed not only to follow the development of the must throughout the whole fermentation process (both alcoholic and malolactic fermentations), but also to distinguish wine form different vintages and terroirs. Application of the Interval Extended Canonical Variate Analysis (iECVA) chemometric classification tool [3] allowed discrimination between wineries even at very close proximity and provided information about the involved metabolites. Isopentanol and isobutanol compounds were found to be key biomarkers for La Rioja terroir [2].

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EFFECTS OF *DAUCUS CAROTA* L. AND *MORUS ALBA* L. EXTRACTS ON *PLODIA INTERPUNCTELLA* HBN. (LEPIDOPTERA, PYRALIDAE) LARVAE MORTALITY

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Indian meal moth (IMM), *Plodia interpunctella* (Hübn.), probably the major pest of raw and processed stored human and animal food products was tested in lab-conditions. The potential insecticidal efficacy of aqueous extracts of *Daucus carota* L. (fam. *Apiaceae*) and *Morus alba* L. (fam. *Moraceae*) against IMM was tested. Pobeda is winter wheat variety - a mid-season variety of good cold hardiness, Serbian leading variety, known for its wide adaptability and high yielding potential. Test insects were reared from the initial population collected in the Kragujevac Faculty of Science herbarium, in the lab (29±1°C, 60–70% r.h. and 14:10 (L:D)). There were used three types of larval instars stages, S1 (L1, L2, L3), S2 (L4, L5) and S3 (L6, L7). A single treatment per Petri dish involved 10 larvae of one type's stage and 10g of kernels treated by aqueous extracts obtained from *D. carota* or *M. alba*. Three concentrations of extracts were used: 1%, 2% and 5%. Each treatment was replicated three times. Controls for each set of treatments/Petri dish contained 10 larvae from one type stage and 10 g of untreated wheat kernels. The number of dead larvae/Petri dish was counted daily - 1, 2, 3 and 4 days after treatment (DAT). Biological effects of plant extracts were calculated using the Henderson - Tilton's formula. Inspections in all groups demonstrate increase of mortality in untreated reps, up to 33% 4 DAT. In replications with *D. carota* extracts the highest number of dead larvae was registered in S1 group, in treatment with 5% extracts 2DAT, 3DAT and 4DAT with 51%, 59% and 57% efficiency, respectively. The highest number of dead larvae, in replications with *M. alba* extracts was registered in S1 and S2 larval groups. The absolutely highest efficiency (65%) was recorded in treatment with 1% extract 4DAT in S2 group. In treatment with 2% extracts we determined 4DAT 42% efficiency in S1 group and 33% efficiency 3DAT in S2 group. The highest efficiency (35%) in applications with 5% extracts of M. alba we registered in S2 group, 4DAT. In S3 group we recorded unsatisfactory efficiency in all reps with both applied plant extracts.

UTILIZATION OF ULTRA PERFORMANCE MASS SPECTROMETRY COUPLED TO LC IN ANALYSIS OF PESTICIDE RESIDUES IN DIFFICULT MATRIX â€“ BLACK TEA

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The promising performance parameters of ultra performance mass spectrometry – mass resolution up to 100,000 (FWHM) and accurate mass data (<1 ppm) - are enabled by utilizing a unique multi-reflecting time-of-flight mass spectrometry technology referred to as a Folded Flight Path (FFPTM). Key to this FFP technology are the two opposing, high precision rectangular gridless ion mirrors and an array of gridless periodic focusing elements separating them. The system provides selectable high mass resolutions of between 1000 up to 100,000 by offering different effective flight paths, The FFP system permits a long flight path in a compact design (up to 64 reflections corresponding to a flight path of 40 m). Also, key to the system is a novel high data acquisition speed hybrid detection system providing high in-spectrum dynamic range (> 4 orders) that allows the fastest separations to be measured with speeds of 200 full spectra/sec (written to the disc) utilizing the full mass range and all benefits of high resolution MS. The gridless design permits high ion transmission through the FFP flight tube resulting in high sensitivity and minimal signal loss with increasing resolving power. The novel FFP technology enables hyphenation not only with the high-speed HR-GC, but also with ultra-high pressure LC (UHPLC) to provide separations, which meet current analytical demands â€“ high-throughput analyses with high mass accuracy achieved even with trace and ultra-trace analysis. The capabilities of this novel technology (high resolution and mass accuracy) enabled the identification of analytes using elemental composition based accurate mass analysis and isotopic fine structure. In this contribution, targeted and non-targeted screening of multiple pesticide residues spiked into very difficult matrix - black tea extracted by Quechers method will be demonstrated.

DETERMINATION OF METHIDATHION IN BARLEY MALT BY A SOLID PHASE EXTRACTION METHOD

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The use of pesticides in agriculture has brought many obvious benefits, but their inappropriate use can result in unacceptably high levels of these compounds in cereals. Pesticide residues can be found even when they are applied in accordance with good agricultural practices. A solid phase extraction (SPE) method has been developed for determination of methidathion in barley malt samples. The method involves a rapid extraction procedure with acetonitrile using salting out step. Non-polar coextractives are removed by passing a portion of the acetonitrile extract through an octadecyl (C18) solid phase extraction clean-up cartridge. An aliquot is taken and concentrated for second extract clean-up, which is done with a carbon cartridge coupled to an aminopropyl cartridge using acetonitrile:toluene 3:1 (v/v) as the elution solvent. Analysis is performed by gas chromatography, employing mass selective detection in the selected ion monitoring mode. The method rendered recoveries ranging between 91 and 96%, the associated relative standard deviations ranging between 1 and 3%. Limit of detection methidathion were less than or equal to 0.002 mg/kg. The applicability of the proposed method to detect and quantify pesticide residues has been demonstrated by the analysis of 20 genuine samples. The methidathion content in barley malt samples is not regulated by Serbian legislation (Official Gazette of RS, 28/11) and relevant EU regulation (Council Directive 90/642/EEC, 1990). The methidathion concentration found in barley malt samples were bellow the MAC value permitted by EU regulations and in accordance with the currently valid Serbian regulations for barley.

MONITORING OF GLUTATHIONE IN WINES DURING ALCOHOLIC FERMENTATION

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Glutathione (γ-L-Glutamyl-L-cysteinyl-glycine, GSH) is the most abundant non-protein thiol compound widely present in living organisms, from prokaryotes to eukaryotes. It is a critical factor in protecting organisms against toxicity and diseases connected to oxidative stress. Its depletion is linked to a number of chronic diseases such as cancer, neurodegenerative and cardiovascular diseases. In wine production, glutathione from grape plays an important role in preventing oxidative spoilage of white wines and it aids in decreasing aroma loss and the browning that occurs due to oxidative processes in white wine. In our work we measured the GSH levels in several grape juices and wines with HPLC method. Glutathione derivatization was done by reacting GSH with o-phtalaldehyde and 2-aminoethanol, the formed derivative was detected applying fluorescent detection. To the white grape juices 40 mg/L (1x), 120 mg/L (3x) and 400 mg/L (10x) glutathione amounts were added. Monitoring during ripening were done parallel at cellar temperature (10-12°C) and room temperature (20-22°C). Sugar solutions containing 1x, 3x and 10x GSH were used as a control at both cellar and room temperature. GSH levels were monitored also in experiments, which were carried out under CO2 atmosphere. Samples were taken at 5, 10, 20 and 60 days after GSH addition.

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DEVELOPMENT OF A CATALASE BASED AMPEROMETRIC BIOSENSOR FOR THE DETERMINATION OF INCREASED CATALASE CONTENT IN MILK SAMPLES

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Mechanical (trampling, beating, kicking), chemical (acid-base) effects and different bacteria strains, such as Staphylococcus aureus and Pseudomonas mastitis are responsible for the common disease, the inflammation of the udder of diary cattles. As a consequence, changes occur in the structure of the milk, which causes the spoilage of the quality and lower lactation. Under natural circumstances milk contains certain amounts of catalase enzyme, which can be higher during inflammation.

The aim of our work was to develope a catalase enzyme based amperometric biosensor, to determine the increased amount of catalase in milks. The enzyme (EC 1.11.1.6) was immobilized onto the surface of the thin layer enzyme cell with glutaraldehyde in the presence of polyethylenglycol. Known amounts of hydrogen peroxide were added to the milk samples, and after a short incubation time the samples were injected onto the enzyme cell. The changes of the concentration of hydrogen peroxide were measured. A certain amount of hydrogen peroxide was degraded by the catalase content of the milk. The degradation of the hydrogen peroxide is proportional with the infection of the milk samples.

The measurements were carried out in Flow Injection Analysis system in organic phase. The organic phase contained 5% 200 mM pH 6.0 sodium acetate buffer, and ferrocene conductive salt dissolved in 7.5 mg /L in acetonitrile. During the measurements, we applied 0.8 ml min-1 flow rate and +590 mV polarization potential in flow and stopped flow mode

The developed system can be utilized for the fast and cost-effective preselection of raw milk samples.

LABEL-FREE IMMUNOSENSOR FOR THE DETECTION OF PROBIOTICS IN FERMENTED DAIRY PRODUCTS

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Quartz crystal microbalance (QCM), optical waveguide lightmode spectroscopy (OWLS) and surface plasmon resonance (SPR) have been known as label free biosensoric methods suitable for the detection of immunological reactions. The development of simple immunosensoric methods for rapid identification and quantification of microbial cells is still a significant challenge in food analysis. Piezoelectric immunosensors are efficiently applicable for immunoassays and provide a special combination of sensitive mass detection and high sensitivity of immuno-recognition. In this work, a QCM-based direct immunoassay method was developed for the real-time determination and quantification of two probiotics, *Lactobacillus acidophilus* O1132 (*L. acidophilus*) and *Bifidobacterium bifidum* O1356 (*B. bifidum*) in fermented milk products.

All measurements were carried out in flow injection analysis (FIA) method: simple flow and stopped-flow procedures were compared to find the most effective measuring method. To optimize the immunosensor system, model measurements were carried out with bovine serum albumin (BSA) and anti-BSA antibody. Two kinds of self-assembled monolayers (SAM) were created with MHDA (16-mercapto-hexadecanoic acid) and with sulfo-LC-SPDP (sulfosuccinimidyl 6-[3'-(pyridyldithio) propionamido] hexanoate) cross-linking agents [1,2] for immobilizing anti-BSA antibody onto the gold surface of the quartz wafer. The reusability of the crystals was also examined with repeated measurements.

After the model experiments probiotic bacteria, *B. bifidum* and *L. acidophilus* were detected from buffer solution and from real samples (spiked milk samples, acidophilus and bifidus milk samples). Using the novel immunosensor the target bacteria could be detected in the range of 104–107 colony-forming units (CFU)/ml within 60 minutes. The selectivity of a-*Bifidobacterium bifidum* and a-*Lactobacillus acidophilus* antibody coated sensors was also tested.

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III
FOOD ENGINEERING, PROCESSING AND TECHNOLOGY

MATHEMATICAL MODELLING OF SOLAR DRYING OF UNPROCESSED APRICOT AND SULPHURATED APRICOT IN NATURAL CONVECTION SOLAR FOOD DRYER

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This paper presents a study on the mathematical modelling of solar drying of unprocessed apricot and sulphurated apricot. In this purpose, natural convection solar food dryer which has solar air collector was designed and manufactured for drying food products. Solar drying experiments of apricots were conducted in Izmir, Turkey and experiments were realized in two steps. In the first experiment, natural drying was done without applying any pretreatment. In the second experiment, apricots were dried after sulfuring pretreatment. During the drying period, relative humidity, air flow rates, drying air temperature, solar radiation and lose of food product's mass were measured continuously in the different parts of the dryer. Drying time and solar radiation are examined with mass ratio for each apricot type as polynomial and exponential correlations, separately. Fourteen different mathematical drying models available in literature were compared based on their coefficient of determination, mean bias error, root mean square error, modelling efficiency and reduced chi-square to estimate the solar drying curves. According to statistical analysis results, the most suitable mathematical model for describing the solar food drying curves of untreated apricot and sulphurated apricot was found.

COMBINED HOT-AIR AND MICROWAVE VACUUM DRYING OF JONATHAN APPLE

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A widespread and simple method for preserving fruits and vegetables is drying. Hot-air-, freeze-, vacuum- and dielectric drying are the most common methods. In this study, the combined hot-air and microwave-vacuum drying was investigated for Jonathan apple. This combined drying method produces a snack-like product with crisp and puffed structure, preferred by consumers. During microwave vacuum drying, the rapid evaporation of residual moisture of raw material causes the fruit tissue to expand, creating a porous crunchy texture with low density. This puffed fruit snack can be a good alternative to products like deep-fried potato, or hot-air dried fruit chips.
Our aim is to investigate the technology-related properties of combined microwave vacuum drying. Raw apple is uncored, cut, sliced, then hot-air dried, and microwave vacuum-dried for 60-80% and 97-98% dry basis, respectively. The mass load of the pre-dried fruit was 200g, the microwave energy is provided by two magnetrons, with severally 850Watts nominal output power, and the applied vacuum was 50 mbar. The factors were investigated in 3 levels: pre-dried dry mass content, (60, 70, 80%) the specific energy input (1,62, 1,89, 2,16 kJ/g specific energy) and the ratio of double-magnetron treatment and total radiation. (0,5, 0,75, 1) Two of the measurable properties of the product were analyzed, the burning ratio and the density. In both cases, low value is desirable. The energy input is directly proportional to the density and the burning ratio of treated apple. Within the studied range, at low initial dry matter content of the pre-dried product (60% dry matter content) with intense energy input, desirable product can be achieved. The ultimate optimum results at medium initial dry matter (70%), 0,8 double magnetron-treatment ratio, and 1,755 kJ/g energy radiation.

DETERMINATION OF THE DRYING KINETICS OF PUMPKIN PUREE POWDER AND THE POWDER PROPERTIES

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Pumpkin is a good source of carotene, pectin, minerals, vitamins, phenolic compounds and terpenoids constituting nutritional value. This study was intended to produce freeze dried pumpkin puree powders as a functional ingredient in food products such as noodles, breads, cakes and pasta products for improving their nutritional values and flavor. For this reason, the peeled pumpkin slices were grinded in a home type blender and samples of 3 mm thickness were frozen in air blast freezer and freeze dried at 13.33 Pa absolute pressure and at a condenser temperature of -48°C. Physicochemical and powder properties of the obtained powder such as moisture, ash, crude fiber, vitamin C, total carotene and total phenolic content, water activity, color change ( ), bulk density, wettability, solubility, flowability and cohesiveness were measured.

During drying process, the total time was determined to be 9 hours by following the change in weight of the sample. Depending on the results, moisture content and water activity of pumpkin powder were in acceptable limits for safe storage of products. The functional properties of the fresh product as nutritional and antioxidant components were evaluated for vitamin C (19mg/100g), total carotene (9.5ppm) and total phenolic content (211.88mg/100ml). Freeze drying process decreased the vitamin C 18%, total carotene content about 26% and the total phenolic compounds as 3%. Total color change of pumpkin puree powder with respect to pumpkin puree was found as 32.2. Among the powder properties of the dried product, the bulk density was found to be 0.113g/ml and average wettability and solubility times were recorded as 710 s and 16 s, respectively. Determination of flowability and cohesiveness in terms of Carr Index and Hausner ratio were evaluated as good and intermediate levels respectively.

The results showed that freeze drying can satisfactorily be applied for drying of pumpkin puree to obtain powders that can be used as an ingredient for flavoring and improving nutritional value purposes.

EFFECT OF DRYING ON THE PHYSICAL PROPERTIES OF QUINCE

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Quince is very fragrant and has a balanced sweet-tart flavour. Besides its nutritional properties, quince has some health benefits, related to antioxidant, antiseptic, and diuretic or anti-viral properties. However, since it is relatively hard, is used mostly for cooking preparations like jellies, jams or marmalades. Therefore, drying appears as an alternative, since it allows softening of the pulp.
This study aimed evaluating the textural properties of quince in fresh and after drying at different conditions. In parallel, colour was also measured to evaluate how the visual aspect of the product changed with drying.
The experiments were done in a tunnel drier, at different temperatures, from 30 to 60 ºC, and different air velocities, varying in the range 0.7 to 1.2 m/s. Texture was assessed using a texture analyser (TA–XT Plus), and from the obtained TPA's the textural attributes were calculated: hardness, Springiness, Cohesiveness, Resilience and Chewiness. For every state twenty measurements were made. Colour was analysed with a colorimeter (CR-400), using CIELab colour coordinates: L*a*b*. At each state twenty measurements were made.
The results obtained for the colour coordinates were: L* = 78.02+-0.86, a* = -1.27+-0.32 and b* = 31.75+-1.68. These values indicate that the samples were bright, because L* was closer to 100 than to 0. Furthermore, it can be seen that quince is greenish, although very slightly and strongly yellowish. With drying, the samples became darker, and redness and yellowness were intensified, as a result of browning.
In relation to textural properties in fresh, the values were: hardness = 48.46+-6.47 (N), springiness = 74.86+-5.17 (%), cohesiveness = 0.75+-0.06, resilience = 0.47+-0.08 and chewiness = 27.23+-4.06 (N). Furthermore, it was observed that drying, regardless of the conditions, induced an important softening, diminishing hardness in a great extent.

ONLINE IMAGING AS A TOOL TO MONITOR NEO-FORMED COMPOUNDS IN BISCUITS DURING BAKING

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The color is the first sensation that the consumer perceives and uses as a tool to accept or reject. There are commercially available devices to measure color but they have some drawbacks. They measure a small area with a fixed geometry, and this area is unrepresentative for heterogeneous foods such as thermally processed foods. Digital image analysis makes possible to register the color of these foods.
Color is an indicative attribute for thermally processed foods. Computer vision based image analysis can be used as an alternative tool to measure color and predict the levels of neo-formed compounds. In our study, we developed MATLAB® codes which work on color evaluation using two computer vision techniques. One of these techniques is based on an average color as a mean feature. An algorithm for the determination of mean color was developed to measure surface color of biscuits in CIE Lab color space. Among the color space coordinates, CIE a* value was better indicated the development of browning on biscuit surface during baking. We found that CIE a* values measured in the edge (cropped from the original biscuit image) could be correlated (r2=0.927) well with acrylamide concentration. Another technique is based on color segmentation to extract a new feature from an image. Color references were defined as yellow (dough color), brown, and dark brown prior to image segmentation process. Brown ratio and dark brown ratio were calculated and the results indicated that brown ratio and dark brown ratio were rational features that could be potentially correlated with acrylamide and hydroxymethylfurfural, respectively. As a result, being an objective, rapid and non-contact tool, computer vision may be a powerful technique for inspection and evaluation purposes of food quality.

EFFECT OF ELECTROMAGNETIC WAVES (MICROWAVE) ON MICROBIAL LOAD OF WHITE LIQUID STORED AT DIFFERENT TIME

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Pasteurized eggs exhibit better keeping quality and longer shelf life in comparison with un Pasteurized eggs. Also pasteurization guarantees the consumer's safety but thermal processing affects the egg proteins quality therefore in this study, microwave heating has been considered for white liquid egg pasteurization. White liquid was pasteurized by using electromagnetic method in two different frequencies (2950-4500 MHz) and both frequencies together for constant times of (3,5,6) second and two pulses (1,2), then with blank samples after different storage times (5, 15, 60, 180 and 360 days), the population of aerobic mesophilic bacteria, coliforms and molds & yeasts were measured. Results revealed that the effect of four variables include adding frequency, duration process, number of pulses and pasteurized product durability on reduction of total mesophilic aerobic count was statistically significant and the number of bacteria in the 360 th day in the pasteurized and blank specimens were 1/8×104 cfu/ml and 2/15×106 cfu/ml respectively. The number of coliforms in pasteurized samples were less than 10 pcs/mL and in the blank samples were 1/15×104 cfu/ml as the number of molds & yeasts in pasteurized samples were less than 30 pcs/mL while in the blank samples were 7/5×103 cfu / ml. According to Iranian National Standard, in electromagnetic method, liquid white shelf life has been defined 360 days which it is very ideal in comparison with thermal pasteurization (7d max) and blank sample (2d max).

CHANGES IN THE QUALITY OF WHEAT FLOUR AS A RESULT OF USING INERT DUSTS IN ORGANIC SYSTEMS OF PROTECTION AGAINST STORAGE INSECTS

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The aim of the work was to describe the impact of inert dusts as agents officially approved for use in the storage of crops from certified organic production system on the technological quality of wheat flour.

In order to control storage insect (Sitophilus oryzae L.) in wheat, various inert dusts were used: natural zeolite, two preparations of diatomaceous earths originating from Serbia and a commercial preparation Protect-It®. Wheat samples, infested and non-infested, treated with the inert dusts were milled and the obtained flour samples were analyzed on rheological behaviour using Mixolab®. The nine parameters obtained were analyzed using the method of Principal Component Analysis (PCA). It was found that the three principal compounts accounted for 80.8% of total variance in the data. This research showed that dough stability (0.85) and starch gelatinization rate (-0.85) contributed most to the first principal component, starch retrogradation (0.90) to the second component, and dough stability (-0.62) and protein breakdown rate of (0.62) to the third one. Flour obtained from wheat treated with inert dusts showed higher water absorption and stability during mixing, and less protein weakening during heating in comparison to the control wheat non-treated with inert dusts. The component scores indicated the similarities among the treatments with inert dust. The outlier sample was the control with insect infestation and without inert dust protection.

STARCH HYDROGELS AS MATRIX FOR CONTROLLED RELEASE OF THEOPHYLLINE

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Starch ability to interact with low molecular weight compounds is a particularly important feature, especially in the production of starch-based tablets and microspheres. The hydrogels made of starches of different botanical origin were investigated as matrix for controlled release of theophylline.

Sorghum starch was isolated from grains (Sorghum bicolor (v. Rona 1)) purchased from Sugar Beet Breeding in Straszkow, Poland. Commercial maize starch was donated by the Institute of Agricultural and Food Biotechnology, Poznań, Poland. Theophylline was obtained from Sigma (T1633).The starch-water suspensions (30%, w/v) were heated in water bath (70 C/ 80 s) in order to prevent the phase separation during autoclaving and then autoclaved (121C/20 mins). The theophylline (10, 25 and 50 mg/ 0.5g db of starch) was added to the starch paste prior to autoclaving. The hydrogels with bioactive compound were rapidly frozen using liquid nitrogen, freeze dried, grinded and sieved. Fraction with particle size of 60-100 um was taken for analysis regarding the thermodynamic properties (DSC) and morphology (SEM). The release profiles characteristic were carried out using UV-VIS recording Spectrophotometer (Shimadzu) at wave length 270 nm.

The changes in starch crystallinity that occurred during temperature treatment resulted in formation of amorphous matrices varying in microstructure. That phenomenon provided significant differences in release of theophylline between the starch hydrogels. It was found that the gel matrix formed by corn starch was more effective in retarding the compound release compared to sorghum matrix. The average release time of theophylline calculated for 50% of its dose in capsule was 8 mins and 16 mins for sorghum and corn matrix, respectively.

It was not found statistically significant differences between theophylline release time and its concentration in the starch matrix. The DSC results indicated high temperature peaks as a result of formation of complexes between amylose and theophylline.

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CROSSLINKING AND ACETYLATION OF WHEAT AND POTATO STARCHES

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Starch is widely used in the food and non-food industry due to unique chemical, physical and structural properties. Native starch has limitations in food industry applications such as high tendency toward retrogradation, low thermal resistance and shear resistance. Therefore, starch is often modified in different ways (chemical, physical or enzymatic) to change and improve its performance.
The aims of this research were: (a) to isolate native starch from two sorts of wheat, (b) to obtain different modified starches (wheat and commercial starch of potato) through acetylation and cross-linking (c) to explore rheological and thermophysical properties of native and the obtained modified starches with the purpose of defining the possible application. Rheological and thermophysical properties were measured with Brabender Micro-Visco-Amylograph and Differential Scanning Calorimeter.
The measurement results showed that wheat and potato starches acetylated with an 8% acetanhydride had lower gelatinization and enthalpy temperatures, as well as retrogradation enthalpies (after 7 and 14 days of storage) than native starches.
Pastes of acetylated potato starch had lower viscosity levels compared to native starch at 50ºC, whereas pastes of acetylated wheat starches at the same temperature had higher levels in relation to the native ones.
Cross-linking of potato starch with sodium tripolyphosphate (2,5 and 5% STPP) resulted in decrease of gelatinization temperature and enthalpies as compared to native starches, where a 2,5% STPP modification had greater effect. Cross-linking of wheat and potato starches lowered the retrogradation enthalpy of all sampless after 7 and 14 days of storage, and raised the viscosity levels of all samples.

EFFECT OF MACERATION AND PASTEURIZATION ON COLOUR OF CLOUDY SOUR CHERRY MARASCA (PRUNUS CERASUS VAR. MARASCA) JUICE

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Introduction

Colour is very important quality factor for fruit juices which affects consumers preferences. Sour cherry juice colour is mainly due to the presence of anthocyanins. Fruit maceration with enzymes improves extraction of anthocyanins, while pasteurization, as the integral part of sour cherry juice production, can cause their degradation. Therefore, the aim of this study was to investigate the effect of different duration of the maceration and pasteurization on colour stability of cloudy Marasca juice.

Methods and Materials

Sour cherries Marasca grown near Zadar were harvested in 2011 and kept at -18ºC till juice production. Producing juice was conducted on small scale equipment with hydraulic press and included thawing (without depitting), maceration, pressing and pasteurization. Duration of maceration varyied (30-150 minutes) and juices were sampled after pressing and after pasteurization. Colour parameters were determined with colorimetric CIELAB method. Anthocyanins were determined by a spectral method based on bisulfite bleaching, total phenols by Folin-Ciocalteu reagent and antioxidant activity by FRAP method. All samples were sensory evaluated using Quantitative Descriptive Analysis.

Results

Duration of maceration and pasteurization had significant effect on colour parameters in Marasca cloudy juice, except on the H value. Anthocyanins were present in the highest concentrations in juices with 0.5 h of maceration. Furthermore, pasteurization affected positively on its amounts, as well as on the content of total phenols and antioxidant activity. Maceration enzymes treatment significantly affected taste attributes of Marasca cloudy juice.

Conclusions

Maceration of 0.5h is sufficient for producing well coloured Marasca cloudy juice with good sensory attributes. Pasteurization doesn't negatively affect juice colour as well as the content anthocyanins, total phenols and antioxidant activity.

THE EFFECTS OF DIFFERENT SPICES EXTRACTS ON SOME QUALITY PROPERTIES OF SAUSAGES PRODUCED FROM MECHANICALLY DEBONED CHICKEN MEAT

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In this research, the effects of different spices (rosemary, thyme, oregano and their combination) extracts on some quality properties of the sausages produced from mechanically deboned chichen meat were investigated. For this purpose, the mechanically deboned chicken meat samples were separated into five groups and the extracts were added into these groups to prepare sausage samples as: (1) Control (no added spices extract), (2) rosemary extract (500 ppm), (3) thyme extract (500 ppm), (4) oregano extract (500 ppm) and (5) rosemary+thyme+oregano extract (500 ppm) and then vacuum packaged and stored in refrigerator conditions for 90 days. Moisture, protein, fat and total ash analyses of different spices extracts added sausage samples were determined in the 0th day. Peroxide value (PV), free fatty acidity (FFA), iodine number (IN) and sensory analyses were periodically performed at storage day 0, 15, 30, 45, 60, 75 and 90.

Mean moisture, protein, fat and total ash contents of sausage samples were determined to range between 59.47-61.12%, 11.70-12.26%, 22.39-24.23% and 3.54-3.81%, respectively. The lowest peroxide value were observed in the combinated extract added sausage samples at all tested storage times. FFA values of all of the sausage groups increased depending on the storage period. Mean IN values of sausages were detected to range between 67.85-69.46 g/100 g fat. In sensory evaluations, the combinated extract added sausage sample received the highest colour and texture scores.

Keywords: Rosemary extract, thyme extract, mechanically deboned chicken meat, sausage, oregano extract

THE INFLUENCE OF THE CARRIER AGENT AND TEMPERATURE ON ANTHOCYANINS AND PHENOLIC ACIDS OF SPRAY-DRIED SOUR CHERRY MARASCA (PRUNUS CERASUS VAR. MARASCA) JUICE

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Introduction

Spray-drying is suitable technique for producing functional powders from fruit juices rich in biologically active compounds. However, the process demands testing drying parameters as they affect the product quality and biological activity to great extent. Thus, the objective of this study was to evaluate the effect of drying temperature, type and concentration of carrier agent on the content of anthocyanins and phenolic acids of spray-dried sour cherry Marasca juice.

Materials and methods

Concentrated sour cherry Marasca juice (65°Brix) was diluted to 15°Brix and mixed with malt dextrin (MD) 4-7 DE and 13-17 DE in concentrations of 30, 35 and 40% (w/v). Mixture was dried using pilot scale spray dryer (Labplant, UK) at inlet air temperature of 160, 170 and 180°C. Phenolics were extracted in 80% methanol with 0.1% HCl at 50°C in water bath 20 minutes. Anthocyanins and phenolic acids were determined using HPLC UV-Vis/PDA.

Results

In all obtained powders five phenolic acids and four anthocyanins were determined, with chlorogenic acid and cyanidin-3-glucosilrutinoside being the most abundant. All identified anthocyanins were significantly affected by MD concentration during spray-drying process, showing a decrease in concentration with an increase in MD addition, while inlet temperature and DE did not show significant influence. DE of added carrier affected the concentration of chlorogenic and p-coumaric acid, as higher concentrations were obtained using MD 13-17 DE. MD concentration influenced only the content of chlorogenic acid, showing the same trend as the anthocyanins.

Conclusions

MD type and concentration affect the biological value of sour cherry Marasca powder juice. Using MD in lower concentrations resulted in higher content of chlorogenic acid and all anthocyanins, while higher DE had positive effect on the concentration of chlorogenic and p-coumaric acid. Varying the inlet air temperature did not have significant influence.

EFFECT OF WHEAT GERM AND EMULSIFIERS ON SOME PROPERTIES OF CAKE

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Wheat germ is higly nutritious food supplement with its high protein content, B group vitamins, minerals, oils which contains high proportion of unsaturated fatty acids and tocopherols. In this research, coarse and fine wheat germ replaced with wheat flour in cake formulation up to 30% level for nutritional enrichment. Sodium stearoyl-2-lactylate (SSL) and diacetyl tartaric esters of mono (and di) glyceride (DATEM) were used as emulsifier for technological improvement. Experiment was conducted according to (2 x 3 x 2) x 2 factorial design. Some properties of cake dough (pH and specific gravity) and physical (weight, volume, volume index, symmetry index, uniformity index, crust and crumb color, firmness and springiness), chemical (moisture, ash, protein, fat, cellulose and minerals) and sensory properties of cake samples were determined. Coarse germ and SSL usage gave higher cake volume and volume index and lower hardness than that of fine germ and DATEM. Coarse or fine germ addition increased ash, protein and fat content of the samples. Protein content of the cake with 30% coarse germ increased up to 11.95%. Crust and crumb color of the cake samples was significantly ($p<0.05$) affected with coarse or fine wheat germ addition. Ca, Fe, Mg, P, K and Zn contents of the cakes containing 30% coarse wheat germ increased from 38.94 mg/100g, 0.71 mg/100g, 7.5 mg/100g, 222.8 mg/100g, 117.4 mg/100g, 0.48 mg/100g to 43.21 mg/100g, 1.32 mg/100g, 42.0 mg/100g, 297.4 mg/100g, 194.3 mg/100g and 1.73, respectively. As a result of sensory evaluation, cake samples containing 20% coarse germ with SSL were liked by the panelist.

Key words: Wheat germ, cake, emulsifier, mineral, sensory

FAT REPLACMENT BY PROTEINS FROM DIFFERENT LEGUMINOUS SEEDS

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Overweight is increasing worldwide and is emerging as an important public health issue. One of the main reasons for overweight and obesity is supposed to be a high fat diet. In the development of fat-reduced or fat-free products, the application of fat replacers plays a major role. However, consumer acceptance still lacks due to an unsatisfactory sensory profile of these products. Thus, the production of tasty low-fat variants with appropriate sensorial properties is still an important research topic.
At the Fraunhofer IVV, a process is being developed to produce a specific fat-like or rather creamy protein isolate from lupin seeds. The processing technique still lack a final industrial implementation and literature data regarding an optimisation of this isolation process with common grain legumes are scarce. Therefore, a systematic raw material selection by simultaneously varying relevant processing parameters was investigated to produce a fatty-like protein-based bulk in an efficient way.
A D-optimal design was used and analysed by response surface methodology considering the individual and interactive effects of pH-value, NaCl concentration, solid-to-solvent ratio and the different raw materials as a categorical factor on the extraction and protein yield. A second-degree equation for independent and response variables were calculated and used to create optimum protein extraction conditions for all raw materials used. Highest amount of proteins were calculated with full-fat lupine as raw material. The protein yields of the other grain legumes were considerably lower. Furthermore, the sensory properties of the lupine protein isolate showed an unique creamy, smooth and fat-like characteristic. The knowledge of the relationship between individual processing parameters and their influence on product yield and product characteristics, respectively, will facilitate the implementation of plant protein processing on industrial scale and will ensure appropriate amounts of protein isolates with superior quality.

PROXIMATE AND MICROBIAL QUALITIES OF BEVERAGE PRODUCED FROM PRETREATED BLENDS OF TIGERNUT (Cyperus esculentus) AND MORINGA OLEIFERA

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The effect of pretreatments such as roasting, germination, fermentation and pre-gelatinization on the processed beverages from tiger nut and moringa leaves was investigated.
Four different beverages were produced in the ratio of 95:5, 90:10, 85:15 and 80:20 with100% references.
The pretreated tiger nut and moringa leaves were processed into beverage using standard methods.
Proximate, microbial and sensory analyses were carried out on the beverages to determine the nutritional content, shelf stability and acceptability. The results of the proximate analyses revealed that pre-gelatinized beverage (95-10) had the highest protein content (4.50g/ml), germinated (95-5) beverage had the highest fat content (2.00g/ml).The germinated and pre-gelatinized (95-5) beverages had the highest moisture and ash content respectively. The result of the sensory analysis showed no significant difference in terms of general acceptability ($p > 0.05$). All the sample were generally accepted with pre-gelatinized beverage (95-5) being the most accepted (6.6a).Total bacteria and fungi count varied from 2.6 ×106 to 9.8 ×106 Cfu/g and 2.0 ×104 to 9.7×104 Cfu/g from the first day to the fourth day for the beverages respectively. This study shows that beverage produced from tiger nut and moringa leaves could serve as good alternative for local beverage produced in Nigeria.

OPTIMIZATION OF OSMOTIC DEHYDRATION OF APPLE IN SUGAR BEET MOLASSES

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Osmotic dehydration is an environmentally acceptable, material gentle drying method, which received considerable attention because of the low processing temperature, base waste material and low energy requirement.
Response surface methodology (RSM) was used to determine the optimum processing conditions that yield maximum water loss and dry matter content and minimum solid gain and water activity during osmotic dehydration of apple in sugar beet molasses on the one hand, and that reduce energy requirements for the process, on the other hand. Temperature (45–65°C), processing time (1–5 h), molasses concentration (40–80%) were the factors investigated with respect to water loss, solid gain, dry matter content and water activity. Experiments were designed according to Box-Behnken full factorial experimental design with these three factors each at three different levels. For each response, second order polynomial models were developed using multiple linear regression analysis. Analysis of variance (ANOVA) was performed to check the adequacy and accuracy of the fitted models. The response surfaces showing the interaction of process variables were constructed.
Using Maple 13 Software optimum operating conditions were found to be temperature of 45°C, molasses concentration of 80%, and treatment time of 222 min. At this optimum point, water loss, solid gain, dry matter content and water activity were found to be 0.6628 (g/ g initial sample weight), 0,1156 (g/ g initial sample weight, 49,34% and 0,879, respectively.

CHARACTERISTICS OF SPELTA WHEAT AS A RAW MATERAL FOR ORGANIC PASTA

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Spelta wheat (Triticum aestivum subsp. spelta) is an old European crop. In the past few decades there has been a cosiderable intrest in consumption of ancient wheat. Spelt wheat is growing without the use of pesticudes in harsh ecological conditions and marginal areas of cultivation. It is believed that primitive wheat species are more disease-resristant and can produce healthier foods than those dieade-resistant and can produce helthier foods than those made from modern varieties.

Spelt wheat is suitable raw materal for production organic food like of pasta, speciality bread and other products of altered nutritional characteristics compared to conventional wheat products. In determining the purity of products spelt aleuron layer plays a key role.

This paper investigates the technological quality and dough rheology of wholemeal spelta flour as a raw material for pasta. Technology quality of wholemeal spelta is defined by basic chemical analyses (protein, starch, fat, fiber, ash, reducing sugars and Hagberg falling number) and heavy metal content of Ca, Zn, Mn, Fe. Rheology of wholemeal spelta is defineded by gluten farinogram and alvegram. Activity of amylases is defned by Falling number and amylograoph. Beside chemical and rheological properties the convinience of spelt wholemeal flour for pasta is evaluated on the data concerning cooked pasta quality.Data point at good indicators of technological quality and sensor characteristics of spelt pasta. Pasta obtained from wholemeal spelta flour may be a new organic safe product on the market.

Key words: wholemeal spelta flour, quality of spelta pasta, pasta color

CHANGES IN CHEMICAL PROPERTIES OF CARROT DURING OSMOTIC DEHYDRATION IN SUGAR BEET MOLASSES

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Osmotic dehydration is an alternative method for reducing postharvest quality losses of vegetables, and a common process for producing dried vegetables which can be directly consumed or used as an ingredient in bread, cakes, pastries and many products of other food industries. The objective of the present study was to investigate the effect of using sugar beet molasses as an osmotic agent in the dehydration of carrot and to evaluate chemical characteristics of osmotically dehydrated products as compared to the in natura vegetables. Sugar beet molasses is an excellent medium for osmotic dehydration, primarily due to the high dry matter (80%) and specific nutrient composition.

The paper describes the effects of different concentrations of sugar beet molasses (80, 60 and 40%) and immersion times (1, 3 and 5h) on osmotic dehydration/impregnation of carrot cubes. Osmotic dehydration process was conducted at constant temperature of 55°C and under atmospheric pressure. During the process the solution to carrot ratio was 8:1.

Analyses of variance (ANOVA) was used in order to find significant effects of solution concentration and immersion time on water loss, solid gain, dry matter, carbohydrates and minerals content.

It was found that, both process variables had statistically significant effects ($p< 0,05$) on all examined responses, with the exception of sodium content ($p<0,10$).

Immersion time was found to be more significant factor affecting water loss, dry matter content, carbohydrates and minerals content, while the effect of concentration was more evident on solid gain and magnesium content (significant at $p<0,05$).

OPTIMIZATION OF THE SPECIALTY BREAD FORMULATION CONTAINING SUGAR BEET MOLASSES, FLAX SEED AND VITAL WHEAT GLUTEN

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Sugar beet molasses can be used as an ingredient in the production of bakery products (special types of dark bread) and fine bakery products (various biscuit types especially those of gingerbread type). Earlier studies showed that incorporation of molasses in the production of standard bread produced significant improvements in the nutritive profile of bread (firstly the mineral content) but impaired bread volume and crumb elasticity and increased crumb firmness.

In order to improve the deficiencies caused by the addition of molasses, in this work, additional, nutritively important, ingredients such as flax seed and vital gluten were included in the formulation.

The addition of flax seed in the bread formulation has been shown to positively affect the sensory quality of the end product (improvement of bread volume and crumb texture) as well as its nutritional value (high content of dietary fibers, lignans, omega-3 and omega-6 acids). Vital gluten is important dough improver which contributes to better sensory properties of bread.

The ingredients were added at three various levels (molasses at 5%, 10%, 15% levels; flax seed 4%, 6%, 8% levels; wheat gluten 0%, 2%, 4% levels, flour basis) with the objective of optimizing the formulation that provides higher volume and better textural characteristics.

Textural properties were determined instrumentally using a TA.XT2 Texture Analyzer. Bread firmness and resilience were measured according to modified 74-10A AACC method. Crumb texture was determined by ‘‘Texture Profile Analysis’’ (TPA) double compression test.

The experiment was organized according to response surface Box-Behnken design and the subsequent optimization of the responses was done using the Design-Expert 8.1 software by applying the desirability approach.

The optimal ingredient doses were established to be 4% vital gluten, 5% of molasses and 6% of flax seed.

PARTICLES SIZE DETERMINATION IN FOOD PRODUCTION: APPLICATION TO CRYSTALLIZATION PROCESS IN SUGAR BEET PROCESSING

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Particles size has important role as parameter for control and evaluation of food processing and quality characteristic of final product. In sugar cane or sugar beet processing the most important influences of particle size are evident in phase of juice purification and crystallization. Particle size of calcium carbonate has great effect to the nonsucrose compounds removal from raw juice and filterability of juices in the juice purification. Crystallization is the final stage in production of organic or nonorganic sugar.

The paper has dealt with applications of Coulter Counter technique in evaluation of crystallisation process in technical sucrose solutions under laboratory conditions. The crystal growth rate was determined by measuring crystal size and crystal size distribution. The Rosin-Rammler-Sperling-Bennet function was applied for evaluation of characteristic size and uniformity of crystals.

In sugar industry determination of crystal size distribution is applied in order to optimize production of crystal footing, evaporation and cooling crystallisation. Crystal size distribution has a significant influence on the processes of centrifugation, drying, sifting, storing and on the quality characteristics of the final product. The aim of crystallization is to produce a maximum amount of crystal sugar, sucrose crystals of best possible quality without any twin crystals, conglomerates or very fine grain and reduce energy counsumption.

THE CHANGE IN MICROBIOLOGICAL PROFILE DUE TO THE OSMOTIC DEHYDRATION OF PORK MEAT

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The aim of this study was to investigate effects of osmotic dehydration on microbiological profile of pork meat, in order to indicate the usefulness of this drying treatment. Samples of pork meat were dehydrated in sugar beet molasses and aqueous solution of sodium chloride and sucrose (AOS), at three different temperatures (20oC, 35oC and 50oC). Also, aw values of the fresh and processed meat were determined and the change of the microbiological profile between the fresh and dehydrated meat was examined. It was detected that the process of osmotic dehydration does not cause deterioration of the initial microbiological profile of the pork meat, but rather improve it due to increasing dry matter content and lowering aw value of the processed meat. Better results of the reduction of the present microorganisms in pork meat were obtained in the process of osmotic dehydration of meat in molasses in comparison to the osmotic dehydration of meat in the AOS at all three temperatures. In addition, reduction of total number of yeasts was higher in meat dehydrated at 22oC, while osmotic dehydration at 35oC and 50oC noticeable reduced the total number of bacteria.

KEYWORDS: Osmotic dehydration, pork meat, sugar beet molasses, microbiological profile

OSMOTIC DEHYDRATION OF PORK MEAT IN THREE DIFFERENT SOLUTIONS-MASS TRANSFER KINETICS

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The presented paper describes an investigation of osmotic dehydration of pork meat (M. triceps brachii) in three different osmotic solutions (sugar beet molasses, ternary solution and combination of these solutions in a 1:1 ratio) at room temperature (20oC) under atmospheric pressure. The most important kinetic parameters of the process: water loss (WL), solid gain (SG), weight reduction (WR), normalized solid content (NSC) and normalized moisture content (NMC) were determined after 1, 3 and 5 hours of dehydration and mass transfer coefficients were calculated using Hawkes and Flink's model.
The results indicate that the diffusion of water and solids was the most intensive in sugar beet molasses, during the first hour of dehydration.

KEY WORDS: Osmotic dehydration, pork meat, mass transfer kinetic, sugar beet molasses, ternary osmotic solution

RHEOLOGICAL PROPERTIES OF BREAD AND DURUM WHEAT FLOUR DOUGH AND THEIR RELATION TO THE PROTEIN FRACTION CONTENTS

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Quality of bakery products depends on wheat flour characteristic to form a three-dimensional viscoelastic dough when mixed with water. Flour dough is complex system composed mainly of starch, water, protein and pentosans. The gluten proteins certainly play a predominant role in dough rheology, but the other components have significant effects too.

In this study, we focus our attention on influence of wheat proteins to the rheological behaviors of flour dough. Therefore, dough rheology properties were determined by farinograph and extensograph using five bread (T. aestivum L.) and five durum wheat (T. durum Desf.) genotypes with variable protein quality. Moreover, the classical Osborne wheat protein fractions (albumins, globulins, gliadins, and glutenins) and several polypeptides from the non-gluten protein fractions, as well as, from each of the four subunits of gliadin using SDS-PAGE analyses were determined in white flour.

There was significant difference in the mean content of all protein fractions, as well as, gliadin subunits between bread and durum wheat flour that highly affect the rheological properties of dough. In average, bread wheat flour had higher content of gliadin and soluble glutenin for about 5.5 and 23.4%, and lower content of albumin+globulin and insoluble glutenin fractions for about 14.5 and 2.5% than durum wheat flour, respectively. Therefore, bread wheat flour belonged to C1-C2 qualitative group, while the rheological properties of durum wheat flour dough were unacceptable for breadmaking. Extensibility, as one of most important characteristic, ranged from 16.7 to 11.3 cm and from 5.1 to 7.6 cm in bread and durum wheat flour dough, respectively. Among bread wheat, 87/I genotype was distinguished by extensibility and resistance to extension of flour dough which resulted in a high dough energy (67.7 cm2).

A more knowledge could facilitate ongoing efforts to improve both quantity and quality of wheat proteins for breadmaking industry.

DETERMINATION OF THE WATER APPARENT DIFFUSIVITY COEFFICIENTS DURING OSMOTIC DEHYDRATION OF CARROT IN SUGAR BEET MOLASSES

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Osmotic dehydration is a minimal process, and due to it's low temperature and energy requirements it's becoming more interesting. Recent research has shown that use of sugar beet molasses as hypertonic solution improves osmotic dehydration (OD) processes. The objective of this research was to determine influence of different concentration of sugar beet molasses and the duration of the process of OD of carrot on apparent diffusion coefficients of water (Dw). The equilibrium values of water loss (WL∞) and Dw were calculated based on the equation proposed by Crank for the diffusion in spheres in contact with an infinite amount of solution WL/WL∞ =6•(Dt/(πr^2))^(1/2), where D is the Dw. Carrot samples were cut into cubes, dimension 1x1x1 cm, and immersed in different concentrations of sugar beet molasses (40,0%, 60,0% and 80,0% dry matter) during maximim process time of 5 hours. After each sampling time (40, 60 180 and 300 min) the carrot samples were weighed and analyzed for dry matter content. The highest value of dry matter content (DMC) and water loss (WL) in carrot samples, were achived after 5 hours, in 80% solid content sugar beet molasses as a osmotic solution (64,66 % DMC and 0,8173 g/g WL), while the highest value for the Dw was achieved for the carrot samples dehydrated in 80% solid content sugar beet molasses at the process time of 40 minutes (3,06•10-10 m2/s). Solution concentration and immersion time had a significant influence on the Dw ($p<0.05$) at 95% confidence limit. Proposed equation that describes dependance of the concentration of osmotic solution and the time of osmotic dehydration on the apparent coefficient of diffusion, can be successfully used for modeling process of OD of carrots in molasses solutions.

ONE-DIMENSIONAL (FD) MODEL OF TEMPERATURES PREDICTION IN THE CENTER OF PORK MEAT SAMPLE DURING HEAT TREATMENT

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Introduction
The mathematical model can be defined as a set of mathematical relations that describe or define the relationship between certain physical quantities in the reporting process.

Materials and methods
The pork meat sample was processed in the oven by dry method of heat treatment (double-sided rasting) at three different temperatures (114°C, 152°C and 204°C) to reach 71°C in the center of the sample at a given distance x from the bottom surface. The temperature is controlled using a thermocouple.

Results
After the heat treatment system, we developed thermodynamic equations that describe the processes from the initial temperature to the temperature of thawing of the sample, in the thawing process and to the end of the process that take place to achieve the set temperature at a given distance x. According to the set of equations for the three ambient temperature we developed 9 polynomial functions $T_c=f(t)$ on which is placed in the MATLAB code for calculating the temperature in the center of the sample as a function of time t at a given distance x, and for the calculation of a series of statistical parameters that serving for verify the validity of the model. In the end we made an experimental comparison of results with those obtained in the FD model.

Conclusions
The developed model showed a high degree of determination and correlation with experimental results, which range in the interval R = 0,9622 – 0,9948 and determination R^2 = 0,9259 – 0,9897.

Keywords: FD model, pork meat, heat processing of meat, temperature in the furnace

MITIGATION OF ACRYLAMIDE FORMATION IN BISCUITS BY PROCESS AND RECIPE MODIFICATIONS

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This study aimed to mitigate acrylamide in biscuits by lowering thermal energy input along with certain recipe modifications. Lowering temperature required longer cooking times as expected in order to achieve desired final moisture content. To shorten cooking time, conventional baking was combined with radio frequency post-baking process. Lack of development of surface browning in biscuits during lower-temperature baking could be overcome by adding the Maillard reaction products (MRP) into biscuit dough. The MRP used to modify biscuit dough was prepared by heating a binary mixture of arginine and glucose at 100°C for 6h or by over baking thin layered discs of biscuit dough. In comparison to control biscuit baked at 205°C for 11 min, combined conventional baking (205°C for 8 min) and radio frequency (RF) post-drying process (45 s) decreased acrylamide formation in biscuits by up to 50%. Combined process and recipe modifications described here offer a viable approach for the mitigation of acrylamide without affecting color and texture of biscuits.

VALORIZATION OF CEREAL PROCESSING BY-PRODUCTS BY BRIQUETTING

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In the primary agricultural production by the amount of area planted and quantity of production cereals, beside oilseeds, occupy the leading position. In the technological process of receving, drying and cleaning of either the commercial or seed grains admixtures of organic and inorganic origin are separated. If their nutritional aspect can not be valorized as animal feed, by briquetting process organic impurities can be used in industry and households as a fuel.The paper describes the technological process, energy and quality of briquettes in terms of European standards for quality energy briquettes.
Briquetting was carried out on eccentric presses at temeratures between 80 – 90 C° and pressure of 160 bar. Starting moisture content was 16% and 40% for wheat organic impurity and wood sawdust, respectively. Prior to briquetting, saw dust moisture was reduced to 16%. Briquettes were made of organic wheat impurity, saw dust itself, as well as with the mixture of wheat impurity and saw dust in equal shares. Moisture content of the resulting pellets varied from 9.55 to 8.34% and ash from 8.95 to 1.38%. The briquettes quality was characterized by the content of total nitrogen, arsenic, cadmium and copper, and the values were between 1,25 - 0,25%, <0,2- <1 mg/kg, 0,1-<0,5 mg and 2,368-1,43 mg/kg, respectively. Briquettes energy detemined in calaorimeter bomb was 1685.23 kJ/kg. Briquettes made of wheat organic impurities and wood sawdust in a mixture 50 : 50 % fully meet the quality requirements of the European Union standard for energy briquettes.

Key words: Wheat, by-product, briquetting, energy briquettes

INFLUENCE OF TWISTED TAPE AND BLADE TYPE TURBULENCE PROMOTERS ON THE MICROFILTRATION OF MILK

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The aim of this research was to study influence of turbulence promoters on permeate flux improvement and energy savings during microfiltration of milk. Low pressure loss turbulence promoters, twisted tape and blade shape static mixer, named Koflo, were used. The chosen turbulence promoters are of the same aspect ratio (ratio of pitch length to diameter of promoter) 2.5 and inserted into the tubular ceramic membrane (0.1 μm pore size). By applying turbulence promoters, fouling was reduced and the permeate fluxes were increased by a factor of three for twisted tape and by a factor of four for blade shape static mixer. Intensity of turbulence in a module fitted with promoter depends on the applied cross flow rate. An increase of cross flow rate induces a rise of flux in the both modes of operation, with and without turbulence promoters. When compared at the same cross flow rate, the flux obtained by application of turbulence promoters is always higher than the flux obtained without promoters. The cross flow rates under which the maximal flux improvement (300% for twisted tape and 320% for Koflo) are several folds lower than that applied in operation without promoter. In the presence of turbulence promoters permeate flux was increased as well as the pressure drop along membrane. Despite the higher pressure drop, operation with turbulence promoters provides significantly reduced energy consumption compared to operation without turbulence promoters.

DETECTION OF VOLATILE COMPOUNDS IN DOUGH DURING MIXING

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Dough mixing is very important stage in the bread making process. The mixing process promotes numerous physical, chemical and physic-chemical modifications that conduct to dough development. Some ingredients, such as sugar, salt, water and yeast are included in dough formulation in order to improve sensory and keep quality of bakery products. These ingredients also have a significant effect on dough physic-chemical properties, what can form aroma compounds in dough mixing process. The aim of this work was to investigate the mixing time and temperature influence on volatile compounds in dough made from flour blend (triticale, hull-less barley, rye, rice, corn flour). Dough was made from flour blend, sugar, salt, yeast and water, according to the recipe and technology used in wheat bread making. An investigation of volatile compounds was done using solid-phase microextraction (SPME) and gas-chromatography mass-spectrometry (GC-MS). Volatile compounds were analyzed during dough mixing after 6, 8, 10 and 15 minutes at dough temperature 20, 25 and 32 °C. The optimal parameter for qualitative dough making (appropriate elastic) could be: time 6 min and temperature 32 °C, time – 8 and 10 min and temperature 25 °C. In mixing processes totally were detected 13 volatile compounds. Identified volatile compounds belong to alcohols, aldehydes, carboxylic acids and terpens. Part of identified volatile compounds such as hexanal, D-limonene, 1-hexanol, 1-octen-3-ol and heptanol was detected in dough originate from flour blend. Some compounds are released from dough due to physical and chemical changes taking place in dough mixing process. Total peak area of volatile compounds increased extending dough mixing time and temperature.

Keywords: mixing, flour blend, volatile compounds, solid-phase microextraction.

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USING THE IMPACT DETACHERS AT THE HEAD OF THE REDUCTION SYSTEM IN THE WHEAT FLOUR MILLING PROCESS

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In the impact mills material is reduced by the loss of kinetic energy when the particle is struck by a high-velocity impeller or accelerated and thrown against a wall to stress the particle beyond its elastic limits. In flour mills they are used: to break infested kernels and destroy insects and insect eggs, to support the grinding by supplementing the roller mills, or even to completely replace the rolls in both break and reduction systems in order to increase capacity and flour extraction. Most commonly, impact detachers are applied to support the grinding of clean middlings (clean endosperm with minimal bran contamination) at the head of the reduction system supplementing the roller mill before sifting. In the flour milling process, along with the size reduction, efficient removal of the bran and germ from the endosperm of the wheat kernel has to be achieved. Using the impact mills, the conditions for controlled and "selective" milling are less favorable and could result in deterioration of the flour quality.

The purpose of this work was to examine the effect that impact detachers have on the milling results on the front passages of the reduction system. The streams entering and leaving the impact detachers applied on the different reduction passages (1M, 2M and 3M) in the industrial mill were intercepted and employed in the experiments. The changes in the particle size distribution and ash content of the material were followed.

Results show that impact detachers significantly increase the degree of particle size reduction of the feed. Under dominant impact forces both endosperm and bran particles are fractured limiting their use to the passages with the low ash content of the stock (<0,5%). Otherwise, the fractured bran particles would pass into the flour causing the deterioration of the flour quality.

INFLUENCE OF HEAT TREATMENT IN WATER ON CHANGES OF TOMATO PROPERTIES DURING POSTHARVEST STORAGE AT LOW TEMPERATURE

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Storage of tomato after harvest at low temperature in order to prevent decay and prolong its postharvest shelf life induces chilling injuries and makes fruit susceptible to the colonization of microorganisms that can cause fruit deterioration. One of postharvest treatments used for reducing of chilling injuries is the heat treatment in water or in the air flow.

In order to investigate influence of heat treatment in water on properties of tomato stored at low temperature (4°C) during three weeks, commercial tomato was harvested at breaker and red-ripe stage. Tomato harvested in breaker stage was treated in water at 42°C for 1 h. Samples of treated and non treated tomato harvested in breaker stage, as well as sample of non treated tomato harvested in red-ripe stage were stored at 4°C. Tomato ripening was monitored once a week by instrumental measurement of fruit color using Minolta Chroma Meter CR-400. After three weeks of cold storage, all tomato samples were evaluated by sensory panel consisting of 10 trained assessors. Differences between treated and non treated tomato samples were observed and compared with properties of red-ripe harvested tomato.

It was concluded that heat treatment in water of 42°C for 1 h results in less chilling injuries, delayed but more uniform development of red color, less presence of vessels, and lower intensity of non-characteristic odor and taste.

PHYSICAL AND SENSORY PROPERTIES OF CHEWING GUMS PREPARED WITH VARIOUS SWEETENERS

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BRIEF INTRODUCTION:
Chewing gum is one of the most popular confectionery products, due to its sensory properties, and possible health effects, such as positive influence on dental health, reduction of the post-operative ileus following gastrointestinal surgery, reduction of muscular tension and relief of gastroesophageal reflux disease symptoms. Consequently, chewing gum production is a constantly growing field of confectionery industry. However, scientific activity performed on physical and chemical properties of chewing gum as well as their production procedures does not follow the production growing trend. Therefore, this study comprises development of different chewing gum recipes and application of lab-scale production process. Sensory analysis of the most important properties was performed. As texture is one of the most important chewing gum properties, relation between instrumental and sensory texture analysis of different chewing gum recipes has been determined.
METHODS AND MATERIALS:
Different chewing recipes were designed in order to study influence of carbohydrate ingredients and commercial aroma preparations on sensory properties of final product. Chewing gum samples were produced in the lab scale sigmoid kneader (Heligear HDMO) coupled with Thermomix 1480 thermostate. Sensory analysis was performed by evaluation of basic chewing gum properties (smell, taste, appearance, texture), together with bubble size and gum extensibility. Texture analysis was measured with Stable Micro Systems Texture Analyser TA.HD.plus. A 6 mm cyllinder probe was used for measuring of texture properties of chewing gums. Measured texture parameters were elasticity, hardness, adhesivity and work needed for first bite.
RESULTS:
Sensory analysis showed that glucose syrups of different dextrose equivalent had different influence on chewing gum hardness. Fructose and sorbitol syrup were responsible for softer chewing gum texture, but problem with the use of sorbitol syrup was considerable crumbling at the beginning of chewing. Different fruit aroma preparations showed low influence on texture, except liquid orange aroma, which induced stickiness of chewing gum. Different instrumental texture analysis probes gave comparable results when it comes to hardness and chewing work, while flexibility results varied among used probes because all samples, except orange, showed no flexible behavior during instrumental measurement.
CONCLUSIONS:
Texture analysis revealed lemon chewing gum with glucose syrup (DE=38) as the hardest of produced samples. Orange flavoured chewing gum produced with the same syrup was the softest, probably due to the limonene content in the liquid orange aroma preparation. Sensory analysis results showed fructose syrup chewing gum being the most acceptable, while instrumental texture analysis ranked the gum in the middle. Both texture analysis methods are only partly comparable. The problems occur with crumbly chewing gums that are very soft in mouth in the beginning, but instrumental analysis recognizes them as being reasonably hard.

CHANGES IN NUTRITIVE QUALITY OF PORK MEAT OSMODEHYDRATED IN SUGAR BEET MOLASSES AND AQUEOUS SOLUTION OF SODIUM CHLORIDE, SUCROSE AND SUGAR BEET MOLASSES

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Osmotic dehydration is a water removal process involving soaking food in a hypertonic solution. Process of osmotic dehydration is typically used as a pre-treatment for many processes in order to improve the sensory and functional properties of food, without a significant decrease in nutritive values of the product. This paper analyzes the effects of different hypertonic solutions, after the process of osmotic dehydration of pork meat under atmospheric pressure at room temperature of 22oC, to determine the nutritive quality of the final product. As osmotic agents sugar beet molasses and aqueous solution of sodium chloride and sucrose and sugar beet molasses in the ratio 1:1, were used. The ratio of raw material and hypertonic solution was 1:5, and immersion time was set to 5 hours. Fundamental chemical composition was determined by SRPS ISO methods, and mineral content was determined using AAS method. The results indicate that during the process of dehydration significant changes occur in water loss and growth dry matter content. The initial dry matter content of meat was 26.21% and after the immersion in molasses increases to 68.52%, while in aqueous solution of sodium chloride and sucrose and sugar beet molasses in the ratio 1:1 increases to 63.70%. Also, after the process of dehydration meat was enriched in some minerals Na, K, Ca and Fe, while the content of Mg was slightly reduced. Based on the results, it can be concluded that the applied solutions significantly improve quality of semi-products and that osmotic dehydration represent a suitable pre-treatment for meat drying. Water loss was slightly higher when sugar beet molasses was used as osmotic agent. Using sugar beet molasses as an alternative medium for the process of osmotic dehydration opens new opportunities for innovation in dehydrated products.

SEPARATION OF PHOSPHOLIPIDS FROM PLANT MATERIAL RESIDUES

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Introduction:
Design of new products with special characteristics or design of new processes, which are environmental friendly and have an impact to sustainable processes, are a great challenge for chemical engineers. Supercritical fluids are relatively new tool, which leads to sustainable manufacturing methods that are not only ecologically preferable but also gives products with special properties.

Materials and methods:
Separation or formulation of products by supercritical fluids and production of substances and composites with unique properties and characteristics for the use in different applications are nowdays intensively studied. One of the most important advantages of the use of supercritical fluids is selective extraction of components or fractionation of total extracts.
The main disadvantage using conventional solvents is that the extracts are contaminated with organic solvents which cannot be easily removed. The legal limitations of solvent residues and solvents (for products for use in human applications) and isolation/fractionation of special components from total extracts in combination with different formulation and sterilization processes will increase the use of dense gases for extraction applications.

Results and conclusions:
Examples on selective extraction and further fractionation of components' of lecithin from plant materials residues (residues after pumpkin seed oil processing) will be presented. Plant material residues were first extracted by dense CO2 to separate oils and waxes. De-oiled plant material was later extracted with ethanol to obtain relatively pure and highly concentrated phospholipids.

Fundamentals, like phase equilibrium data for the system oil/SC CO2 as well as the economy of the process will be presented.

THERMAL ANALYSIS OF OSMOTICALLY DEHYDRATED PORK MEAT

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DSC thermograms of osmotically dehydrated and/or dried pork meat shows two phase transitions: the protein denaturation and the glass transition. The first phenomenon is important in the moist products while the second one is important to the dried products. Besides the water, protein is the most important component of meat and this approves the relevance of studying their denaturation, particularly that of myofibrillar proteins.

The aim of this study was to follow thermal stability and water content in osmotically dehydrated meat samples during two months storage.

Pork meat was osmotically dehydrated in the solution of sugar beet molasses, packed in modified atmosphere (30% CO2 - 70% N2) and stored for 2 months under the refrigerator temperature (40C). Dehydrated meat was sampled every 15th day and thermal analysis have been carried out by means of differential scanning calorimetry (DSC) and thermogravimetry (TGA). All DSC measurements were performed on TA Instruments DSC Q 1000, differential scanning calorimeter and TGA measurements on TA Instruments TGA Q 500 under N2 purge flow of 50 ml/min and 60 ml/min respectively. Water loss (obtained from TGA curves) and protein stability, expressed as temperature of protein denaturation Td and ΔHcal enthalpy of protein denaturation, during the storage was followed. Results have been compared to fresh pork meat thermal characteristics. Water activity (aw) of fresh and dehydrated pork meat have been obtained from DSC and TGA results. It was shown that sugar beet molasses solution affects on thermal stability (DSC results), and water loss (TGA results) dehydrated pork meat samples compared to fresh pork meat. No significant changes, during 2 months storage time have been induced concerning protein thermal stability, but there were changes of water content during storage (TGA) what influenced aw.

CONVECTIVE DRYING KINETICS OF RASPBERRY

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The drying kinetics of raspberry in a laboratory dryer was studied. Fresh, untreated raspberries were dried at selected temperatures of 50 oC with a constant air velocity of 1.2 m/s. The drying rate curves showed that drying process took place only in the falling rate period. Thin-layer drying models of Lewis, Henderson and Pabis, logarithmic, Page, Wang and Singh evaluated based on coefficient of determination (R2), reduced chi-square ($\chi 2$) and root means error (RMSE). The logarithmic model was found to be a better model for describing the characteristics of raspberry. The changes of colour on raspberry's surface were determined by original approach, combining digital camera, computer and graphic software. Pearson correlation coefficients and triplicate sample paired t-test on R (red) colour index frequency were calculated during the experiment. A mathematical model to predict the shrinking of geometrical bodies was proposed, assuming unidirectional drying and two-dimensional shrinkage. The model was numerically solved by finite differences, taking into account a convective term in the mass balance equation, which appears as a consequence of non-unidirectional shrinkage. Thermal analysis, by means of differential scanning calorimetry (DSC) and thermogravimetry (TGA) of fresh and dried raspberries have been performed on TA Instruments DSC Q 1000, differential scanning calorimeter and TGA measurements on TA Instruments TGA Q 500 thermogravimetric analyzer under N2 purge flow of 50ml/min and 60ml/min respectively. DSC scans were conducted in temperature range from -90ºC to 400ºC, with heating rate Hr=5Cº/min, and TGA scans were performed in temperature range of 25ºC to 900ºC, with heating rate Hr=5Cº/min. From results obtained differences in thermal stability of fresh and dried raspberries were shown.

PARAMETERS OF OSMOTIC DRYING EFFECT ON SOME PHYSICAL PROPERTIES OF QUINCES

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Drying quince is not a common procedure for processing. In the experiment was done of combined drying of quince. Osmotic drying of quince is used as the first step in combined drying. The removal of moisture during osmotic drying ensures less time for convective drying. Osmotic treatment reduces water activity, provides microbiological stability and extended shelf life of products. In addition, osmotic pre-treatment has a positive effect on the mechanical properties of the final product. The impact of osmotic drying on the change of quince color, size and volume was examined. Quince cubes of dimensions 15x15x15 mm were used in the experiment. Osmotic drying was carried out with the following combinations of temperature and concentration of sucrose solution in water: 50oBx 40oC, 60oC and 50oBx, 40oC and 60oC and 65oBx and 65oBx. Drying time was 180 minutes. The samples were tested every 20 minutes. The samples treated by osmotic drying were air dried convectively at the temperature 40oC for 20 hours. Color measurement was performed by Konica Minolta colorimeter CR-400. CIE Lab values were used for color parameters. During osmotic drying significant changes in parameter b* (yellow) were measured, while the parameters L* and a* did not change significantly. Higher total color change (ΔE*ab) were measured at a concentration of solution 65oBx. At high values of temperature and concentration of osmotic solution less color change occurs after convective drying. The biggest changes in volume and dimensions were measured again at the highest values of temperature and concentration of osmotic solution.

Keywords: quince, osmotic drying, color, volume, dimensions

OSMOTIC DRYING KINETICS OF NECTARINE HALVES (PYRUS PERSICA L.)

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The experimental research of the osmotic drying kinetics of nectarine tissue in a sucrose solution has been conducted. As the research material, the mesocarp tissue of the nectarine variety Fantasia has been used in the shape of fruit halves. The experiment of osmotic drying has been conducted by means of a semi-industrial osmotic dryer with the capacity of 0.035 m3. The conducted randomised experiment has been based on two experimental factors and three repetitions for all factor combinations. The experimental factors have been the temperature of osmotic solution (tr), varied at two levels (40oC and 60oC), and the concentration of osmotic solution (Cr), varied at two levels (40oBx and 65oBx). The duration of the osmotic drying has been 3 hours and the mass percentage ratio of the osmotic solution and the material has been 8:1. The monitoring of the effects of experimental factors on the osmotic drying kinetics of the nectarine tissue has been done by the measurement of tissue moisture change, dry matter increase, and tissue volume change. The measurements have been conducted every 20 minutes from the beginning of drying to the end of the measuring period.

Based on the data obtained by a dispersion analysis of this two-factor experiment (with the statistical probability of 99%), it can be concluded that there are impacts of the selected factor levels on the drying speed of the nectarine tissue and the dry matter increase. The most significant moisture decrease, dry matter increase, and volume shrinkage has been noted in the combination tr = 60oC and Cr = 65oBx, (2,27 kgw/kgsm; 3,78%, 0,3449, successively), whereas the least signicifant changes have ben noted in the combination tr = 40oC and Cr = 50oBx (1,45 kgw/kgsm, 2,45%, 0,174, successively).

Using a regression analysis, a mathematical modelling of moisture change (compared to the dry base) and dry matter increase of the nectarine tissue was conducted during the osmotic drying. Three empirical models, enhanced with factors of non-dimensional osmotic drying, have been selected for every modelled value. Based on the statistical indicators such as the correlation coefficient (R), the chi-square test (X2), the mean bias error (MBE), and the mean squared error (MSE), models have been assessed and the most precise models have been selected. Ultimately obtained mathematical models have high correlation coefficients (R = 0,9886 and R = 0,9936).

THE INFLUENCE OF REACTION CONDITIONS ON THE HYDROLYSIS OF NATIVE CORN, POTATO AND PEA STARCHES

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Enzymatic modification of starch provides a good solution for improving the processing behaviour and stability of starches. The composition of starch, especially in terms of amylose and amylopectin, seems to be the most researched aspect of influence on functional behaviour of starch. The granular structure and extension of crystalline and amorphous zones have direct impact on starch characteristics. Using of amylolytic enzymes under the gelatinization temperature leads to a partial degradation of the suspended starch granules with retention of the grained structure.
The influence of the reaction conditions (type of starch, type of enzymes, reaction temperature and reaction time) on the grade of enzymatic hydrolysis of native corn, potato and pea starches, which differ according to the starch-type (A, B and C-type starches) has been investigated in this project. The progress of the enzymatic reaction was monitored by the determination of glucose content in the supernatant (converted to starch) at specified reaction temperatures (30, 40, 50 and (55)60 ° C) and in specified time intervals (20, 44, 68, 92 h).
The results show that the degree of hydrolysis of potato starch is significantly lower than that of corn and pea starch. The highest glucose values were determined after the degradation process with amyloglucosidase (Dextrozyme). By the hydrolysis of potato starch, glucose content in supernatant was less than 10 %. The degradation process at the corn and pea starches was most easily (to 60 %) in comparison to the degradation process of the potato starch. The framework conditions such higher temperature and longer hydrolysis time led to the more efficient degradation of native starches.

EFFECT OF NITROGEN FERTILIZER ON ROOT YIELD AND TECHNOLOGICAL QUALITY OF SUGAR BEET

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Mineral nutrition of sugar beet is more specific than other field crops. This means that besides root yield, for achieving higher sugar yield per unit area is very important its technological quality. Of all the elements of mineral nutrition, nitrogen has the greatest impact on these features. Increased nitrogen fertilization in sugar beet production often does not give the desired economic effects, and can have negative consequences for the environment.
Researches of impact of fertilization on sugar beet yield and quality in the period of three years are conducted in the stationary field experiment at the Institute of Field and Vegetable Crops in Novi Sad, Serbia, at Rimski Šančevi experimental station. The experiment was carried out on ten fertilization variants with increasing doses of N, P2O5 and K2O, and the object of investigation was a local variety Irina.
Root yield was the highest on the fertilization variants with the highest amounts of nitrogen fertilizers (150 kg N ha-1), but in any case, the difference in yield was not statistically significant in comparison with 100 kg N ha-1 applied. The sugar content significantly decreased, while the content of harmful nitrogen and sodium increased with increasing doses of N. Refined sugar yield was the highest at the fertilization variant N50P50K50.

INFLUENCE OF HYDROCOLLOIDS ON THE RHEOLOGICAL PROPERTIES OF BUCKWHEAT DOUGH

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Due to the greater awareness among the scientists and technologists regarding unbalanced diet of celiac patients, buckwheat flour has been recently in a focus as a novel material in gluten-free formulations because of its unique nutritional profile. However, the use of buckwheat flour in baked product formulations has been limited due to the lack of gluten-forming protein which imparts the dough viscoelastic properties and gas retention. In order to improve the processing properties of gluten-free cereals and pseudocereals hydrocolloids are commonly used as gluten substitutes.

Therefore, the aim of the present study was to investigate the influence of different hydrocolloids (xanthan and hydroxypropyl methylcellulose) on thermomechanical and viscoelastic properties of buckwheat dough. Concerning the thermomechanical behavior determined by Mixolab, xanthan and hydroxypropyl methylcellulose incorporation in buckwheat dough resulted in significantly decreased water absorption and increased dough development time. Moreover, due to the specific behaviour of examined systems, standard Mixolab protocol was modified by increasing the dough weight from 75 to 90 g and duration of dough mixing during the cold stage from 8 to 15 min. During the heating stage, the addition of xanthan significantly affected the weakening of the buckwheat dough induced by mixing and temperature enhancement, as well as the peak viscosity, while hydroxypropyl methylcellulose significantly affected breakdown torque. The study of rheological properties of dough by oscillatory and creep measurements showed that xanthan significantly strengthened the buckwheat dough.

DEVELOPMENT OF INNOVATIVE TECHNOLOGIES FOR A HIGHER LEVEL OF BERRY FRUITS PROCESSING IN SERBIA

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Serbia has a large quantity of natural and acquired raw material resources available in agriculture and in food industry. The fruit processing chain is at a low level within the current development and a food product range. Serbia exports fruit as frozen products, processed at the lowest level. In the case of the berry fruits (raspberries, blackberries, etc...) the products of a higher processing level are mostly imported, while domestic production is poorly represented and is carried out according to traditional methods and with small production capacities. In accordance with the national strategy for sustainable development, the objective of our investigation is to develop innovative technology for a higher level of raspberries procession and to obtain products for the food and confectionery industries (juice concentrate, aroma, natural colors), as well as active ingredients for functional foods and dietary supplements (seeds, pectin, cellulose).

The concept of food engineering is applied in the development scale-up processes from laboratory to semi-industrial level. Key entities of the product qulity for medical application are verified by antioxidant capacity, anti-microbial and anti-cancer effects.

Incremental innovation is achieved in the process development and additive innovation in the design of technical solutions. A preliminary economic feasibility shows positive economic effects in relation to the domestic market capacity and sales prices of competitive products.

The current level of innovative technology and of estimated economic indicators provide the basis for the development of industrial technology, competitive production and international technology transfer through a business model based on partnership relations with the use of development funds, loans and grants.

PREPARATION OF WATER-IN-OIL EMULSIONS USING MEMBRANE EMULSIFICATION SYSTEM AND HIGH-SPEAD HOMOGENIZER

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Water-in-oil emulsions, consisting of demineralized water dispersed in sunflower oil and stabilized with polyglycerol polyricinoleate, have been prepared by using two emulsification methods: high-speed homogenizer and ceramic membranes (alpha-aluminum oxide), with mean pore size 20 nm.
Influences of the water phase content and the emulsions storage time on the mean droplet size and droplet size distribution were investigated. The mean droplet size and droplet size distribution of the prepared emulsions were measured using a laser light scattering instrument.
As expected, the results showed that the mean droplet size and droplet size distribution depended on the dispersed phase content in the emulsion in a way that increasing the water phase content the mean droplet size was increased. The results showed that application of membrane emulsification process can significantly reduce mean size diameter of water droplets in emulsions of this type. However, when membrane emulsification is used, the small water droplets, which were initially of the diameters less than 100 nm, tend to reduce the total amount of interface by coalescence, and form the droplets of the mean peak diameter of about 400 nm. At the same emulsifier content in the continuous phase (3%, w/w), the mean droplet diameter was about 750 nm in emulsions produced using high-speed homogenizer.

FOOD PROCESSING CAN IMPAIR PROTEINS IN MEAT: DETECTING THE PROTEIN CARBONYLATION DUE TO HEATING

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Preparing food is old as mankind. We all think that we know how to cook and eat. But it is also true that food kills more people than alcohol, smoking or HIV. Besides "what" or "when" we eat it is important also "how" we cook. European project entitled "Design and development of REAlistic food Models with well characterised micro- and macro-structure and composition" (DREAM) has developed realistic, physical and mathematical food models for four major food groups, which will be used to study the influence of food processing on food molecular structure. Our work package will develop meat models and it will evaluate the effect of composition and structural properties of proteinous foods on the reactions which are promoted by heating (e.g. oxidation). During heating, amino acid residues in proteins may become carbonylated, which can lead to changes in nutritional and biological value. Additionally, they could cause oxidative damages of cell components. In humans, oxidative stress is involved in many diseases, such as atherosclerosis, Parkinson's disease, Alzheimer's disease, etc. Study of these effects on real meat samples is nearly impossible because we cannot assure controlled conditions like equal meat structure in all tested samples. Realistic meat models make this possible. Our contribution in the work package was to quantify protein carbonylation using the developed proteinous models. Our approaches include SDS-PAGE, 2-D PAGE, HPLC, and fluorescent staining of carbonyls. HPLC proved to be simple and fast, but the resolution of separated proteins was low. SDS-PAGE was more complex but showed better selectivity while 2-D PAGE proved to be most complex among the methods used but showed highest possible resolution of separated proteins. The added value of food models will be shown through improved functional and nutritional properties of food and by that it will contribute to the food safety and quality.

INFLUENCE OF ULTRASONICATION PARAMETERS AND NACL ON THE STABILITY OF OLIVE OIL MODEL EMULSIONS CONTAINING XANTHAN.

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Introduction
The use of ultrasonics in the food industry is gaining more interest. It represents a less energy consuming technology, hence is considered a trend of “green chemistry”.

Materials and methods
This research involves the ultrasonic emulsification of primary-coarse 20wt% o/w emulsions (pH ~4) containing a food-grade emulsifier (whey powder isolate, WPI, 2.7wt%) and xanthan gum (XG, 0.25wt%). Two major parameters of the ultrasonic treatment (20kHz), time and amplitude, where investigated to evaluate the influence on emulsion droplet size characteristics (by diffusion NMR and microscopy), viscosity and stability (by multiple light scattering profiles) during cold storage (10 days at 5oC).

Results
In the case of time, the ultrasonic treatment duration was 1, 2, 3 and 4 min, while amplitude was kept constant at 70%. Considering the amplitude, intervals of 40, 60, 80 and 100% where chosen, for constant time of 1min. The same conditions of time and amplitude where used to treat solutions of XG 1wt% and evaluate their influence on viscosity. Increase of sonication time from led to significant decrease of oil droplet size and finer emulsions. Although the viscosity of emulsions and XG solutions was decreased with sonication time applied, a decrease of the serum layer was observed, thus more stable emulsions were produced due to smaller oil droplet size. A similar trend was observed when the amplitude was increased. Finally, a combination of time and amplitude (70%/3min and 90%/1min) was used in order to further reduce the droplet size in the submicron range in the presence of 0, to 400 mM NaCl. It was found that the presence of NaCl up to a limit of 300mM was beneficial towards stability when comparing to the reference samples (0mM NaCl), even though the serum index (SI) was increased (up to 28.9%).when increasing NaCl concentration.

Conclusions
The moderate use of sonication time and amplitude as well as low NaCl concentration increased the stability of emulsions containing relatively low amounts of stabilizer.

OPTIMIZATION OF DRYING KINETICS OF BROCCOLI (BRASSICA OLERACEA L.)

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Broccoli (Brassica oleracea L.) is a vegetable with exceptional medicinal and nutritional properties. Dried broccoli can be found on the international market and it is produced primarily for preservation purpose. In dried form broccoli can be used in the production of instant soups, sauces even for the tea production. The aim of this paper was to optimize the technological process of broccoli drying.

Broccoli was dried in the laboratory dehydrator. The drying experiment were carried out at two temperature regimes of drying, batch process (constant air temperature of 70 ^{0}C for a period of 8h) and simulated continual process (the air temperature of 70 ^{0}C for a period of 3h and the air temperature of 50 ^{0}C for a period of 5h). The amount of evaporated water was expressed in relative and absolute units of measure. The experiment was conducted to follow the speed of drying of broccoli and was expressed as speed changes in the ratio of humidity in the moist material depending on the current humidity. The total dry matter content was measured by standard gravimetric method.

The results showed that in simulated continual process of drying the lower maximum speed of drying was achieved, drying was more evenly and in this way the technological process was finished with a smaller temperature stress for plant tissue, resulting in a better quality of the final product. The second temperature regime of draying, which simulated continual process, was more acceptable in terms of the final product. Broccoli dried at this temperature regime was less browning, with more acceptable colour, which indicates that the lower temperatures are more favorable for drying foodstuffs prone to enzymatic browning.

Key words: broccoli, drying process, the kinetics of the drying process, temperature stress

STABILITY AND DESIRED ATTRIBUTES OF PALM OLEIN IN DEEP FRYING APPLICATIONS

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Deep Frying is a high temperature frying carried out at a temperature of 185 – 200C. It is an efficient method of heat transfer that allows quick cooking and adds flavor to the fried food. At high-elevated temperature and in the presence of air and moisture, frying oil will undergo several chemical changes including oxidation, polymerization and hydrolysis among others. Stability at high frying temperature is the single most important attribute for deep frying oil. In the fried food and snack food industry, Palm Olein is the preferred choice for frying oil because it imparts superior shelf life to the final products due to its high oxidative stability. Unlike the unstable polyunsaturated edible oils, palm olein does not have to be hydrogenated to impart stability. Hence, it is naturally free of trans fatty acid. Palm Oil also has balanced fatty acid content with equal ratio of saturated to unsaturated fatty acids. The presence of natural antioxidants, tocopherol and tocotrienol further contribute to the superior oxidative stability of palm oil. Another important attributes of palm oil, which help to distinct it from others, is its bland taste. This helps to carry the natural flavor of the food during frying process. The most important reason palm oil is the preferred choice for deep-frying applications globally is because it is easily available at anytime and is the most cost effective edible oil among many.

IMPROVING THE TECHNOLOGY FOR PRODUCING FOOD GRADE DYE FROM RED BEET JUICE

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Red beet juice is very useful food product, because it contains significant amount of sugars, mineral substances, vitamins. It is also valuable because it's used for producing food grade dye.

Nowadays in order to give to food products a color, close to natural coloring of fruits and vegetables, expansive synthetic dyes are used, which when being accumulated by human organism might have cancer-inducing effect. Therefore improving the technology for producing food grade dye from red beet juice is remarkably important task.

Currently for the purpose of obtaining dye from red beet juice, a part of pectin substances, which make the process of juice concentration more difficult, is removed with the help of expensive enzymatic agents.

The authors have suggested using natural carbon-bearing adsorbent shungite to purify red beet juice from pectin substances.

Shungite's important characteristic is the presence of fullerene carbon nanotubes with the diameter of their cylindrical pores constituting 1…6 nanometers and the width - up to several micrometers. The cylindrical surface of tubes is formed by active carbon circles and has empty pores.

It has been established that shungite does not adsorb dyeing substances from red beet juice, because at inter-phase border anthocyans' molecules, which constitute the basis of dyeing substances, are situated in such a way that hygrophilous group remains in liquid phase and hydrophobic effect takes place.

The research has showed effective capacity of shungite to adsorb pectin substances from red beet juice. Moreover, the adsorbent adsorbs nitrate ions, harmful microorganisms, heavy metals ions, improving juice ecological safety while preserving its high quality parameters.

The obtained optimal technological parameters of purifying red beet juice from impurities have been recommended to be introduced in production. Economical efficiency of improving the technology for producing food grade dye from red beet juice has been confirmed.

STRUCTURAL AND TEXTURAL PROPERTIES OF RICE-CARROT EXTRUDED PRODUCTS

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In recent years, there is an increasing trend for the consumption of ready-to-eat products which maintain their nutritional characteristics. Extrusion cooking is used in the food industry, to produce direct expanded snacks; the nutritional value of these extruded snacks usually increases with the addition of high-value food ingredients. The objective of the present study was the determination of the effect of process conditions on the structural and textural properties of rice flour-carrot extruded snacks. Extruded snacks were prepared from rice flour-carrot mixtures using a twin-screw extruder, operated at different conditions, including screw speed (150-250 rpm), extrusion temperature (140-180ºC), feed moisture content (14-20% wet basis) and carrot-rice flour ratio (5-10%). Before extrusion, the ingredients were mixed and stored for 24 h in order to equilibrate. True density of the products was measured using a helium stereo-pycnometer and apparent density was obtained by measuring the dimensions of the samples using a Vernier caliper. Porosity is defined as the volume fraction of air in each sample. The expansion ratio was determined as the ratio of the diameters of the extrudates to the die. The textural properties of extruded products were obtained using a universal testing machine and maximum stress, maximum strain, elasticity modulus and number of breaks were calculated from the stress-strain curve. A stereomicroscope was used in order to visualize the macrostructure of selected extruded snacks. Simple mathematical models were used in order to correlate the examined properties with the extrusion conditions. Results indicated that apparent density increased significantly with moisture content and material ratio and decreased with temperature and screw speed, while the opposite trend was observed for porosity. Expansion ratio decreased with moisture content, material ratio and temperature, while a screw speed rise resulted in products with higher expansion ratio. The textural properties were also significantly affected by process conditions.

INFLUENCE OF DIFFERENT DEHYDRATION PROCESS ON THE ANTIOXIDANT PROPERTIES OF RASPBERRY

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Raspberries have a brief harvest season and can be stored under refrigerated conditions only for few weeks after harvesting. Thus, raspberries are candidates for further preservation by freezing, canning or drying. Dehydration of raspberries can be used to extend the shelf life at room temperature. Water removal leads to a loss of nutritive and sensory properties of the food. Because of the possible beneficial roles of phytonutrients present in raspberries, it is critical to measure their changes during processing to better assess the quality and nutritional value of the processed products.
Thus, the objectives of this study were to evaluate the effects of different drying treatments on antioxidant properties, total phenolics and anthocyanins content of raspberry (Rubus idaeus). Whole raspberry fruits were dried convectivelly (air-drying), osmotically and freeze-dried. Acetone-water extracts of fresh and dried raspberries were assessed for total phenolics content by Folin-Ciocalteau method and for total anthocyanins content by pH differential method. ABTS test were applied for determining antioxidant activity of samples and it was expressed as Trolox Equivalent Antioxidant Capacity (TEAC). Trolox (6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid) reprezenting a water-soluble analogue of vitamin E, was used to eliminate the ABTS.+ oxidant (cation radical of 2,2´-azino-bis-(3-ethylbenz-thiazo-line-6-sulfonic acid)). Comparison of drying methods and their evaluation has been based on preservation of antioxidant activity, total phenolics and anthocyanins contents.
Raspberries preserved by freeze-drying appears the highest antioxidant activity, total phenolics and anthocyanins content among dried samples. Convective drying caused slight changes, while osmotic dehydration caused significant decrease of all investigated parameters. Significant correlation has been obtained between antioxidant assay and total phenolics content of samples. Anthocyanins of raspberry have been found sensitive to dehydration treatments.
The obtained results confirmed superiority of freeze-drying as dehydration process.

Key words: freeze-drying, dehydration, antioxidant activity, total phenolics, anthocyanins, raspberry.

MICROBIAL PROFILE OF DRIED PORK PRODUCED WITH LOWER SALT CONTENT

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Production of food with lower amount of common salt (sodium) is challenge for food industry. Particularly problematic is the production of dried meat with lower amount of common salt because these products are not preserved by high temperature. In this paper is presented the microbial profile of dried pork produced with lower amount of salt during production and storage under vacuum conditions for 120 days. Total plate count is determined during processing, in the fresh meat, after curing and after 7th, 14th and after 21st day of production by standard method ISO 4833:2008. During storage under vacuum conditions on the 1st day, 60th day and 120th, count of halotolerant bacteria is determined using Manitol salty agar and count of lactic acid bacteria by standard method ISO 15214:1998. Maximum total plate count was after curing, average 5.04 cfu/g and after that it is decreased up to the end of production, average 2.68 cfu/g. Average count of halotolerant bacteria was 2.19 cfu/g in the final product in superficial layer of meat and 1.41 cfu/g in inner layer of meat, but after 60 and 120 days of storage halotolerant bacteria were not presented. Lactic acid bacteria were presented only at the beginning of storage, 2.17 cfu/g in the superficial layer of meat; and 1.98 cfu/g in the inner parts of dried meat. Maximum total plate count after curing is presented due to handling with meat and it is under positive influence of added salt. Vacuum conditions had negative influence on presence of halotolerant and lactic acid bacteria which are not presented during longer storage, because of anaerobic conditions in the vacuum packing.

SOME PARAMETERS OF DRIED PORK PRODUCED WITH LOWER SALT CONTENT

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Production of meat products with lower salt/sodium content is the goal of today's meat industry because of bad influence of exceed sodium intake by food. In this paper are presented some physico-chemical parameters during processing of dried pork produced with lower salt content. Pork (m. longissimus dorsi) was cured with nitrite curing salt in amount of 3 kg/100 kg of meat. In meat were measured the weight loss during curing and drying; moisture content by standard method ISO 1442:1998, water activity using aw-meter (Wert-Messer, Durotherm) at temperature of 25°C; and pH value by pH-meter (MA-5730; PAT N° 35398, Iskra) according to ISO 2917/2004. Average moisture content in dried meat at the end of production was 40.10%. Average weight loss was 2.39% after 7 days of production (after curing) and it is increased up to the end of production, average 34.57%. Acidity of meat during curing, smoking and drying was similar; pH value was around 6.00. Water activity was gradually decreased from average 0.985 after curing (7th day) up to 0.899 at the end of production. During the storage of dried meat under vacuum conditions, pH value decreased from 5.43 in the final product up to 5.11 at the end of storage (120th day). These values are characteristic for curing, drying and fermentation of meat. Dried meat was shelf stable for 120 day under vacuum conditions, without signs of rancidity and without changes in other sensory attributes.

THE EFFECT OF SPRAY DRYING PROCESSING CONDITIONS ON PHYSICAL PROPERTIES OF SPRAY DRIED MALTODEXTRIN

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Maltodextrin was subjected to spray drying to determine the effect of spray drying conditions on moisture content, water activity, particle properties (particle size distribution and particle density) and bulk properties (bulk and tapped densities, porosity, flowability) of the powder product. Experiments have been performed in a pilot scale spray-dryer (Mobile Minor Niro-Atomizer, Denmark) using a full-factorial design to provide data and correlations that predict the powder properties as a function of the main operational variables of the spray-dryer. The inlet (170-190°C) and outlet air temperatures (60-90°C) and the atomization pressure (196-392 kPa) were investigated as spray drying process variables. The effect of spray drying conditions on physical properties of powders was expressed with three dimensional response surface and perturbation graphs. Perturbation and 3-D graphs revealed that outlet air temperature and atomization pressure had more effect than inlet air temperature, on the physical properties of maltodextrin powder. The results showed that the Sauter mean diameter (D3,2) was between 6.728 and 12.87 µm for maltodextrin powders . The bulk densities of samples were changed in the range of 476 and 568 kg/m3. Maltodextrin powders had bad flowability due to their small particle size.

INFLUENCE OF HIGH INTENSITY ULTRASOUND AS DRYING PRETREATMENT ON THE TEXTURE PROPERTIES OF PEARS

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Introduction

High intensity ultrasound is effective method for shortening of drying time of various fruits. Besides shorter drying times which lead to significantly lower energy consumption, this also allows using lower temperatures. This in turn ensures higher vitamin and antioxidant content in final product compared to standard drying process. Ultrasonic cavitation which enlarge existing and create new pores in fruit tissue could also negatively impact sensory properties, and lead to changes in textural properties such as hardness and elasticity. Thus determining of optimal ultrasound and drying parameters is crucial to ensure consumer acceptance of final products and minimizing drying times.

Materials and Methods

15 g of pear slices were immersed in distilled water and treated with ultrasound. Each batch of samples treated with intensities of 10, 20, 30 and 40 Wcm-1 using full cycle during 4 minutes. After treatment samples were dried in infrared dryer at 60 oC, until moisture content drops to 10 %. Instrumental analysis of texture was performed, and hardness, elasticity, as well as chewiness were calculated based on obtained TPA curves.

Results

Drying time gradually drops with the increase of ultrasonic intensity, from 240 min for untreated samples to 145 min for samples treated with 40 Wcm-1. Hardness and elasticity of samples were also decreasing with the increases in ultrasonic intensity. This is main reason why samples treated with two of highest intensities have unacceptable sensory properties, and only two treated using lowest intensities (10 and 20 Wcm-1) appear to be acceptable from consumer perspective.

Conclusions

Optimal ultrasonic intensity was 20 Wcm-1 during 4 minutes, as this substantially shortens drying time, while retaining changes in measured textural parameters in acceptable range. Loss of hardness and elasticity at larger intensities was too large, and despite shortest drying times, such samples were deemed unacceptable.

NON-THERMAL ULTRASOUND-INDUCED GLYCATION OF B-LACTOGLOBULIN IN MAILLARD REACTION

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Maillard reaction is reaction of non-enzymatic browning by reaction of carbonyl group, especially reducing saccharides with compounds with free amino groups, such as amino acids and proteins. This reaction occurs during thermal food processing and its products are responsible for color, taste and flavor, which can be desirable or non-desirable depending of kind of food. It is well known that ultrasound field has unique chemical and physical effects generated by collapsing cavitation bubbles. Therefore, the aim of this study was investigation of Maillard reaction promotion by non-thermal effects of ultrasound in protein-saccharide solution. As model protein β-lactoglubulin, the main whey protein was treated with ultrasound in absence or in presence of saccharides, such as glucose, fructose, lactose, ribose, arabinose and pectin.

Ultrasound treatment of BLG in presence of saccharides results in reduction of amino group content, increasing of BLG pI value, increasing in mass of monomeric BLG and BLG polymerisation. Mass spectrometry analysis of obtained BLG derivatives shows conjugation of one, or more, molecules of saccharides (with elimination of water molecule). The results of all experiments unequivocally demonstrate that ribose is the most efficient in BLG modification of saccharides used, able to modify even 9 amino groups of lysine/arginine residues. BLG secondary and tertiary structure were anlysed by far UV and near UV CD spectrometry. Sonication in presence of saccharides the most efficient in glycation resulted in the most pronounced changes in secondary structure. The secondary structure alteration reflected in increased beta-sheet and random coil, and decreased alpha-helix content. Tertiary structure changes were more noticeable then secondary structure.

On the basis of obtained results it can be concluded that ultrasound, under conditions applied in this study, promoted mostly early stage of Maillard reaction without dramatic BLG structure changes. It seems that by proper choice of experimental conditions (ultrasound intensity, exposure time, maintained temperature, pH, concentration and protein/saccharide ...) ultrasound induced Maillard reaction, could be much easier controlled compared to thermal induced.

INFLUENCE OF PRE-TREATMENT ON YIELD AND QUALITY OF MANDARIN JUICES

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INTRODUCTION

Croatia in the Neretva valley produces remarkable quantities of mandarins but, as always, one part of yield, according to fruit characteristics, are not suitable for consumption as fresh. At the same time those fruit are suitable for processing industry e.g. for juice production. In Croatia, mandarin juice is not industrially produced, and generally is rare on market. The current study is contribution to mandarin juice processing with the aim to investigate influence of different pre-treatment on yield, quality, biological and sensorial attributes of obtained juices.

METHODS AND MATERIALS

Mandarin from Neretva valley was used to produce cloudy juices on small scale equipment. Before pressing, fruits were peeled and treated (i) with maceration enzymes at various temperature and duration (ii) by ultrasound (US) with different amplitude and duration. Control juice was produced without enzyme or US pre-treatment. In fruit and juices total carotenoids, total phenolics, the antioxidant capacity and sensory evaluation (SE) by quantitative descriptive method were determined. The results were statistically analyzed.

RESULTS

Considering the investigated parameters there are no remarkable differences among juices produced by enzyme treatments independent of enzyme concentration, temperature (20 or 48oC) and duration of 30 or 60 min. Also, different US treatment conditions did not show any remarkable influence on investigated parameters. But in comparison of these two types of treatment better yield and SE were obtained by US and higher content of total carotenoids was obtained by enzyme treatment.

CONCLUSIONS

Treatment by US could be recommended to produce mandarin juice due to high yield and SE but also further investigations are needed to optimize US conditions due to better preservation of biologically active compounds.

EFFECT OF PROCESSING ON COMPOSITION OF NUTRITIONAL STARCHES IN PLANTAIN (MUSA AAB)

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Plantain, a member of the banana family is an important staple food in the tropics. It is edible when fully ripe but in most cases it is cooked before consumption. Despite its abundance in the diet of many populations, quantitative and qualitative data on various starch fractions are scarce. In vitro digestibility of starch for processed and unprocessed samples was determined using pancreatic α-amylase and amyloglucosidase (Englyst & Englyst, 2004), and D-glucose was measured using glucose oxidase/peroxide reagent. Resistant starch in content in uncooked samples was 36.6±1.5g/100g and 62.7±2.9g/100g for ripe and unripe samples respectively. These were values reduced in the processes samples, with values ranging between 3.5-6.5 g/100g in the ripe samples and 15.0 - 19.9 g/100g in the unripe samples. Slowly digestible starch (SDS) values were between 0.6 and 9.2 g/100g, while rapidly digestible starch (RDS) ranged between 25.6 – 56.6 g/100g for processed samples. Starch digestibility index (SDI), which is the ratio of the rapidly released glucose to the total starch content was lowest in the grilled samples (60.0). It is concluded that processing techniques affect the type and content of nutritional starches and therefore it will be essential to optimize processing techniques to maximize the RS and SDS which are known to have positive effect on postprandial glucose response.

Keywords: Plantain, resistant starch, slowly digestible starch, rapidly digestible starch, processing

ULTRA-SHORT GAS-PHASE PCD REACTOR VOCS ABATEMENT PERFORMANCE

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The food processing industry is currently facing difficulties in handling the emissions of hazardous substances, especially cooking fumes and vapours. Existing gaseous contaminant removal systems are of low efficiency. The remaining vapours condense and settle in the ventilation system, potentially creating a fire hazard in the fast air flow. Furthermore, existing solutions carry substantial capital and operating costs due to lost energy (since the hot contaminated waste air is not usable in heat exchangers without further purification) and require frequent replacement of extraction system filters. In order to investigate more efficient and cost effective alternative systems, a novel ultra-short gas-phase pulsed corona discharge (PCD) reactor was designed and tested for the abatement of diluted gaseous volatile organic compounds (VOCs). The novelty of the PCD reactor is that the high voltage (HV) generator produces ultra-short, high repetition rate HV pulses that enable the reactor to operate in an environment of high humidity. The production of ultra-short pulses is achieved using advanced magnetic pulse compression (MPC) technology and the results show that the PCD reactor efficiently oxidises ethanol, acetaldehyde, acetone and toluene. A test chamber, where controlled atmospheres of known VOC concentrations could be introduced under well characterised environmental conditions, was employed in the proof of concept tests. The gaseous VOCs employed were monitored with the discharge on and off and the removal efficiency was determined using flame ionisation detectors. The formation of transient products, such as ozone, were monitored using a Fourier transform infrared spectrometer (FTIR). As an alternative technique a pulsed dielectric barrier discharge (DBD) reactor was also built and evaluated, but the VOCs abatement efficiency was superior with the PCD reactor, which will be employed in the next stage of development.

LIPASE-CATALYZED SYNTHESIS OF ASCORBYL OLEATE: THE OPTIMIZATION OF SUBSTRATE CONVERSION WITH RESPONSE SURFACE METHODOLOGY

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L-ascorbic acid has good antioxidative properties. Despite that, efficiency of vitamin C in stabilizing fats and oils in foods with high lipid content is negligible due to its hydrophilic characteristics. On the other hand, fatty acid ascorbyl esters are liposoluble, with even better antioxidative properties comparing to L-ascorbic acid. Therefore, developing of industrial process for lipase-catalyzed synthesis of vitamin C fatty acid esters, considering numerous advantages over conventional chemical methods (mild reaction conditions, high regioselectivity, and simplified downstream processing), is of great interest.

In this study, L-ascorbyl oleate was synthesized in esterification reaction between vitamin C and oleic acid catalyzed by immobilized lipase from C. antarctica in acetone as a reaction medium. Response surface methodology (RSM) and 5-level-5-factor central composite rotatable design (CCRD) were employed in order to investigate interactions between key experimental factors (initial water content, temperature, substrates molar ratio, vitamin C concentration, and enzyme amount), determine their individual influence on the molar conversion, and eventually optimize the synthesis.

Based on the experimental data, regression model, expressed with second order polynomial equation, was obtained. At values in the range of examination, enzyme amount had no influence on molar conversion and, therefore, it was fixed at the minimum (0.2 % (w/v)). The maximum molar conversion of 91.3 % was predicted and corresponding, optimal reaction conditions were: temperature – 60 ºC, initial water content – 0 % (v/v), vitamin C concentration – 0.02 M, and substrate molar ratio – 1:15. Strong negative interaction between substrate molar ratio and vitamin C concentration was observed (high molar conversions were achieved at high substrate molar ratios and low vitamin C concentrations and vice versa).

This research has shown that selected system provided reaction conditions which enabled high molar conversions. Obtained results are promising and may be used as a starting point for the scale-up of the process.

MICRO PROCESS ENGINEERING FOR THERMAL PRESERVATION

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Food preservation is the process of treating and handling food to ensure food safety, stop or slow down spoilage (loss of quality, edibility or nutritional value) and allow longer storage. Preservation usually involves preventing the growth of bacteria, yeasts, fungi and other micro-organisms, as well as inactivating most enzymes and retarding the oxidation of fats which cause rancidity. Based on the mode of action, the major food preservation techniques can be categorized as: slowing down or inhibiting chemical deterioration and microbial growth, directly inactivating bacteria, yeasts, moulds, or enzymes, and avoiding recontamination before and after processing. (Rahman 2004).

As described by Bolivar, Wiesbauer et al. (2011), micro processing is an innovative technologies suggested for process optimization in the chemical and pharmaceutical industries. Interest is high to carry out chemical conversion in flow micro reactors, replacing flasks or stirred vessels operated in batch mode. Rapid screening at low material input is one of the advantages of a miniaturized device which is both highly automated and can be operated continuously. Flexibility of the equipment constitutes a major benefit of the micro systems. Different process lines can easily be simulated and monitored through sensors. The interests for the chemical and pharmaceutical industries can easily be transferred to the food industry.

STUDIES ON MAPPING THERMAL DEGRADATION BEHAVIOUR OF DISTINCTIVE FRUCTO-OLIGOSACCHARIDES

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Fructo-oligosaccharide derivatives can be found in more than 36.000 plant species and they might be regarded as the most abundantly occurring carbohydrates the in nature following starch. This compound family contain fructose oligomers with linear chains of β(2→1) bound monomers. As a result of the beta connection, these derivatives cannot be digested by the human digestive system, however can be digested by the colon microbial flora and these oligomers can be categorized as prebiotics. Furthermore, resistant starch and cyclodextrin derivatives represent an important carbohydrate family as they play crucial role in constituting proper cell structure. In addition prebiotic acivity might be attributed to some of their derivatives.

Development of novel, reliable HPLC-ELSD method was set as our major objective in order to be able to analyse thermal degradation behaviour of the selected bioactive substances, as it is of huge importance in terms of their practical application. The aim of our work was to investigate thermal transformation processes of resistant starch and cyclodextrin derivatives, as well as to identify thermal decomposition products in order to reveal plausible degradation pathways under various conditions of thermal treatments.

Application of high-performance liquid-chromatography coupled with evaporative light scattering (ELS) and mass-spectrometry (MS) detection of non-heated samples showed the distribution of oligomers (DP - degree of polymerization) ranging from DP3 up to DP31 of native fructo-oligosaccharides and starch-derivatives. At 250°C the complete decomposition occurred for all of the studied derivatives, however marked differences were observed in respect of the ratio of the formed products.

QUALITATIVE RESPONSE OF LETTUCE GROWN IN AERATED WATER OF PALIC LAKE

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Increasing need among human population for fresh vegetables has generated numerous investigations related to growing alternatives. This research aimed at evaluation of possibility to grow plants on treated wastewater. The growth of Lactuca sativa (lettuce) was tested in laboratory conditions, using treated communal and industrial wastewater inflowing from Subotica town into Palic lake. This water is loaded with organic matter, and as such suitable for plant growth, containing plant nutrients phosphorus, nitrogen, and carbon (total N – 7.93; total P – 1.46; TOC – 9.81). The concentration of heavy metals determined by AAS, using flame absorption atomizer and hydride technique, in the water used for the research was below the permitted values (Ni – 0.06mg/l; Cr – 0.11mg/l; Cd – 0.012mg/l; Pb – 0.19mg/l; As – 5.5.ppb; Hg < 0.5ppb). The objective was to assess the safety of examined lettuce for human consumption applying controlled conditions, among which most importantly-water aeration. The water used in the experiment contained human pathogens, which were found on the plant samples at the end of the examination period. Total coliform and fecal coliform count were analyzed using 3M Petri film test at the beginning of the experiment and at the end of growing period of 30 days.

Results of the experiment indicated that lettuce could be used in ecoremediation technologies for water quality improvement (root length – 20cm; plant top end length – 8cm; total biomass – 11.21g), but considering the presence of human pathogens in it, this lettuce would be a risk for human health. After growing period of 30days, the water used for growing lettuce had total fecal coliform count of 60 CFU/ml, which is less than at the beginning of the examination period (total fecal coliform count – 106 CFU/ml). Regarding the research results the future examination should assume investigation of transport mechanisms in lettuce of E.coli and other human pathogens.

REDUCTION OF OCHRATOXIN-A LEVEL IN WINES BY APPLYING APPROPRIATE CLARIFICATION METHODS

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Ochratoxin A (OTA) is the most abundant and the most toxic among ochratoxins. The International Agency for Research on Cancer has classified ochratoxin A as a possible human carcinogen (category 2B). The occurrence of OTA in wine samples has been reported in various studies predominantly dealing with European wines but also with wines of other regions. Generally red wines seem to contain a higher amount of OTA than white or rosé wines, and some results suggest, that at least for European and North African cultivation areas, southern regions are more affected by the contamination problem.

The aim of the present work was to investigate the change of OTA content during wine clarification methods, using artificial contamination of wine samples with OTA of higher than 98% purity. Different concentrations of OTA combined with different sort of wines (white, rosé, red) were applied. Our experiments were carried out in laboratorial as well as in industrial scale, and demonstrated significant reduction in the level of OTA content in must and wine after different wine treatment (clarification) processes. Sample collections and preparations were carried out systematically, the prepared samples were analyzed by HPLC-MS and by HPLC.

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STUDY OF STABILITY OF VITAMINS, AS CRUCIAL FUNCTIONAL FOOD COMPONENTS, AS WELL AS PARAMETERS AFFECTING THEIR STABILITY

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There has been increasing interest in recent years for healthy life styles, especially the intake of antioxidants, vitamins and food supplements. Variegate alimentation and the intake of essential nutritive are necessary for health-preserving. The role of vitamins is inevitable in our life but the low consumption of fresh fruits, vegetables causes declination in the amount of vitamins in the human body thus biochemical processes (the metabolism, the energy transport and the renewal processes) can not work properly. In Hungary the majority of mortality can be attributed to illnesses relating on the inappropriate alimentation. The fact is that the reduction of the related chronic and non- infectious diseases can not reach without the changing of the eating habits.

The demand the appearance of food products on the market that have positive health effects and contribute the preservation of our health is on the rise. Healthy lifestyle becomes more and more popular as well as the role of the functional food products in the healthy diet the economically well developed countries. The functional food has got traditional appearance; some of the ingredients have special nutritive and/or physiological benefits beyond the traditional characteristic of the basic food. As a result of this, it promotes the prevention of diseases, improves the physical and mental condition as well. Its positive health effects have to be scientifically justified.

The aim of our investigation to establish the conversions and determine the lifetime of the chosen vitamins, which are very important for functional product development, by modeling different technological conditions like temperature, pH, matrix-effect. By the obtained results we can estimate the optimal storage circumstances and the appropriate technological conditions during the food processing in order to preserve as much vitamin as possible. Thus storage life of vitamin enriched foods can be estimated from the viewpoint of the efficiency of bioactive components.

POSSIBILITIES FOR THE USE OF PLANT OILS IN FERMENTED SAUSAGES PRODUCTION

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Fermented sausages in Europe are mostly made from pork meat and backfat, and may contain over 40% of fat, which has unfavourable ratios of polysaturated/saturated (PUFA/SFA) and ω-6/ω-3 fatty acids. As pork backfat affects sensory characteristics, it can only be partly substituted by an oil rich in PUFA and ω-3 FA. To prevent PUFA oxidation, pre-emulsified or encapsulated oil can be added.

Three batches of fermented sausage were made: control (C – 75/25 meat/backfat ratio) and two variants (20% of backfat was substituted by grapeseed oil): variant 1 (var1) with pre-emulsified oil and variant 2 (var2) with encapsulated oil as microspheres. pH (days 2, 7 and 15), basic chemical composition (days 0 and 15), colour, texture profile analysis (TPA) and sensory evaluation (day 15) were monitored. Single-factor analysis of variance was used ($P<0.05$).

pH value changes were similar in all variants, reaching minimum 5.08–5.16 (day 2) and values 5.21–5.35 (day 15). As for basic chemical composition, there was a significant difference in moisture content between variants C and var1 with respect to var2 (day 15). Colour measurements showed a significant difference in terms of lightness (L* – var1 and var2), redness (a* – var2 and C), yellowness (b* – in all variants). As for TPA, the most pronounced differences were observed in terms of hardness and chewiness; the highest were in var1 and 2–4 times greater when compared to C and var2. Sensory evaluation showed no differences in terms of appearance, cut appearance or colour. In terms of odour and taste, the best graded was var2. The texture of var1 was graded significantly lower than the other two variants.

Backfat can be substituted with oil prepared as illustrated in the experiment, though with certain corrections primarily because of texture. More research is required in order to monitor the changes in observed parameters during storage.

THE INFLUENCE OF WHEY PROTEIN CONCENTRATES AND ULTRASOUND TREATMENT ON CHARACTERISTICS OF SET-STYLE YOGURT MADE FROM GOAT'S MILK

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Due to the specific composition of goat's milk (smaller casein micelles, different attitude of casein fractions, smaller milk fat globules) there are difficulties in the production of set-style yoghurt with required consistency. In order to obtain desirable consistency increase of total solids non fat content is required. Furthermore, some new processing techniques, such as ultrasound can be used to obtain satisfactory rheological properties.
In order to improve rheological properties of yoghurt made from goat's milk, the influence of ultrasound treatment and whey protein concentrates on these properties was investigated.
Set-style yogurt was prepared of goat's milk supplemented with 1% WPC. Milk was treated by ultrasound for 10 minutes at 35 kHz/200W (sample B) and 35 kHz/400W (sample C) prior to inoculation. As a control, goat milk's set-style yogurt was produced by standard treatment (sample A).
Physico-chemical properties and viscosity of produced yogurt samples were investigated on the 1st, 7th, 14th and 21st day of storage.
During storage there were no large changes in chemical composition of yogurt samples, except in the lactose content.
At the end of the storage period the highest values of pH and the lowest titrable acidity were recorded in samples B. Throughout storage period smallest syneresis was found in samples C. Also, the highest water holding capacity was recorded in samples C on 14th day of storage.
Results of viscosity measurements at constant speed of spindle rotation shown that the highest value of viscosity on the first day of storage had samples C, while samples A had highest viscosity on 7th, 14th and 21st day of storage.
It could be concluded that addition of WPC and application of ultrasound have significant influence on characteristics of set-style yogurt made from goat's milk, particularly with regard to better consistency, viscosity, WHC and syneresis.

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EFFECTS OF TWO DIFFERENT RESISTANT STARCHES ON SOME PROPERTIES OF LOW CALORIE COOKIES

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Resistant starch (RS) is functional food ingredient due to its potential health benefits. It increases faecal bulk, prevents colonic cancer, reduces the glycemic index, promotes the growth of beneficial gut microflora. Besides the health benefits, resistant starch has a bland flavor and improves the texture, appearance of foods. In this research two different commercial resistant starches (RSa and RSb) were used in cookie formulation with no added sugar. Instead of sugar in cookie, oligofructose, polydextrose, isomalt and sweeteners were used. RS is replaced with wheat flour at 0, 10, 20 and 30 % levels. In control cookies no RS were used. The effect of RS on low calorie cookie properties (thickness, diameter, spread ratio, hardness, color, ash, protein, fat and mineral content) were researched. RSb gave higher diameter and lower thickness compared to RSa. The moisture and ash content of cookies substituted with RSa were higher than other cookies. Protein content of the cookies decreased with all levels of RSa and RSb substitution. L*, a* and b* values of the cookies was significantly ($p<0.05$) affected by RSa and RSb substitution. Fe, K and Mn contents of the cookies decreased with two type of RS addition. 10% substitution levels of RSb gave similar sensory properties to control cookie samples.

Key words: Cookie, low calorie, resistant starch, sugarless

THE EFFECTS OF ULTRASOUND SOAKING ON LEGUME AND CEREAL SEEDS

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Ultrasound is a nonthermal food application with have growing interest and an alternative method for thermal food processing. This nonthermal processing used for drying, inactivating microorganizms, determination of food composition, soaking, cleaning, rapid extraction, determination of flour quality, reduction of oligosaccahride content of legumes, fermentation process of yoghurt and emulsifiying by some researchers in their studies. Soaking is an important preliminary step before cooking processes of legume seeds. In literature, ultrasound increased the absorption of water during the soaking and cooking by allowed water to penetrate the rice kernel. And also, decreasing the soaking and cooking time with this treatment have been reported before some researchers.

In this study, the effect of ultrasound soaking application on the protein content and color values of legume (common bean, soy bean and chickpea) and cereal (corn and wheat) seeds were investigated. Legumes and cereals were soaked for 6 min in an ultrasonic water bath. The color of seeds and their soaked samples was determined by measuring the L*, a* and b* values using a Hunter Lab Color QUEST II Minolta CR-400 (Minolta Camera Co., Ltd., Osaka, Japan). Protein content were determined by using standart method (AACC,1990).

Ultrasound soaking gave lighter color for soy bean and corn seeds compared to their raw seeds. When soaking with ultrasound, common bean, chickpea and wheat seeds showed more redness (a*) and yellowness (b*) color than their raw seeds, but soy bean and corn seeds gave less redness color. With ultrasound soaking, SI (saturation index) values of all soaked seeds were increased, except the soy bean seeds. Protein contents of raw seeds decreased with ultrasound treatment. Protein loss were variable as 17.9; 11.3; 11.7; 4.7; and 12.3 for common bean, soybean, chickpea, corn and wheat seeds respectively. Common bean had most protein loss in all legume and cereal seeds.

As a results ultrasound is an important application and alternative method for thermal food processing methods. So there is a need to study more about ultrasound application on food systems.

Keywords: Ultrasound, soaking, color, protein

IMPACT OF QUANTITY AND QUALITY OF GLUTEN ON HARD BISCUITS PROPERTIES

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Dimensions of individual biscuit pieces such as height, width and length thereof are a significant factor in the quality of hard biscuits. Provided that these dimensions are uniform, it would possible to apply an automatic packing of desired weights. Dimensions of hard biscuits largely depend on the quality of flour, which is closely related to the content and quality of gluten in the flour.
The object of this study was to analyze the impact of quantity and quality of wet gluten on the physical, chemical and on sensory properties of hard biscuits.
Three wheat flour samples T 500 containing 20, 22 and 24% of wet gluten was used in this study. The quality of flour samples in terms of granulation, ash content, moisture, acidity and amylolitic activity was equalized.
Production of hard biscuits was carried out under industrial conditions in the biscuit and cookies factory „Agrokomerc“ d.d. Velika Kladuša according to a standard recipe.
Measured were physical parameters (length, width, height and weight of the samples) as well as chemical properties of the biscuit samples. In addition to this, the sensory analysis of the samples was carried out.
Statistical analysis of the results obtained has shown that the quantity and quality of gluten had no effect on length and width of biscuit samples. Differences among the samples were statistically significant however in terms of height and weight. The minimum deviation in dimensions and weight of the biscuits comparing to manufacturing specifications were noted in samples produced from flour with 22% of wet gluten. According to the results achieved, this content of wet gluten is optimal for production of hard biscuits. Using this kind of flour in production of hard biscuits would require minimum adjustments in terms of recipe or technological parameters.

MAJOR MINERAL COMPOSITION OF THE OSMOTICALLY DEHYDRATED PORK MEAT IN SUGAR BEET MOLASSES SOLUTION

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Mineral composition of the raw pork meat and osmotically dehydrated pork meat in the solution of sugar beet molasses were investigated. Sugar beet molasses is an excellent medium for osmotic dehydration, primarily due to the high dry matter (80%) and specific nutrient content. From nutrient point of view, an important advantage of sugar beet molasses, as hypertonic solution, is enrichment of the food material in minerals and vitamins, which penetrate from molasses into the meat tissue. Pork has a high mineral content of phosphorus, selenium, sodium, zinc, potassium and copper. Variation in major mineral (Ca, K, and Na) content is mainly determinate by food processing. The aim of this study was to compare mineral content of raw pork meat and in molasses osmotically dehydrated meat in the goal of producing enhanced meat product refined by molasses minerals. Mineral composition in the examined meat were determined by ionic chromatography (Dioenex, Sumyvale, USA) after wet digestion 0.5 g of meat with 5.0 ml 65% HNO3 and 0.5 ml 35% HCl on the hot plate. No significant changes in Mg content in dehydrated and raw pork meat were found. K and Ca content were significantly increased, and Na content in dehydrated meat was 10 times higher. It can be stated, from results obtained, that sugar beet molasses solution affects treated pork meat samples concerning concentration of major minerals.

Keywords: major minerals, pork meat, osmotic dehydration

CAROB FLOUR ENRICHED GLUTEN FREE BREAD RHEOLOGY AND STRUCTURE

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Introduction

Celiac is an autoimmune disorder of the small intestine that occurs in genetically predisposed people. Sufferers cannot tolerate gluten, mainly found in wheat, rye and barley. The only effective treatment up to now is a life-long gluten-free diet. Commercially found gluten-free products present inferior quality compared to their wheat counterparts mainly due to their lower nutritional value.

The purpose of this study is the development of gluten-free products with high nutritional value. For this reason carob flour, rich in protein and fibers, was incorporated into bread dough.

Materials and methods

The basic ingredient for the production of bread was rice flour, which was partially substituted by carob flour in a percentage of 5%, 10% and 15%. The water in the various recipes ranged from 80% to 150% of the flour.

Chemical analysis of the gluten-free bread was conducted, in order to determine the protein, fiber and micronutrients content. Textural properties of bread were evaluated, such as the firmness and the relative elasticity of the crumb. Porosity values were estimated with stereopycnometer and image analysis. Mathematical models, which determine the dependence of textural properties and porosity on the concentration of carob flour and water content were developed. Micrographs were also taken using a Scanning Electron Microscope (SEM). Viscoelastic behavior of doughs was also evaluated performing creep and frequency sweep tests.

Results and Conclusions

The incorporation of carob flour in gluten-free bread leads to a final product with enhanced nutritional value. Carob protein absorbs high water amount in order for a bread with acceptable characteristics to be produced. Increasing the amount of water 10% and having constant carob flour content leads to 18% softer product. The amount of water also affects the number and size of the air cells. An increase of 10% in water content leads to an 8% increase in porosity values. The viscoelastic character of the dough was evaluated through rheological tests which showed that dough becomes significantly more viscous-like, when high water content is used.

The incorporation of carob flour as gluten substitute in breads results in bakery products with good functional attributes and improved nutritional value and can be proposed for a gluten-free diet.

A COMPARATIVE STUDY OF VARIOUS STRUCTURES OF GRINDING PROCESS ON THE HEAD BREAK SYSTEM

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Milling is the physical process of converting the endosperm of wheat kernel into flour. The first stage of the modern flour milling process is the break system, in which the wheat kernel is opened up and the contents released so that the endosperm may be separated from the bran. The aim of the study presented in this paper was to investigate effect of various structures of the head break system on the particle size distribution and ash content of the streams from the three break systems at the laboratory mill. The conventional milling break system (A), the break system with double high rollermills at B1 and B2 (B), the break system with debranning pre-treatment (C) and pre-break system pre-treatment (D) at the similar break release on B1 and B2 was compared. The lower coarse fraction (through 1000-µ and over 630-µ) yield, higher yield of other streams, higher ash content of common streams from three break systems and higher energy requirements for grinding has been obtained using double high rollermill. In the opposite of that grinding with debranning pre-treatment led to increase coarse fraction yield, decrease small fractions yield (including break flour yield) and decrease energy requirements for grinding but ash content of common streams was close to this one using double rollermill and was higher compared to conventional break system. The most effective break system structure was grinding with pre-break system pre-treatment (3-5 % break release through 1000-µm) in which yield of all fractions was close to conventional break system, but with insignificantly lower ash content of all fractions and energy requirements for grinding.

APPLICATION OF HIGH HYDROSTATIC PRESSURE TO DECONTAMINATE PICKLED CUCUMBERS FROM ESCHERICHIA COLI

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Introduction

High hydrostatic pressure is novel technology in the food process industry. Using pressures in the range of 100 to over 1000 MPa on packaged foodstuff opens possibility to inactivate microorganisms, as well as induce various chemical, textural and sensory changes in food. Treatment with pressures up to 600 MPa during few minutes (typically 5-10) at room temperature had no influence on nutritional and some sensory properties of pickled cucumbers, whilst ensures inactivation of pathogenic microorganisms in the final product.

Materials and Methods

100 g of cucumbers were pickled in plastic packaging using 300 mL of vinegar solution. Approximately 8 log CFU/mL of Escherichia coli were added to two different sets of samples. Packages were tightly sealed and treated with high pressures of 300, 400 and 600 MPa during 5 minutes at 22 oC. All samples were cooled immediately after treatment and subsequently microbiologically analyzed. Instrumental textural analysis of cucumbers was performed in which hardness and elasticity were calculated.

Results

In samples treated with 300 MPa, there was 2 log reduction in bacteria. Further increase in the pressure leads to even larger reductions, up to 6 log reduction at 600 MPa. However, hardness and elasticity of samples gradually degrade, and optimal pressure which allows retaining of quality of product appears to be about 400 MPa.

Conclusions

High hydrostatic pressure processing of pickled cucumbers proved to be viable method for elimination of the E.coli bacteria. 5 minutes of treatment with 400 MPa was enough to reach 4-log reduction in bacterial count and satisfy requirements for the food safety even when using very high inocullum. Up to this pressure there were minimal changes in the analyzed texture parameters.

DECONTAMINATION OF POULTRY MEAT WITH NEUTRAL ELECTROOKSIDYZING WATHER

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Durability of poultry meat is also dependent of microbiological contamination. During the slaughtering the surface of chicken carcasses can be often contaminated with intestinal contents. This is the main reason for contamination of poultry meat with Campylobacter spp. Neutral electrolyzed oxidizing water (NEOW) is a new generation biocide, which mainly operates on the abstraction of electrons from the environment, does not leave residuals on the surface and it is not needed to rinse. We tried to find out whether it can be used for rinsing of contaminated chicken carcasses and whether this could improve the durability and safety of food.

For our experiment we took parts of chicken carcasses from one flock randomly. We selected parts of meat with skin and without it. We selected control samples and samples that were treated with 5% NEOW. All samples were then packed into controlled atmosphere (70% N2 and 30% CO2) and stored at +4 °C. Samples were tested from first to tenth day of storage for total count and presence of Campylobacter jejuni and coli.

On average, the total count on the meat with skin was 80% lower after washing then without. The results suggest a potential use for NEOW treatment of chicken carcasses and parts of meat with the skin. We believe that with proper use of NEOW, extended shelf life of foods can be achieve as well as the reduction of the contamination with Campylobacter jejuni/coli. This could improve the microbiological condition of poultry meat and so reduce the possibility of alimentary infection of consumers.

BAKING OF POTATOES AT DIFFERENT OVEN TYPES; CONVECTIONAL AND STEAM ASSISTED HYBRID

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Potatoes baking at different types of ovens were studied with respect to some physical and chemical quality criteria of baked sample as a function of baking time. As well as convectional baking, steam assisted baking was utilized in the study. Steam assisted baking is a hybrid method combining the advantages of steam-baking and convectional baking. The shorter baking times provided with steam results in healthier products, with the constitution of harmful compounds at a minimal level.

The potatoes by steam assisted baking were produced in a hybrid oven having an inner steam generator. The steam generated from ~350 ml water was injected into the oven cavity totally five times, at five minutes intervals during the baking process. Potatoes baked in steam assisted (steam+forced convection/turbo) and convectional ovens for different baking times (20-70 minutes) was analyzed in the scope of this study. Moisture content, colour (CIE a* value), texture (hardness, N), sensory evaluation and acrylamide content were investigated. The results of natural and forced convection/turbo baking of potatoes were compared with steam assisted baking, statistically.

Acrylamide content of potatoes was found to be related to the oven type; where, the steam assisted oven baking resulted in minimum formation of this compound ($p<0.05$). The sensory points of the potatoes baked at different times was significantly different ($p<0.05$), for all baking ovens.

Keywords: potatoes; steam assisted baking; acrylamide

BAKING POTENTIAL OF SPELT CULTIVARS FROM ORGANIC FARMING SYSTEMS IN SERBIA

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Spelt (*Triticum aestivum* ssp.*spelta*) is an ancient bread-making crop which production declined over time as it has been displaced by modern wheat. Recently, however, it has undergone renewed interest as an "eco-alternative" to common wheat owing to its low nutritional requirements and suitability for cultivation in low-input organic systems. In Serbia, spelt grain production has no traditional base but it has been gradually increasing along with the spread of organic production. This paper examines several spelt cultivars available for Serbian farmers.

Three cultivars of spelt wheat grown in organic farming in the Province of Vojvodina (Serbia), harvested in 2010, were evaluated for breadmaking potential. The assessment of baking potential included the evaluation of indirect (protein content, gluten content, gluten index, falling number, rheological parameters) and direct indicators (bread and volume yield, crumb hardness and resilience).

The spelt cultivars had high protein contents (15.5-17.0%), very good wet gluten content (40-45%), and optimal falling number for bakery applications. Two cultivars showed high gluten index. However, one cultivar exhibited good rheological properties (A2 quality group) and high deformation work whereas others were inferior and showed lower dough stability and higher softening. Bread yields were in the range usual for standard wheat breads (132.32-135.54 g). Volume yields ranged between 322.29-486.32 cm3 and were lower than for standard breads. The spelt cultivar with better rheological behavior gave bread with satisfactory volume, softer and elastic crumb, good porosity and pore fineness.

SUNFLOWER OIL PRODUCTION BYPRODUCT AS A RENEWABLE ENERGY SOURCE

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Food and agricultural production often leads to generation of various types of by-products. The same is with sunflower oil production. Sunflower is a crop that is widely grown in Serbia, as well as in the world mainly for edible oil production, and sunflower shell is a by-product which is generated through this production. It is in accordance with European regulative to find an ecologically friendly way of disposal for this kind of waste. Sunflower shell falls in the category of biomass and can be used for energy generation. The most common way to utilize biomass for energy generation is by combustion. In this study sunflower shell was investigated as an energy source, and it was pelleted in order to achieve better energy conversion and combustion characteristics. The optimal conditions of pelleting process were determined, such as granulation of the material, conditioning temperature and optimal water content in the material for pelleting. When the material is well prepared less energy is consumed during pelleting process.

The aim was to analyze energy and combustion properties, as well as physical and chemical properties of pellets made from sunflower shell. Sunflower shell had satisfactory characteristic as a biomass fuel, although its pelleting required a lot of energy, and the pellets had poor abrasion characteristics (around 7-14%). The heating value was around 19.00 MJ/kg, and the volatile matter just above 70%. These values are mostly in accordance with European fuel pellets standards, with some minor aberrations for some of the properties. Since these standards are manly for wood, and wood-residue pellets, lower criteria could be applied for agricultural biomass pellets, such as spelt pellets. Basic chemical and ultimate analyses of sunflower shell were in accordance with literature data for biomass samples, and low level of sulphur were detected (< 1.00%).

BRIQUETTING AS A WAY OF UTILIZATION FOR WASTE BIOMASS

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Technology briquetting is the process by which the crushed material under high pressure into a compact form of high density. Because of the variability of biomass consisting of: wheat, barley, oat, rye straw, maize, oilseed straw, sunflower stalks and remnants of shells, fruit and pruning of vineyards, forest biomass, waste wood in wood processing machine consists of a complex technological process of production of briquettes. Contemporary machine-technological solution for the biomass briquette plant is a complete solution that comprises following processes: collection, transportation, drying, grinding, briquette, and storing and product delivery. Process of transferring biomass into briquettes has a significant positive contribution to environment protection.

Key words: briquetting, biomass, environment protection

EXTRUSION PROCESS TECHNOLOGY FOR FEED AND FOOD USED IN ANIMAL NUTRITION

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Deficit of food for population that grows every year, significantly makes the food production a very important problem the world and in Serbia. The solution to increase the feed and food production is in the usage of new technologies, technologies in biotechnology, actually in bioindustry. One of the main features of contemporary agriculture is production of feed of high nutritive value and microbiologically safe feed in sufficient quantities. The most important feedstuffs that are used in animal nutrition like cereals and other grain – soybean, rapeseed, corn, barley and sorghum, beside nutritive substances contain certain antinutritive substances, that represent limiting factor of their usage. Many antinutritive substances can be eliminated or significantly reduced with the usage of adequate heat treatments. The aim of this study was to collect, display and interpret the results, achievements and latest world science and technology trends trough application of contemporary technical and technological processes of feed processing. With the application of the latest heat treatment, such as extrusion, it comes to destruction of antinutritive substances and improvement of nutritive, hygienic, physical-chemical and other feed properties. The usage of processing technology such as extrusion is certainly one of the most important alternatives for feed and food production which by its high nutritive values can fulfill high demands of modern nutrition.

Key words: feed, heat treatments, extrusion, animal nutrition

COMPARING DIFFERENT COMMERCIAL FENUGREEK GALACTOMANNANS FOR THE PRODUCTION OF EMULSIONS WITH HIGH INTENSITY SONICATION. EFFECT ON PHYSICAL STABILITY AND RHEOLOGICAL PROPERTIES

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Introduction

This study aims at the potential substitution of common stabilizers (locust bean, guar) in salad dressing products with fenugreek galactomannans for nutritional and financial reasons.

Materials

High intensity sonication (20kHz, 4min, 70 and 90% amplitude) was used to prepare secondary whey protein model submicron emulsions (pH ~4). Primary emulsions were prepared with a high shear device contained 2.7wt% whey protein isolate (WPI), 20wt% olive oil and four different types-fractions of commercial fenugreek gums (FGA, FGB, FGH and FGD) at 0.25 and 0.5wt% concentration.

Results

Fenugreek gum fractions differ in galactomannan and protein content. All emulsions where stored at 5oC and their physical stability was evaluated for 10 days by using a multiple-light scattering method. The galactomannan content and viscosity of 1% gum solutions for FGA, FGB and FGH follows the trend FGH>FGA>FGB, while the protein content is FGB>FGA>FGH. FGD is a debittered fraction, not exhibiting any unpleasant (spicy) odor or bitter taste. We observed that at low gum concentration (0.25wt%) the stability of emulsions containing FGA, FGB, and FGA fractions followed the trend FGB>FGA>FGH, while at higher concentration (0.5wt%) the trend was changed to FGH>FGA>FGB. This suggests that at low concentrations the stability is governed primarily by the gum protein content, while the gum solution viscosity is a major factor at higher concentrations. This phenomenon was confirmed by preparing 0.5wt% gum emulsions in the absence of WPI (whey was replaced with citrate-phosphate buffer solution), which were observed for 20min. FGB emulsions had higher back-scattering value and it was reduced in a lower rate with time in comparison to FGA and FGH. At 0.25wt% gum concentration, FGD emulsions were the least unstable of all (Serum index, SI=17.6%). The effect of sonication on the viscosity of 1wt% gum solutions was evaluated. Steady stress flow curves of sonicated gum solutions revealed that ultrasonic treatment significantly reduces their viscosity. Finally, the effect of gum type and concentration on oil droplet size is further discussed.

Conclusions

Crude fenugreek gum (FGB) could be used at low concentrations to effectively stabilize products like salad dressing.

REVEALING PLAUSIBLE REACTION PATHWAYS OF MAILLARD REACTION IN LYSINE FORTIFIED, PATENTED BAKERY PRODUCTS

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More and more people look for products with positive physiological effects which may contribute to the preservation of their health. Therefore EGERFOOD RKC develops and introduces new functional foodstuffs into the market in order to satify the rapidly groving demands of conscious customers. One of these functional food is a biscuit prepared with lysine and selected saccharides in order to achieve the maximally available antioxidant capacity. Antioxidant feature of the biscuit is basing on the Maillard reaction, the reaction of carbohydrates and proteins during the baking process.

The key point of the study is the analysis of the Maillard-reaction products with high antioxidant-activity formed by the reaction of carbohydrates and proteins. Our object was to acquire an extended pathway by the identification of the Maillard reaction products (MRPs), generated during the thermal treatment of selected saccharides and lysine. Diverse saccharides and baking temperatures were applied in order to optimise the most appropriate circumstances for the generation of MRPs with the highest antioxidant activity. MRPs were analyzed with GC-MS and HPLC-MS methods, antioxidant activity was also tested, while the residue of lysine after Maillard reaction was also determined. The chemical structures of 28 products, involving Shiff-base, Amadori-products and other melanoidines have been characterised. The transformation processes of saccharides and lysine have been revealed and a reaction pathway has been proposed. Most of them are responsible for the outstanding antioxidant activity of the bakery products. Thanks to the results, a new functional bakery product was developed by our research team with unique composition of Maillard transformation products and enhanced antioxidant activity.

IV PACKAGING AND SHELF LIFE, PRODUCT DESIGN

TECHNICAL AND PHYSIOLOGICAL ISSUES IN APPLICATION OF NOVEL POSTHARVEST

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Controlled atmosphere (CA) storage of apples is widely used in order to diminish physiological disorders and retain fruit quality. According to consumers preferences, firmness, aroma, acidity and freshnes are main quality attributes that could be preserved during storage and shelf life. Nowadays ultra low oxygen (ULO, 1,2 kPa O2, 1,3 kPa CO2) and dynamic controlled atmosphere (DCA; 0,5 kPa O2, 0,7 kPa CO2) are used in apple storage technology. While ULO storage is well known and regularly applied, DCA is regarded as novel postharvest technology. DCA uses chlorophyll fluorescence signals that are sensitive to gas levels in fruits to adjust O2 level in storage atmosphere according to physiological state of fruit. Since chlorophyll fluorescence highly correlates in response to low-oxygen stress, this technique proved valid to monitor DCA storage.

Another widely used technique to reduce metabolic rate of apples is application of ethylene inhibitor 1-methylcyclopropene (1-MCP). 1-MCP is known to preserve well fruit firmness, colour, acidity and freshness but greatly reduces total aroma compounds. Comparing the effectiveness of DCA and 1-MCP DCA proved to be better choice with regard to total aroma. The main drawback of DCA is that chlorophyll fluorescence is not always reliable due to fruit season variability and because only limited number of fruits are monitored. On the other hand, 1-MCP and DCA proved to be effective alternative to application of some phytochemicals to prevent scald.

For organically grown apples, physical treatment with hot water has been shown to be effective for the controll of microbiological decay, controll of superficial scald and reduced sensibility to chilling injuries. Application of novel postharvest technologies may alter some physiological responses of fruit and may provoke the appearance of new storage disseases. As observed in commercial storage houses, application of 1-MCP alter the response of fruit toward CO2 concentration in storage.

CHARACTERISTICS OF PACKAGING MATERIALS FOR SPECIFIC PACKAGING CONDITIONS OF MEAT AND OSMOTIC DEHYDRATED MEAT

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Packaging materials with different properties affect the quality and sustainability of the meat and meat products. Improvement of the protective effect of applied packaging materials can be achieved by selecting appropriate conditions of packaging (vacuum, modified atmosphere and the latest trend is active packaging). The aim of this study was to investigate characteristics of polymer materials and discuss if they meet the requirements of vacuum or modified atmosphere packaging. This paper presents comparative results related to combinations of materials usually used in meat industry, obtained by different methods of production (laminating, extrusion laminating and co-extrusion). Physical, mechanical, structural and barrier properties are determined: thickness, determined using micrometer; tensile strength (MPa) and elongation at break (%), determined at device for testing the tensile properties; the structure of polymers, using FT-IR Spectrometar; water vapour permeability, by gravimetric method and the permeability of gases, using gas chromatography method, according to Lyssy, DIN 53380. The results showed that monomaterials pass their good properties on multilayer materials. In terms of mechanical properties uniformity is observed. Mechanical characteristics are related to the thickness of the sample. Significant differences in barrier properties were obtained. Among multi-layer composition PE/PET (80μm), air permeability was 118.5 ml/m224h, and in case of PA/PE film (85μm) permeability was 23.1 ml/m224h. The lowest permeability value was recorded in case of multi-layer foil type PVC//PE–EVOH-PE (65μm), in which the measured value of air permeability was 3.6 ml/m224h. Multi-layer materials containing barrier materials (PA, EVOH) and being produced by co-extrusion process have better barrier properties. Better barrier properties in terms of gas and water vapour permeability along with modern packaging conditions (vacuum and MAP), better is protection for packed meat and meat products.

QUALITY CHARACTERISTICS OF CHICKEN MEAT ENRICHED DRIED BAGUETTE SLICES DURING STORAGE

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In this research, quality characteristics of enriched and dried snacks were studied during three months storage period. White and whole wheat flour mixture blended with chicken meat and chicken meat powder for producing protein enriched baguettes. These enriched baguettes were sliced into 5 mm thickness and dried at 190°C to develop a new functional savoury snack. Snacks were packed under 100% N2 atmosphere with a package material having opaque lacquered PET (12µ) on the upper layer, metalized OPP (20 µ) in the middle layer and PE-EVA-PE (58 µ) mixture at the inner layer and stored at ambient condition for 90 days. Starting from the first day of storage, all quality parameters were analyzed 15 days of intervals. During storage moisture, water activity, pH, TBA and texture values of snacks were found significantly different for all four types of snacks ($P<0.05$). L (brightness) values were changed significantly ($P<0.05$) during 90 days and it is clear that all snacks had lightest colour on the last period (day 90). Sensory evaluations of enriched snacks were conducted using the hedonic test and the results were tested using one-way ANOVA Tukey test. According to hedonic test, 10% chicken meat enriched white flour snack had the highest score among all samples ($P<0.01$).

Keywords: Snack, enrichment, baguette, dried baguette, storage.

SURVEY OF OVERALL MIGRATION IN DIFFERENT KIND OF LACQUERS IN METAL PACKAGING

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Metal cans as an economic and useful packaging usually have a polymeric coating, and it is possible that different compounds transfer from this coating to foodstuff. If this transferring includes known and unknown compounds, it will be known as total migration. In this study total migration caused by metal can polymeric coatings in food stimulants, is investigated. Investigated metal can liquor coatings, were from golden phenolic epoxy kind, beige phenolic epoxy kind, and white Andric epoxy kind, obtained from four metal can producer factories and 10% ethanol and 3% acetic acid was used as simulant. The method which used in this study is to gravimetric determination of total migration. This study showed that total migration ranges obtained from golden phenolic epoxy, beige phenolic epoxy, and white Andric epoxy liquors are around 2-4.2 mg/dm2, 1.65-4.9 mg/dm2, 2-4.2 mg/dm2 respectively. All migration levels in study samples were below European Union (EU) standard permitted amounts.

APPLICATION OF TPS IN PROCESSING OF BIODEGRADABLE PACKAGING MATERIALS

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Due to environmental considerations native and modified starches are now attracting increased attention as raw materials in the production of biodegradable plastics. The interest to use starch as a basis for packaging material originates to the 1970's when environmental awareness increased drastically. Since then a steady development of new products can be seen. The possibility to compete in price with traditional materials, like plastics, has always been indispensable for the general acceptance of these new materials.
Starch biodegrades to carbon dioxide and water in a relatively short time compared with most synthetic polymers. Considering some drawbacks of the existing technologies of biodegradable materials manufacture, in the recent years there have been started large-scale researches to increase amount of starch in starch-plastic composites to the highest possible level. The final objective of these investigations is to obtain commercial items for one-time use, produced from pure starch and to exclude synthetic polymers from the formulation. Thermoplastic starch (TPS) seems to be a perfect solution because it can be processed with conventional technologies used in synthetic plastic manufacture as extrusion and injection moulding (Souza & Andrade, 2002; Guan & Hanna, 2006; Janssen & Moscicki, 2009).
To obtain TPS, thermal and mechanical processing should disrupt semi crystalline starch granules. As the melting temperature of pure starch is substantially higher than its decomposition temperature there is a necessity to use plasticizers, for example water. Under the influence of temperature and shear forces, disruption of the natural crystalline structure of starch granules and polysaccharides form a continuous polymer phase is reported. To increase material flexibility and improve processing other plasticizers are also used, e.g. glycerol, propylene glycol, glucose, sorbitol and others. To improve the mechanical properties of TPS based materials also other additives can be applied, like emulsifiers, cellulose, plant fibers, bark, kaolin, pectin and others (Janssen & Moscicki, 2009).
Since years in the Department of Food Process Engineering of Lublin University of Life Sciences (PL) we joined forces to develop starch-based biodegradable packaging materials with physic-chemical and mechanical properties, handling, shape and cost of the end-product that must be competitive with the conventional stable and non-degradable plastics. The main results of these investigations as well as other important information concerning TPS and its biodegradability are discussed in the paper.

NEW BIOMATERIAL BASED ON PUMPKIN OIL CAKE PROTEINS

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In recent years, the development of biodegradable materials from renewable resources with excellent mechanical and barrier properties has been an important research challenge for the plastic industry. Protein-based biodegradable films was found to be superior as gas barrier and mechanical properties compared with lipid and polysaccharide films (Ou et al., 2005). Still, natural mixtures of polysaccharides, protein and lipids, which can be obtained in the form of flour, cake or straw from raw materials of plant origin such as cereals, legumes and oil seeds, can be used to produce films with improved characteristics (Tapia-Blácido et al., 2011).

In this work, the production of the new biodegradable films from pumpkin oil cake (PuOC) and PuOC protein isolate (PI) was presented. Also, properties of obtained films were compared. To examine the ability of film formation, film-forming solutions (PuOC and PI) were prepared varying pH in the range from 2 to 12. Films based on PI were successfully made at pH=2, 3 and 9–12, when the 0.4 and 0.5 g glycerol/g PI were used. When films were made from PuOC, glycerol amount was set on 0.25g/g PuOC, but temperature was varied from 50 to 90°C. Films based on PuOC were made at alkaline pH (9 to 12), at all examinetd temperature. However, the highest employed temperature gave the maximum benefit to the film characteristics. Comparing the mechanical properties, obtained by Instron 4301, it was observed that PuOC films have approximately 10 times higher values of TS then PI films, while PI films showed 6-7 times higher EB. Films made of PI also had better gas barrier properties (analysed by isostatic gas-chromatographic method).

PuOC and PI were successfully employed to produce novel edible films. The impact of pH of the film solution was significant on film formation and film's characteristics. Due to different composition of film-forming solutions, films made of PuOC and PI had different properties.

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SHELF LIFE EXTENSION BY HIGH PRESSURE OF A VEGETABLE BASED MEDITERRANEAN DELI SALAD

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Several traditional Greek deli salads are based on a mayonnaise emulsion with a variety of ingredients mixed in, including vegetables such as eggplant, carrots, potatoes, traditional pasta components and herbs and spices. In the aim to replace mayonnaise as the basis of an innovative, fresh, ready-to-eat, prepackaged salad, named 'Green Mediterranean Deli-salad', corn, carrots, cucumbers, peas, capers and Aloe Vera and lemon juices were combined into an emulsion like homogenized avocado puree. All above ingredients were of Greek organic agriculture. The product was vacuum packaged in transparent, polypropylene containers.

The objective of developing a commercially viable non mayonnaise based, vegetable deli salad with fresh-like quality and extended shelf life was achieved with the use of in pack High Pressure (HP) non-thermal processing, targeting on microorganisms and enzymes inactivation while maintaining the nutrients and sensorial quality of the food. The main quality deterioration factor for avocado-based products is the enzymatic browning attributed to polyphenoloxidase (PPO). Control of PPO activity is prerequisite for product stability through time.

After refining the formula of the product for final texture, flavour and quality, it was HP processed at pressures ranging from 100-800MPa and process times from 2 to 30min to allow for optimal HP conditions selection. Based on sensory evaluation and colour degradation of the processed samples, the conditions selected were 600MPa for 15 min. Adequate microbial and enzyme inactivation was measured at these conditions, while texture and flavour were maintained. Shelf-life experiments were conducted at temperatures from 0 to 15ºC. Based on all quality indices monitored and modeled with time, the shelf life of this product was estimated as 72, 45, 20 and 7 days for storage at 0, 5, 10 and 15ºC, respectively.

A superior product with commercial stability addressed to European markets was developed, based on the healthy image of avocado and Aloe Vera and other organically grown Mediterranean ingredients.

REPLACEMENT OF CONVENTIONAL RIPENED CHEESE COATINGS BY NATURAL WHEY PROTEIN EDIBLE COATINGS WITH ANTIMICROBIAL ACTIVITY

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Packaging and food industries made efforts to reduce the amount of residual waste associated with food consumption, in particular by developing edible packaging materials. Whey protein edible films and coatings have already proven to be successful in some food applications. Their ability as carriers of antimicrobials, antioxidants or nutraceuticals, associated to their primary barrier and mechanical properties as packaging films, are very attractive for commercial applications.
Our goal was to assess the effectiveness of antimicrobial whey protein edible coatings in cheeses by evaluating their physicochemical, microbiological and sensorial properties during 45 days of ripening compared with uncoated cheese and cheese coated with conventional commercial products.
Three different methods of coating formation were assessed (protein thermal denaturation, UV polymerization and both simultaneously). Natamicin and lactic acid were used as antimicrobial agents in coatings formulations.
Physicochemical evaluation showed that water loss, hardness and color changes decreased in coated cheeses. The coating produced simultaneously by the thermal denaturation and UV polymerization method revealed the best performance in the aforementioned results. No differences were found ($p > 0.05$) between cheese samples bearing edible or commercial coatings in terms of weight loss, moisture, fat and salt contents, as well as aw, pH and hardness, what reveals that the antimicrobial edible coatings applied, could be used as an alternative to their commercial counterpart(s).
Microbiological analysis proved that the antimicrobial edible coatings prevented growth of Staphylococcus spp., Pseudomonas spp., Enterobacteriaceae, yeasts and molds which demonstrates their ability to assure the safety of cheese for, at least 45 days of storage. In fact thermally denatured and UV polymerized coatings were the ones that showed less growth due to the synergetic effect of antimicrobial and UV light.
With regard to sensorial analysis, the cheeses with the antimicrobial edible coating were the most accepted by the panelists at the end of the ripening period.

MECHANICAL PROPERTIES OF TPS FILMS

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Nowadays the leading product in food packaging is a plastic film, whose main ingredients are, inter alia, polypropylene and polyethylene - totally not decompose in the environment. The solution to the problem of disposal of such packaging is the use of biodegradable plastics in the environment through chemical transformation of photochemical or biological means. The scientists are looking for materials that are both durable and degradable to become an alternative to plastics.

Mechanical properties of the thermoplastic starch (TPS) films, enriched with the emulsifiers were conducted in the laboratory of Food Process Engineering Dept., Lublin University of Life Sciences. TPS was processed by extrusion-cooking in the modified single screw extruder type TS-45 (Polish design), using a potato starch, a glycerol, and emulsifiers: keratin, polyvinyl alcohol and linseed oil.

The process of the film blowing was performed on a specially designed laboratory plastic extrusion line (L/D = 24, produced by SAVO, Poland). TPS pellets were processed at the temperature range 59 - 128 ° C (along the barrel), at constant screw speed of 70 rpm, which allowed to obtain the film sleeves with a diameter of 150 to 700 mm, and thickness from 0.15 to 0.6 mm, depending on TPS composition.

The strength of TPS films was carried out using the material testing machine Zwick/Roell type DO-FBO.5TH (Germany) to measure: the maximum stress , the strain at break and the longitudinal elongation at break, transversed to the direction of the film extrusion.

The obtained results of the measurements confirmed the usefulness of potato starch films as a competitive packaging material, whose physical and mechanical properties are more or less similar to those of the conventional polyethylene films.

THE INFLUENCE OF PACKAGING MATERIALS ON THE QUALITY OF GOOSEBERRIES DURING STORAGE

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The quality of berries during storage could be influenced by using different packaging technologies and materials. The aim of this research was to investigate the effect of some packaging materials to the chemical, physical and microbiological parameters in gooseberries during storage time.
Two varieties of gooseberries ('Kolabok' and 'Lielas dzeltenas') were analysed. 'Kolabok' berries are medium-size with dark red colour skin. 'Lielas dzeltenas' berries are also medium-size but with yellowish- green skin and pulp colour. Berries were harvested in full maturity stage.
Samples of berries were packed in hermetically sealed biodegradable and home compostable NatureFlex NVS (INNOVIA) transparent cellulose film and breathable AgriFresh 35 PB film pouches, as well as in biodegradable PLA containers with lids, and stored in refrigerated camera in +8±0.5 C temperature. The quality parameters where analysed before packaging and during storage in the 4th, 7th, 11th and 13th day. The control sample was packed in PP containers with holes.
The results show that the chemical composition of the berries varied depending on the packaging material was used as well as the changes of composition influenced by the variety of gooseberries. The content of anthocians in berries of variety 'Kolabok' during storage has decreased. The highest content of anthocians was preserved in control sample. Changes of carotenoids were insignificant; with the exception of sample packed in AgriFresh 35 PB where during storage of five days the content of carotenoids was preserved significantly higher. The content of polyphenols and DPPH activity during storage has changed slightly and moderate positive correlation between tested parameters was determined. It could be concluded that influence on the changes of chemical properties by used packaging materials was insignificant, while other parameters like hardness and microbial safety have changed more considerably.

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EFFECT OF CONTAINERS AND PACKAGING ON THE QUALITY OF PASTRY AND BAKERY PRODUCTS

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Alterations in quality of food during storage in most cases have negative effects on sensor and biological values of products.
Packaging must maintain the quality of a product unchanged from the moment of packing until consumption. Barrier properties of packaging materials are very important for this purpose. These properties must protect the products from the effects of the environment such as air, especially oxygen, which may cause oxidation of some product components when exposed to the light.
Depending on the moisture content, bakery products show various signs of aging. Products with higher initial content of moisture, which are soft inside when fresh, lose elasticity and harden during aging with undesirable changes of smell and taste. Flour products with low initial content of moisture absorb the ambient moisture during aging, they soften, become sinewy and stale. The problem is also microbiological contamination of bakery products, particularly molds which are most often causes of deterioration of this group of products.
The paper gives a review of the research results on sustainability of pastry and bakery products. Wheat flour T-500, wheat semolina, toast bread and croissants were tested, i.e. durability of these products was controlled in their standard packaging. The obtained results indicate that packaging used during this research did not affect the sustainability of the tested products. They also showed that the right selection of packaging and determination of optimal procedure of packaging and bagging of pastry and bakery products assured optimal period of durability of these products and did not shorten it.

Key word: containers, packaging, wheat flour, wheat semolina, toast bread, croissants

INFLUENCE OF STORAGE ON ANTHOCYANINS AND POLYPHENOLS OF RASPBERRY CREAM FILLINGS WITH ADDITION OF SUGARS AND MODIFIED STARCHES

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Anthocyanins are very unstable pigments but their stability can be improved by addition of different additives. Chemical compositions, technological process of production and different food additives have influence on anthocyanins and polyphenols of food. Starch is used as additive in many foods for improving of rheological properties and gelling. Natural starch is not suitable for application in many foods because of retrogradation, syneresis and low stability. Because of above mentioned, modified starches are in use. This paper deals with an influence of storage on anthocyanins and polyphenols of raspberry puree with sugars and modified starches addition. Samples were prepared only with addition of sugars, and with addition of sugars and modified starches. All of purees were put in the bottle and pasteurised on 85°C within 15 minutes. Pasteurised purees were stored at room temperature. Pasteurised cream fillings were stored at room temperature within 16 months.

During storage at room temperature significant decrease of anthocyanins and polyphenols were occurred. Comparing samples only with addition of sugars, trehalose had the biggest impact on anthocyanin and polyphenol content, while samples with addition of sucrose had the lowest anthocyanin and polyphenol content. Samples with addition of sugars and modified starches showed the same tendency. Comparing addition of modified starches, samples with waxy maize modified starch addition had higher anthocyanin and polyphenol content in comparison to samples with tapioca modified starch addition. Our results showed that interactions between ingredients of food matrix play an important part in retention and stability of anthocyanins and polyphenols in stored raspberry cream fillings.

INFLUENCE OF STORAGE ON AROMA COMPOUNDS OF RASPBERRY CREAM FILLINGS WITH ADDITION OF SUGARS AND MODIFIED STARCHES

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Aroma compounds are very important for fruit quality. Knowledge of its stability is of great importance, since it helps to predict the shelf-life of products, and technological processes in order to make more consumer-friendly products. This paper deals with an influence of storage on aroma compounds of raspberry cream fillings with sugars and modified starches addition. In this study different sugars (sucrose, fructose and trehalose), and modified starches (tapioca and waxy maize modified starches) were used for raspberry cream fillings preparation. After preparation, samples were stored at room temperature in dark within 16 months. Measurements of aroma compounds were conducted after 8 and 16 months of storage.

Using gas chromatography-mass spectrometry (GC/MS) and SPME sampling technique it was determined twenty-five ingredients in the raspberry cream fillings, divided into five groups: volatile acids, carbonyl compounds, terpenoids, lactones and alcohols.

During storage at room temperature significant decrease of carbonyls and terpenoids were occurred. Only acid content increased within 8 and 16 months of storage. Addition of sugars (both individually and in mixtures) in the raspberry cream fillings showed no significant impact on retention of aroma compounds. Modified starches addition in samples with sugars increased the content of carbonyl compounds, terpenoids and lactones. Acid content was significantly less with added sugars and modified starches. Comparing addition of modified starches, samples with waxy maize modified starch addition had higher aroma retention in comparison to samples with tapioca modified starch addition. However, cream filling with addition of sugar mixture, sucrose and trehalose, in combination with waxy maize modified starch had the highest retention of aroma compounds.

Our results showed that small modifications (addition of different modified starches or partial replacement of sugar) of the food matrix composition greatly affected the aroma compounds of raspberry cream fillings, probably due to the interactions between the food matrix ingredients.

CHARACTERIZATION OF POLY(D,L-LACTIDE)/SILICA NANOCOMPOSITES FOR FOOD PACKAGING APPLICATION

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Polylactic acid (PLA) is recyclable and compostable polymer, with high transparency, good processability and water solubility resistance. The application of PLA polymer for food packaging was not possible, because of the poor mechanical properties, barrier and oxidative properties that are not suitable for this kind of application. Because of the small particle size and extremely high surface area, the incorporation of nanoparticles into a polymer matrix creates a great amount of interphase and changes the intermolecular interaction of the matrix. As a result, by incorporation of only small amounts (less than 10 wt%) of nanofillers, a polymer nanocomposite can exhibit markedly improved physical and mechanical properties. The goal of this work was to research the potentials of PLA /silica nano composites for food packaging application. Neat PLA and PLA with 0.2, 0.5,1 and 2 wt% of nanosilica were prepared by solution method in chloroform. Several procedures were used to experimentally characterize the PLA nanocomposite samples The size of the silica nanoparticles was measured by zeta nano sizer. Differential scanning calorimeter (DSC) was used to measure the Tg of the polymer nanocomposite samples with heating rate 10°C/min. Thermogravimetric analysis was performed for investigation of thermal stability of all samples in inert atmosphere at heating rate 10°C/min from 25°C to 600°C. Incorporation of nanoscale silica particles into PLA shows the improvement in both thermal stability and mechanical properties. As the applied method provides the improvements of PLA properties, it is a very good starting point for developing novel materials for food packaging appllication from renewable resources.

SHELF LIFE OF PATISSERIE PRODUCTS UNDER DIFFERENT STORAGE CONDITIONS

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The paper present part of a testing study about shelf life of patisserie product at a temperature that is greater than defined for that type of product. According to the "Regulations on general and special conditions of food hygiene at any stage of production, processing and transport (Official Gazette RS 70/2010)" study tests are conducted to determine compliance with the criteria of shelf life of products. One of the ways of checking compliance with the criteria is application testing capabilities for testing under different storage conditions. Defined temperature storage products were up to 100C, a part of the study included the examination of test microbiological and sensory changes at room temperature. The tests were carried out in accordance with a clearly defined plan for a period of eight months.

Examination included microbiological criteria that are commonly used for determining the microbiological and sensory testing of products in accordance with current methods.

By monitoring changes in the parameters of microbiological criteria, as well as sensory characteristics leads to the conclusion about the possibility of storing the product at room temperature at the stipulated time period.

Part of a study testing the shelf life of the product showed that the chemical composition of the product significantly affects the very viability of the product in defined conditions. Products that have had the same viability at a temperature of 100C showed a huge difference in viability at room temperature. On the viability of the product, in the changed conditions of storage, chemical composition of the finished product has a key impact.

SELECTION OF OPTIMAL THERMAL PROCESS PARAMETERS FOR THE PRODUCTION OF SEA BUCKTHORN BEVERAGES WITH HIGH ANTIOXIDANT ACTIVITY AND LONG SHELF-LIFE

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Sea buckthorn (Hippophaerhamnoides) is a unique medicinal and aromatic plant and belongs to the family of Elaeagnaceae. Sea buckthorn juice, derived from the sea buckthorn berries, provides a nutritious beverage, high in suspended solids and rich in vitamin C and carotenes. The juice may contain an oil phase trapped within the suspended solids, or it may be removed. In view of its highly perishable nature, sea buckthorn juice has to be processed in order to extend its shelf-life.

The objective of this study was to evaluate the effect of mild heat treatment on microbial behavior and the shelf-life extension of Sea buckthorn beverages during storage at temperatures from 5 to 20°C. Two different beverages were produced by mixing sea buckthorn juice with concentrated fruit juices from orange, apple and/or pomegranate. These beverages were evaluated through storage time.

Thermal treatments were applied at 60, 70 and 80°C for 1, 3 and 5 min. Total aerobic microflora and yeasts and moulds were enumerated through the whole storage period at appropriate time intervals. Total antioxidant activity was measured for produced samples. Organoleptic evaluation was performed before microbial analysis of all samples. The shelf-life of all beverages was determined based either on the growth of microorganisms or on the reduction of antioxidant activity, depending on the storage temperature.

All thermal treatments delayed the recovery and the growth of all studied microorganisms during storage. Higher thermal treatment resulted in slower growth rates of microorganisms, while simultaneously the antioxidant activity was significantly reduced after treatment. All the obtained results were kinetically described. The effect of temperature on the deterioration rates was studied.

The optimum process conditions were chosen based on the shelf-life extension which was estimated according to the higher antioxidant activity and the simultaneous lower microorganisms' growth rates.

WOUND-INDUCED RESPONSES DURING LOW TEMPERATURE STORAGE OF SHREDDED CARROT

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Fresh-cut shredded carrot processing involves peeling and cut operations. These stress conditions promote several metabolic pathways which lead to fast quality deterioration (physiological and microbiological). However, advantages can be drawn from the use of these stresses due to the related effect of phenolic synthesis induction. Wounding induces activation of vegetables defence systems to enhance the respective antioxidant capacity. Phenolic accumulation is dependent on several factors such as wounding intensity, initial concentration and storage time/temperature. Also known is the phenolic distribution along carrots tissues where higher concentrations can be found in peels. This study aimed to evaluate the effect of peeling and cut on the total phenolic content (TPC, Folin assay) of cv. Navajo carrot during low temperature storage. Whole and shredded samples (with/without peels) were placed separately in 4-L clear glass jars (closed and vented every 8 h to avoid CO2 accumulation) and stored for 7 days at 5 ºC. At day 0, when comparing peeled and unpeeled carrot samples (regardless of shredding) it was possible to observe higher phenolic contents (≈40%, $p<0.05$) in the latter ones. Wound-induced responses were shown to be dependent on storage time, since significant increases in TPC levels ($p<0.05$) were found from day 3 onwards. At day 7, TPC levels of 47.5 and 27.1 mg GAE.100 g^-1 were found in unpeeled and peeled shredded samples, respectively, corresponding to increases in TPC when compared to raw material ($p<0.05$; 21.2 mg GAE.100 g^-1). However, the similarity between increase rates of TPC in both shredded samples leads to the conclusion that peel removal does not compromise wound-induced responses and higher TPC values are exclusively due to peel presence. These results are of great importance to the fresh-cut technology since peel removal prevents accelerated microbial decay while allowing the production of high quality products with expectable longer shelf-lives.

EFFECT OF THE PACKAGING METHOD AND THE STORAGE TIME ON LIPID OXIDATION OF TRADITIONAL PETROVSKÀ KLOBÀSA SAUSAGE

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In this paper influence of packaging method (vacuum and MAP) and storage time on hydrolytic and oxidatve changes, and fatty acids composition of the traditional Petrovská klobása sausage were examined. Sausages were produced in household and subjected to smoking, drying and ripening processes during 45 days. After that time, sausages were divided in three groups. The first one consisted of unpacked sausages, while the sausages from the second and the third group were packed under vacuum and in MAP, respectively. The hydrolytic changes were followed by the value of acid number and oxidative changes were monitored through the concentration of malonildialdehyde (MDA). These parameters were examined at the end of drying process (45th day of production) and at the end of storage period (270th day of production). Acid number at the end of drying process was significantly ($P < 0.05$) lower, while content of malonildialdehyde and fatty acids composition did not differ significantly ($P > 0.05$) comparing to unpacked sausages stored until 270th day. At the end of storage time, acid number for unpacked sausages (21.83 mg KOH/g lipids) was significantly ($P < 0.05$) higher than for sausages packed under vacuum (15.03 mg KOH/g lipids) and in MAP (16.90 mg KOH/g lipids). Based on obtained results for malonylaldehide content at the end of storage period, the lipid peroxidation level in unpacked sausages (0.85 mg MDA/kg) was significantly ($P < 0.05$) higher, while fatty acids composition did not differ significantly ($P > 0.05$) comparing to sausages packed under vacuum (0.38 mg MDA/kg) and in MAP (0.53 mg MDA/kg). Thus, it can be concluded that traditional Petrovská klobása sausage can be successfully stored using vacuum or MAP packing.

EFFECT OF VACUUM PACKAGING ON THE COLOR OF TRADITIONAL DRY FERMENTED SAUSAGE (PETROVSKÁ KLOBÁSA) DURING STORAGE

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The aim of this study was to examine influence of vacuum packaging on the color characteristics of Petrovská klobása during storage. Sausages were manufactured in two rural households from hot boned (A samples) and cold meat (B samples), stuffed into collagen casings and subjected to the processes of smoking, drying and ripening in the traditional way. After completing the drying process (90 days) sausages were stored non-packed (AN; BN) and packed in vacuum (AV; BV).

Color and color maintenance on the cut surface of sausages were sensory evaluated. Also, color characteristics were determined instrumentally using Minolta CR-400 and expressed by CIE L*a*b* system (L*- lightness, a*- redness; b*- yellowness). Samples for the analyses were taken at: 0th, 30th, 120th, 180th day of storage. After 30 day of storage sausages of B group retain optimal score (BN-5.0; BV-5.0), while sausages of group A had significantly better score for sensory evaluation of color (AN-4.52; AV-4.58) comparing to 0th day (A-4.0; B-5.00). Differences in sensory evaluation and instrumental characteristics (L*; a*; b*) of color were not significant ($P>0.05$) between non-packed and vacuum packed samples at 30th day of storage. Decline in sensory evaluation of color for non-packed sausages was determined after 120 days of storage (AN-3.86; BN-4.75), while for vacuum packed sausages decline was determined after 180 days (AV-3.64; BN-4.88).

During the storage period (120th and 180th day of storage) samples of sausages packed in vacuum had highly significantly higher ($P<0.01$) score for sensory evaluation of color comparing to non-packed sausages.

The results obtained in this study showed that fermented sausages packed in vacuum, in general, had higher values of color characteristics (L*; a*; b*) compared to the non-packed sausages, and that could be stored without significant losses in sensory quality of color for 120 days after finishing the drying process.

PREDICTIVE MODELLING OF THE SHELF LIFE OF SMOKED FISH

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Smoking is a traditional method used for preserving fish due to the synergistic action of salt incorporation, the preservative effect of smoke compounds, and dehydration. However, the objective is not only to retard the action of bacteria and enzymes but also to alter or improve the taste, texture and structure of the raw material, creating a product with a characteristic flavour and an extended shelf life. The aim of the study was to model and comparatively assess changes in quality characteristics of smoked eel, mackerel and salmon, during refrigerated storage.

Hot smoked eel (Anguilla anguilla) fillets, whole smoked mackerel (Scomber japonicus) and cold smoked salmon (Salmo salar) slices were provided by a Greek farming and processing unit in their commercial packages. Eel fillets were stored isothermally at 0, 5, 10, 15°C and at variable temperature conditions (Teff=7.5°C) and mackerel and salmon slices were stored at 5 and 10°C. Quality assessment was based on microbiological analysis (total viable count, Pseudomonas spp., Brochothrix thermosphacta, lactobacilli), colour, lipid oxidation (TBARs) and sensory scoring. Quality indices were kinetically modelled and temperature dependence of quality loss rates was modelled by Arrhenius equation.

According to sensory evaluation, the shelf life was 8-9 weeks at 5°C and 3-5 weeks at 10°C. Organoleptic degradation was well correlated with lipid oxidation. The limit TBARs value for sensory acceptability was 2 mg•kg-1 flesh for mackerel and salmon. Eel fillets exhibited higher TBARs values due to their significantly higher lipid content (24% crude lipids). TVB-N level of 10 mg TVB-N•100g-1 flesh could be regarded as the limit of acceptability for smoked eel.

Results from variable temperature experiment were in good agreement with the prediction of the shelf life models developed from the isothermal experiments validating their applicability at the fluctuating storage conditions that usually occur in the cold chain.

INFLUENCE OF PACKAGING IN VACUUM THERMOSHRINKABLE FOILS ON THE CHEMICAL CHANGES OF BEEF ON MARKET

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It is common practice in Serbia to sale and to keep fresh meat in refrigerated showcases, and on the customer´s request cuts to desired pieces. Consequently in our regulations the shelf life of meat on the market is determinated in a relatively short period compared to the other country.

Therefore, the aim of our study was that continuous monitoring of microbiological, chemical and sensory parameters determine the advantage of the originally packed meat cuts in industrial conditions.

The paper presents the results of changes in chemical parameters, obtained in the first year of the project III 46009, relating to the use of domestic packaging materials (multilayered combined biaxially oriented thermoshrinkable polimer foil with barrier properties to passage of oxygen and moisture - Spektar, Gornji Milanovac) for packing in industrial conditions cuted beef (rump and rib eye steak - Yuhor, Jagodina), and then transported to retail, where is held under the usual conditions for fresh meat (refrigerated showcases - Maxi supermarket, Beograd). As control samples were used unpackaged fresh meat held under the same conditions.

Samples were tested every 7 days to 35th days, or until the date when the meat is assessed as unacceptable. There was investigated the changes of the total volatile nitrogen (TVB-N), peroxide number, acid number, TBK, pH and aw, using the usual methods.

Previous studies show that unpackaged fresh meat viable up to 7 days maximum (rated unacceptable to the 12th day), while packaged meat viable up to 21 days (in some cases is only 28 days rated as unacceptable).

*The paper is based on research generated in the project III 46009, funded by the Ministry of Education and Science RS.

A NEW METHOD FOR DETERMINATION OF BISPHENOL A DIGLYCIDYL ETHER (BADGE) AND ITS DERIVATIVES IN CANNED OILY FOODS

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Bisphenol A diglycidyl ether (BADGE) and its derivatives are determined in canned oily foods from Iran's market using a new simplified extraction method. Samples are extracted with methanol, back extracted with methanol, and were analyzed by using reversed –phase high performance liquid chromatography (RP-HPLC) with fluorescence detection (FLD) and excellent validation data were obtained. Whereas detection limit for BADGE.2H2O was detected in 0.04 ppm. Also the present of recovery for BADE and its derivatives in comparison to previous investigations is suitable. This method can detect the amount of BADGE and its derivatives in low concentration. From 57 analyzed cans, containing various fatty tuna fish products, BADGE.HCL, BADGE.H2O.HCL and BADGE.H2O were not detected in any samples. However, BADGE, BADGE.2H2O and BADGE.2HCL were detected in samples but the amounts of specific migration of BADGE and its derivatives from metal cans into the samples conform to European Community legislation (EC 1895/2005 that determined specific migration limits (SML) for sum of the BADGE and its hydrolyzed derivatives is 9 mg/kg and Sum of chlorinated derivatives is, 1 mg/kg), which confirm the safety of these cans container that were used for packaging oily foods in Iran.

EFFECT OF ANTIOXIDANTS ON INHIBITION OF OXIDATIVE PROCESSES DURING SPREADS STORAGE

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Manufacturing of butter in Ukraine has lost its profitability because there are no raw-materials. A combination of butter with oil (spread) is a new product at the Ukrainian market.

Studying the oxidation process of fats is associated with a reduced loss of fat and fat-containing products during their storage. This is important for fat, food, candy, perfume and cosmetic industries. The process of fat oxidation is a chain free radical process with branching chains. Hydrolytic and oxidative processes occur during the manufacturing and storage of fats. The final product of oxidation is malonic dialdehyde.

Selection and addition of antioxidants of natural origin of the crude drug is very urgent. The goal of the studies was to compare the effects of various antioxidants on the stability of spreads to oxidation during storage. Phenolic compounds, natural vitamins A, E and β-carotene materials have been used as antioxidants.

Samples were subjected to accelerated oxidation. Spreads with antioxidants were kept at room temperature in standard conditions: thickness of the layer is 4-5 mm, area of the contact with air is 2.8 cm2/g, duration of storage in a glass case at the North side of the room under the scattered light is 20 days.

There are defined organoleptic properties, as well as acid and peroxide numbers and malonic dialdehyde content in the samples. It has been shown that antioxidants exercise an inhibitory effect on the formation of peroxides. The effect of antioxidant action depends on the number of introduced additives. In most cases with increasing concentration of additive, its stabilizing effect increases. However, there is a negative impact on the organoleptic properties of the spreads.

The spreads with antioxidants have high biological and nutritional value.

STUDY ON EFFECTS OF STORAGE CONDITIONS AND PET PACKAGING ON QUALITY OF EDIBLE OILS

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The Effects of polyethylene terephthalate (PET) pieces and different storage conditions on fatty acids profile and some quality factors in three types of commercial oils, namely sunflower oil, canola oil, and blended oil containing sunflower oil, soy bean oil, and cottonseed oil were studied. Quality factors such as peroxide value, free fatty acids, and iodine value and induction period before and after storage of samples at 25 and 45°C for 20 and 60 days in the presence or absence of PET pieces were investigated. It was concluded that the stability of vegetable oils is dependent on the type of oil and its initial physical and chemical properties, time and temperature of storage and the type of employed packaging material (PET and glass). This study showed that storing oils at low temperatures (T<25 °C) may be recommended in order to extend the shelf life and maintenance quality of commercial oils which are packaged in PET containers.

EFFECT OF DIFFERENT PROTEIN-BASED EDIBLE FILMS ON MICROBIOLOGICAL PROPERTIES OF HOT SMOKED RAINBOW TROUT FILLETS

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Introduction

Smoked fish has major economic importance in the world. Spoilage of smoked fish results from changes brought about by biological reactions such as oxidation of lipids and the metabolic activities of microorganisms. These activities lead to a short shelf life in smoked fish and other seafood products. Coating the foods with edible materials has been researched as an effective method to improve the food quality. Edible coating and films offers multiple advantages to the fish industry and the consumer. Thus, the present study was undertaken to determine the effect of protein based film coating on the microbiological quality of hot smoked rainbow trout fillets stored at 2ºC.

Material and Methods

Hot smoked rainbow trout fillets were supplying a Bagci fish company (Mugla, Turkey). The materials of protein based film were selected as soy protein, whey protein, egg powder, gluten, zein, gelatin, collagen and fish protein from rainbow trout and Atlantic Bonito. The total psychrotorophic, mesophilic counts, anaerobic counts and anaerobic sulphite-reducing Clostridium count were determined during storage (ICMSF, 1986).

Results/Conclusions

Both mesophilic and psychrotrophic bacteria count in hot smoked rainbow trout fillets under different protein films packaging increased with length of storage at 2ºC. After 3 weeks in vacuum packaging (control groups) psychrotrophic and mesophilic bacteria counts reached above than 6-7 log cfu/g, respectively. However, growth of aerobic and anaerobic bacteria in the fillets packaged under gelatin film was slower during storage, psychrotrophic bacteria count reached 7 log cfu/g at the 4th week of storage. Bacteria count was below 2 log cfu/g in fillets packaged under gluten, zein, collagen and fish protein film on week 8. Soy protein, gluten, zein, collagen and fish protein film treatments predominantly reduced microbiological spoilage.

Acknowledgements

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MICROBIOLOGICAL EVOLUTION OF SEA BREAM (SPARUS AURATA) DURING ICE STORAGE

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The aim of this longitudinal study was to investigate the microbiological changes in whole ungutted Gilthead sea bream (Sparus aurata) stored in ice. The fishes were obtained from an aquaculture farm located in Gran Canaria (Canary Islands, Spain). There are many factors that can influence on the rate of microbial spoilage of fish, they depends on the bacterial flora present and on the storage conditions, handling such as temperature.

The microbiological evolution in three different tissues (muscle, skin and gills) during 18 days in two different seasons were determined. In order to explore the growths of germs through of observation days, zone and batch, the log10 N i,j,k,t were plotted against the day and by zone. The plots for aeromonas, meshophilic, enterobacteria, psychrotrophs, Shewanella putrefaciens and Pseudomonas sp. suggest a statistical mixed model.

To account for excess zeros for clostridiums and phosphobacteria (44.6% and 46.4% respectively), the zero-inflated Poisson (ZIP) model was defined as a statistical model, which is a mixture of two distributions to incorporate extra zeros.

The results of this study showed that the highest count of bacteria was found in gills, followed by skin and lowest was by muscle. This different was found to be statistically significant. In reference the lot there were not statistically significant between batch of statistical model 1, but there were statistically significant in the statistical model 2.

From highest to lowest microbiological counts results after 18 days stored on ice were: meshophilic, Pseudomonas sp., psychrotrophs, Aeromonas sp., Shewanella putrefaciens, enterobacteria, P. phosphoreum and sulfide-reducers Clostridium.

The results are similar to those shown by other authors, where Pseudomonas sp., Aeromonas sp., Shewanella putrefaciens, are the main spoilage causing microorganisms, considering that this study was carried out in warmer waters than other studies.

MODERN TRENDS OF FOOD PACKAGING

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Packaging has an active role in processing, preservation and retaining the quality of food. The growing consumers demands for the food that are ready to eat, fresh-tasting, nutrient and vitamin rich and minimally-processed and preserved are a major challenges for the current food industry. In order to realize these demands more significant role is gained to the packaging through the application of an appropriate active and intelligent packaging.

Active packaging changes the conditions of the packaged food in order to extend shelf life or to improve the safety or sensory properties, while maintaining the quality. The chemical, physical and microbiological processes that lead to deterioration of packaged food can be regulated in different ways by using an appropriate active packaging. Techniques of active packaging systems include three groups: scavenging systems or absorbers, releasing systems or emitters and other systems. Adsorbers remove undesirable compounds such as oxygen, carbon dioxide, ethylene, excessive water etc. Releasing systems actively add or emit carbon dioxide, preservatives or antioxidants in the packaging unit for extend the shelf life.

Intelligent packaging involves the use of indicators for monitoring the quality of packaged food. The indicators provide information about the quality of packaged products during transport, storage and use. Further development of intelligent packaging using radio frequency identification will provides information of the origin of food, their originality, content, expiry date and will be able to track the product in the food supply chain, to protect it from theft and unauthorized use.

It is obvious that in a future the application of active and intelligent packaging will increased, because it fits perfectly with the food safety strategy, involving an improved level of food safety and transparency to consumers. However, prior to the introduction of new forms of packaging, it is necessary to carry out detailed studies that would assess consumer attitudes toward these techniques.

V
FOOD BIOTECHNOLOGY, NOVEL BIOPRODUCTS

PRODUCTION OF BEER WITH REDUCED ALCOHOL CONTENT

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In the production of beer with reduced content of alcohol, two main concepts are applied. One utilises classical brewing processes followed by alcohol removal techniques such as dialysis, reverse osmosis, distillation or vacuum evaporation. The other strategy, a so-called limited fermentation, involves fermentation of fermentable saccharides to ethanol that is either suppressed or interrupted in its early stage – cold contact process or stopped fermentation, respectively. An alternative method to produce beer with a reduced ethanol concentration involves the use of genetically modified yeasts that form less ethanol during a complete wort fermentation.

We studied a set of fourteen yeast strains of S. cerevisiae defective in one of TCA cycle genes: ACO1, CIT1, CIT3, FUM1, IDH1, IDH2, KGD1, KGD2, LSC1, LSC2, MDH1, SDH1, SDH2 or SDH3. A model strain used in our study was standard bottom-fermenting brewing yeast S. cerevisiae W96.

Strains deficient in fumarase and α-ketoglutarate dehydrogenase encoded by the FUM1, KGD1 and KGD2 genes produced beers with an alcohol content in the range of 0.42–0.48% (v/v), which, according to the European legislation, are considered non-alcoholic (maximum alcohol content of 0.5% v/v).

The most important finding is that the described strains enabled us to produce non-alcoholic beers at conditions almost identical to those for standard alcoholic beers.

The presence of organic acids, such as lactatic and citric acid, has a protective effect against bacterial contamination. Lactic acid also helps to mask the unacceptable worty flavour of non-alcoholic beers and, with the other acids, serves as an important sensorial factor with a positive effect on the taste and flavour profiles of the final product. Pre-acidification of wort or maturation can be omitted completely, which can lead to significant economic savings.

This work was supported by the Scientific Grant Agency of the Ministry of Education of the Slovak Republic VEGA 1/0096/11.

CONSECUTIVE REPITCHING TECHNOLOGY EFFECTS SUGAR UTILISATION PROFILE DURING FERMENTATION OF BEER

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The quality of beer is strongly infiuenced by the biochemical performance of the yeast during fermentation. It is well known that other process parameters like temperature, size and geometry of the fermentation vessel are also important parameters affecting not only fermentation rate, but also beer flavour. Fermentation performance of brewing yeast strains is dependent on their ability to adapt to changes, particularly during batch brewery fermentation which involves the recycling (repitching) of a single yeast culture (slurry) over a number of fermentations. The ability of yeast to respond effectively to these conditions is essential not only for beer production but also for maintaining the fermentation fitness of yeast for use in subsequent fermentations. It is generally accepted that slurry quality is directly related to fermentation performance and therefore, the quality of the final beer. A common problem in the brewing industry is incomplete sugar utilization, resulting in a beer with residual maltotriose. In this study we examined the impact of prolonged usage of starter culture during the continues subsequent explatation. Beer production in industrial scale during 12 serial repitching using brewing strain *Saccharomyces pastorianus* (W 34/70) was performed. The viability and amount of yeast being pitched into the wort was controlled. We measured in relevant stages of primary and secondary fermentation following parameters: rate of fermentation, pH, specific gravity, alcohol formation, yeast growth. The consumption of glucose, fructose, maltose and maltotriose was monitored. The quality of final product was determined with routine chemical and sensory analysis. The general purpose of this study was to determine the effect of serial repitching on the ability of yeast to ferment sugars from wort. It was also important to established how many times the yeast starter culture can be reused without affecting the quality of beer.

Keywords: beer; fermentation performance; sugar metabolism; brewing yeast.

MECHANISM OF 5-HYDROXYMETHYLFURFURAL DEGRADATION DURING MALT FERMENTATION

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5-Hydroxymethyl furfural (HMF) may occur in malt in high quantities depending on roasting conditions. However, HMF contents of different types of beers are relatively low indicating its potential degradation during fermentation. This study aimed to investigate the mechanism and kinetics of degradation of HMF in malt during fermentation by Saccharomyces cerevisia.

Malt was roasted in an incubator at 200ºC for 4 hrs in order to obtain dark colored malt. Wort was prepared from roasted and pale malt and they were fermented at 30ºC for 24 hrs. HMF and sugar contents were measured with HPLC during fermentation. To confirm the conversion of HMF to HMF alcohol, sample was analyzed by LC-MS system. The results indicated that HMF decreased exponentially as fermentation progressed. The first order degradation rate of HMF was 0.693×10-2 min-1 and 1.397×10-2 min-1 for wort and sweet wort, respectively, indicating that sugar enhances the activity of yeasts. In wort, HMF was converted into hydroxymethyl furfuryl alcohol by yeasts with a remarkable yield (79-84 % conversion). Sucrose was converted into glucose and fructose just in the first hour of fermentation. Glucose and fructose were utilized more rapidly by the yeasts in dark roasted malt than in pale malt ($p<0.05$). The conversion of HMF into hydroxymethyl furfuryl alcohol seems to be a primary activity of yeast cells, and presence of sugars in the fermentation medium increases this activity.

There are no available mitigation strategies for HMF reduction up to date although its health hazards are well known. Yeast fermentation seems to be a useful technique to reduce HMF content in dark malt and it could be regarded as a mitigation strategy.

CONTINUOUS SYNTHESIS OF FRUCTOOLIGOSACCHARIDES IN A MEMBRANE REACTOR USING SOLUBLE ENZYMES

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The demand for healthier and low-calorie foods is increasing worldwide. Fructooligosaccharides (FOS) are new alternative sweeteners with functional properties. This study presents an easily scalable continuous process to increase functionality and to reduce calorie-content of sucrose syrups that can be used to sweeten food stuff. The proposed technique involves the enzymatic conversion of sucrose to FOS using a stirred-tank reactor equipped with an external ultrafiltration module for enzyme retention. The enzyme-free product stream consists of small-chain FOS, unreacted sucrose, and by-product monosaccharides.

In our laboratory we have tested the fructosyltransferase and hydrolytic activity of about twenty commercially available enzyme preparations, which are primary used in fruit juice processing, evaluating the potential of using them for production of FOS from sucrose. The amount and nature of FOS formed in the enzymatic membrane reactor depends upon several factors including the enzyme source, the concentration and nature of the substrate, membrane fouling issues, enzyme stability, and operation conditions. Operation and reaction conditions affecting the enzymatic production are investigated experimentally. A mathematical framework is proposed to predict the process dynamics for different reactor configurations.

Our results show that the two main critical factors often associated with enzymatic reactors utilizing free enzymes, namely membrane fouling and loss of enzyme activity due to inactivation, did not limit the performance of the EMR under the selected process conditions in the studied operation period. The permeate flux of the membrane can be restored with appropriate cleaning. In addition, since a ceramic membrane is employed, the proposed process is particularly suitable for food and biotech applications in which repeated steam sterilization is required.

This integrated process combines reaction and separation in a single-step. The on-site implementation of this technology might be attractive for food manufacturers aiming at using a value-added sweetener mixture with prebiotic properties instead of pure sucrose.

BEERS ENRICHED WITH BIOACTIVE COMPONENTS- POLYPHENOL AND ANTIOXIDANT ACTIVITY

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Antioxidants have important nutritional importance for the human body. They are considered as promoters of cardiovascular health, powerful ingredients in cancer preventing, and even possible solution for slowing down the aging process in humans. Beer is known as a good source of antioxidants, mainly phenolic acids originating from hop and barley rich in phenolic compounds. Like this it is very good natural base for developing a variety of new products with novel taste and flavors, and improved functionality.

This study examined total polyphenol content and antioxidant activity of regular pils beer and special beer types produced with herbs (*Melissa officinalis, Thymus vulgaris, Humulus lupulus*), medicinal mushroom (*Ganoderma lucidum*) and red grapes. Total polyphenol content was determinate using the standard EBC method and the Folin-Ciocalteu method, while antioxidant activity was measured by the ferric reducing antioxidant power (FRAP). The results of the antioxidant assays are presented through basic indicators of descriptive statistics and graphically through box-plots based on the arithmetic mean, standard deviation and standard error.

Total polyphenol and phenolic acid content to a great extent vary among different beer types. The highest value for polyphenol content showed beer with a grape 318,43 mg/l (ebc method) while standard pils beer was 116,98 mg/l. Similarly, the antioxidant activity of beer with grape showed higher values then other obtained beers. Furthermore it was established correlation and dependence between used methods. The contribution of single herbs and mushroom extract, as well as red grape must, to the antioxidant activity of beer were also significant.

SURVIVABILITY OF *LACTOBACILLUS GASSERI* AND *LACTOBACILLUS DELBRUECKII* SSP. *BULGARICUS* PROBIOTIC STRAINS ENTRAPPED IN CA-ALGINATE BEADS DURING STORAGE

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Survivability of two *Lactobacillus delbrueckii* ssp. *bulgaricus* (IM396, IM411) and a *Lactobacillus gasseri* (IM 105) probiotic strains encapsulated in calcium alginate beads has been tested during storage at 4°C. Beads were produced by electrostatic extrusion. After production, alginate microcapsules were resuspended in reconstituted skimmed milk and the number of viable bacteria has been evaluated immediately at encapsulation, after 2, 3 and 4 weeks and after 2 and 3 months of storage. After homogenisation of beads in calcium citrate, an appropriate series of dilutions in physiological solution was made and the appropriate dilutions were plated on MRS agar. Plate counts were performed in two parallels per each dilution tested. In addition, the ratio of intact cells was evaluated by a molecular method real time PCR. One aliquote of each sample of homogenised beads was treated before DNA isolation with propidium monoazide which selectively inhibits the amplification of DNA which is free or inside the damaged cells. During storage the number of IM105 strain was reduced by one order of magnitude in three months. In the same period, the number of cultivable IM396 cells was reduced by five orders of magnitude and the IM411 strain count has fallen below the level of detection after 3 weeks of storage. The strain specificity of the survivability during encapsulation and storage was confirmed also by PMA-real time PCR. The PMA-real time PCR approach in combination with plate counting was found useful for the monitoring of the survival of microencapsulated probiotic bacteria.

Key words: probiotics, microencapsulation, extrusion, Ca- alginate, PMA, real time PCR

THE INFLUENCE OF CALCIUM, MAGNESIUM, AND ZINC ADDITION ON APPLICATION OF TRITICALE IN BIOTECHNOLOGY

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Introduction.

Triticale is cultivated in more than 30 countries world wide on araund 3.7 milion ha in total, yielding more than 12 milion tonnes a year. In many regions of the world, triticale has found definite role as a crop for low growing cost systems. It can be grown on marginal soils (e.g. acidic, alkaline, etc.). Triticale's better disease resistance compared to wheat or barley is a major advantage, which makes triticale particulary suited to organic farming systems. The aim of this study was to determine the influence of calcium, magnesium, and zinc ions addition on fermentable sugars content during fermentation of triticale mashes.

Methods and materials.

Triticale variety Odyssey, from experimental fields, Rimski Šančevi location (Serbia) was used in this study. The influence of calcium and magnesium ions on triticale starch degradation was investigated by adding $CaCl_2$ or $MgSO_4$ solution before liquefaction at following concentrations: 10, 20, 30, or 40 mg/L. The influence of zinc ions on fermentation of triticale mash was investigated by adding $ZnSO_4$ solution before fermentation at following concentrations: 0.8, 1.6, 3.2, or 6.4 mg/L.

Results.

The supplementation of mashes with calcium and magnesium ions had positive effect on triticale's amylolytic enzymes which caused higher total fermentable sugars yields. The addition of calcium and magnesium ions at all applied concentrations also accelerated fermentation rates and reduced fermentation time. The addition of zinc ions in triticale mashes prior to the fermentation increased total fermentable sugars yields but not as much as the addition of magnesium ions.

Conclusions.

The obtained results showed that the addition of calcium and magnesium ions in mash is necessary to increase the activity of triticale's amylolytic enzymes during liquefaction and saccharification. Zinc ions had positive influence on the activity of yeast cells during fermentation of triticale mashes.

Key words: triticale, calcium, magnesium, zinc, fermentation

MANAGEMENT OF CONTAMINANTS WITHIN WINE PROCESSING WITH YEASTS: CASE MYCOTOXIN AND FFS RESIDUA

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The interaction between four industrial wine yeast strains and grape juice contaminants, during alcoholic fermentation was studied. Industrial strains of *S. cerevisiae* (AWRI 0838), *S. cerevisiae* mutant with low H_2S production phenotype (AWRI 1640), interspecies hybrid of *S.cerevisiae* and *S. kudriavzevii* (AWRI 1539) and the hybrid of the last two strains (AWRI 1810) were exposed separately to fungicides pyrimethanil (Pyr, 10 mg/L) and fenhexamid (Fhx, 10 mg/L) as well as with the most common toxin produced by molds on grapes ochratoxin A (OTA, 5 µg/L). The strains were exposed to the contaminants during alcoholic fermentation of cv. "Sauvignon Blanc" grape juice and during the extended contact with yeast lees after the end of it. Yeast's capacity to remove contaminants from media was determined by GC-MS (Pyr), LC-MS/MS (Fhx) and HPLC (OTA) at the end of the alcoholic fermentation, and after extended contact (7 days) with the media. All the strains were able to remove contaminants from media, moreover, after extended contact; the concentration of contaminants was in most cases even lower. On the other hand, contaminants were found to strongly impair fermentation performance and metabolic activity for all yeast strains studied. Wine's chemical profile analyzed by HPLC (ethanol, volatile acidity, concentration of fructose, glucose, glycerol and organic acids) and the aromatic profile analyzed by using a (GC/MS) stable isotope dilution technique (ethyl esters, acetates and aromatic alcohols) and Kitanawa tubes (H_2S) was in all cases significantly different from the wines produced without the presence of contaminants. Of particular note, the quantity of aromatic compounds produced by yeast was significantly lower. Fermentation kinetics was impaired as well; Pyr was the most inhibiting, followed by OTA and Fhx. In this study we elucidated that the interactions between industrial yeast strains with different genetic background and chemically different contaminants; Pyr, Fhx and OTA dictate low quality chemical composition of wine.

STABILITY AND BIOAVAILABILITY OF VITAMIN D NANOENCAPSULATED IN CASEIN MICELLES

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Introduction:
Vitamin D (VD) is oil-soluble, crucial for calcium homeostasis and associated with cardiovascular health, cancer prevention, immune function and more. Because VD deficiency is prevalent worldwide and its nutritional sources are limited, food fortification is imperative. However, VD is sensitive to light, air and heat. VD insolubility in water hinders enrichment of nonfat products. Consumer demand for "all-natural ingredients" precludes synthetic emulsifiers, which also hardly protect against vitamin degradation.
To overcome these problems, we introduced a novel approach utilizing the natural self-assembly into micelles of the milk protein casein, for nanoencapsulation of VD [E. Semo et al. Food Hydrocolloids 21, 936-942 (2007)]. Casein micelles (CM) are natural nanovehicles which evolved to deliver calcium, phosphate and protein, from mother to newborn.
Here we studied the protection and bioavailability conferred to VD by re-assembled CM (rCM).
Methods and materials:
Size distribution was studied by DLS. The protection conferred by rCM against degradation of VD3 during heating and simulated shelf life was studied using reversed-phase HPLC. Bioavailability of VD3 in rCM was investigated in a clinical study (87 volunteers).
Results:
VD3-rCM average diameter was 91nm. When encapsulated in rCM and subjected to 80°C, 1min, no significant vitamin loss was observed, vs. 13% loss of VD3 in a synthetic emulsifier and 14% loss of un-encapsulated VD3. VD3 in rCM was also more stable during 28 days of cold storage (~40% loss) compared to emulsified (~50% loss) or un-encapsulated (~70% loss) vitamin. Homogenization of D3-rCM (~155MPa) further enhanced vitamin stability, resulting in only ~13% loss after 28 days of storage. Bioavailability of 50,000IU VD3 encapsulated in rCM and added to 1% fat milk was as high as in an aqueous synthetically-emulsified VD3 supplement in which VD3 is known to be fully bioavailable.
Conclusions: rCM show great promise for enrichment of staple-foods with hydrophobic nutraceuticals.

DARK CHOCOLATE AS A MATRIX FOR PROBIOTIC BACTERIA

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Food products containing beneficial microorganisms, mostly lactic acid bacteria which effectively affect human digestive and immune systems, represent one of the largest market of functional foods, with dairy products as the most accessible ones. However, for some, non-negligible percentage of the global consumer's population, usage of dairy products is limited due to diet (vegetarian), traditional reasons, or because of lactose intolerance, cholesterol content and allergenic milk proteins. These major drawbacks related to the intake of dairy products promote the idea of replacement of milk with alternative delivery formats for probiotics, which makes the development of new nondairy probiotic foods, that can appeal to a wider range of consumers, essential. In this context, our idea was related to the incorporation of probiotic microorganisms into one of the most popular foods - chocolate, which significantly contributes to the favorable impact of this product on human health. Therefore, in this study addition of probiotic strain *Lactobacillus acidophilus* NCFM® in dark chocolates with 44% cocoa solids, was carried out in industrial conditions. In order to determine the shelf-life of these chocolates their sensory properties (appearance, texture, aroma) were evaluated, along with the determination of viability of added probiotic bacteria during storage at different temperatures (4ºC and 22ºC), immediately after production and after 180 days. Results indicated that the enrichment of dark chocolates with *Lactobacillus acidophilus* NCFM® caused no modification of the their sensory properties, and the number of incorporated live probiotic bacteria maintained at a high level of 107-108 cfu/g during storage of 180 days. Based on the above it can be concluded that dark chocolates with 44% cocoa solids have a protective effect on *Lactobacillus acidophilus* NCFM® cells and make a good matrix for the preparation of functional probiotic products.

Keywords: dark chocolate, *Lactobacillus acidophilus*, probiotics, sensory properties

WHITE BRINED CHEESE AS A DELIVERY MEDIUM FOR PROBIOTIC BACTERIA

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The traditional white brined cow cheese was tested as a delivery medium for probiotic bacteria. The white brined cheese was manufactured by the traditional method. The cheese produced in this way has relatively short period of ripening, large percentage of fat and suitable pH values and therefore provides good conditions for survival of the probiotic culture. Two different initial concentrations of the probiotic bacterium, *Lactobacillus casei*, were used in this study. The traditional and probiotic type of cheeses were produced in a dairy plant in three separate batches. The incorporation of the probiotic bacteria did not change the traditional method of manufacture. Due to the mild production conditions, the number of survived bacteria in the enriched cheeses was higher than 107cfu/g. The quality of the probiotic cheese was comparable with the traditional product in respect of the dry mass, pH values, titrabale acidity, NaCl content, fat content as well as the protein content. There was no significant difference in all quality parameters at the $p < 0.05$ level between the two probiotic cheeses. These cheeses differ significantly from the traditional product only in respect to the fat and salt content. They were fully accepted for consumption by the panel group.

INFLUENCE OF INERT GAS APPLICATION ON QUALITY AND STORAGE OF FRUIT JUICES

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McCarter Bratislava(1)
Výskumný ústav potravinársky Bratislava(2)

This presentation will deal with influence of inert gas application during production of fruit juices. This latest technology makes possible to protect fresh juices against oxidation processes due to absence of oxygen. During preparation and storage of obtained fruit juices, various parameters have been measured such as antioxidant capacity by electron paramagnetic resonance, colour characteristics by colorimeter, flavonoid content by high pressure liquid chromatography, flavour active compound content by gas chromatography mass spectrometry and olfactometry. As results showed, application of inert atmosphere is enable to guarantee original organoleptic characteristics in comparison to traditional procedures of fruit technology.

THE CHANGES OF THE AMOUNT OF AMINO ACIDS IN FERMENTED MILK ENRICHED WITH FLAKES FROM BIOLOGICAL ACTIVATED HULL-LESS BARLEY GRAIN AND MALT EXTRACT

Ilze Beitane

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The changes of the amount of amino acids in milk fermented with YF-L811 enriched with flakes from biological activated hull-less barley grain in concentration 5% and with malt extract in different concentrations (2%, 4% and 6%) were studied. Pasteurized milk, freeze-dried culture YF-L811 (Chr.Hansen, Denmark), flakes from biological activated hull-les barley grain (Latvia) and malt extract (Ilgezeem, Latvia) were used for experiments. The fermentation process was realized at 43 oC for 4 hours. The amount of amino acids was determined by Method AS/HPLC-MS.

Results showed that the ability of yoghurt culture YF-L811 (contain *Streptococcus thermaphilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus*) to produce the amino acids can be to promote by adding flakes from biological activated hull-less barley grain and malt extract. The amount of amino acids in the fermented milk samples depends on the concentration of added malt extract. The highest content of amino acids was determined in fermented milk sample with flakes from biological activated hull-less barley grain and malt extract in concentration 4%. There are established significant differences ($p<0.05$) between fermented milk sample with flakes from biological activated hull-less barley grain and malt extract in concentration 4% (the total amino acid content – 11.899 mg•100 g-1) and fermented milk samples with flakes from biological activated hull-less barley grain and malt extract in concentration 2% and 6% (the total amino acid content – 4.714 mg•100 g-1 and 6.609 mg•100 g-1).

THE IMPACT OF *FUSARIUM GRAMINEARUM* CONTAMINATION LEVELS OF BARLEY ON DEOXYNIVALENOL AND ZEARALENONE CONTENT IN KILNED MALT

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The aim of this study was to establish the impact of initial *F. graminearum* contamination level of barley on deoxynivalenol (DON) and zearalenone (ZEA) content in kilned malt. The influence of applied unit operations during the malt production on development of the above-mentioned fungus and its ability to synthesize DON and ZEA was also considered. Barley samples contaminated with different initial *F. graminearum* contamination levels (0, 10 and 20 %) were subjected to micromalting procedure. Barley samples, green malt and kilned malt underwent microbiological and toxicological analyses at which the share of *F. graminearum* contaminated grain and concentrations of mycotoxins were determined. The results show that the strongest proliferation of fungus occurred during steeping and germination, while the drying phase significantly reduced the contamination level. Furthermore, the results indicate that barley with higher initial *F. graminearum* contamination level ensured higher concentrations of mycotoxins in kilned malt. The highest DON concentrations were determined in germ/rootlets samples, while the highest ZEA concentrations were determined in kilned malt.

SELECTION OF *LACTOBACILLUS* STRAINS FOR FUNCTIONAL WHEY-BASED BEVERAGE PRODUCTION

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The aim of this study was the selection of appropriate *Lactobacillus* strains for functional whey-based beverage production. Sixteen strains of different species of *Lactobacillus* genera were selected based on fermentation activity and their ability to carry out fast production of beverage with satisfactory fermentation parameters.

Preliminary screening of strains was performed. The fermentation activity was evaluated by determining the volumetric productivity of tested strains after 24 h of the fermentation. One strain from each species was selected based on the productivity to further test their beverage production performances. The beverage production performances were evaluated by determining the basic fermentation parameters achieved. The fermentation was carried out until pH=4.6 was attained. During the incubation time samples were withdrawn every 1 h for determination of pH value. When pH=4.6 was reached, the fermentation was stopped by a quick cooling. Samples were evaluated in term of fermentation time, titratable acidity, cell number and sensory characteristics. Both fermentations, the preliminary screening and the selection based on beverage production performances, were performed at temperature of 37 ^{0}C, statically. Some of the strains showed low volumetric productivity during the preliminary screening. Many of those strains that passed the preliminary screening manifested some defects when tested for beverage production performances. The strains showed remarkable differences in cell number and sensory properties, which were particularly useful in the selection.

Based on the obtained results, the strains *Lb. casei* ssp*. casei* ATCC 27139 and *Lb. johnsonii* NRRL B-2178 are good candidates for beverage production. These strains are rather similar in terms of beverage production ability, but strain *Lb. johnsonii* NRRL B-2178 is top candidate for functional whey based beverage production. The research will go on to employ the best strain or eventually the combination of different species and to optimize the beverage production, especially in terms of sensory characteristics.

TEMPERATURE INFLUENCE ON LACTIC ACID FERMENTATION WHIT USAGE OF TRITICALE STILLAGE AS MEDIUM

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Introduction

Triticale is known as a crop very useful for the bioethanol production, due its autoamilolitical complex which degradates starch without supplemental addition of technical enzymes. Stillage received after alcohol fermentation, could be used as a potential resource for other biotechnical process. One of the possibilities is lactic acid production, during which the stillage can be preserved by produced lactic acid. The aim of this research was to see if temperature on which lactic acid fermentation is maintained would have influence on lactic acid production.

Methods and Materials

After standard alcohol fermentation and distillation, given triticale stillage was used as a medium for lactic acid fermentation by *Lactobacillus fermentum* PL-1, at three different temperatures (30, 37, and 44 °C) for 72 hours. Lactic acid fermentation was monitored at the laboratory level by the measuring of pH, acidity, viability of lactic acid bacteria cells, while the utilization of carbohydrates and concentrations of D- and L- lactic acid were determined by the enzymatic kits.

Results

There were only slightly difference in pH values, and acidity among samples fermented at various temperatures. The concentration of L-lactic (more favourable isomer) acid was the highest for the fermentation at 30 °C, while the highest concentration of D-lactic acid was recorded at 44 °C. Utilization of carbohydrates was the same in all cases, and viability of lactic acid bacteria was better at 30 and 37 °C.

Conclusions

The same concentration of L-lactic acid can be obtained during the lactic acid fermentation at lower temperatures. In that way, there is a possibility for the same production of lactic acid at lower cost, which can play a significant role in optimization of biotechnical process.

DETERMINATION OF FATTY ACIDS DURING MILK FERMENTATION BY KOMBUCHA CULTIVATED ON BLACK TEA

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This study evaluated the impact of the different fermentation temperatures on the fatty acids profile of fermented milk beverages produced by kombucha cultivated on black tea.

Milk with 2% fat (w/w) was inoculated with 10% (v/v) kombucha inoculum. Fermentations were performed at 37ºC and 42ºC until pH 4.6 was reached. Content of fatty acids was determinated during fermentation on pH 6.0; 5.1 and 4.6. Analyses of fatty acids composition were carried out by gas chromatography – mass spectrometry.

The results of this investigation indicate that fatty acids profile were similar in milk and fermented milk beverages produced by kombucha. The level of palmitic acid was the highest of all fatty acids among investigated samples.

COPPER CONTENT IN KOMBUCHA FERMENTED MILK PRODUCTS

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Copper belongs to a group of essential elements, and needs to be replenished through food in certain quantities every day. But on the other hand, ingestion of large amounts of copper has an adverse effect on the human body, so that food should be subject of control in terms of copper content. In this work the copper content was determined in twelve different samples of kombucha fermented milk products using potentiometric stripping analysis. Fermentation liquid used as inoculum for the fermentation of milk is obtained by cultivation of kombucha on cooled tea. Four different kinds of tea were used for preparing tea: winter savory, peppermint, stinging nettle or wild thyme. Thus, four different kinds of fermentation liquids were obtained. The technique of potentiometric stripping analysis is applied with the dissolved oxygen as an oxidant, and the mercury film electrode as a working electrode. The copper content in samples was calculated using standard addition method. The contents of copper in the analysed kombucha fermented milk products were within the range from 0.016 mg/l to 0.036 mg/l, mean value was 0.25 mg/l. On the basis of the results of this study we can conclude that daily consumption of kombucha fermented milk products provides significant amount of copper to the human body in relation to milk, that is necessary for both adults and children alike.

CHARACTERISTICS OF KOMBUCHA FERMENTED MILK PRODUCTS WITH PEPPERMINT

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According to a widely accepted definition, a functional food is any modified food that may provide a health benefit beyond the nutrients it contains.
Fermented milk products are widely consumed as functional food and excellent vehicle to deliver probiotics to consumers.
Kombucha is a symbiosis of yeasts and acetic acid bacteria. This symbiosis converts a simple substrate (sweetened black or green tea) into a pleasant, acidic and carbonated beverage, containing a number of nutritional and pharmacologically active components. Kombucha is also successfully cultivated on herbal extracts, milk and other substrates.
Peppermint is commercially used in food, pharmaceutical and cosmetics industries. Peppermint essential oil contains menthol, menthone, menthofuran and menthyl acetate. Other pharmacologically active ingredients are caffeic acid, flavonoids, polymerized polyphenols, carotenes, tocopherols, betaine, choline and tannins.
The aim of this study was to investigate characteristics of fermented milk products, obtained from milk with 2.8% milk fat, by using two starter cultures at 37, 40 and 43°C. One starter culture was kombucha fermentative liquid, obtained from peppermint extract sweetened with sucrose (7%), and the other is a mixture of kombucha fermentative liquid on peppermint and probiotic yoghurt culture. The quality of the products was followed by monitoring of chemical composition, physico-chemical characteristics, syneresis, water holding capacity and sensory characteristics of the products after fermentation and after 10 days of storage.
Fermentation performed using a mixture of fermentative liquid of kombucha on peppermint and probiotic yoghurt culture was significantly shorter in comparison to the other starter culture, at all temperatures. It was the only major difference because the quality of the obtained products was very similar regardless of the fermentation temperature, applied starter culture and storage.

ENCAPSULATION AND RELEASE PROFILES OF CAFFEINE FROM MICROPARTICLES

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BRIEF INTRODUCTION:
In the past decade, increased progress has been achieved towards the production of microencapsulated therapeutic products and formulations, and their commerciallization. Micro- and nanoparticles have the potential to revolutionize food production and nutrition, and modify modern drugs and phytochemicals by increasing their efficacy, stability, and solubility, decreasing their toxicity and sustaining their release, thus enabeling advanced pharmacological effects. The purpose of this study was to evaluate the potential of using electostatic extrusion for encapsulation of caffeine in alginate-chitosan cross-linked microparticles enriched with ascorbic acid.
METHODS AND MATERIALS:
Three different forms of caffeine were evaluated for immobilization in alginate-chitosan microbeads; liquid extract of caffeine obtained from the plant guarana (*Paullinia cupana*), solid caffeine isolated from a natural source for food purposes and analytical standard of caffeine for drug analysis. High performance liquid chromatography (HPLC-PDA) was used to evaluate the release kinetics of caffeine from the microbeads in water, while the corresponding antioxidant capacity was evaluated by applying the ABTS radical scavenging assay. The thermal behaviour of alginate-chitosan beads encapsulating caffeine was investigated by thermogravimetric (TG) and differential scanning calorimetry measurements (TG-DSC) under heating conditions. Scanning electron microscopy and laser diffraction particle size determination were used to provide adittional information about the physical properties of obtained microparticles.
RESULTS:
The obtained microbeads encapsulated in alginate-chitosan matrix were uniformly sized spheres of about 600-800 μm. The extraction efficiency of all microparticles ranged between 80-89%. The majority of caffeine was released within 10-30min, depending on the used caffeine form, while the antioxidant capacity exhibited by ascorbic acid was relatively rapidly released from alginate-chitosan cross-linked microbeads (within 10 min).
CONCLUSIONS:
The obtained results suggest that electrostatic extrusion exhibits significant potential for the entrappment of caffeine in alginate-chitosan microbeads, while the adittion of ascorbic acid further enhances the biological activity of such obtained microcapsules.

PRODUCTION OF BLACKBERRY WINE BY MICROFERMENTATION USING COMMERCIAL YEAST FERMOL MEDITERANEÉ AND FERMOL ROUGE

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INTRODUCTION:
Although blackberry wine is a popular fruit wine and traditional product in the continental part of Croatia, the scientific literature on Croatian blackberry wines is scarce and there is no data concerning characterization of wine yeasts for blackberry wine production. In this work, two commercial yeasts were tested in a small scale to evaluate their application possibility in commercial production of blackberry wine. The wines produced using Fermol Rouge and Fermol Mediterraneé yeasts were designated as FR wine and FM wine, respectively.

METHODS AND MATERIALS:
Microfermentations of blackberry juice were performed at 23ºC to test the fermentative abilities of commercial yeasts in a small scale. Fermentation activity was monitored by measuring CO2 evolution and CO2 production rate. Reducing sugars, alcoholic strength by volume, pH, total and volatile acidity, glycerol as well as malic and lactic acid of blackberry wines were estimated based on procedure described by OIV.

RESULTS AND CONCLUSIONS:
It was shown that Fermol Mediterraneé yeast started fermentation faster compared to Fermol Rouge yeast. Level of volatile acids formed by Fermol Mediterraneé yeast was slightly lower than that obtained by Fermol Rouge yeast, while concentrations of residual sugars, ethanol, pH and total acids were similar in wines produced using both yeasts. Glycerol production by both yeasts was nearly the same. Compared to FM wine malic acid level in FR wine was twice lower, while lactic acid concentration was twice higher in FR wine. Chemical composition of the produced wines was in accordance with the Croatian fruit wine legislation. Good fermentative properties of commercial yeasts Fermol Mediterraneé and Fermol Rouge could be beneficial for blackberry wine production.

EFFECT OF ENCAPSULATED AUTOCHTHONOUS POTENTIAL PROBIOTIC BACTERIA *LACTOBACILLUS PARACASEI* 08 ON THE CHARACTERISTICS OF SOFT GOAT CHEESE

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The use of goat milk in combination with bacterial strains, having probiotic properties, represents one of the options for production of new functional dairy products. Spray-drying has been investigated as a convenient method for producing large quantities of some probiotic cultures.
The aim of this work was to investigate the survival of encapsulated potential and commercial probiotic bacteria and their effect on the chemical composition and sensory quality of soft goat cheeses. According to phenotypic, technological, biochemical and probiotic characterization, autochthonous strain *Lactobacillus paracasei 08* was selected for spray-drying using reconstituted skim milk.
Three variants of soft goat cheeses were produced using mesophilic lactococci starter culture CHN 11 (Chr. Hansen, *Lactococcus lactis* and *Lactococcus cremoris*): 1. control cheese (starter); 2. starter + spray-dried potential probiotic Lb. paracasei 08 (Culture Collection of the Department for Food Microbiology, University of Belgrade); 3. starter + freeze-dried commercial probiotic *Lactobacillus acidophilus* LA-5 (Chr. Hansen).
The survival of encapsulated probiotic bacteria, the changes of starter bacteria counts, as well as the chemical composition, pH values and sensory evaluation were examined during 5 weeks of soft goat cheeses storage. *Lb. paracasei* 08 and *Lb. acidophilus* LA-5 counts were maintained at the level of 107-108 cfug−1. Starter bacteria counts were >106 cfug−1. The chemical composition and pH values of cheeses produced with probiotic bacteria did not significantly differ from the control variant. Sensory evaluation has shown that control cheese and cheese produced with *Lb. paracasei* 08 had a high sensory quality, while cheese produced with *Lb. acidophilus* LA-5 had an acceptable sensory quality.
Results of high viability of spray-dried potential probiotic strain *Lb. paracasei* 08 and acceptable sensory properties of cheese indicate that this strain can be successfully used in the production of soft goat cheeses as a new functional dairy product.

IMMOBILIZATION OF PORCINE PANCREATIC A-AMYLASE ON MAGNETIC FE2O3 NANOPARTICLES: ITS APPLICATIONS IN THE HYDROLYSIS OF STARCH

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Enzymes play pivotal role in catalyzing diverse reactions. However, their instability under repetitive/prolonged use and inhibition by high substrate and product concentration remain an important area of concern. In this study, porcine pancreatic α-amylase was immobilized on magnetic Fe2O3 nanoparticles in order to hydrolyze starch. The magnetic nanoparticle bound enzyme retained 94% of initial enzyme activity. X-ray diffraction and atomic force microscopy analysis showed that the prepared matrix has advantageous microenvironment and large surface area for binding significant amount of protein. Functional groups present in soluble and immobilized enzyme was monitored by Fourier transform infrared spectroscopy. Immobilized enzyme exhibited lower pH-optima (pH 6.0) than their soluble counterpart (pH 7.0). Temperature-optima for immobilized enzyme were shifted towards higher temperature. Immobilized enzyme was found significantly more resistant to the inactivation caused by various metal ions and chemical denaturants. Immobilized α-amylase hydrolyzed 92% starch in batch process after 8 h at 40oC while the free enzyme could hydrolyze only 73% starch under similar experimental conditions. Reusability experiment demonstrated that immobilized enzyme retained 83% of the original activity even after its 8th repeated use.

Keywords: α-Amylase; immobilization; nanoparticles; stabilization; starch hydrolysis.

PHYSİCAL PROPERTİES OF FERMENTED MİLK DRİNK PRODUCED FROM HİGH POWER ULTRASOUND-TREATED MİLK

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Effect of high power ultrasound on physical properties of fermented milk beverage was investigated. Pasteurized milk was treated with ultrasound by using a sonotrode with a diameter of 22 mm providing an acoustic power density of 85 W/cm². Pasteurized whole milk was treated with high power ultrasound at adjusted power (25%) - temperature (20, 60°C) - time (10 min) parameters. Control sample (85°C-30 min) was also prepared using the conventional manufacturing procedure for comparison. Samples were prepared by addition of water to yoghurt at a level of 50%. Samples prepared were stored at 4°C for 30 days. pH, titratable acidity, serum separation and rheological properties of the samples were measured. During storage serum separation levels increased in all the samples. The sample treated with 25%-60°C-10min combination was found to have similar viscosity and serum separation compared to those of the heat-treated sample. pH decreased and titratable acidity increased with storage time in all the samples.

THE EFFICIENCY OF IN VITRO ADSORPTION OF MYCOTOXINS BY ADSORBENTS OF PLANT ORIGIN

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The paper describes in vitro model for evaluation of ability of two adsorbents of plant origin,to adsorb different mycotoxins.
Fresh harvested tissues of submerged aquatic plant *Myriophyllum spicatum*, were taken from Sava Lake, Belgrade. Plant biomass was washed with HCl solution (3%) and then with distilled water. Plant material was afterwards dried for few days at room temperature, then for 6 hours at 50ºC, crushed and sifted.
Peach stones were obtained from "Vino Župa", Aleksandrovac. The fruit stones were separated from soft fruit residues, washed, dried at room temperature, crushed and separated from kernels. The peach stones were further used as milled shell fractions.
A total of six mycotoxins: aflatoxin B1 (AFL), ochratoxin A (OTA), deoxynivalenol (DON), zearalenone (ZON), diacetoxyscirpenol (DAS) and T-2 toxin were tested in vitro. For adsorption experiments crude extracts of mycotoxins were used. The ability for binding mycotoxins was evaluated in the electrolyte 0.1 M K2HPO4 which (pH 3.0 and 6.9, respectively). Mass ratio of individual mycotoxin and natural mineral adsorbent was 1:5000. The experimental mixtures were incubated for 1 hour on a rotary shaker (185 rpm) at room temperature (22-25^{o}C). The extractions of unadsorbed mycotoxins from the filtrates were performed with organic solvents, and their quantifications were done by thin-layer chromatography.
M. spicatum binded more (94.7-96.0%) of applicated AFL B1 than peach stones (73.3-80.0%). In the case of OTA higher adsorption indexes were observed by peach stones (50.0-66.7%). Binding of DON has been observed only by peach stones. Its adsorption index varied from 25.0 to 50.0% depending on the pH of the used electrolyte. *M. spicatum* adsorbed more ZON at pH 6.9 while peach stones adsorbed more ZON at pH 3.0. In the case of type A trichothecenes (DAS and T-2 toxin) adsorbents of plant origin binded only T-2 toxin. The amount of adsorbed T-2 toxin ranged from 16.7 (pH 3.0) to 33.33% (pH 6.9).
The obtained results point out the need for further investigations of other adsorbents of plant origin.

ETHANOL PRODUCTION FROM HOMINY FEED

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Hominy feed (HF) is a by-product generated by the manufacture of corn meal and is similar to ground corn in appearance. The initial composition (db) of HF is 60% starch, 14% fibre, 12% fat, 10% protein and 4% cellulose. The market competitiveness and price of HF can be boosted by fermentation of HF starch into ethanol (Sharma, Moreau and Singh, 2008). Before fermentation HF has to be defatted (HFDF). Saccharification and fermentation were performed by three different methods: application of ultrasounds after enzymes addition (US), addition of CaCl2 (Ca) and simultaneous application of two enzymes, α-amylase and glucoamylase, on double quantity (DE). These three different methods, plus a control, were tested using first hydrolysis followed by fermentation (SHF) and in simultaneous saccharification and fermentation (SSF). Fermentation was performed by Saccharomyces cerevisiae, at 108 cfu/ ml. After 48 h of fermentation of 30% HFDF (% W/V), ethanol was the main product (from 62 to 97 g/ L), and glycerol (from 8 to 10 g/ L) and acetic acid (from 0.7 to 1.4 g/ L) the secondary products. Highest level of glycerol occurs in simultaneous with highest concentration ethanol, experiments coded DE/HSF and Ca/SSF. Highest level of acetic acid occurred at lowest concentration ethanol in the ultrasonicated experiments. In conclusion, ethanol yields varied from 260 to 500 l/ton HFDF, on the control/SHF and Ca/SSF experiments, respectively. The highest hydrolyzed starch conversion factor into ethanol was 90%. After fermentation the levels in protein and fibre increased almost three times to 30% protein, 31% NDF, 8% ADF and 1.8% ADL. These new nutritional values of hominy feed, after fermentation, can be used to value this as a co-product alternatively to the current selling as a by-product for animal feed. HF showed to be a good sugar source to produce bioethanol.

QUANTIFICATION OF VIABLE SPRAY-DRIED *LACOBACILLUS PLANTARUM* TA AND 7A AFTER TWO YEARS OF STORAGE BY USING REAL-TIME PCR

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Viability of probiotic bacteria in food products is an important for their efficacy. Encapsulation techniques contribute to enhance their viability in food production and spray-drying is commonly used microencapsulation method.
The aim of this study was to compare survival of two spray-dried *Lactobacillus plantarum* TA and *Lactobacillus plantarum* 7A strains isolated from plant and human. In addition, beside the plate-count technique, aim was to examine the possibility of using real-time PCR (qPCR) for enumeration of spray-dried *Lb. plantarum* strains after two years of storage at 4°C.
Strains *Lb. plantarum* TA and 7A were spray-dried with a laboratory scale spray-dryer (B-290 Buchi mini spray dryer, Swiss) with a constant inlet air temperature at 170°C and outlet temperature at 80˚C. Reconstituted skim milk 20% (w/v) was used as a spray-drying carrier. The viability of *Lb. plantarum* TA and 7A cells, before and after spray-drying, were assessed by pour plate method using MRS agar after 48h of anaerobic incubation at 37°C.The number of spray-dried *Lb. plantarum* TA and 7A cells, after two years of storage at 4°C, were detected by plate count method and qPCR, combined with propidium monoazide (PMA) (50µmol-1) treatment.
Total plate count of *Lb. plantarum* TA and 7A, were 1.55x1011 CFU/g and 3.84x1012 CFU/g before spray-drying and 1.13x1010 and 5.71x109 after spray-drying. After two years of storage at 4°C, total plate count of *Lb. plantarum* TA and 7A were 8.5x109 and 2.3x109 and their viability detected by qPCR were 6.55x109 and 3.06x109, respectively.
Both tested strains have shown very good ability to survive spray-drying. The spray-drying was effective in maintaining the viability of *Lb. plantarum* TA and 7A after two years of storage at 4°C. Results demonstrate that spray-drying may be an effective way to produce large quantities of potential probiotic cultures.

INVESTIGATION OF PROBIOTIC POTENTIAL OF *LEUCONOSTOC* SP. AND *LACTOBACILLUS* SP. NATURAL ISOLATES FROM NON-COMMERCIAL MILK AND WATER KEFIR

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Non-commercial milk and water kefir grains (from a household in Belgrade, Serbia) were used for isolation of lactic acid bacteria on TSA, MRS and M17 agar.
Preliminary identification has been performed according to morphological traits (Gram staining, cells shape and colony characteristics on agar plate). Isolates suspected to lactic acid bacteria were tested for selected physiological and biochemical characteristics. Investigations of potential probiotic properties included antimicrobial activity against three different pathogens, sensitivity to simulated gastrointestinal tract conditions and autoaggregation ability. In total, ten cultures were selected for further analysis, five from each milk and water kefir grains.
The morphological and physiological profiles showed that isolated strains belong to genera *Lactobacillus and Leuconostoc*. There were some differences in their sugar fermentation pattern as well as in their antimicrobial activities, with milk kefir cultures being more potent pathogen inhibitors. In simulated gastrointestinal tract conditions all strains showed high sensitivity towards bile acids, while their growth in low pH and pepsin was good. Two cultures only (one from water kefir grains and one from milk kefir grains) showed good autoaggregation ability.
Overall, most isolates exposed good probiotic potential. There are no significant differences between lactic acid bacteria isolated from milk and water kefir grains.

Key words: lactic acid bacteria, probiotic, milk and water kefir

EFFECT OF FERMENTATION BY *STREPTOMYCES* SP. ON ANTIOXIDANT PROPERTIES OF SPENT COFFEE EXTRACTS

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During esspreso coffee preparation large amounts of spent coffee residues are produced and discarded daily as a part of the comunal waste. However, there is a great potential in recycling this type of waste for exctraction of natural antioxidans and manufacture of dietary supplements. The aim of this study was to investigate the effect of fermentation on the antioxidant properties of spent coffee extracts. Six series of spent espresso-type cofee samples were inoculated with selected natural strains of *Streptomyces* sp. The solid state-fermentation was carried out at 30°C five days. Aqueous extracts have been prepared and evaporated in the spray-dryer. The total polyphenol content was determined by Folin-Ciocalteu method and the antioxidant activity by two methods: inhibition DPPH (2,2-diphenyil-1-picrylhidrazyl) radicals and FRAP (Ferric Reducing Antioxidant Power). Inhibition of DPPH radicals was expressed as IC50 value. Results were compared to that of nonfermented control sample. Fermentation of spent coffee with these cultures have resulted in increased contents of polyphenols. Also, both methods have confirmed increased antioxidative activity in certain samples depending on the selected strains. It was therefore concluded that fermentation of spent coffee with *Streptomyces* sp. cultures have improved its antioxidative properties which presents a potential for its application in pharmaceutical and food industry.

STILLAGE FROM BIOETHANOL PRODUCTION AS SUBSTRATE FOR PARALLEL PRODUCTION OF LACTIC ACID AND BIOMASS

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Introduction:
Stillage as a by-product of bioethanol production on starch substrates is rich in proteins and minerals essential for lactic acid bacteria (LAB) growth. Parallel production of lactic acid and biomass for animal feed on the stillage could bring additional value to the bioethanol production process and resolve environmental problem of the stillage disposal.

Materials and methods:
Fermentations were preformed on liquid and whole stillage from bioethanol production on wasted bread with a strain *Lactobacillus rhamnosus* ATCC 7469. The stillage was obtained from ethanol factory Reahem, Srbobran and sterilized (121°C/103kPa/15 min). After adjustment of reducing sugar concentration with sterile 70% (w/w) glucose solution, the media was inoculated with 5% (v/v) of the overnight *L. rhamnosus* ATCC 7469 culture. Effect of different initial sugar concentrations was studied in batch fermentations at 41 ^{o}C, under microaerophilic conditions, with shaking (90 rpm). Lactic acid concentration (enzyme method), reducing sugar concentration (spectrophotometric method according to Miller) and a number of viable cells (pour plate technique) were determined during the fermentation.

Results:
Under selected conditions the highest yield of lactic acid of 92.7% was achieved on whole stillage with initial sugar concentration of 55 g/l. The number of viable cells at the end of fermentation was above 109 CFU/ml.

Conclusions:
Whole stillage from bioethnol production could be used without nitrogen or mineral supplementation as a substrate for parallel production of lactic acid and biomass. Spent fermentation media enriched with LAB biomass could be a valuable animal feed.

THE INFLUENCE OF RAW MATERIAL AND FERMENTATION CONDITIONS ON POLYPHENOL CONTENT OF GRAPE BEER

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Over the last decades, there has been an increased interest in researching the potential health benefits of moderate wine and beer consumption. Researches indicate that wine and beer consumed moderately can have a very favorable effect on overall health condition. The effect can be explained by a high content of antioxidants and other biologically active compounds, particularly polyphenols, which can prevent occurrence of some diseases, especially cardiovascular disease.
In this research, a special type of beer, the grape beer, was produced using three different grape varieties Prokupac, Pinot Noir and Cabernet Sauvignon. Beer samples were fermented using conventional brewer's wort and 20 % and 30 % of crushed grape. The fermentation was carried out using two different yeasts: *Saccharomyces uvarum* industrial strain obtained from one of the Serbian breweries and wine yeast *Saccharomyces cerevisiae* K1-V1116. The influence of grape variety, proportion of grape and yeast strains on the polyphenol content was examined. The total polyphenol content was determined according to the official EBC (European Brewery Convention) spectrophotometric method.
The results suggested that grape varieties, their contents, as well as yeast strains had a very significant influence on the total polyphenol content of obtained beer. The polyphenol content rang in samples went from 95.94 mg/L in beer without grape fermented by brewing yeast and up to 754.40 mg/L in beer with 30 % of Cabernet Sauvignon grape fermented by wine yeast.

Keywords: beer, grape, polyphenol, fermentation

SYNTHESIS OF ETHYL CINNAMATE CATALYZED BY LIPASE B FROM *CANDIDA ANTARCTICA*

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Cinnamic acid and its esters are widespread throughout plant kingdom and therefore, they are common components of our daily diet. Ethyl cinnamate is one of cinnamic acid esters commonly used as flavor and fragrance agent. FDA has approved it for direct addition to food for human consumption, and due to its sweet balsamic odor and flavor described as cinnamon, fruity, sweet and balsamic it is often found in brown cocoa, alcoholic beverages, dairy products etc. There is growing interest in cinnamic acid esters synthesis using immobilized lipase in non-aqueous solvents. Although their synthesis can be chemically catalyzed by acids or bases, enzymatic esterification offers environmental advantages and a reduction in energy consumption. Furthermore, the enzyme synthesis is strongly preferred when product quality is a main issue as is the case for food production. The aim of this study was to examine possibilities for enzyme catalyzed synthesis of ethyl cinnamate, and to optimize the synthesis in terms of selected parameters, including the type of the organic solvent, initial water activity, agitation speed, reaction time and substrate molar ratio.

All reactions were performed batchwise under pH and temperature control in vessels containing 5 mL of reaction medium, using cinnamic acid as limiting substrate (0.167 M). Each reaction mixture was supplemented with 75 mg of commercial immobilized lipase B from *Candida antarctica*, Novozyme 435. The antioxidant activity of obtained ester was measured by using chemical and electrochemical techniques.

The results showed that ethanol in large excess led to inactivation of enzyme, while less concentrations of ethanol were proven to be suitable for this reaction. The best reaction yield (89%) was obtained in isooctane when molar substrate ratio of 1:3 was used. Both, DPPH assay and cyclic voltammetry measurement has shown that ethyl cinnamate has better antioxidative properties than cinnamic acid itself. We have proven that ethyl cinnamate can be synthesized using lipase B from *Candida antarctica* with very high reaction yields in the simple bioreactor system.

PROBIOTIC YOGHURT PRODUCTION USING IMMOBILIZED *LACTOBACILLUS CASEI* ON PREBIOTIC SUPPORTS

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Nowadays an upsurge of interest in developing novel foods containing probiotic microorganisms is observed. Such functional foods have a great potential in promoting human health. Maintenance of the intestinal microbial homeostasis, prevention of pathogenic infections, stabilization of the gastrointestinal (GI) barrier function and production of anti-cancer and anti-mutagenic compounds are included among the beneficial effects of probiotic-based foods, mainly yogurt and other dairy products. To deliver the health benefits, probiotics need to contain an adequate amount of live bacteria (at least 6 logcfu/g), able to survive the acidic conditions of the upper GI tract and proliferate in the intestine, a requirement that is not always fulfilled. Since it is well established that cell immobilization enhances the viability of starter cultures, the aim of the present study was to evaluate the survival of free and immobilized *L. casei* ATCC 393 in yoghurt during refrigerated storage in comparison to *L. delbrueckii* subsp. *bulgaricus*. Cell immobilization on supports widely added in commercial yoghurts, such as strawberry, banana and oat pieces, was studied by electron microscopy. Microbiological and molecular analysis using strain specific multiplex PCR showed that both free and immobilized *L. casei* ATCC 393 were detected in probiotic yoghurts at levels required for conferring a probiotic effect (at least 6 logcfu/g) for longer time periods than required by the dairy industry (≥ 30 days) during refrigerated storage at 4^{o}C. On the contrary, cell mortality of *L. delbr.* subsp. *bulgaricus*, determined using species specific multiplex PCR, decreased to levels < 6 logcfu/g after 14 days of cold storage. Apparently, high acid resistance of the probiotic strains remains an undeniable prerequisite for maintenance of high survival rates. Finally, the overall high quality of the novel probiotic products was ascertained by the preliminary sensory test.

PROBIOTIC DRY SAUSAGES PRODUCTION USING IMMOBILIZED *LACTOBACILLUS CASEI* ON PREBIOTIC SUPPORTS

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Nowadays an upsurge of interest in developing novel foods containing probiotic microorganisms is observed. Such functional foods have a great potential in promoting human health. To deliver the health benefits, probiotics need to contain an adequate amount of live bacteria (at least 106 cfu/g), able to survive the acidic conditions of the upper GI tract and proliferate in the intestine, a requirement that is not always fulfilled. Since it is well established that cell immobilization enhances the viability of starter cultures, the aim of the present study was to investigate the potential of *Lactobacillus casei* ATCC 393 immobilized on wheat as starter culture for the production of probiotic dry fermented sausages. For comparison reasons, dry fermented sausages containing either free *L. casei* ATCC 393 or no starter culture were also produced and the quality characteristics were monitored during maturation. The determination of microbial groups revealed that numbers of lactobacilli remained high (> 7 logcfu/g) in probiotic sausages, while a drastic decrease was observed in numbers of enterobacteria, staphylococci and pseudomonas in all cases. Microbiological and molecular analysis confirmed that the levels of *L. casei* ATCC 393 in the probiotic sausages after 66 days of ripening were above the minimum concentration for conferring the probiotic effect (6 logcfu/g). However, after heat treatment (70oC for 8-10 min), our strain was detected in the above levels, only in sausages containing immobilized cells. Finally, the overall high quality of the novel probiotic products was ascertained by the preliminary sensory test and an indication of increased shelf-life was evident, as no spoilage was observed, in contrast to sausages containing no starter culture. In conclusion, our study demonstrated the application and efficacy of cell immobilization for the production of novel probiotic products in meat industry.

THE USE OF UNMALTED TRITICALE IN WORT PRODUCTION

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Introduction:
Triticale is the product of a cross between wheat and rye. Triticale has agronomic advantages, it can be grown on more marginal land and requires less agricultural chemicals. In addition to those quality criteria, substantial savings (up to 25% in costs for raw materials) could be achieved by using triticale instead of brewing adjuncts currently in use. Most non-malt adjuncts do not contribute enzyme activity. However, some triticale varieties already contain high levels of amylolytic activity in their unmalted natural form. The aim of this work was to investigate the possibility of triticale application as the partial substitute for malt in wort production.

Methods and materials:
Triticale variety Odyssey, from experimental fields, Rimski Šančevi location (Serbia) was used in this study. Triticale was added in each of the carried series of experiments as the substitute for malt: 10, 30, 50, and 70% in grist. For wort production two different infusion mashing regimes, standard (30 min at 45°C, followed by 60 min at 70°C) and modified (30 min at 45°C, followed by 30 min at 55°C, 30 min at 60°C, and 30 min at 70°C), were used in which triticale variety Odyssey was used as the substitute for barley malt in grist with and without the addition of commercial enzyme Ultraflo Max for wort viscosity reduction (Novozymes, Denmark).

Results:
Higher extract and free amino nitrogen contents were determined in worts produced according to the modified mashing regime. With the increase in the content of triticale in the grist, viscosity increased. The addition of Ultraflo Max significantly reduced wort viscosity.

Conclusions:
The obtained results indicate that worts produced according to the modified mashing regime and with the addition of triticale variety Odyssey in grist had good analytical quality parameters. Modified mashing regime enabled triticale's amylolytic enzymes to degrade its own starch which lead to higher extract content in produced worts.

Key words: triticale, wort, beer

PRODUCTION OF LOW-LACTOSE YOGURT

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The lactose disaccharide consisting of glucose and galactose, is the main carbohydrate present in bovine milk (4.5 to 5 g/100 ml). In the small intestine of humans it requires the presence of the enzyme β-galactosidase (or lactase) for proper absorption. When the body can not digest it properly, if there is absence or deficiency of this enzyme, there are various gastrointestinal complaints, known as lactose intolerance. This problem is widespread in the adult population.

The aim of this study was to investigate the application of β-galactosidase to produce yogurt with reduced concentration of lactose in order to develop new functional fermented milk product. The parameters of biotechnological process of yoghurt production with reduced concentration of lactose have been determined. The concentration of lactose in the samples was assessed indirectly through the determination of glucose with the enzymatic method of Trinder, by analytical hydrolysis. Obtained results show that the sufficient concentration of β-galactosidase for the hydrolysis of lactose in milk during the production of standard yogurt with reduced lactose concentration of the investigations, was 0.016 (v/v) %, and that such product could be consumed by people with the highest degree of lactose intolerance, it is necessary to add 0.025 (v/v) % β-galactosidase to obtain hydrolyse of lactose more than 90%.

MICROENCAPSULATION OF *LACTOBACILLUS PLANTARUM* JS7A BY SPRAY DRYING

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Probiotics are live microorganisms that are added to the diet in order to maintain the balance of intestinal microbial flora. Spray drying is an economical process for the preservation of probiotic cultures, which provides high productivity and relatively low operating costs. The aim of this study was to examine the possibility of using spray drying for microencapsulation of *Lactobacillus plantarum* JS7A derived from fermented carrot, with potential probiotic ability.

Microencapsulation was done using reconstituted skim milk (RSM), inulin and maltodextrin as carriers. The feed solution was atomized in drying chamber using a two-fluid nozzle. Drying was conducted at the constant outlet air temperature of 80 °C. In order to study potential cellular damage as a result of spray drying process, the sensitivity of tested strain to high concentration of NaCl before and after drying was determined.

When RSM was used as a spray drying carrier a microbial survival rate of 73 % was achieved (with 2.77x1010 CFU g-1 of viable cells), although the partial substitution of skim milk with inulin also resulted in high level of survival of 70 %. The poorest survival of 41 % was obtained with maltodextrin as a carrier. The moisture contents in powders were ranging from 4.1 % to 4.4 % which was regarded as a good-quality parameter of dried-dairy products. Spray drying process stressed the cells which was shown by increased sensitivity to NaCl. However, it was obtained that reconstituted skim milk showed the significantly lower inhibition of cells of 49 % comparing with inulin and maltodextrin with 55 and 75 % of inhibition, respectively.

Our data demonstrate that spray drying may be a cost-effective way to produce large quantities of some probiotic culture. Also, powder obtained with skim milk as a carrier could be a useful ingredients in functional food applications.

Key words: microencapsulation, *Lactobacillus plantarum*, spray drying

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In the two past decades, there has been a great deal of research on polyphenol compounds and their antioxidant properties. Raspberry as a fruit species is widely grown in Serbia and is well known in the world for its quality. Being very rich in polyphenol compounds, raspberry is a great source of components of excessive biological value.

The objective of this study was to investigate influence of temperature, sulfur-dioxide and selected yeast on fermentation of raspberry pulp and the total polyphenol content of raspberry wine. The pulp of Meeker, one of the most abundant varieties of raspberry (Rubus idaeus) in Serbia, was fermented at 15°C and 22°C with and without selected yeast cells, and with and without addition of sulfur-dioxide. The total polyphenol content was determined every 24 hours, according to the Folin Ciocalteau method and results were expressed in mg/l galic acid equivalents (mg/l GAE).

The obtained results indicate that fermentation temperature and addition of sulfur-dioxide significantly influence the extraction of phenolic compounds from raspberry pulp, while the addition of selected yeast cells has no influence. Immediately before fermentation, total polyphenol content in the sample was 1415,7 mg/l GAE. After 72 hours of fermentation, the sample fermented at 15° C with addition of sulfur-dioxide and without selected yeast cells reached its maximum value of 2191 mg/l GAE, whereas the same sample fermented at 22° C reached the value of 2820 mg/l GAE. Other samples had lower values then these two. After 96 and 120 hours of fermentation, in all samples total polyphenol content was slightly lower then after 72 hours.

Key words: raspberry, fermentation, polyphenol content, raspberry wine

SUGAR CONTENT CHANGES DURING MILK FERMENTATION WITH KOMBUCHA ADDITION

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The aim of this research was to examine changes in sugar content during production of fermented milk beverages from milk with 2% fat (w/w) by using 10% (v/v) inoculum of kombucha, cultivated on black tea. Kombucha is a mixed culture of acetic acid bacteria and yeasts with complex metabolic pathways. The traditional carbon source for kombucha fermentation is sucrose. Novel researches showed that application of any other sugar such as lactose is possible.

Milk fermentation temperatures were 37 ºC and 42 ºC. Final pH value was 4.6. Dry matter, milk fat, total proteins and ash were analysed in milk and products by standard methods. Changes in lactose, galactose, glucose and fructose content were investigated during fermentation on pH 5.8; 5.4; 5.1; 4.8 and 4.6. Lactose, galactose, glucose and fructose were detected using specific enzymatic tests. Products of the reactions were monitored using spectrophotometer.

The obtained results indicated that the pattern of changes of lactose, galactose, glucose and fructose concentration during milk fermentation on two different temperatures were similar.

ABSORBTION OF NICKEL AND MANGANESE IONS IN MILK PROTEINS SOLUTIONS ON POLYACRYLIC HYDROGEL

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Polyacrylic hydrogels are non-toxic, biodegradable polymers widely used in medicine, pharmacy, agrochemistry and environmental chemistry. It was found that heavy metal ions can be presented in milk because of different types of milk contamination. Some nickel compounds are carcinogenic and could cause allergic reactions, whereas manganese had important role in some neurological disorders. The aim of this study was to establish whether polyacrylic hydrogels could be used for milk heavy metals decontamination.

Investigation was carried in whole milk protein solutions (WMP), whey proteins solution (WP), serum albumin proteins solution (SAP) and in distilled water (as a comparing medium) until equilibrium swelling degree, SDeq was reached. Presence of heavy metal ions in milk protein solutions was determinated by atomic absorption spectrometry. Swelling process of hydrogel in investigated milk proteins solutions was significantly reduced compared with distilled water. Moreover, in WMP solution hydrogel completely collapsed. The explanation for this can be a high ionic force in this solution. On the other hand hydrogel showed great preferences for binding of heavy metals ions. Formation of chelatic complexes among heavy metal ions and dissociated carboxylic groups of acrylic monomers could be possible explanation. Results showed that amount of bind nickel ions on hydrogel were higher in WP solution than in SAP solutions, whereas in the WMP solution nickel wasn't identified. On the other hand, absorption of manganese ions was, also, the highest in WP solution but this metal wasn't found in SAP solutions. It was found in WMP solution.

This study indicated that using polyacrylic hydrogels, it could be possible to remove heavy metal ions from investigated milk proteins solutions. This is particularly important concerning toxicity of these ions and their harmful effects on human health, especially when milk and dairy products are used in infants and children diet.

APPLICATION OF TEA FUNGUS CULTURE IN PRODUCTION OF FERMENTED MILK BEVERAGES

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Kombucha and fermented milks have again become very popular during the past decades due to their positive effect on human health and increased awareness of the general population about proper diet. The aim of this work is investigation of possible usage of tea fungus culture as a starter culture for manufacture of fermented milks. Local tea fungus culture was grown on traditional substrate at 28 ºC and 42 ºC. One group of samples of milk (pasteurized and sterilized, with 2.8% fat) was incubated without added kombucha (control samples) and another group was inoculated with 10% of local kombucha beverage. All fermentation of milk-based samples were performed at 42 ºC and 30 ºC and fermentation was stopped when the pH value of samples reached 4.5. Fermentation process was monitored by determination of basic chemical and microbiological parameters. The samples of the traditional kombucha beverage incubated at 42 ºC after 5-day fermentation had the initial pH and titrabile acidity (4.61 and 0.37 g acetic acid/L). During the first day of fermentation at 42 ºC, total count of acetic acid bacteria dramatically decreased from 6.6 x 10^5 (CFU/mL) to <1 (CFU/mL). Pasteurized milk-based products, with and without kombucha inoculum, incubated at 42 ºC, reached target pH level in almost the same fermentation time (10.5 – 16 h). In these products dominant microorganisms were lactic acid bacteria - lactobacilli and lactococci, (about 10^8 CFU/ml and 10^9 CFU/ml, respectively). All samples produced on sterilized milk and fermentation performed at 30ºC did not reach the target pH during 24h fermentation. These results have shown that it is impossible to perform kombucha fermentation at 42 ºC due to the fact that viability of acetic acid bacteria was not detected. In milk-based samples the main roles in fermentation have lactic acid bacteria from pasteurized milk and/or environmental contaminant bacteria.

COMPARATIVE STUDY OF BREWING YEASTS STRAINS FOR BEER PRODUCTION WITH IMMOBILIZED CELLS

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Significant impact on the flavoring-taste profile of the beer, in addition to the raw materials, wort, fermentation conditions, methods of stabilization and technological equipment, the have used yeast strains. The brewing yeasts, which have good reproductive capacity, fermentation activity, metabolism and stable properties are crucial for obtaining competitive beers with high quality. Therefore, an important step in developing of a new or improving an existing technology is the selection of yeast strains.

In the present study were investigated three yeasts strains from the species Saccharomyces cerevisiae. All analyses were performed with the standard methods of brewing technology and microbiology. Fermentation processes were carried out with free and immobilized cells at different initial wort extracts. The yeasts immobilization was carried out in the capsules of chitosan-alginate with internal liquid core. It was investigated some basic parameters of the received beers and was made an initial organoleptic evaluation of the beverages.

As a result of the study were selected yeast strains suitable for obtaining of a beer with immobilized cells.

ENCAPSULATION OF NATURAL ANTIOXIDANT RESVERATROL IN LIPOSOMES

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Introduction:
The concept of stability improvement and extended release of an encapsulated compound has become a main competitive technology. Liposomes have been shown to be extremely suitable systems for encapsulation and preserving the health–beneficial properties of wide range of biological active ingredients such as resveratrol. The aim of this study was to encapsulate resveratrol in liposomes, with a goal to achieve the extended release and improved stability of resveratrol.
Materials and Methods:
Multilameral liposomes were prepared by means of two different methods: thin film method and proliposome method. Mixture of cholesterol and phospolipon 90G was used for lipid film preparation, while phospolipon 90G was used for proliposome method. In both methods, the ratio between added resveratrol and phospolipon 90G was 1:20 w/w. Extrusion and sonication were applied in order to obtain unilameral liposomes. Size measurements and stability of liposome dispersions were monitored by Zetasizer Nano Series. Determination of free radical-scavenging activity of resveratrol was performed UV-spectrophotometrically. Franz diffusion cell was used for release studies.
Results:
Both methods for encapsulation of resveratrol in liposomes provided high encapsulation efficiency (92,9% in case of thin lipid film and 97,4% in case of proliposomes). Methods for diameter reduction revealed significantly different results; the average diameter ranged between 120 and 270 nm. There was no considerable alteration in liposome diameter during three weeks. Antioxidative activity was retained at high desirable level (approximately 95%). The release profiles during 6h did not show any impact of liposome diameter on diffusion rate of resveratrol.
Conclusion:
Liposomes appeared to be suitable vehicles for encapsulation of resveratrol, as they preserved antioxidant capacity of resveratrol during several weeks and provided extended release. The results suggest that formulations based on proliposomes would be useful for encapsulation of functional food ingredients.

Key words: encapsulation, liposome, resveratrol, release study

ENCAPSULATION OF *THYMUS SERPYLLUM L*. AQUEOUS EXTRACT IN CHITOSAN AND ALGINATE-CHITOSAN MICROBEADS

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Introduction:
Plant polyphenols exhibit high antioxidant properties, but the most common way of their consuming often results in lost of stability and bioactivity. One way to preserve the health–beneficial properties of plant extracts is their encapsulation within a matrix or behind a membrane, enabling superior handling of the active compounds by liquid-to-solid form conversion. This study reports on encapsulation of *Thymus serpyllum* L. aqueous extract in chitosan and alginate-chitosan microbeads and its consecutive release.
Materials and Methods:
Chitosan microbeads were prepared in water-in-oil (W/O) microemulsion with gluteraldehyde as a crosslinking agent, while alginate-chitosan microbeads were prepared by electrostatic extrusion. The outer surface of microbeads was observed by optical microscope. The interaction between chitosan and/or alginate-chitosan microbeads and polyphenolic extract were analyzed by FT-IR. Swelling studies and release kinetics of polyphenolic compounds from the microbeads in water were monitored. Total polyphenolic content was measured using Folin-Ciocalteu reagent.
Results:
Experimental results show that applied methods gave chitosan and alginate-chitosan microbeads with an average diameter of 200 μm and 800 μm, respectively. FT-IR analyses confirmed the presence of polyphenolic extract within synthetized microbeads. Encapsulation efficiency was determined with respect to total polyphenolic content. Chitosan microbeads showed lower encapsulation efficiency of ~36%, but prolonged release, compared to alginate–chitosan microbeads where encapsulation efficiency was ~86%. The observation of microbeads by optical microscope, confirmed the uniformity of the obtained microbeads, as well as no aggregation appearence.
Conclusion:
The microbeads exhibited somewhat slower release rates compared to our previously achieved results using plain alginate microbeads. The results showed that, by some synthesis modification of both, chitosan and alginate-chitosan microbeads, have potential to be used for encapsulation of aqueous phenolic extracts. These microbeads can be used to improve stability and functionality of polyphenolic compounds in food products.

FERMENTED DAIRY BEVERAGES PRODUCED BY DIFFERENT STARTER CULTURES AND TRANSGLUTAMINASE

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The objective of this study was to investigate the effect of different starter cultures and transglutaminase on chemical characteristics and textural properties of fermented dairy beverages produced from milk of 0.9%[w/w] fat content. Samples were produced by application of probiotic starter culture or microfiltrated kombucha inoculum. Quality of fermented dairy beverages were analysed after production. It was found that two times faster fermentation was achieved in the probiotic yoghurt compared to fermented milk samples with microfiltrated kombuha inoculum. Chemical analyses of the obtained beverages has shown that the fermented dairy beverages produced with microfiltrated kombucha inoculum contained higher concentration of lactose and lower level of galactose and L-lactic acid than probiotic yoghurt. Probiotic yoghurt had better textural properties than the sample with microfiltrated kombuha inoculum. Application of transglutaminase in fermented dairy beverages manufacture improved physicochemical properties of products.

MICROENCAPSULATION OF NATURAL ANTIOXIDANTS FROM *PTEROSPARTUM TRIDENTATUM* IN DIFFERENT ALGINATE AND INULIN SYSTEMS

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Introduction:
The bioactivity of natural antioxidants from plant extracts is well known. Still, the effectiveness of these natural antioxidants, namely polyphenols, depends on preserving their stability, which can be increased by microencapsulation. The aim of this study was to protect natural antioxidants of *Pterospartum tridentatum* extracts by encapsulation in alginate beads. *Pterospartum tridentatum* is a wild herb widely used in traditional medicine and cuisine in Portugal.
Material and methods:
Medium viscosity alginate and inulin were used for preparation of microbeads, since those are materials allowed in food applications. Three types of microbeads entrapping polyphenols from the extract were prepared by electrostatic extrusion technique: plain Ca-alginate microbeads and Ca-alginate microbeads with 10 mass% and 20 mass% of inulin as a filler substance. Total polyphenol content was analyzed by the Folin-Ciocalteu reagent. The radical scavenging activity was determined as Trolox equivalent antioxidant capacity (TEAC) and also by using stable free radical 1,1-diphenyl-2-picrylhydrazyl (DPPH assay). The release studies of polyphenols from freshly prepared beads were performed in laboratory conditions. Samples were analyzed by Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and optical microscopy (OM).
Results:
Encapsulation efficiency for all samples was in the range from 49 to 73%. Average diameters of all microbeads were from 600 to 900 μm. The problem of the gel collapse during freeze-drying process was significantlly reduced by addition of inulin, as confirmed by SEM analysis. The results of TEAC and DPPH tests indicate that antioxidant activity was preserved in a satisfactory level.
Conclusions:
Antioxidant assays and release studies showed that alginate-inulin microbeads encapsulating polyphenols appeared to be suitable dosage forms. The inclusion of inulin contributes to improved microbeads structure, as well as to nutritional values of food. Thereby, potential applications of these microbeads could be functional food products, an increasingly valued market.

ENCAPSULATION OF BASIL (*OCIMUM BASILICUM*) ESSENTIAL OIL

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Basil (*Ocimum basilicum*) is an aromatic plant widely used as a culinary herb, commonly added as fresh. There are many scientific studies that have confirmed health benefits of the basil oil. Bioactive compounds found in basil essential oils have antioxidant and antimicrobial properties. However, effectiveness of these compounds depends on preserving their stability, which can be increased by encapsulation.

The aim of this study was to encapsulate the basil essential oil (EO) in alginate microbeads in order to protect and stabilize containing bioactive compounds.

Calcium alginate microbeads entrapping the EO were produced by electrostatic extrusion technique. The obtained microbeads were characterized from the aspect of total phenol content, encapsulation efficiency and antioxidant capacity. Total polyphenol content (TPC) of microbeads was analyzed by the Folin-Ciocalteu reagent. Encapsulation efficiency was calculated as the ratio between the TPC in the citrate solution of dissolved microbeads and the TPC of the initial EO. The radical scavenging activity was determined as Trolox equivalent antioxidant capacity (TEAC) and by using stable free radical 1,1-diphenyl-2-picrylhydrazyl (DPPH). The rehydration properties of air dried microbeads were investigated in water and phosphate buffer solution. Also, samples were analyzed by optical microscopy (OM).

Encapsulation efficiency was obtained to be approximately 60.0 %. The results of TEAC and DPPH tests indicate that antioxidant activity was preserved at a satisfactory level. The average diameters of fresh and dried microbeads were 860.8±44.9 and 416.0±37.2 μm, respectively. The particles, with and without EO, rehydrated in buffer were highly swollen, from 5000 to 10000 %w/w.

The results suggest that alginate microbeads encapsulating EO appeared to be suitable dosage forms with possible applications in the production of functional foods.

MİCROBİOLOGİCAL PROPERTİES OF FERMENTED MİLK DRİNK PRODUCED FROM HİGH POWER ULTRASOUND-TREATED MİLK

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Thermal treatment of milk denatures serum proteins and is essential in production of fermented milk beverage for its physical quality. High power ultrasound can be used as a processing aid in production of fermented milk beverage through its denaturating effects on proteins. The objective of this study was to investigate the effect of high power ultrasound treatment of milk on microbiological properties of fermented milk beverage during storage .

Pasteurized whole milk was treated with ultrasound by using a sonotrode with a diameter of 22 mm providing an acoustic power density of 85 W/cm². Milk was treated with ultrasound at 25% power level for 10 min at two different temperatures (20°C, 60°C). Milk was also incubated at 85°C for 30 min as a control representing the heat treatment in conventional production of the fermented milk beverage. Yoghurt was made from the treated milks using the standart procedure. The fermented milk beverages were prepared by mixing the yoghurts obtained with water at a 1:1 proportion and were stored at 4°C for 30 days. Numbers of lactic acid bacteria, aerobic mesophilic bacteria and yeast/molds were determined in the samples after 1, 10 and 30 day of the storage.

Lactobacilli count in samples prepared from ultrasound treated milk was 1 log lower compared to that of the control after 30 days of storage. However, no difference was detected in *Streptococci* count in samples during storage. The count of lactic acid bacteria was above 6 log cfu/mL in all the samples during storage. Total bacteria and yeast/mold counts were less than 2 log cfu/mL in all samples during storage.

In conclusion, ultrasound treatment applied to milk used in fermented milk beverage production did not adversely affect its microbiological quality during 30 days storage.

ANTIMICROBIAL ACTIVITY OF PHENOLIC EXTRACTS FROM OLIVE LEAVES AND GRAPE SKINS AND SEEDS – IMPACT OF ENCAPSULATION

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Introduction: Olive leaves and grape skin and seeds produced as by-products in wine production constitute a cheap source of plant material with certain amount of bio-active substances. Antioxidant, antimicrobial, anti-inflammatory and anticancer properties were reported due to their phenol compounds. The efficiency of extracts activity depends on the preservation of biological availability of bioactive compounds. Encapsulation can improve stability, biological availability, hydrophobic/hydrophilic character and unpleasant taste in potential use for food preservation.
Methods and materials: In this study antimicrobial activity was first screened by broth microdilution method for minimal inhibitory concentrations (MICs) of phenolic extracts from olive leaves (*Olea europaea,* cv. "Leccino" and grape skins and seeds (*Vitis vinifera* L., cv. "Zelen") (ethanol:water extraction, 7:3, 1:1, respectively). Yeasts were used as target organisms -14 strains of *Candida, Pichia and Ogataea* spp. were isolated from spoiled olive oil and *Dekkera bruxellensis* from grape must. The kinetics of antifungal activity was followed by the yeast inhibition/death curves in YPD medium with phenolic extracts in MICs determined by broth microdilution test. Finally, the impact of extract encapsulation into ß-cyclodextrin and liposomes on antifungal activity was tested.
Results: Phenolic extracts from olive leaves and grape skins and seeds expressed high efficiency against most isolates of spoilage yeasts. Encapsulated olive leaves extracts in ß-cyclodextrins and liposomes showed the same or better efficiency than non-capsulated in broth microdilution screening test and kinetics of yeast growth inhibition. The encapsulation into ß-cyclodextrin has been proven to be more efficient.
Conclusion: Grape skins, seeds and olive leaves as plant waste materials proved to be a rich source of phenolic compounds with antimicrobial activity against spoilage yeasts. In addition, a positive impact of encapsulation was confirmed with preserved or enhanced antimicrobial activity of tested phenolic extracts against spoilage yeasts.

VI
FOOD STRUCTURE, SENSORY ANALYSIS, FOOD AND CONSUMERS

COMPARATIVE STUDY ON TRANSGLUTAMINASE CROSS-LINKED COW AND GOAT MILK GELS

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Microbial transglutaminase (mTGase) is an enzyme that introduces new covalent bonds in the protein systems. In the present study we investigated the impact of mTGase cross-linking on acid gels obtained from goat milk, compared with acid gels made from cow milk, using model systems. Gels were obtained from UHT cow and goat milk by acidification with 4 % glucono-δ-lactone at 30 °C, which mimics the slow acidification produced by starter cultures. Previously, 3 U mTGase/g protein were added for 0.5 and 1 h incubation, and enzyme inactivation was achieved by applying a heat treatment at 85 ºC for 10 minutes.
The rheological properties of the acid gels were analyzed using small and large deformation tests. Since a proper firmness of the acid gels without syneresis is essential for a high quality of yogurt, this study investigated also the mTGase effect on the water holding capacity of acid gels from the two different substrates. SDS-PAGE was used to semiquantitatively determine the cross-linking degree of the cow and goat milk proteins.
Results showed a 3-fold increase in gel stiffness and firmness and a 2-fold reduction in syneresis in cross-linked goat milk gels, due to the introduction of the ε(γGln)Lys links by mTGase. However, comparing with acid gels made from cow milk, much smaller values were obtained, even in the presence of mTGase, when the low protein content affected the characteristics of the gel formed. This aspect should be considered if it is to obtain a dairy product from goat milk with a gel texture comparable to that obtained from cow milk.

VISCOELASTIC STUDIES OF FRESH MANGO PUREE TEXTURIZED WITH GELLAN GUM

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Consumption of fresh fruits products, increased during the last decade, probably as a consequence of the public awareness regarding the importance of healthy eating habits and consumer's tendency for eating ready-to-eat cut fruits (Olivas G.I., et al. 2005).

Mango (Mangifera indica L,) is an economically important tropical fruit due to its excellent pleasant taste, nutritional composition and antioxidant activity (Youngmok K., et al. 2009). On the other hand, gellan gum is widely used in the food industry because it allows to produce strong and transparent gels at very low concentrations, which are resistant to heat and low pH (Garcia Carmen M., et al. 2011).

The objective of this study is the development of ready-to-eat fresh fruit jellified products based on mango puree and gellan gum. The effect of the type of gellan (low acyl or high acyl), gellan concentration (1% and 2%wt) and dissolution temperature (70ºC and 90ºC) on gels setting temperature and dynamic moduli (G' and G'') was studied.

Gels prepared with mango puree and low acyl gellan have shown higher values of dynamic moduli than those with high acyl gellan. Moreover, no significant differences were observed between the gels obtained with 1% and 2%wt of biopolymer. The heating temperature of the mango puree-gellan mixture was determinant on the physical properties on the jellified product. Gels produced after heating the mixtures to 90ºC for 1 min have shown higher dynamic moduli and higher gel setting temperature (Tg=65ºC), than those obtained after heating at 70ºC for 1 min (Tg=45ºC).

Future work will be focused on the optimization of product formulation (e.g. use of low acyl and high acyl in different proportions) and production process, in order to design a fresh fruit product with improved sensorial acceptance.

THE PROSPECT OF USING BIOPOLYMERS TO CONTROL THE NANOSTRUCTURE AND FUNCTIONAL PROPERTIES OF BUTTER

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One of the most important current social issues today is creating functional products, aiming at preventing diseases and preserving people's health. Special attention is paid to using food supplements of raw vegetable material. We created new types of butter containing pectin and inulin biopolymers, obtained from raw vegetable materials. According to the results of clinical studies the designed types of butter are recommended by Ministry of Health to use in prophylactic nutrition and diet.

Complex research showed us, that pectin and inulin polysaccharides in the butter heterosystem are surface-active substances (SAS). Butter micro- and nanostructure consists of crystalline aggregates, nanoblocks and nanograins, that form during the process of its self-organizing. The mechanism of nanostructure self-organization is based on phase transformations and glyceride fractioning.

Primary stage of crystalline fat phase formation is generation of crystalline embryos out of most high-melting glycerides. During the process of growth of nanograins, nanoblocks and aggregates there's glycerides fractioning on solidification, conformation and polymorphic forms. Identic glycerides pack into lamels; noncrystallized glycerides and liquid phase with dissolved biopolymers are pushed back on periphery. Crystalline nanograins about 5-10 nm in diameter form lamels, on their bounds adsorptive layers of biopolymers and liquid phase are formed. The nanostructure of crystalline aggregates and nanoblocks consists of nanograin alternate lamels and liquid phase streaks. Amorphous crystalline polysaccharide lipidic layer is formed on the surface of aggregates and nanoblocks.

It has been established, that bringing in pectin and inulin polysaccharides stimulates the reduction of butter structural elements by 5-25 times, bigger part of the elements varies from 1 to 100 nm. The amount of liquid phase dispersed at nanolevel increases to about 60%. This slows down microbiological and oxidating processes of product spoilage, and therefore increases its biological value. Thus, the rise of biological value of butter types that contain inulin and pectin is connected with functional properties of these polymers as well as with nanostructure peculiarities of these types of butter.

Everything mentioned above proves the prospect of using biopolymers for nanostructure control, control of functional and physical-chemical butter properties and other food products that contain fat, and for creation their nanotechnologies.

ACCEPTANCE OF FOOD ADDITIVES IN HUNGARY AND SPAIN: AN EXPERIMENTAL STUDY

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The level of worry against food additives is higher in Hungary (81%), than in Spain (54%) (Eurobarometer, 2010), probably as a result of different knowledge levels and attitudes towards them.

A shelf-administered questionnaire was developed and filled out in Hungary (N= 437) and in Spain (N= 347) in order to explore consumers' knowledge and their judgement related to food additives. On the basis of the results, strong demands were detected for artificial additive free products in both countries, even at higher prices. Thus, the aim of our work was to analyse and compare the willingness to pay (WTP) and preference of foodstuffs containing natural and artificial food additives in Hungary and Spain.

For this purpose a conjoint analysis was done. Conjoint cards from two groups of food additives (preservatives and packaging gases), and from two "model foodstuffs" were created. One expected high additives content (chips) and one expected low additives content (pre-packed sliced cheese) foodstuff were used to stimulate the shopping situation. Three factors were selected: preservatives (artificial/natural), packaging gases (contains/does not contain) and price (+10%/+20%). By means of an orthogonal design seven cards were chosen. Results (N> 200 for each country) were collected through internet, which is a comfortable and cost effective tool, although only internet user consumers were reached. Preference and WTP affected by the factors from the point of view of different socio-demographic factors (e.g. age, gender) in the countries will be demonstrated in the presentation. Eurobarometer (2010): Special Eurobarometer 354: Food-related risks.
http://www.efsa.europa.eu/en/factsheet/docs/reporten.pdf

EFFECT OF GENDER, AGE AND OCCUPATION OF JUDGING CONSUMERS ON SENSORY EVALUATION OF VARIOUS LAMB MEAT FOODS

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In a research aiming to improve lamb meat quality and quantity of 8 different genotypes were examined. Various lamb meat foods were developed based on genotypes to study the differences among them: Wiener sausage (8 kinds); marinated, smoked and cooked ham (8 kinds); kitchen ready, seasoned, marinated, sliced and roasted lamb meat (8 kinds); whole roasted (restaurant style) lamb leg (4 kinds).
Altogether 285 (60% male and 40% female) randomly selected heads of consumers were included in sensory evaluation/ judging of the products. The consumers represented different age groups: below 20 years; between 21-30; 31-40; 41-50; 51-60; 61-70, and above 70 years. The groups of consumers were involved in: sheep farming; other animals' farming; other agriculture; industry; catering, education, student, other service; administrative department of the state, and others.
The stringiness, flavour and smell were judging in food sensory evaluation. In stringiness and flavour five (from 1 to 5), and concerning smell three (from 1 to 3) categories were created according to decreasing quality.
Analyses of variance were calculated to estimate the effects of lamb genotype; the gender, age, and occupation of judging consumers on sensory evaluation of the various meat foods.
In conclusions, it was stated that new lamb meat foods were highly appreciated by consumers. Consumers made definite distinctions among genotypes according to flavour, stinginess and smell. There were significant interactions between gender, age and occupations of ~~s~~ consumers as well as sensory evaluation of various lamb meat foods.

Key words: lamb genotypes, meat products, consumer, sensory evaluation

WHY DO WE NEED TO CONDUCT SENSORY TESTS ON CONSUMERS? THE CASE OF INNOVATIVE SWEET TOPPING

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A significant component of new food development process is precise identification of consumer preferences and expectations. In this paper we empirically show that findings form a preliminary research, in which is reflecting the initial enthusiasm for the new product, can be used for development guidance, however, when more objective research techniques are applied, suggested managerial decision could critical differ. The new food product is dessert topping based on traditional Slovenian wine Teran, which is highly valued among consumers and perceived as a national speciality. We assumed that these positive elements of consumers' perception about wine Teran will be transferred to new developed product and will form central marketing elements.
The research involving consumers combined semi-structured interviews, focus groups and questionnaire with consumer sensory test. First two stages gave us qualitative data which was highly encouraging and the expected market potentials were substantial. The third phase aimed at product fine-tuning, applying consumers' sensory tests; hedonic evaluation and preference testing, where four commercial toppings were included besides the newly designed one. Questionnaire gave important inputs to the marketing strategy, elucidating the purchasing behaviour and consumer expectations regarding the products in target market segment.
We found out that the market is in highly mature phase. As distinguished from the quantitative stages of the research, the questionnaire reviled consumers' preference for established topping flavours, particularly chocolate. Consumer sensory test disconfirmed high expectation, since the average score in preference testing was in lower end for Teran's topping, being surpassed by the standard topping tastes. Sensory attributes from JAR (just about right) scale showed that respondents liked the new product, but they still preferred the classic tastes. Market acceptance of the new product is below the threshold to continue the outlined product development strategy without risking business failure that is why we suggest product concept redefinition.

HOW THE POPULATION'S PERCEPTIONS INFLUENCE THEIR BEHAVIOURS REGARDING THE CONSUMPTION OF FIBRE RICH FOODS

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The association between dietary fiber, health benefits and healthy food has been studied in recent years. The food industry, to accompany the strong interest shown by consumers, has placed at their disposal new products, rich in dietary fiber.

In order to meet this huge interest and demand for these products, this work was elaborated, which had as main objective to evaluate the degree of knowledge of the Portuguese population about fiber and its effects on health, as well as evaluating the their consumption habits in respect of fibers. To achieve this goal an inquiry was carried out by questionnaire to 182 adults.

The most relevant results indicate that only 13% of the inquired eat two meals a day with vegetables and/or salads and 9% eat at least 3 pieces of fruit. Whole grains are never consumed by 41% and 18% do so at least once a week. The vast majority (90%) of respondents have the notion that fibre intake contributes to the prevention and treatment of diseases.

With this work it was concluded that respondents' knowledge about dietary fibre is insufficient, and that although they give great importance to their role in treatment and prevention of diseases, the level of intake is too low.

FOOD WITH NUTRITION AND HEALTH CLAIMS AND TRADITIONAL FOOD: CROSS-COMPARISON OF THE WESTERN BALKANS CONSUMER PROFILES

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Traditional food is usually defined as a typical food of local origin, home-made or on-farm produced (Ricketts et al., 2006; Vogt and Kaiser, 2008; Wilson and Fearne, 2000; Hamermesh, 2007). Food with nutrition and health claims (N&H claims) have been often seen as an opposite to the traditional food. Applied in the practice of the well known food companies worldwide, it is considered as a much more global concept.
Local versus global perspectives of foods, seen from the consumer perspectives, are analyzed in this paper based on the case study of the Western Balkans region. The six countries (Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro and Former Yugoslav Republic of Macedonia) are included in the analysis. The sample is representative at national level. The findings are derived from the data collected in face-to-face interviews with main shoppers in the households (n=3086).
The research is based on observation of the traditional food and products with N&H claims consumers' profiles in the Western Balkans. The paper describes opposite consumers' profiles by various demographic and economic variables. Additionally, their food choice motives are presented in the paper. The policy implications are derived according to the most important factors that influence on the frequency of consumption of chosen products.

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Key words: traditional food, nutrition claims, health claims, functional food, consumer profile, WBC.

ENHANCEMENT OF WINE SENSORY QUALITY WITH YEAST STRAINS

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Wine varietal aroma is one of the most important parameters of sensory quality and it is greatly influenced by vintage year, temperature and volume of alcoholic fermentation and many other vitivinicultural practices. In recent years the importance of yeast starter culture used for alcoholic fermentation has been highlighted. The aim of the present study was to investigate the influence of three commercial wine yeast starter cultures on aroma and chemical composition of Sauvignon Blanc wine together with three different fermentation volumes and two fermentation temperatures. The basic chemical parameters, volatile thiols (GC-MS), metoxypyrazines (HS-SPME GC-MS), glutathione (HPLC-FLD) and hydroxycinnamic acids (HPLC-DAD) were determined in produced young wines. Sensorial evaluation of young wines was also performed. The results showed significant differences in the concentrations of some measured parameters and in the sensorial quality of the wines with regard to the yeast strain, volume and temperature of the alcoholic fermentations. It can be concluded that all three paramters investigated could be an important tool for the winemakers to produce wines with enhanced varietal aroma and better overall quality.

Key words: oenology, wine, Sauvignon Blanc, yeast starter culture, alcoholic fermentation, sensory quality

EDUCATION IN SENSORY SCIENCE IN SLOVENIA

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Sensory analysis is an indispensable part of development, characterisation and quality control process, respectively. It is a scientific discipline applying principles of experimental design and statistical analysis. However a panel of skilled assessors is required for sensory evaluation of a product.

The need for education in sensory analysis of food was recognized in Slovenia as early as 1975. The courses in sensory analysis became a part of B.Sc. and post-graduate study programmes at Department of Food science and technology of Biotechnical faculty. However in-depth knowledge of sensory evaluation is often needed by professionals from the food industry, therefore we organize different short courses and post-graduate seminars adjusted to users' demands. Sensory courses and trainings are also organized for various audiences i.e. beekeepers, school teachers, farmers, consultants and winemakers.

The majority of Slovenian food producers nowadays employ internal sensory assessment of products as a part of quality control. Over the years the quality of food products was improved, the progress was notable especially in those of artisanal production, e.g. honey.

At the Department a panel of sensory assessors was formed, whose members collaborate with food industry in product developments and quality controls as well as they participate as lecturers in sensory courses and skilled assessors in sensory evaluations for various clients. The importance of sensory quality of food was also found important for consumer protection and therefore introduced in product testing performed by Slovenian consumer association.

Sensory analysis is in Slovenia well recognised among professionals, however the education needs to be complemented with consumer science. Moreover, implementation or diffusion pathways of information obtained with sensory analysis to the end users should be clarified. Only so, the importance of continuous training of the assessors may be recognised and understanding of differences between sensory evaluation and hedonic tasting by the general public improved.

SENSORY PROPERTIES OF FERMENTED JUICE DEPENDING ON THE ADDED YEAST STRAINS

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The taste and aroma of the final products are formed not only from the juice used for fermentation, but also important is the added yeast. The aim of current research is to evaluate the influence of different yeast strains on the sensory properties of fermented apple juice of the variety 'Lietuvas Pepins'.
Apples were harvested in the Latvia State Institute of Fruit Growing. For fermentation four different commercial yeast strains – Saccharomyces bayanis yeasts 'EC-1118', 'Cider yeast', Saccharomyces cerevisiae yeasts '71B-1122' and 'K1V-1116' were used.
Experts (trained for evaluation of fermented drinks and employed in alcoholic beverage industry) and consumers evaluated intensity of sensory properties (clarity, apple, fruit and yeast aroma, apple, fruit, yeast, sour, bitter and astringent taste and after taste). For evaluation the line scale (ISO 4121:2003) was used. A panel of 11 experts and 35 consumers took part in this study.
Evaluation of the intensity of sensory properties of fermented apple juice with different yeasts showed that there is no significant difference ($p > 0.05$) in apple and fruit aroma, sour, astringent and bitter taste, but there is significant difference in intensity of clarity, yeast aroma, apple and yeast taste ($p < 0.05$). Apple juice samples fermented with yeasts 'EC-1118' had more intense yeast flavour and odour intensity, while the fermented juice with highest intensity of apple flavour was in samples fermented with the yeasts '71B-1122 'and 'K1V-1116'.

Keywords: fermented apple juice, yeast strains, sensory properties

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FOOD PRODUCT DEVELOPMENT AS OPPORTUNITY FOR SUCCESS OR SURVIVAL IN THE MARKET

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The aim of this paper was to give an overview of up-to-date papers covering sensory evaluation and consumer preference research that can form a basis for user-oriented food product development in Small and Medium Enterprises (SMEs). The paper points out the most important factors with impact on food products fail, that may arise as a consequence of not matching consumers' needs. Collecting of appropriate information concerning consumers' needs and expectations are essential requirements of a consumer-oriented product development. Consumer's sensory tests can provide sensory information related to food product quality and consumers preference, useful and important for product quality control and improvement. The elements with impact on consumers' food products preferences are identified and discussed.

Success and survival of SMEs on the market could be expected if producers identify and satisfy current and future needs of consumers. Management and policy makers of the enterprise should support development and implementing sensory programs within an enterprise, and use it as a tool for ensuring quality of product and competitive food manufacturing. Consumer-oriented food product development should be considered as a tool for building competitive advantage and long-term enterprise success in the market and for prevention of negative changes in product quality and acceptability, consumers' complaints and product rejection.

Keywords: food product development, sensory evaluation, consumers

SENSORY EVALUATION AS TOOL IN QUALITY IMPROVEMENT OF BOILED CHICKEN SAUSAGE

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Food product quality and stability during storage is very important for the successful manufacturing. It is known that different factors during processing have impact on quality characteristics of final product. The aim of the study was to investigate influence of selected food additives with antioxidant and stabilising functional characteristics on quality of finely comminuted boiled chicken sausages “parizer” type, during storage. Samples were produced in industrial conditions, five experimental model samples with selected additive blends added separately to each: (a) 0.04% GUARDIAN Rosemary Extract 08 (Natural rosemary extract, E471, E472a, E1520); (b) 0.10% (based on the fat content) GRINDOX 539 Antioxidant (E304, E306, E322, rapeseed oil); (c) 0.30% GRINDSTED Carrageenan CC 310 (E407, E410); (d) 0.3% GRINDSTED MEATLINE 345 A Emulsifier and Stabiliser System (E401, E516, E470a, E450); (e) 0.30% GRINDSTED MEATLINE 333 Stabiliser System (Carob germ flour, E466) and (f) control sample, according to the producer’s specification. The samples had adequate chemical composition and quality. Sensory evaluation of selected sensory characteristics was done 7 days and 35 days after samples production: (1) by the descriptive sensory analysis - scoring method, and (2) by discriminatory sensory analysis - ranking method, after assessment and comparison of the overall quality of sausages model samples. The results of the sensory analysis indicated differences between model samples dependent on added additives. On the basis of descriptive sensory evaluation results, it was found that the best quality of compared had sausage sample produced with addition 0.30% GRINDSTED MEATLINE 345 A Emulsifier and Stabiliser System (E401, E516, E470a, E450). Discriminatory sensory analysis – ranking confirmed that finding.

SENSORY AND INSTRUMENTAL EVALUATION OF QUALITY ATTRIBUTES OF COOKIES ENRICHED WITH MEDICAL PLANT MIXTURE

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Increasing health-consciousness among consumers has boosted their interest in added value food products. As a source of biologically active substances including antioxidants and antimicrobials, medicinal plants can be considered as functional food ingredients.
In this research, new cookie formulations were developed by supplementing the basic cookie formula with a mixture of medicinal plants, composed to promote digestion. The objective of this study was to investigate the effects of addition on the quality properties of cookies. The medicinal plant mixture was included in cookie formulations at three levels (2%, 4%, 6%) and compared to the control, which was based on wheat flour. Referring to the results, medicinal plant addition caused statistically significant ($P < 0.05$) differences in sensory and instrumentally measured colour and texture parameters of the cookies.
Based on their overall good sensory acceptability and previously confirmed antioxidant and antimicrobial properties of the mixture, new cookie formulations can broaden the utilization of this mixture and may be regarded as health-promoting functional foods.

Keywords: cookies quality, medicinal plants, sensory evaluation, colour, texture

ATTRIBUTES AFFECTING APPLE QUALITY IN SENSORY ANALYSIS

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Apples are one of the most popular and most frequently used fruits in Latvia. They provide human body with the necessary biologically active substances – vitamins, minerals, organic acids and fibre and for that reason apples are essential in a healthy diet. It is important to choose the appropriate storage technology to preserve not only the fruit quality but also their sensory properties.

During the last five years usage of the method with 1-methylcyclopropane (MCP) for fruit processing has grown. The basis of this conservation method is MCP gas, which blocks emission of ethylene from fruit a maximum slowdown moderation of the rottenness. There has been set a goal for a research to evaluate the effect of MCP on apple sensory quality changes during the storage and the credibility of the results of the panellists. The research has been conducted in Latvia State Institute of Fruit-Growing in association with Riga Technical University. Sixteen cultivars grown in Latvia have been evaluated in the research. All apples were processed using 1-methylcyclopropane and stored in cooling camera environment at temperature +2±1°C and 90% relative humidity. Research duration was 9 months. Samples have been evaluated according to taste, flavor, sourness, sweetness, juiciness and change of colour. The collected data was processed with SPSS 15 software and PanalCheck software.

It can be derived from the collected data that processing with 1-MCP is beneficial for sensory characteristics because fruits remain juicier and with higher acid content but with weaker aroma. The overall results of evaluation were improved by excluding the panellists with wide range of marks using the PanalCheck software.

THE SENSORY EVALUATION OF DIFFERENT FRESH-CUT FRUIT SALADS

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Apples and pears are used not only for fresh produce, but also for processing and manufacturing of several canned products. They could be used for fresh-cut fruit salad preparation as a main component. Fresh-cut fruit salads have great consumer appeal due to their convenience and flexibility of use. Sensory aspect is one of the determinative parameters in consumer choice of product and its further purchasing. However, consumer acceptance of fresh-cut fruits most often relies upon the inherent flavour and texture quality of the product, seldom with accompaniments.

The research was performed at the Fruit and Berry Experimental Processing Department of the Latvia State Institute of Fruit-Growing. Different fruit and berry juices and whole and cut berries (Japanese quince, sea buckthorn, black currant, cranberries and strawberries) and apple-pear mix were used to prepare nine different salads. Apple-pear mix without any additives was taken as a control. The sensory evaluation of salads was carried out by 20 trained panellists. A nine-point hedonic scale and five-point descriptive method was used to determine their degree of acceptance. Panellists evaluated taste, aroma, consistency and colour of fruit salads.

According to the sensory evaluation, fresh-cut fruit salads with black currant juice were evaluated by the highest score (6.6). Slightly lower results showed salad with strawberries pieces, black currant juice (6.3) and sea buckthorn berries and juice, as well as control sample (6.2). At the beginning more acceptable taste (4.7) and aroma (3.7) was for salad with black currant juice, while better colour was for salad with Japanese quince juice (4.3) and for control sample (4.3). Sensory properties of fresh-cut salads depended on added fruit and berries and decreased during storage time significantly.

ORGANOLEPTIC CHARACTERIZATION OF HONEY FROM GRAN CANARIA ISLAND

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The importance of apiculture in Gran Canaria island is based on its particular climatology, orography and vegetation that fix the composition of the final product: the honey.
The interest in sensory evaluation of foods has experienced remarkable growth in recent decades with the realization by the food industry that the organoleptic characteristics are what determine, ultimately, the acceptability of a food product by the consumer.
According to these premises we developed a study focused on the description of the honey native from this island across its organoleptic characteristics.
A subjective estimate was performed of the organoleptic quality of the honey by a semi-trained panel of tasters consisting of staff working with the Veterinary Faculty of the University of Las Palmas de Gran Canaria (Spain).
60 samples of honey from Gran Canaria, were taken for this study. To each taster were distributed sheets, one for each honey sample to evaluate. Each concept (fluidity, color, crystallization, odor, taste, acceptability) was scored on a hedonic scale of 1 to 10 points.
The overall average of mean values, standard deviations, and ranges for the fluidity was 7.14 ± 2.09, which defines this honey as little fluid.
The overall average values related to the color was 4.39 ± 1.68, which describes it as a honey amber color tending.
Regarding the odor, the overall average found was 4,07 ± 0,77 which defines a noticeable odor honey.
The overall crystallization for the samples analyzed was 4.19 ± 2.26 of which corresponds to a thin syrup crystallization.
The overall average values related to the flavor was 6.13 ± 0.77, which defines it as a nice honey.
The acceptability is appreciable according to its overall average values of 5,87 ± 1,11.
This study allowed us to establish one classification for the Gran Canaria honey according to their organoleptic characteristics.

CONSUMER ATTITUDES TO BROILER MEAT AND PRODUCTS

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The aim of this paper was to select the most acceptable housing system of production broiler meat and sausage made of chicken meat, applying quantitative descriptive sensory analysis according to consumer attitudes. Based on the survey conducted among consumers of different sex, age and education, it was concluded that majority of consumers of both sexes finds that the price of meat produced in organic production is justifiably higher because of the quality of meat provided, meat should be labelled according to production system and quality of meat should be controlled by scientific institution according to the opinion of female consumers, whereas male consumers feel that meat quality should be controlled by producers and inspection.
Compared sausages samples are made with different chicken meat type: A – commercial broiler, B – commercial broiler and Naked Neck chickens (50:50 ratio) and C – Naked Neck chicken. In all three variants of sausages 20% of pork fat was added. Sensory evaluation was done after roasting. System of 9 points was used for scoring: 1-exceptionally unacceptable to 9-exceptionally acceptable. Following attributes were determined/scored: external appearance, cross-section appearance, colour, smell, taste and texture. Thirty untrained panellists participated in scoring.
The appearance of all examined sausage was very good. The colour of group B and C was evaluated as acceptable, but not the usual for this sausage type. Sausages from group A had lighter colour and assessed as too pale. Group B had the highest scores for smell and taste. As a result of conducted sensory analysis, sausages from variant B were selected as the best of compared samples, with overall scores of 7.87.

Key words: Broiler meat, product, consumer, attitudes

FRUITS AND VEGETABLES AS FUNCTIONAL FOOD – CROATIAN CONSUMERS' OPINIONS

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Public perceptions relating to fruits and vegetables as functional foods using a survey was investigated. It was examined the cross-relation of their perceptions influenced by gender, age and educational level as well as the importance of characteristics of the product. The main aim was to identify the public acceptance of the concept of functional food and possibilities of marketing in this filed.

In this paper was used a convenience sample and data were collected using a self-administrated questionnaire designed to assess opinions and attitudes regarding consumption. Individuals of both genders (N = 628) aged from 19 to 65 with different educational levels were interviewed. Stratification of the units from the sample has been made according to gender, age and educational structure as well as social-economic status of respondents in the sample.

The study showed that over 45.7% of female consumers is familiar with the term "functional food", opposite to the male consumers (36.5%). Results also indicated differences regarding educational level and age because the majority of younger consumers with higher education are willing to pay more (34.6%) for vegetables and fruits. The consumers consider the origin (67.5%) and the quality (77.9%) of fruits and vegetables as important characteristics. The place of sale and the brand of the product are not as important as expected (49.6%). The opinions are especially divided ($p<0.05$) according to the age and educational level and not to the gender ($p>0.05$). The results have shown that general familiarity with functional food varies systematically as a function of age, gender and educational level.

Consumers' classification of fruits and vegetables in a group of functional food has differed regarding the educational level and age. Presented findings could be an indicator for successful marketing approach in sale of vegetables and fruits as functional food.

CONSUMER'S ATTITUDES TOWARDS FULL-FAT FOOD PRODUCTS AND THEIR LOW-FAT ALTERNATIVES

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Understanding consumers' buying habits and motives for selecting high-fat products and their low-fat alternatives is useful in launching new reduced-fat food items.

In order to collect information on the most commonly chosen fat-reduced products available on the Serbian market and identify motives for their consumption, a survey among 250 randomly selected consumers in Vojvodina, Serbia was conducted. The participants could have chosen between high- and low-fat milk, yoghurt, margarine and mayonnaise and different statements referring the apprehension of these alternatives. The study also assessed the socio-demographic influence on motivation for choosing full- or low-fat food versions. The data were analysed using chi-square analysis.

In contrast to mayonnaise, participants chose low-fat milk, yoghurt and margarine in preference to their full-fat version. The results also showed that taste was the infinitely preferable attribute for choice of full-fat food, while the healthiness factor was the most crucial for selection of low-fat products. Different age as well as educational level groups showed different preferences to taste, while the consumption of low-fat food due to healthiness was more frequent among women.

The obtained results indicated the necessity to improve the taste of low- or reduced fat products in order to be competitive with its high-fat alternative.

THE EFFECT OF THE TECHNOLOGY NAME ON CONSUMER JUDGEMENT – THE RESULTS OF FOCUS GROUP INTERVIEWS

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In the framework of NovelQ EU FP6 project, the consumer acceptance of novel technologies was studied with the use of qualitative and quantitative methods based on each other. According to the research results the name ‘Pulsed Electric Field’ (PEF) evokes the fear of electricity, thus not widely accepted. Prof. Dietrich Knorr, Chairman of NovelQ Scientific Advisory Board proposed a new expression „micro pulse" to replace PEF.
The acceptance of the new terminology was studied with focus group interviews. Three focus groups were organised with consumers (older age consumers, young adults and health conscious consumers) and one with experts of different fields of food sciences.
Focus group interviews with consumers discovered, that 'micro pulse' name has better associations than pulsed electric field and 'micro pulse' is in no way associated with 'electricity'. Consumers expressed their definite need of getting informed about the technologies even if this leads to distrust because the lack of comprehensive knowledge. Consumers’ judgment about the name changing is divided: in the opinion of two focus groups, it does not misleading to use the name 'micro pulse' instead of PEF, though the electrical feature of the treatment should be mentioned. According to the respondents of health conscious focus group, changing the name is misleading, because the aim is the reduction of consumers' fears. The most important issues appeared during the expert focus group, that clear communication is important for the consumers, and it is needed to communicate the electrical feature of the technology. Name ‘pulsed electric field’ is threatening and ‘micro pulse’ is not informative. Name ‘micro electrical pulse’ can be acceptable, according to the experts. It is important for the market introduction of a new technology that it has to offer unambiguous benefits for the consumers. Communicational campaign is needed to the introduction of novel technologies.

KNOWLEDGE AND JUDGEMENT OF FOOD ADDITIVES IN THREE EUROPEAN COUNTRIES

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According to the results of the Eurobarometer (2010) worry against food additives varies between different European countries. In Hungary it is really high (81%), while in Spain is lower (54%). In Romania the perceived worry rate (74%) is closer to the EU mean (66%). Regarding the possible problems or risks associated with food, additives were mentioned more frequently in Hungary (25%) than in Romania (8%), Spain (5%) or the whole EU (9%).
In 2009 self administered questionnaire was developed in CFRI to evaluate the Hungarian consumers' knowledge and judgement about food additives, from which in the frame of a "pilot study" 400 respondents' data were collected. Following the analysis of the data a concise and more targeted questionnaire was designed, which was translated into Romanian and Spanish. This questionnaire was filled out in the three countries with the help of internet, which is a comfortable and cost effective tool, although data from internet users were only collected.
On the basis of the results differences amongst the three countries' consumers judgement and knowledge regarding food additives from the point of view of different socio-demographic factors (e.g. gender, age, highest level of education), furthermore the perceived hazard levels about food risk factors will be demonstrated in the presentation.

Eurobarometer (2010): Special Eurobarometer 354: Food-related risks. http://www.efsa.europa.eu/en/factsheet/docs/reporten.pdf

WHAT DO YOUNG PEOPLE THINK ABOUT FOOD RELATED INFORMATION ON THE INTERNET?

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INTRODUCTION:
The food is the „fuel“ of the people and has significant impact on the human health. Therefore, it is necessary to be familiar with the quality and the composition of the food products. Primarily sources of the information about the composition of the food are declarations on the food package. In the last 20 years the Internet has become a new important source of the information for the customers, so some, before unimaginable and incomprehensible, information have became readily available and known. Objective of this study was to investigate if young people, and in what wat and to what extent, use the Internet as the source of information about food, its composition and dietary habits.

METHODS AND MATERIALS:
The sample consisted of students of Faculty of Economics University of Mostar (BiH). The questionnaire consisted of questions about the Internet usage for general purposes and for collecting information about food. Data were analyzed by descriptive and inferential statistics methods.

RESULTS AND CONCLUSIONS:
Young people use the Internet very often, mostly up to 3 hours per day. They read news, play games and socialize on social networks. A lot of respondents consider that food and dietary habits affects human health. Most of them talk about food with family and friends, but very few of them read the laws on food and food products. Students think that there are enough information about the food available on the Internet. A small number of respondents use Internet to find out something about food, could specify the web site with the theme of food or purchase food through the Internet.
The results show that searching the Internet with the aim of discovering new knowledge about food and its beneficial impact on human health is not sufficiently affirmed among young people and the environment should work to encourage the aforementioned.

KEYWORDS: Internet, food ingredients, young people, dietary habits

DESCRIPTIVE SENSORY ANALYSIS AND CONSUMER ACCEPTANCE OF INDUSTRIALLY MANUFACTURED STEVIA-BASED FRUIT JUICES

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The growing consumer concern with the obesity and diabetes has led to the quest for alternative sweeteners that can replace sucrose. As the consumer interests are primarily directed to natural, reduced-energy products, the food and beverages manufacturers have been looking for natural sweetener for their formulations. A natural sweetener that has lately attracted a lot of attention is steviose or steviol glycosides. These glycosides accumulate in the leaves of Stevia rebaudiana, a plant native to South America, commonly known as stevia. The steviol glycosides, extracted from stevia leaves, are about 300 times sweeter than sucrose. They are regarded as first natural, commercially available, high intensity, zero calorie sweetener.

In 2008 the Food and Drug Administration approved GRAS status for purified stevia extracts. In November 2011, the final hurdle in the EU regulatory process was lifted and steviol glycosides were declared to be safe for use in foods and beverages in all EU countries.

In this study, steviol glycosides were used as sucrose substitute in industrially manufactured apple and peach juices. The manufacturing process of the stevia-based juices followed the regular procedure of juices containing sucrose as sweetener. Pasteurized juices were aseptically packaged in 250-mL containers and stored.

Although it is believed that the steviol glycosides are light, heat and acid stable, it is important to know how the glycoside levels are affected by processing and storage. A quantitative descriptive sensory evaluation was conducted to determine the preferences for color, sweetness, texture, aroma, aftertaste and other attributes relevant for such type of fruit juices. The overall acceptance of the juices was tested by consumer panelists according to the 5-point hedonic scale. Sensory evaluation proved to be an essential component of a product development process.

INFLUENCE OF FOOD VISCOSITY ON THE PERCEPTION OF AROMA COMPOUNDS

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Food industry invests great effort into attempting to enhance aroma of consumer product and often use natural and artificial flavourings. Aroma compounds release from food during eating. Delivering aroma compound to olfactory and oral cavity (orthonasal and retronasal) is influenced by numerous factors. The aim of this research was to examine the influence of food matrix viscosity on aroma release. The intensity of smell and flavour of ethyl butyrate, ethyl caproate, isoamyl acetate, and benzaldehyde which were added in the same aroma value in the four different food matrixes was sensory analysed by the fifteen trained panellist. The food matrix of different viscosity serves as a barrier to the movement of a flavour substance. Food matrixes were represented by aqueous solution of sucrose, starch, oil-water emulsion and yoghurt, all in three levels of viscosity: low, medium, high. Viscosity was measured by MYR rotational viscometer. ANOVA and Principal Component Analysis (PCA) were used to analyse of sensory results. It was found that the viscosity of sugar, starch and oil matrixes influence on aroma release while the viscosity of yogurt did not significantly influence on delivering aroma to human sensory receptor. Sucrose enhanced perception of aroma compounds. Transmission of aroma compounds to the oral cavity and olfactory epithelia from food matrixes was hindered.

GELATİON PROPERTİES OF HİGH POWER ULTRASOUND-TREATED MİLK WİTH LACTİC ACİD BACTERİA

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Effect of high power ultrasound on gelation of milk with lactic acid bacteria was investigated in comparison with heat treatment applied in the conventional manufacturing procedure. Pasteurized whole milk was treated with high power ultrasound at different power (25, 100%)-temperature (20, 60 °C)-time (10, 30 min) parameters. Ultrasound was applied by using a sonotrode with a diameter of 22 mm providing an acoustic power density of 85 W/cm^2. Treated milk samples were gelled with lactic acid culture as in yoghurt production. A milk sample heat treated as in conventional yoghurt production was also prepared for comparison. Gelation pH and time, water holding capacity and rheological properties of obtained milk gels were determined. In general, when the ultrasound was applied at 60 °C for 30 min, gelation and gel properties of the milk were changed compared to those of the heat-treated milk. Gelation time was found to be shorter and corresponding gelation pH was found to be higher in the sample that was ultrasound-treated at 100% power at 60 °C for 30 min compared to those of heat-treated sample. This sample was also found to have higher water holding capacity and lower elastic modulus, maximum shear stress and strain compared to those of the heat-treated sample. The sample treated with ultrasound at 25% power at 60 °C for 10 min was found to be similar to the heat-treated sample in terms of its rheological properties.

FUNCTIONAL FOOD PERCEPTION BY MACEDONIAN CONSUMERS – DEMOGRAPHIC PROFILE

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Introduction:
Functional foods (FF) include a variety of foods and food components believed to improve overall health and well-being, reduce the risk of specific diseases, or minimize the effects of other health concerns. Our study has been focused on the demographic profile of FF consumers in Macedonia.

Material and methods:
The study was carried out among 518 consumers from all regions in the country. After defining FF and giving the examples of it, consumers were asked to grade their awareness of FF using 5 statements, from “not informed at all” to “fully informed”. Cross tabulations were done to test the significance of differences among demographic groups (Chi-square, $p<0.05$).

Results:
Of all respondents, 35.3% were not at all or poorly informed. Significantly more of them were age 55 and above, having finished elementary school or less, with up to 2 members in the household, who used to be married, self-reporting bad health status and bad standard of living. Out of 41.1% moderately informed, significantly less of them were elementary or less educated, reporting bad health and living conditions. The most informed consumers (22.5%) were statistically different from others if were educated at university level or more, and have between 18 and 34 years of age. Only 10 % of them had lowest level of education.

Conclusion:
Most of the Macedonian consumers were moderately informed about FF. Significantly less awareness were present among the list educated consumers living in bad economic standards and bad health. Beside the fact that they were outnumbered by less informed respondents, the most informed consumers were in good self-reported health and household status, employed, with normal BMI, living in urban settlement, significantly better educated and younger than others.

CONSUMPTION OF ETHNIC FOODS IN THE UK

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Introduction:
One of every six residents in the United Kingdom is of non-White British origin (Statistics UK). With South Asians (people of Indian, Bangladeshi or Pakistani origin) representing the largest minority ethnic group in the UK (approximately 4% of the total population) their food consumption habits influence the increasing consumption of ethnic foods.

Materials and method:
Face-to-face interviews were conducted on a sample (n=100) of the South Asian population living in Leeds, UK. Their diets were assessed by means of an ethnic-specific food frequency questionnaire. The questionnaire covered 13 different food groups with a total of 279 food items, both ethnic South Asian and mainstream British foods.

Results:
The most commonly consumed foods by food group were prioritized and included the following. Cereals: white rice, biscuits and chapattis; pulses: channa dhal, chickpea curry and toor dhal; chicken curry, lamb curry and chicken biryani; dairy: milk, butter and cheese; fruits: apples, bananas and oranges; vegetables: onion, tomatoes and carrots; beverages: water, tea and juice; sweets: chocolate bars, halwa and kheer. The average portion sizes for these foods were established and the nutrient composition per portion was calculated using the latest available data from EuroFIR (www.eurofir.net).

Conclusions:
As the study of ethnic foods in Europe is emerging the prioritized list can be considered a starting guide on South Asian ethnic foods to be included in larger, nation and region-wide dietary assessment questionnaires. In addition, this research suggests that market strategies must examine and exploit the mainstream population's attitudes towards ethnic foods and prepare for the thriving ethnic food market.

ATTITUDE OF THE CONSUMERS DIFFERENT AGES AND EDUCATION LEVELS TOWARD FUNCTIONAL PRODUCTS BASED ON CEREALS

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The aim of this study was to quantify consumers attitude towards functional products based on cereals and to find the underlying dimensions that can predict respondents' willingness to use these products. For the analysis of consumers attitude were used a multivariate methods MANOVA and discriminant analysis. Roy's-test, Pearson coefficient of contingency (χ), multiple correlation coefficient (R) also applied. When the results in relation to the education level of respondents are observed, it was found that highest difference among respondents was in their attitude regarding health status information whereas the least difference was in their attitude regarding the way of presenting information about functional product based on cereals. The introduction of functional products based on cereals will not automatically be successful without the simultaneous introduction of information that is of use to consumers in making informed choices about purchase and inclusion in their diets.

Key words: consumers, functional foods, cereals

VII
TRADITIONAL FOOD, FOOD WITH APPELLATION OF ORIGN

MICROBIOLOGICAL CHARACTERIZATION OF IRANIAN RAW MILK CHEESE "LIGHVAN" WITH REFERENCE TO FOOD SAFETY

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Lighvan is considered the most popular Iranian raw milk cheese made from raw ewe's milk or a mixture of ewe's and goat's milk following ancient cheesemaking technologies without addition of starter. This study aimed to compare the microbiological quality and safety of fresh (curd and day 30) as well as ripened (day 90) cheese as a tool to verifying possible associations between microbial populations, and the detection of the dominant lactic acid bacteria (LAB) with potential antagonistic activity against foodborne pathogens in ripened cheese. Fresh and ripened cheese samples were collected and submitted for the analysis of LAB, mesophilic count, total coliforms, molds & yeasts and coagulase-positive Staphylococcus (CPS). The samples presented high counts of mesophilic aerobes, total coliforms, and LAB, and also high and significant correlation indices between these populations both in fresh and ripened cheeses but with specific trend in each. In total, 95 isolates were identified from the counting plates of M17 (21 isolates), MRS (39 isolates) and KKA (35 isolates). The highest number belonged to Enterococcus faecium (22.44%), Lactococcus. lactis ssp. lactis (20.4%), Lactobacillus plantarum (18.36%) and Enterococcus faecalis (14.28%). Some particular LAB, such as Enterococcus faecalis and Enterococcus faecium have been claimed to have the ability of bacteriocin production. Further investigation necessary to prove the antimicrobial potential of the autochthonous microbiota originated from raw milk and also from other sources such as processing and storage environment of Lighvan cheese.

PROTECT OF GEOGRAPHICAL INDICATIONS OF WINES IN THE REPUBLIC OF CROATIA

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The tradition of protection of geographical indication of wines in Croatia dates back to the 60-ies of last century. The aim of protection of geographical indication is to protect wine-specific characteristics from abuse and fraud, and to guarantee what is declared on the label to the consumers.The first protected wine in Croatia is a Dingač. In today's globalization of the wine market growing number of manufacturers requests the protection of geographical indications for their wines. In Croatia this process is regulated by the Law on Wine ("Official Gazette" no. 96/03) and the Regulations on the labeling of wine geographical origin (("Official Gazette" no. 7/05, 41/08). In the EU this same is governed by Regulation (EC) No 607/2009. Currently, 3.944 wines has a geographical indication in Croatia.

Keywords: wine, protect geographical indication

PHYSICOCHEMICAL AND SENSORIAL CHARACTERIZATION OF PORTUGUESE BREAD FROM VISEU REGION.

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Today, bread is part of the culture and eating habits of most people and can be considered one of the most consumed foods in the world. Bread is made from a simple mixture of flour, water, salt and yeast, being an extremely versatile food and with a very good digestibility. Since it was first produced for thousands of years, it has undergone changes both in terms of production methods and in terms of its constitution, thus giving place nowadays to a wide variety of breads available on the market.
The aim of this study was to characterise the most typical flour mixture bread (wheat flour and rye flour) produced in Viseu region of Portugal and evaluate if there are relevant differences between the samples tested. Nine samples from local producers were analysed considering the morphology, physicochemical (density, alveolus percentage, texture, colour and water activity) and sensorial properties. The form and dimensions of all breads were determined, as well as proximate composition and total salt content.
The forms of the breads were different, some round and others long. Nutritionally this type of bread turned out to be a food with high nutritional value, high percentage of ash (2.8-4.9%) and low values of fat, with a high range of salt content (0.4-1.4%). The physical properties were quite different between samples, although some of them are not perceptible by the consumer. This was the case of bread density whose results were 0.25-0.56 and the sensorial panel, constituted by a panel of 40 untrained tasters aged 7 to 63 years, did not find any difference. The traditional breads presented a global appreciation between 4.8 and 6.8, related with different colour and elasticity parameters. The encountered differences are mainly due to flour composition and the used technology.

PHENOLIC PROFILE AND ANTIOXIDANT ACTIVITY OF SLOVENIAN HONEYS

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Introduction:
Honey is a complex natural food that contains more than 200 biologically active compounds, which presence and content in honey depend on its botanical and also geographical origin. In Slovenia, the wide assortment of honeys is a result of their production in different geographical regions and richness of floral sources. Since honey is often advised as home remedy it is important to characterise the phenolic components that might be responsible for its antioxidant effect, and learn more about Slovenian honey as a source of antioxidants.
Methods and materials:
Folin-Ciocalteu method was used for determination of total phenolic content, while individual phenolic compounds were extracted from honey samples by solid-phase extraction and further analysed by liquid chromatography–mass spectrometry. Spectrophotometric FRAP and DPPH methods were used for evaluation of antioxidant activity. Sampling was performed directly from the Slovenian beekeepers and in total 205 samples of different botanical origin were analysed.
Results:
The lower values of total phenolic content were determined in the light honeys (acacia, linden and multifloral), while the higher values are characteristic for darker honeys (chestnut, fir, spruce and forest). The phenolic acids and flavonoids determined in the analysed honey samples were *p*-coumaric acid, caffeic acid, ellagic acid, chlorogenic acid, myricetin, luteolin, quercetin, naringenin, apigenin, kaempferol, pinocembrin, pinobanksin, pinostrobin, chrysin and galangin. The results obtained indicate that most honeys had similar, but quantitatively different, phenolic profile. Antioxidant activity of different honey types increased in the following order: acacia < linden < multifloral < chestnut < forest < spruce < fir honey.
Conclusion:
The total phenolic content and antioxidant activity vary greatly among different types of honey and were found to be the highest in chestnut, fir, spruce and forest honeys, while the acacia, linden and multifloral honeys showed low total phenolic content and consequently lower antioxidant capacity. From nutritional point of view honeys, especially darker types, may provide an additional source of dietary antioxidants.

Key words: honey, phenolic compounds, antioxidant activity

PROTECTED GEOGRAPHICAL INDICATION AS A TOOL FOR VALORISATION OF AGRO-FOOD POTENTIALS AND IMPROVING MARKETING: CASE OF "SJENICA CHEESE" IN THE REPUBLIC OF SERBIA

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Traditional and typical agri-food products in the Republic Serbia have an important place in consumption. Those products, especially from the Pester region in the South-Western of the Republic of Serbia where the Sjenica cheese is produced, have a good image in the Serbian market.

From the market side there are no difficulties for commercialisation of traditional and typical agri-food products. However, only some of them are protected properly, while for the majority there is no protection of any kind and many of them are at risk to be lost from the market and therefore the agri-food potential would be not valorised.

Evidence from other countries, especially from the EU, showed that Protected Geographical Indications (PGI) could ensure proper valorisation of agri-food potential and improve marketing. The objective of this paper was to analyse how PGI of Sjenica Cheese could allow preserving and valorising of resources of Pester region.

MOLECULAR DIVERSITY AMONG LACTIC ACID BACTERIA ISOLATED FROM TRADITIONAL CHEESES MANUFACTURED IN WESTERN BALKAN

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Western Balkan Countries (WBC) is a distinct geographical area in Europe with the long tradition of manufacturing artisanal dairy products. The characterisation of indigenous LAB strains in the artisanal cheeses could have important impact on starter culture development in order to start marketing the traditional dairy products with specially defined functional properties. The main goal of this research was the isolation and characterisation of autochthonous LAB from 18 artisanal cheeses from selected households in Serbia and Croatia.

After preliminary phenotypic and genotypic (GTG)5-fingerprinting analysis of 828 LAB strains, 87 isolates were identified by 16S rDNA sequencing. Detailed technological characterisation of the LAB strains such as milk protein coagulation, proteinase and antimicrobial activity, exopolysaccharide production, as well as production of aroma and taste precursors was performed.

In the sampled cheeses five LAB groups were found, with the following distribution: lactococci (30.68%), enterococci (29.85%), leuconostocs (20.36%), lactobacilli (14.92%) and streptococci (4.18%). The results revealed that lactobacilli were dominant LAB in the cheeses collected from mountain Golija. Leuconostocs were the most abundant in cheeses collected from three different regions in Croatia, while lactococci were the most abundant in cheeses collected from mountain Beljanica, Serbia and Prigorje region, Croatia. The results of antimicrobial analysis revealed that 47 out of 87 tested isolates produced antimicrobial compounds. The antimicrobial activity has been shown in 25 enterococci, 20 lactococci, one Lactobacillus plantarum and one Streptococcus thermophilus strain. Among 87 isolates the ability to degrade β-casein showed 15 lactococci, 12 lactobacilli, 11 enterococci, and two leuconostocs strains.

In conclusion, the investigation of microbial diversity of artisanal cheeses, give a possibility to select region specific LAB. The characterisation of the metabolic and technological potentials of the isolates makes possible formulation of defined functional starter cultures for novel dairy foods with geographical origin.

ANTIOXIDANT CAPACITY AND SENSORY CHARACTERISTICS OF SPECIAL HERB BRANDY

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Plum brandy is traditional Serbian alcoholic beverage, made by distillation of fermented plum variety *Prunus domestica.* Distillate is colorless and has characteristic fruit aroma, which originates from the component of the inner layer of the plum skin. According to the Serbian tradition, plum brandy is sometimes mixed with different medicinal herbs, and these products are treated as forms of herbal medicine. Medicinal herbs are rich source of polyphenols and other valuable compounds, which can contribute to the functional properties of brandies. These products are usually produced from a large number of herbs and spices, which, also, change the aroma complex and contribute to the color.
In this study, we have investigated the effects of two herbal compositions which were consisted of 39 medicinal plants with different ratio of aromatic and bitter herbs on sensory characteristics and antioxidant capacity of herbal brandies. Sensory assessment of samples was performed by using modified Buxbaum model of positive ranking. The total phenolic content of samples was determined according to the Folin-Ciocalteu spectrophotometric method. The antioxidant capacity (ATC) was tested by using two methods: DPPH and FRAP.
The total sensory quality of samples was 17.85 and 17.95, which are very good scores. The total phenolic content of samples was 145.56 and 130 mg/L gallic acid equivalents, while the antioxidant capacity was 0.69 and 0.61 mM Trolox according to DPPH assay, and 2.08 and 1.75 FRAP units according to FRAP method. The obtained results suggested that higher content of the bitter herb significantly influenced the antioxidant capacity and adversely affected the sensory profile of special brandy. Based on sensory assessments, the sensory properties of these special brandies were completely acceptable for the testers.

MICROBIAL DIVERSITY IN TRADITIONAL EWE CHEESES FROM WESTERN BALKANS REGION

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Region of Western Balkans has a long history of producing Traditional cheeses made of ewe milk. In effort to characterize some of these traditional products researchers from Western Balkan country's started a joint FP7 project called SEE-ERA-NET PLUS's "RegTraC". The cheeses characterized in this project were Livanjski and Travnički from Bosnia and Herzegovina, Krčki, Paški and Istarski from Croatia, Zlatarski, Lisnati and Sjenički from Serbia and Bovški, Kraški, Dolenjski from Slovenia. Project involved characterization of these ewe cheeses on three major levels: Technological, Chemical and Microbial. Microbial characterization involved following growth and composition of microbial population in fresh (0 days), half-ripened (30 days) and fully ripened cheese (60 days). Four major groups of lactic acid bacteria were followed: lactobacilli, enterococci, mesophilic and thermophilic cocci. From fully ripened cheeses, microbial population was also isolated as consortia representing the same four major LAB groups and characterized using denaturing gradient gel electrophoresis (DGGE). Microbial analysis was also preformed on the level of single strain isolates which were identified using both phenotypic and genotypic methods. For phenotypic identification the BIOLOG system (BIOLOG Inc., USA) was used and for genotypic identification and confirmation classical polymerase chain reaction together with primers specific for different genera and species. As expected the number of lactobacilli grew during ripening to approximately 108 CFU/g while the initially high number of different mesophilic and thermophilic cocci showed a slight drop during ripening. Population of enterococci showed different growth pattern depending on individual cheese. A more detail analysis using DGGE and also phenotypic and genotypic identification clustered cheeses from Bosnia and Herzegovina and Croatia in to two separate groups while the cheeses from Slovenia and Serbia were distributed evenly between both. The main features of selected cheeses will be presented in the first Regional Atlas of traditional ewe cheeses of Western Balkans.

KOUMİSS ANCESTOR DRİNK

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Koumiss which is a traditional Turkish drink, is a fermented dairy product made from mare's milk by nomadic families. Starter culture, that is composed lactic acid and yeast used in production, is effective on the koumiss characteristics. During the fermentation, lactose convertes into lactic acid, ethanol and carbondioxide. At fermantation of lactic acid and ethyl alcohol propyl alcohol, butyl alcohol, propionic acid, purivate, glycerine, aldehydes, acetone, volatile compounds and variety ethers such as compounds giving special taste and aroma to koumiss. Koumiss has been used as energizer, cheering and the health-care functions since ancient times by Turk living in Central Asia. Koumiss which is a drink, is beneficial for health and it has some beneficial influence on enhancing immunity, treating tuberculosis and cardiovascular disease. Furthermore, lisin, thyrosine, tryptophan and glutamic acid which have been rich in acidic functions, inhibit atherosclerosis. It is emphasized that koumiss is used as a cure for the diagnosis of the disease due to its inclusion of the adequate amount of these compounds. It has been mentioned that koumiss which has been produced and still drunk by Middle Asia Turks, it hasn't been drunk by Turks that settled in Anatolia. Koumiss has been produced by Kazak Turks. It is emphasized that koumiss which contains lactic acid, ethyl alcohol and carbondioxide, has the effect of circulation, excretion and stimulant digestion. Koumiss that is a ancestor drink, is a probiotic food. Nowadays, the world tends to propiotic foods and alternative foods have gained importance. Therefore, this study has great significancy. This study will provide the infrastructure for dairy manufacturing industry.

THE RIPENING OF WHITE BRINED CHEESES MADE WITH COMMERCIAL AND POTENTIAL AUTOCHTHONOUS PROBIOTIC STRAINS

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The white brined cheeses are the most popular cheeses with the long tradition of production and consumption in Serbia. Modern medical research studies indicate the importance of diet in the maintenance and improvement of health. In this regard, for the last decades, there is rapid growth of food products with dietetic and functional properties, including products with probiotic bacteria, which could be beneficial for human health. Milk products, including cheeses, represent a good base for the development of new products with functional properties, especially those with probiotic bacteria.

The effects of commercial and autochthonous strains of lactic acid bacteria on the composition and proteolysis of white brined cheeses were studied throughout 30 days of ripening. Cheese A was produced with commercial strains (LL 50 A and MY 721, DSM, Netherlands) Lactococcus lactis ssp. lactis, Lactococcus lactis ssp. cremoris and probiotics Lactobacillus acidophilus and Bifidobacterium lactis and cheese B with autochthonous strains Lactococcus lactis ssp. lactis 563, Lactococcus lactis ssp. cremoris 565 and potential probiotics Lactobacillus plantarum 564. The rate of proteolysis was analyzed by the water and 5% phosphotungstic acid soluble nitrogen fractions, as well as by SDS and UREA PAG electrophoresis. The viability of probiotic strains during cheeses ripening was also determined.

A significant influence of different starter and adjuncts bacteria on the composition was not found. The proteolysis rate was significantly different ($p<0.05$) between cheeses made with different starter cultures, due to different proteolytic activity of bacteria used. The viability of adjunct probiotic bacteria in both cheeses were maintained on the high level during the overall ripening period that are necessary for acquirement of their therapeutic effects.

Cheeses made with autochthonous bacteria showed a higher rate of secondary proteolysis, as well as higher flavour scores, and were more acceptable than cheese made with commercial probiotic bacteria.

EFFECT OF IRANIAN FETA CHEESE CHARACTERISTICS ON PROCESS CHEESE PROPERTIES

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Feta cheese is the major ingredient utilized to manufacture process cheese. The objective of the present study was to evaluate the effect of Feta cheese characteristics on the chemical and functional properties of process cheese. Three replicates of 8 Feta (Cheddar) cheeses with 2 levels of calcium and phosphorus, residual lactose, and salt-to-moisture ratio (S/ M) were manufactured. After 2 mo of ripening, each of the 8 Feta cheeses was converted to 8 process cheese foods that were balanced for their composition, including moisture, fat, salt, and total protein. In addition to the standard compositional analysis (moisture, fat, salt, and total protein), the chemical properties (pH, total Ca, total P, and intact casein) and the functional properties [texture profile analysis (TPA), modified Schreiber melt test, dynamic stress rheometry, and rapid visco analysis] of the process cheese foods were determined. Feta cheese Ca and P, as well as S/M, significantly increased total Ca and P, pH, and intact casein in the process cheese food. Feta cheese Ca and P and S/M also significantly affected the final functional properties of the process cheese food. With the increase in Feta cheese Ca and P and S/M, there was a significant increase in the TPA-hardness and the viscous properties of process cheese food, whereas the meltability of the process cheese food significantly decreased. Consequently, Feta cheese characteristics such as Ca and P and S/M have a significant influence on the chemical and the final functional properties of process cheese.

TEXTURE DEVELOPMENT AND SOLUBLE NITROGEN DURING THE RIPENING OF IRANIAN

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Full fat, milled-curd Feta cheeses (2 kg) were manufactured with 0.0 (control), 0.1, 1.0, or 10.0 mol of pepstatin (a potent competitive inhibitor of chymosin) added per liter of curds /whey mixture at the start of cooking to obtain residual chymosin levels that were 100, 89, 55, and 16% of the activity in the control cheese, respectively. The cheeses were ripened at 8°C for 180 d. There were no significant differences in the pH values of the cheeses; however , the moisture content of the cheeses decreased with increasing level of pepstatin addition. The levels of pH 4.6-soluble nitrogen in the 3 cheeses with added pepstatin were significantly lower than that of the control cheese at 1 d and throughout ripening. Densitometric analysis of urea-PAGE electrophoretograms of the pH 4.6-insoluble fractions of the cheese made with 10.0 mol/L of pepstatin showed complete inhibition of hydrolysis of S1-casein (CN) at Phe23-Phe24 at all stages of ripening. The level of insoluble calcium in each of 4 cheeses decreased significantly during the first 21 d of ripening, irrespective of the level of pepstatin addition. Concurrently, there was a significant reduction in hardness in each of the 4 cheeses during the first 21 d of ripening. The softening of texture was more highly correlated with the level of insoluble calcium than with the level of intact S1-CN in each of the 4 cheeses early in ripening. It is concluded that hydrolysis of S1-CN at Phe23-Phe24 is not a prerequisite for softening of Feta cheese during the early stages of ripening. We propose that this softening of texture is principally due to the partial solubilization of colloidal calcium phosphate associated with the para-CN matrix of the curd.

Key words: proteolysis, texture, Feta cheese, in -soluble calcium

POSSIBILITY OF USING POTASSIUM CHLORIDE AND GLYCINE AS A SUBSTITUTES FOR SODIUM CHLORIDE IN HOMEMADE SLAVONIAN SAUSAGES

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The excessive intake of sodium (Na) has been linked to hypertension and consequently to the increased risk of stroke and premature death from cardiovascular diseases. The reduction of added NaCl in fermented meat products has been proposed in order to decrease the amount of sodium in the diet. The effect of partial replacement of NaCl by KCl and glycine to physicochemical, microbiological and sensory characteristics of homemade Slavonian sausages was analyzed. According to the results, the partial substitution of NaCl by KCl and glycine had no effect on basic composition, pH, aw, color coordinates and texture of the fermented sausage. The reduction of NaCl slightly increased the number of Enterobacteriaceae and Staphylococcus aureus, but all samples were still microbiologically safe, according to the EU legislation. According to the sensory scoring test the highest rated sausage was the one containing 1% NaCl, 0.9% KCl and 0.1% glycine, the second rated was the control sausage with 2% NaCl and the third one was the sausage with 1% NaCl and 1% KCl.

According to these results, it is possible to achieve the reduction of 50% of NaCl in homemade Slavonian sausages by replacing it with KCl (substitution level between 30 and 50%), and glycine (substitution level between 10 and 20%) while still maintaining traditionally desirable sensory properties.

THE DYNAMICS OF FERMENTATION PROCESS AND SENSORIAL EVALUATION OF SAUERKRAUT, CULTIVAR FUTOŠKI AND HYBRID BRAVO-COMPARATIVE STUDY

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Preservation of foods by fermentation is a widely practiced and ancient technology. Lactic acid bacteria because of their unique metabolic characteristics are involved in many fermentation processes of milk, meats, cereals and vegetables. The fermentation of white cabbage into sauerkraut traditionally proceeds in the presence of salt. White cabbage, cultivar futoški has protected geographical origin according to domestic legislations because of its specific physical and sensory characteristics, as native as well as sauerkraut. The objective of this study was to follow dynamics of biofermentation parameters for white cabbage, cultivar Futoški and hybrid Bravo. These two varieties were spontaneous fermented traditionally with addition of salt in concentrations of 2%. Fermentation process was conducted under anaerobic conditions at temperature of 18 ^{o}C. Organic acids and pH were determinated in defined time intervals during fermentation process. Cabbage heads were also sensorially evaluated in native form before the beginning of fermentation as well as sauerkraut. Sensory evaluation was performed by 4 trained panelists in four measurements. Experiment showed that white cabbage, cultivar Futoški has more acceptable sensory characteristics and faster achievement of completion of fermentation of cabbage tissue.

Key words: cabbage, sauerkraut, fermentation, sensory, salt

PROXIMATE COMPOSITION AND SENSORY CHARACTERISTICS OF SREMSKA SAUSAGE PRODUCED IN A TRADITIONAL SMOKING HOUSE

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Sremska sausage is traditional Serbian dry fermented sausage produced in the past mostly from meat of autochthonous pig breed. Commonly, this sausage is produced in the winter in smoking houses without controlled process conditions such as temperature and relative humidity. Nowadays, Sremska sausage is produced from meat of modern pig breeds, not only in households but also in meat industry under controlled conditions.
The goal of this paper was to determine the proximate composition and sensory characteristics during storage of Sremska sausage produced in a traditional way in the smoking house, from the meat of commercial 7-month-old Swedish Landrace pigs. Sausages were produced in December; the muscle-fat ratio was 75:25, with the addition of 2.2% nitrite curing salt and spices. After filling in pig small intestine, the sausages were hung to dry with the temperature ranging between 10–150C and relative humidity between 75–90%. They were then occasionally smoked during the first 14 days. Sampling and chemical analyses were carried out on 0, 3rd, 7th, 14th and 21st days of production. Sensory evaluation was performed at the end of the production process (21st day) and during storage, on 60th and 120th day.
The sausage was characterized by a long ripening period, which is considered typical for the traditional production method. The minimum pH (4.98) was reached on 14th day, then it increased slightly to 5.12 (21st day). During the ripening, water content significantly decreased (from 58.13% at beginning to 30.21% at the end), that resulted in large weight loss of 41%, while the proportion of fat, protein, ash and sodium-chloride increased. At the end, final product had distinctive spicy flavor, dark red color and firm consistency. During storage, overall sensory quality has slightly reduced, but sensory scores were still high for this type of product.

Key words: Sremska sausage, traditional smoking house, proximate composition, sensory characteristics

CHARACTERISTICS OF COLOR AND TEXTURE OF FERMENTED "UZICKA" SAUSAGES PRODUCED IN THE TRADITIONAL WAY

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With the aim of preserving the quality of traditional fermented sausages and provision of continuity in production, a task of this work is to determine the quality of "užička" sausages, which is traditional Serbian product. This paper presents the results of sensory evaluation of traditional "užička" sausage and the results of instrumental measurement of color and texture, at the end of the production process.
Sausages were made from I category (50%) and II category (20%) beef, II category (20%) pork meat, fatty tissue (10%), nitrite curing salt (2.50%), sucrose (0.33%) and spices (2.5%). Stuffing was filled in beef small intestines. Sausages were smoked at temperature of 16-18°C and dryed up to 21 days. Sausages were made in three replicates.
Sensory properties of sausages (color, cut surface, coherence, tenderness) were evaluated using quantitative descriptive test (scale of intensity, of 1 to 10) at the end of production. Color and texture of ”uzicka“ sausage instrumentally (“MOM Color 100” and “ISTRON model 4301“), were analyzed, aiming to define the total quality.
Results of sensory avaluation showed that the most desired properties had sausages from a third fermentation (produced in the last week of October and first half of November, when climatic conditions were optimal for the production), and the results of instrumental measurements of color and texture are in agreement with the results of sensory evaluation.

Keywords: fermented "užička" sausages, colour, texture, sensory and instrumental analysis

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CROATIAN WINE AND PROTECTED DESIGNATIONS OF ORIGIN, PROTECTED GEOGRAPHICAL INDICATIONS AND TRADITIONAL TERMS

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The European quality policy is not unique for all products. The concept of protected designations of origin (PDO), protected geographical indications (PGI) and traditional terms differs between the food and the wine. Wine sector, as one of the most complex parts of the Common Agriculture Policy has its own very specific rules regarding designations. Croatia had to harmonize all legislation as one of the precondition for EU accession. This paper aims to analyze designations of wine in Croatian wine sector and to identify the perceptions of consumers in connection with wine designations.
This research is based on the qualitative and quantitative research strategy. Firstly, legal framework in Croatian wine sector has been explored and compared to the EU. After that, survey was conducted using self-administered questionnaire on the sample of 120 consumers. Research questions focused on knowledge about designations of wine and their perceptions among consumers. Data were analyzed using univariate statistics and bivariate correlations.
Analyses were conducted using the Statistical Package for Social Sciences, v.17 (SPSS Inc., Chicago, USA).
Croatia has 17 traditional terms and between them are “Mlado vino”, “Plavac” and “Opolo”. The other traditional specific terms are connected with the quality of wine and its categorization.
There are 16 protected designations of origin for wine in Croatia and the most famous is Dingač. Croatia has no wine with protected geographical indication.
The results of the survey have shown that 82.6% of the consumers are familiar with the wine designations. During the purchase for majority of consumers wine designations are important (52.1%) and very important (28.9%) information on the label. Regarding willingness to pay results have shown that great majority of consumers (81.9%) are willing to pay between 10% - 30% more for wine with designations.

PREDICTION OF SOME OENOLOGICAL CHARACTERISTICS OF WINE PROŠEK USING NEAR INFRARED SPECTROSCOPY

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Previous studies have shown that some oenological parameters for red wine can be predicted using of near infrared spectroscopy (NIRs). The aim of this study was to examine the possibility to predict concentrations of ethanol, fructose, glucose and total acidity in wine Prošek using specific wavelength.

Wine Prošek were produced using two grape varieties (Plavac mali and Pošip),. Physical-chemical measurements (relative density, real alcohol, total extract, reducing sugars, pH, total acidity, volatile acidity, ash, free sulphur dioxide, total sulphur dioxide) were conducted for wine samples. The absorbance of wines Prošek was measured using defined wavelengths with the instrument NIR-128-1.7-USB/6.25/50 µm with scan range 904-1699 nm.

Calibration equations were developed from NIR data using partial least squares (PLS) regression with internal cross validation. Using PLS regression, very good calibration statistics ($R2 > 0.80$) were obtained for the prediction of total alcohol, fructose, glucose and acidity for the red wine Prošek produced from grape variety Plavac mali regardless which yeast was used in the production. The same efficiency was detected for the white wine Prošek produced from the grape variety Pošip only in predicting content of alcohol and acidity. From the collected data of the experiment and gained from the models can be concluded that near infrared spectroscopy could be used as rapid alternative method for the prediction of the concentration of alcohol and acidity for Prošek wines regardless the grape variety and in prediction of concentration of fructose and glucose just for Prošek wines produced from grape variety Plavac mali regardless the yeast used in the wine production.

BIOGENIC AMINES CONTENT AS AN INDICATOR FOR THE ESTIMATION OF GOOD MANUFACTURING PRACTICE DURING PETROVSKÁ KLOBÁSA PRODUCTION

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In this paper, good manufacturing practice (GMP) during Petrovská klobása production, throughout three seasons and for the total of 13 batches (A1, A2, B1, B2, B3, B4 – first; C1, C2, C3 – second; D1, D2, E1, E2 – third season), was estimated based on tyramine, histamine, phenylethylamine, vasoactive and total biogenic amines content. Analyses were performed by HPLC-DAD on Eclipse XDB-C18 column. Chromatographic separation of dansyl chloride derivatizated amines was completed in 8 min.

Histamine, as the most important amine from the food safety point of view, was not detected in any analyzed sample. Total content of biogenic amines ranged from 77.8 to 174 mg/kg in the first, from 456 to 744 mg/kg in the second and from 144 to 217 mg/kg in the third production season. Tyramine was not detected in A1 batch, while in others its content ranged from 6.90 (B1) to 160 mg/kg (C3).

For C batches content of phenylethylamin, as well as the sum of vasoactive biogenic amines was found to be higher than values considered as upper limits (30 mg/kg; 200 mg/kg, respectively) for indication of GMP. According to obtained results good manufacturing practice was applied during production of Petrovská klobása in the first and third season, while in the second season that was not the case.

NUTRITIONAL STUDY OF THE HAZELNUT CORYLUS AVELLANA L. CULTIVATED IN ALBANIA

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Scientific studies on the hazelnut have revealed the nutritional and healthy benefits. Studies on the communities that have the hazelnut present in their diet have enforced that conclusion. Beyond the energetically sources the hazelnut fruit is very important for the nature of the fatty acids which are in n-6/n-3 ratio close to that recommended by the Dietary Guidelines for Americans.

Study of the hazelnut on their nutritional is in parallel with a national scheme for the enlarging the area of cultivation with nuts. As e country with geography on both the Mediterranean climate as well as moderate the possibilities to enlarge the area of nuts cultivation is evident.

Preliminary studies on the main constituents from the samples in two selected sites give evidence that the carbohydrates vary on 16.2-17.0 g/100 g dry weight hazelnut. The protein content varies 14.7-15.1 g/100g. The main constituent in the hazelnuts results the triglycerides of 69.1- 70.5 g/100 g dry weight hazelnut. The analysis was carried out according to the AOAC (2000) methods. These results are part of an ongoing study started in 2010 and will last for three years.

THE ANALYTICAL AND NUTRITIONAL STUDY OF THE AUTOCHTHONOUS TABLE OLIVE 'KOKERMADH BERATI'

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Olive tree is one of the most important plants related to the economical interest not only in Albania, but also all around Mediterranean countries. Eventually it is one of the study objects for the region, which constitutes the main areal of cultivation, of more than 93% of global olive trees. Studies with focus the olive tree mainly have been of statistical profile comprising, (yield, area of plantation and their exploitation) and botanical (morphological determinations of olive cultivars). Recently has been growing interest on the analytical studies of chemical compositions.

One of the main olive cultivars used as a Table Olive is the Kokermadh Berati an autochthonous variety cultivated in the region with same name. Its interest is related to the number of the tree that constitute by 20% of the total fond of the country (~6 million olive trees). This study has analyzed samples from the crop year 2010-2011. It evaluated the Oil content, Fatty acid profiles, total phenol content and antioxidant activity. GC analysis of fatty acids revealed that the oleic acid content resulted in 76.26%. The content of Palmitic acid is relatively low to 10.41%). The levels of Linoleic acid is considered relatively low (6.92%). The content of the Stearic acid resulted 2.20%, while the Linolenic acid resulted 0.67%. The Saturated fatty acids (SFA) group resulted in 12.92%, the Monounsaturated Unsaturated Fatty Acid (MUFA) content to 79.53% and the Poly Unsaturated Fatty Acid (PUFA) 7.59%. The nutritional value of n-6/n-3 show very interesting values by 10.31. The Total Phenol Content (TPC) expressed as Gallic Acid Equivalency (GAE) resulted 226.97 ±1.40 mg GAE/kg OO. The antioxidant capacity for this cultivar resulted 1.24±0.06 Trolox (mmol/kg Olive oil).

DETERMINATION OF SUITABILITY OF LB. SAKEI FOR APLICATION AS STARTER CULTURE IN THE PRODUCTION OF PETROVAC SAUSAGE

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Among the starter microorganisms, LAB are the most important in meat fermentation, since these organisms contribute to all the aims of the process.

In order to analyse the behaviour of Lactobacillus sakei in the pure culture, the influence of spices (garlic and red hot paprika), as well as co-culture: Lb. sakei and Staphylococci during fermentation of Petrovac sausages, three fermentation were carried out in meat simulation medium (MSM) on the temperature of 10°C during 7 days. The biomass was monitored by measuring the optical density (620 nm) and viable counts of bacteria (on MRS and MSA plates). Souring properties were determined by measuring pH value, while the concentration of lactic acid and glucose were determined by HPLC method.

During first two days of all fermentations optical density was constant and lower than 0.05, while at the end of the fermentations it reached value of cca 1. In the mixed cultures number of staphylococci showed no changes during the fermentation and was on the level of cca 6 log CFU/ml, while the number of lactobacilli increased from 5.5 to 8-9 log CFU/ml. The generation rate for single lactobacilli culture was 0.08 h-1, while in the fermentations with co-culture this value was 0.06 h-1. All fermentations resulted in the reduction of pH value from 6 to cca 4,3-4,4. The consumption of glucose was highest for the fermentation with Lb. sakei. The amounts of synthesized lactic acid were similar for fermentations without spices. The addition of spices resulted in lower consumption of glucose and synthesis of lactic acid.

The behaviour of Lb. sakei in model medium, with the acceptance of generation rate, was similar for single and co-culture. The addition of spices resulted in the decrease of uptake of glucose and the amount of synthesized lactic acid.

PROBIOTIC PROPERTIES OF AUTOCHTHONOUS LACTIC ACID BACTERIA ISOLATED FROM ARTISANAL SOFT CHEESES

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In the concept of functional food, especially in dairy industry, there is an increasing interest for probiotic products. Therefore, array of 88 diverse autochthonous lactic acid bacteria isolated from eighteen artisanal cheese samples from Serbia and Croatia was used as a source of strains with potential probiotic features.
Knowledge of the antibiotic resistance pattern of probiotic strains would be useful in order to avoid spreading of antibiotic-resistance genes between bacterial species through the gene transfer. Examined bacterial isolates were susceptible to most of 12 tested antibiotics, however they showed resistance to some of them, especially to vancomycin and to the representatives of aminoglycosides - streptomycin and neomycin. According to obtained results, these resistances are rather intrinsic and no transferable resistance genes were found in examined isolates.
In order to select potential probiotic bacteria capable to survive gastrointestinal passage, in vitro experiments were performed in attempt to simulate gastric and small intestinal conditions. Between 88 autochthonous isolates, 60 strains did not survive passage through the most rigorous simulated gastrointestinal (GI) conditions when pH of the gastric juice was 2 and concentration of bile salts 0.3% (w/v). The best survival was obtained for strains: Lactobacillus pentosus ZG3-17, ZG2-25 and BGGO5-3, Lactobacillus plantarum ZG4-14, Lactococcus lactis BGAL1-1, BGLE1-6 and ZG5-9, and, Enterococcus faecium ZG1-54. Strains Lactobacillus sucicola BGGO7-28, Lactobacillus casei BGGO5-7, Leuconostoc mesenteroides ZG4-14 and Lactobacillus rhamnosus BGGO5-47 could also be interesting as functional starter cultures in cheese production as they survive in simulated GI conditions in highest number among their species. Resistance to bile salts could be ascribed, among other resistance mechanisms, to bile salt hydrolase activity (BSH), but high activity of this enzyme is not desirable in probiotic bacteria. All examined strains deconjugated only 10% or less of taurocholate added to the growth medium and therefore are suitable to be applied as probiotics.

COMPARATIVE REVIEW OF SOME OF THE QUALITY PARAMETERS OF TRADITIONAL CHEESES IN BRINE

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In parallel with the industrialization and standardization of modern production, cheese production, based on traditional principles, is an important feature of nations, states and regions. Awareness about the characteristics of this production is supported by growing demand of high-quality organic food with labels of origin. Competitiveness and cost of this food, compared to conventional products, increases respectively from day to day.
This study presents the research which aimed to describe the processes of production of soft white cheese in brine, based on old, traditional technologies, and produced in Serbia (near Nova Varos-Zlatarski cheese) and Montenegro (area surrounding the city of Podgorica and Danilovgrad). In both cases, fresh cow's milk was used as a raw material, without any prior heat treatment. In parallel, the paper presents the most important chemical quality parameters (water content, dry matter content, water content in the fat-free substance of cheese, fat, milk fat content in dry matter and acidity of the cheese), with descriptions and evaluation of sensory properties.
On the basis of the determined values of water content in the constituents of fat-free cheese (cheese named “Zlatarski”: 73.31 ± 0.38; soft white cheese from Montenegro 68.3 ± 3.63), and on the basis of their consistency and appearance, all investigated samples belong to the category of soft white cheese. Based on the share of milk fat in dry matter of cheese (which is the Zlatar cheese was 54.24 ± 5.90%, with soft white cheese from Montenegro, 53.11 ± 4.45) samples examined fall into the category of full-fat cheeses. Sensory properties of soft white cheese in brine, from both sites, showed distinct but characteristic sensory properties of the product and a high level of quality which is present in spite of certain individual differences.
The research was aimed to describe the autochthonous technology of preparing cheese and to prevent forgetting those technologies. Parallel activities in order to protect geographical indications, seek to influence the organized form of their production in order to achieve standardized quality, and intent to make ethnographic richness of these regions noticeable.

HYDROLYSIS OF SARCOPLASMIC PROTEINS DURING THE RIPENING OF TRADITIONAL PETROVSKÁ KLOBÁSA SAUSAGE

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In order to contribute to the knowledge about the proteolysis in Petrovská klobása the composition of water-soluble (pH 7.4) protein extracts of this traditional dry-fermented sausage was regularly examined as ripening progressed (120 days). Instead of widely utilized, classical SDS-PAGE, the Lab-on-a-Chip (LoaC), fast and reliable electrophoresis based method, was used to follow up the hydrolysis of sarcoplasmic proteins during the ripening. Water activity (aw), pH evolution and an increase of non-protein nitrogen fraction were also followed up. Obtained results showed that Petrovská klobása, traditionally produced under low ambient temperature, undergoes slow processes of natural fermentation, drying and ripening. The pH decreased slowly from 5.67 (day 0) to 5.30 (day 60) ($P < 0.05$), what had an adverse effect on drying and proteolysis intensity. The aw gradually decreased from initial value of 0.95 to 0.86 ($P < 0.05$), while the NPN fraction increased up to day 90 (1.05 g/100g dm) and then stabilized further on. Throughout ripening slow degradation of sarcoplasmic proteins took place, resulting in disappearance of several protein bands (≈16, 44 and 93 kDa) during second month of ripening.

ATTITUDES OF VLASINA HONEY PRODUCERS TOWARDS GEOGRAPHICAL INDICATIONS

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The Republic of Serbia is known as a producer of wide range honey varieties. The Vlasina plateau in the south part of Serbia covers the area of 12740.90 ha. According to the Regulation of the Government of the Republic of Serbia ("Official Gazette of RS", no. 30/06) Vlasina area is protected as a landscape of outstanding features and categorized as a natural resource of great importance for the Republic.

The diversity and specificity of biotopes Vlasina areas have caused a high diversity of flora, vegetation, fauna and ecosystems that are characterized by high degree of origins and authenticity of natural features. The area is habitat for a number of natural rarities, as well as natural phenomena. Beekeepers in the area mainly deal with stationed beekeeping in beekeeping directly at Vlasina plateau.

The aim of this paper was to find out whether producers of Vlasina honey are familiar with geographical indications (GIs) and to determine their perception and attitudes about these indications. The article presents the results of a research that shows that only a small part of producers are familiar with GIs. This group believes that GIs would have positive effect on honey competitiveness and especially on marketing, increasing sales prices and reduce a black market. The results suggest that there is a need of better information regarding GIs.

CHANGES IN THE AROMATIC COMPOSITION DURING OFF-VINE DRYING OF PLAVAC MALI GRAPES

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INTRODUCTION:
The study was conducted in order to achieve chemical characterization of dried grape aroma and to improve our understanding of the changes in volatile compounds during dehydratation of grapes for dessert wine production.
MATERIALS AND METHODS:
Red Plavac mali grapes grown at Pelješac in Croatia was harvested at 21 °Brix. The grapes were placed on a perforated plastic holders located inside the glasshouse for 19 days to partially dry. Daily temperature was between 25 to 45 °C. The grapes were dried until reaching sugar content of 31 °Brix. Samples were analysed by gas chromatography-mass spectrometry (GC-MS) with HS-SPME.
RESULTS AND DISCUSSION:
A total of 61 aroma compounds from different chemical groups were identified: 16 esters, 15 alcohols, 10 terpenes, 8 aldehydes, 6 ketones, 4 acids and 2 C-13 norisoprenoids. The drying process resulted in an increase of the aroma compounds. Higher alcohols are quantitatively the largest group of the volatile compounds in dried grapes. Hexanol and 2-phenylethanol were markedly the most abundant higher alcohols, thus their sensorial contribution with herbaceous and honey odour was expected. Among esters, higher amount of ethyl acetate, followed by isoamyl acetate and ethyl hexanoate was found in dried grapes. Ethyl esters of fatty acids (6–16 carbon atoms) were present in the lowest amount. Concentration of specific norisoprenoid β-damascenone in dried grape is associated with a fruity, floral, honey and berry-like aroma. Among terpenes, 4-terpineol had the highest relative concentration. In dried grapes, the total amount of terepens increased higher than that of other classes of compounds.
CONCLUSIONS:
The increase in some of these compounds was the result of simple concentration but it is also expected that the production of these compounds continues after the harverst. These compounds contribute to an increase in fruity and sweety character of dessert wine.
Key words: dried grape, aroma compounds, terpenes, esters, higher alcohols, GC/MS

EFFECT OF SALT REDUCTION ON SOME PARAMETERS OF PROLONGED MATURED DRY-CURED HAMS (KRAŠKI PRŠUT) ORIGINATED FROM SLOVENIA

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The aim of the present study was to investigate the effect of salt reduction on the technological, sensorial and physico-chemical qualities of Slovene 16-months matured dry-cured hams (Kraški pršut) produced under Protected Geographical Indication. A total of 12 green hams (pH24 5.6-5.8) that originated from pigs (Landrace × Large white) were divided into two subgroups according to salt (NaCl) addition during production (normal vs. low-salted). After the salting period, the NaCl concentration in the normally salted muscles was 3.78 ±0.2 %, and in the less salted muscles, 3.39 ±0.3%. After processing of the dry-cured hams, the semimebranosus (SM) and biceps femoris (BF) muscles were analysed for: water activity (aw), pH, NaCl content, moisture, total minerals, non-protein nitrogen, total nitrogen, as well as the instrumental (stress relaxation, texture profile analysis, colour) and sensory parameters. In this time, the aw of both muscles in all experimental groups dropped below 0.885. The total weight losses varied between the groups (35.3%-37.7%), with the low-salted hams showing the highest. The SM and BF muscles with low-salt showed slightly higher proteolysis indices (non-protein nitrogen:total nitrogen ratio), which indicated a trend towards more rapid proteolysis. Generally, the softer texture of the BF muscle compared to the SM muscle was confirmed by stress relaxation test, texture profile analysis, and the related chemical parameters (higher moisture content, aw, and proteolysis index). Hams showed lover cohesiveness for the low-salted hams as compared to the normally salted hams. There were not differences between all others texture and sensorially evaluated parameters (with exception of saltiness) of low-salted and normally salted hams.

RHEOLOGICAL PROPERTIES OF SOME TRADITIONAL TURKISH FOODS

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Rheological properties of foods are essential for evaluation of product quality, process engineering calculations and shelf life of final product. Rheological properties are described as response of materials such as deformation or flow when the force applied. With this review, we will familiarize with the rheological properties of some liquid traditional Turkish foods which are not widely known. Boza and salep are consumed as hot drink while tarhana is a fermented cereal based food which is consumed as hot soup. Tahin is a highly viscous sesame product which is generally blended with different levels of pekmez for consuming as a desert. These products have a different flow behaviour index that is so to say they have different rheological characteristics that should be analyzed before processing of these foods.

Keywords: Rheology, boza, tahin (sesame paste), pekmez (molasses), tarhana, salep.

SAFETY AND QUALITY OF TRADITIONAL CROATIAN PRODUCT "MEAT FROM TIBLICA"

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„Meat from tiblica“, traditional product with special quality and value, is part of cultural heritage of Međimurje, North Croatia.

In this study, „meat from tiblica“ was produced in household and stored in controlled conditions (8 °C) during nine months, sampled and examined monthly in triplicate. Standard microbiological tests included enumeration of aerobic mesophylic bacteria, lactic acid bacteria (LAB), coagulase negative cocci, S. aureus, enterobacteria, E. coli, yeast and moulds, enterococci, sulfite-reducing clostridia, lipolytic bacteria and detection of Salmonella spp. and Listeria monocytogenes. Physico-chemical tests included determination of pH, aw, NH3, titratable acidity, peroxide number and fatty-acid composition.

Microbial population of meat and minced cooked back fat consisted of aerobic mesophylic bacteria (3.25 to 3.94 log10CFU/g and 5.62 to 6.75 log10CFU/g, respectively), lipolytic bacteria (2.72 to 4 log10CFU/g and 5.35 to 6.76 log10CFU/g, respectively), yeasts and moulds (2.42 to 4.32 log10CFU/g and 4.33 to 5.4 log10CFU/g, respectively), coagulase negative cocci (3.04 to 3.9 log10CFU/g and 5.15 to 6.34 log10CFU/g, respectively) and LAB (<2 to 3.37 log10CFU/g and 4 to 5,01 log10CFU/g, respectively), without pathogens. Because of specific production process (thermal treatment after curing), meat had lower microbial numbers than fat, despite lower aw. The ammonia content in meat, titratable acidity and peroxide number in minced cooked back fat, showed constant increase during the storage, but did not point to the spoilage. Amount of SFA increased, while amounts of MUFA and PUFA decreased in the product. Product had higher sensorial grades with longer storage until seventh month, and even after period of storage, grades were still higher than after first month of storage.

Presented results may contribute to process of obtaining Protected Designation of Origin, and refer that traditional production „meat from tiblica“ is acceptable from technologically and hygienically point of view.

DIVERSITY AND FUNCTION OF NATURAL YEAST MICROBIOTA IN TRADITIONAL CHEESES PRODUCED IN WESTERN BALKAN COUNTRIES

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From microbiological point of view, cheese is complex and dynamic system which contains defined starter cultures and undefined variable natural microflora – bacteria, yeasts and filamentous fungi. Presence of yeasts does not result only in cheeses spoilage but due to their lipolytic and proteolytic activity they contribute to the cheese ripening and maturation. The aim of this study was to isolate, identify and characterize yeasts from traditional soft cheeses made from non-pasteurized milk in distant regions of Serbia and Croatia.

Yeast microbiota was isolated by traditional microbiological methods as well as by direct isolation of DNA from cheese samples and its amplification of ribosomal DNA. The DNA was separated on denaturating gradient gel electrophoresis (DGGE) and individual discrete bands were excised and sequenced. Furthermore, the diversity of yeast strains was determined by sequencing of variable rDNA regions as well as with rapid genotyping methods. The lipolytic and proteolytic activities of different yeast strains and species were examined on Trybutyrin and on Skim milk agars.

Culture independent PCR-DGGE method showed great diversity of yeast populations. Apart from yeast species identified by PCR-RFLP, we identified some species like Geotrichum sp., Candida species such as C. pararugosa, C. silvae and Issatchenkia species were detected only by culture independent method. Most yeast species possessed either lipolytic or proteolytic activity.

Yeast microbiota composition was specifically dependent on region of cheese origin, for instance Saccharomyces cerevisiae and Galactomyces geotrichum species were isolated only from some cheeses. The most frequently occurring yeast species were represented by Debaryomyces hansenii, Yarrowia lipolytica, and Kluyveromyces lactis. Apart from these species which were found in all the samples, composition of yeast population is more or less region specific.

TURKISH PIZZA: LAHMACUN (LAHMAJOUN) (GAZIANTEP STYLE)

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Turkish cusine, when coupled with the use of traditional products, cooking techniques for food preperation and preservation methods for food storage, forms a unique culinary culture. Gaziantep is the one of the cities in the world associated by name with its own special cuisine, Gaziantep cuisine, which consists of original dishes that include a lot of special Anatolian flavors. Gaziantep cuisine generously utilizes all cookery techniques: stew, grill, frying, sauté, roast, casserole, baking etc. As cooking techniques, stew, poaching, roasting, grilling, cooking on the iron plate and baking are used. Gaziantep cuisine is classified into two categories: home kitchen and dine-out kitchen. The home kitchen includes dishes cooked at home, and the dine-out kitchen covers dishes that dined out. The dine-out kitchen includes lahmajoun, kebab varieties, lentil soup, beyran, casserole prepared with seasonal vegetables and meat baked in the public bakery, roll (dürüm) prepared with chickpeas stewed with bones, katmer, beyran and liver kebab for breakfast, and baklava and kadayif for dessert. Lahmajoun is one of the most special and famous dishes of this cuisine. As with most Middle-Eastern dishes, the origins of lahmajoun is much debated, and is thought to originate from Turkey. When compared to other cities, the ingrediends and preperation techniques used in Gaziantep makes Gaziantep lahmajoun more delicious and different both in taste and appearence. Lahma tanslates to “meat”, and joun translates to “dough”. The traditional method of preparation is to roll out leavened dough into a thin round sheet. On top of this dough, a mixture of minced fatty sheep meet, sweet or hot red peppers, garlic, tomatoes, parsley, powder of black pepper , paste of tomatoe and red pepper is spreaded thinly and evenly to the edges. It is then baked in stone or wood-burning ovens until the meat is browned and the dough has crisped at the edges. Generally lahmajoun is served together with lemon and parsely. Lemon is squeezed and parsley is spreaded over lahmacun, and than it is wrapped. Lahmajoun is mostly consumed with ayran. Sometimes peoples consumes also lahmacun with roasted eggplant . After peeling and slicing of roasted eggplant, it is spreaded together with parsley over lahmajoun. In addition to being delicious lahmacun also has high nutritional value. It has both carbohydrate, protein, mineral, vitamin and high amount of dieatery fibers. Some call it Turkish Pizza, but it is more than just that when compared to its ingredients.

Keywords: Lahmacun, Lahmajoun, Turkish Culinary, Gaziantep Cuisine, Nutritional Value, Local Food

ANALYSIS OF DISHES STRUCTURE IN THE CATERING INDUSTRY OF SREM MADE FROM TRADITIONAL AND ORGANICALLY PRODUCED FOOD

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Traditional and organically grown agricultural products represent a good basis for the development of authentic gastronomic offer and are an important attribute in the development of regional tourism and tourist destination. This kind of consumption is an integral aspect of tourist experience for the tourist not only consumes the sights and sounds of the visited destination but they also consume the taste. Gastronomy is an important mean to break into another culture which enables the individual to taste the "other" on the sensory level, and not only on the intellectual. Culinary tourism represents an increasingly attractive form of movement of people where exactly these products and dishes are the precondition for visiting the destination because it is defined as the activity of exploration and discovery of culture and history through food. With the assumption that Srem is a very suitable destination for the development of this form of selective tourism, an analysis of 350 dishes from menus (n=350) made in 30 catering facilities in the territory of Srem was carried out through the review of the participation of local, national and international dishes, as well as dishes prepared from organic products that are more and more in demand in the global tourism market. The research was conducted using descriptive methods. The field analysis of the problem was conducted by using the method of interview with the management of the facilities, and for dishes in the menus the methods of analysis and synthesis were used. It was noted that catering facilities for food and beverages do not have a satisfactory number of national and regional gastronomic products of Vojvodina. The fact that the analysed structure of gastronomic products is different in all groups of dishes, like soups, ready meals and meals by order, especially stands out. Catering facilities in the Srem district do not offer a significant number of dishes prepared from organic ingredients from organized production nor from those foods and food products that have a certain level of protection of geographical origin. The study attempted to determine the situation and suggest directions for solutions to the problems in order to develop culinary tourism.

ANALYSIS OF MASS AND ENERGY BALANCE IN THE INITIAL STAGE OF KAJMAK PRODUCTION

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Kajmak is a traditional Serbian dairy product which can be classified between cheeses and butter. In the traditional manufacture of kajmak, the processes of heat and mass transfer at the milk/air interface occur slowly and are highly dependent on the environmental conditions, resulting in uneven product quality. Also, long period of the kajmak formation has very negative impact on the microbiological status of the product. In order to carry out the industrialization of kajmak production it is necessary to reduce the production time, to introduce the environmental conditions control and to manage mass and energy transfer.
Initial stage of kajmak production (first 60 min of kajmak formation process) results in surface coagulation of top layer of milk, due to mutual influences of: (1) surface tension driven protein concentration increase; and (2) water evaporation driven by high milk temperature.

In traditional production, milk temperature is decreased for 30-40°C during the initial phase of kajmak formation. Solid layer, initially formed, incorporates only about 10-15% and 2-3% of total milk fat and proteins, respectively. Numerical simulation of the kajmak formation process indicated the existence of the energy loss, which is mainly caused by the complex processes of simultaneous convective and evaporative cooling of milk.

Creation of the industrial procedure for kajmak production faced the request for changes regarding both, mass and energy balance. Analysis of the mass balance of the kajmak production indicates that it is possible to complete the initial phase of kajmak production with significantly reduced amount of milk. Adversely, energy balance analysis indicates that the reduction in the amount of milk at the same time creates a serious energy deficit. Therefore, one of the central issues of industrialization of kajmak production is addressed to the adequate balance of mass and energy.

Key words: kajmak, surface activity, mass and energy balance, convective and evaporative cooling

SPECIFICITY OF GEOGRAPHIC AREA AS ONE OF THE PREREQUISITES FOR OBTAINING DENOMINATION OF GEOGRAPHIC ORIGIN

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In this paper, principles of traditional production and main characteristics of Sjenica cheese and Pirot kachkaval are presented.
Sjenica cheese is manufactured using fresh sheep milk according to simple technology which is not much different from production of other autochthonous white cheeses in brine such as Zlatar cheese, Travnik cheese, Polimlje-Vasojević cheese, etc. This cheese has high water content (53.46%) and high content of fat in dry matter (58.66%), which is why it is classified as full-fat cheeses. High acidity of the cheese (84.07ºSH) and pH 4.38 are typical for white cheeses in brine which is the group of cheeses to which Sjenica cheese belongs.
Pirot kachkaval is produced by shepherds in »bacije« (herdsmen settlements in the mountain) from mixed sheep and cow milk (ratio 1:2), during pasture/grazing period, on the Stara Planina Mountain. Production takes place in traditional way, by steaming of ripe curdles and manual shaping of cheese wheels. Ripening and salting of cheese in climatic conditions of the Stara Planina Mountain has induced forming of Pirot kachkaval of pleasant taste/aroma, tangy and slightly tart.
Results of the research indicate the presence of significant agricultural and ecological potentials for production of healthy and safe food on the territory of Sjenica – Pešter plateau and Stara planina Mountain.
Considering that the number of consumers who prefer exclusive food products obtained using traditional technology is increasing, it is necessary to direct all available resources and potentials to production of eco-foods/products of protected geographical origin.

Key words: traditional production, Sjenica cheese, Pirot kachkaval, geographic area

VIII
FOOD AND FEED CHAIN MANAGEMENT

NUTRITIONAL CHALLENGES AND AGRICULTURAL STRATEGIES IN NATIONAL NUTRITION POLICIES OF CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Introduction:
Central and Eastern European countries experience fast socio-economic changes and are characterized by nutrition transition. They deal with persistent undernutrition and micronutrient deficiencies while being confronted with emerging consequences of overnutrition and diet related noncommunicable diseases. Effective solutions will require investment in contextual drivers of diet, in particular in agriculture. This study examines how national nutrition policies of Central and Eastern European countries articulate agricultural measures to address nutritional challenges.
Methods and materials:
Nutrition and diet related policy documents were retrieved by study group from Faculty of Bioscience Engineering, Gent University, using following inclusion criteria (i) officially approved policy of a WHO member state; (ii) publicly available document, published between 2004-2011 and (iii) written in English. Information regarding agricultural strategies with regard to undernutrition, micronutrient deficiencies, food safety and overnutrition issues were extracted manually from the text following a structured content analysis approach.
Results:
The Central and Eastern European sub-region consist of 21 countries out of which only 5 (24%) national documents (Bulgaria, Georgia, Moldova, Poland and Slovenia) were retained for review. Agricultural measure to tackle food security in vulnerable population strata were found in 4 policies. The policy measures mainly propose mechanisms to support agricultural production in rural settings and facilitated access (e.g. through subsidies) of healthy foods (e.g. fruits and vegetables) to vulnerable groups. Strategies to promote the production of healthy foods, facilitated access to the markets and education of producers and consumers were in 4 policies.
Conclusions:
Strategies aimed at the agricultural sector for better diets imply various mechanisms i.e. production promoting mechanisms, education and market accessibility. Interesting examples are available to generate lessons learned. This benchmarking exercise generates insights in the nutrition policy development in Europe and hence provides information to further integrate agriculture and nutrition for countries in nutrition transition.

THE IMPORTANCE OF THE TRANSITION PERIOD TO ORGANIC MILK PRODUCTION

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Organic farming primarily aims to produce food with high nutritive value, to maintain or increase soil fertility, prevent and combat soil erosion, biodiversity conservation and to protect natural resources from pollution. In order to base organic production it is necessary to provide the spatial isolation of land parcels and farms of the possible sources of pollution (pesticides, waste water, pollen of genetically modified crops), the plot of land on which the content of harmful substances does not exceed the prescribed maximum level, and proper irrigation water quality (first and second category) and air.

There are many studies that show the health benefits of organic milk compared to milk from conventional production. Organic milk has higher content of polyunsaturated fatty acids and omega-3 fatty acids, more vitamin A, C and α-tocopherol, it does not contain residues of antibiotics, pesticides or other chemicals. Organic milk is healthier because the cows are kept free (in the barn and in the discharge) and they are long time on pasture and without stress.

Although Serbia has an interest for organic milk production, for the health and economic reasons, there is still no market certified milk or other dairy products.

In order to make transition to organic production it must happen through a transition period or the period of conversion to switch from conventional to organic farming. Methods of organic farming in livestock production has to be applicable from the beginning of the conversion period, which begins after the conclusion of the contract on the exercise of control in organic production between the manufacturer and the authorized control organization.

The paper presents a method of organic milk production in period of conversion on a farm in Futog Agricultural High School, where special attention is paid to the following procedures: agro-ecological conditions, the number of animals per hectare, race, diet and posture, health and reproduction of animals, and parallel production (conventional and organic farms at the same farm), cadastral parcel numbers, history of land, fertilization, seed sourcing, analysis of water, controlling weeds, pests and diseases and the effect of biological protection and record-keeping. Detailed implementation of measures of organic plant and livestock production on farms in the period of conversion, which are consistent with the Low on organic farming and regulations on professional standards, are make to avoid the mistakes in next year and ensure the transition to organic milk production.

Key words: transition period, conversion period, farm, organic milk

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VERTICAL COORDINATION IN POST-TRANSITION RED MEAT SUPPLY CHAIN: THE CASE OF SLOVENIA

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Institutional economics theory and reality proves positive effects of collective action on efficiency, competitiveness and product quality. Therefore, emphasise on effective vertical coordination is often the key approach to improve competitiveness especially in the post transitional economies. Slovenian agriculture is characterised with dispersed farm structure, which is beside lack of efficient supply chain operation an important factor for unfavourable economic performance. Among the subsectors of Slovenian agriculture the red supply chain shows several symptoms of a sector in intensive transformation, yet many characteristics are annotating pre-transitional operation models. The key focus of the paper is to analyse the attitudes of pig and cattle breeders towards the collective action being typical for contemporary supply chains. We were investigating in detail perceived benefits or burdens from participation in a vertical chain. The data were collected in a survey including 313 farmers engaged in pig or cattle production. Respondents were asked to evaluate statements related to organizational forms of collective action and its benefits, like higher product quality, prices and lower business risks, express their attitude towards the supply chain coordination, evaluate currently established relationships, etc. The multivariate statistical techniques were used to analyse the survey data, beside the fundamental descriptive statistics. The hierarchical cluster analysis was used to group the respondents regarding the of agreement levels on different aspects of supply chain relationships. Other parts of the questionnaire were than used form and describe cluster profiles (e.g. socio-demography, marketing channels used, and other characteristics related to farming). Results show that the obsolete and inefficient organizational forms of supply chain relationships prevail in Slovenian pig and cattle breeding sectors, however farmers significantly differ according to their attitude and experiences with vertical coordination. Moreover, alternative forms of collective activities are set up in order to overcome weaknesses and inefficiency of the prevalent vertical chains.

THE USE FOOD OF SAFETY OBJECTIVES AND RELATED CONCEPTS IN MICROBIOLOGICAL RISK ANALYSIS

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Foodborne illnesses - especially those caused with microbial hazards - have major public health consequences worldwide. In order to ensure continuous improvement in the health of population related to foodborne hazards, government is responsible for creating the food safety policy. On international level, large efforts are made to develop certain tools to link specific food safety requirements with its effect on public health. Risk analysis framework, laid down by the Codex Alimentarius during the past two decades, linked food safety and public health through risk assessment. Based on the formal approach to risk analysis, Appropriate Level of Protection, Food Safety Objective, Performance Objective, Performance Criterion and Microbiological Criterion are concepts evolved for purpose of risk management. However, the use of these relatively new concepts in microbiological risk analysis is still quit limited and inconsistent.

RAPESEED MEAL AS A BY-PRODUCT FROM BIODIESEL PRODUCTION AS A FEED INGREDIENT

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Rapeseed/canola (Brassica napus L.) is one of the most important edible oilseed crops in the world, as well as a major potential of bio-diesel production in Europe. High oil content is one of the most important characteristics of this crop. Rapeseed meal, which is by-product of oil extraction, is a highly rich raw material and contains up to 50% protein on dry basis. Plant proteins are largely used in the food and feed industry, and rapeseed proteins are regarded as potential ingredients that may be used as a food and feed additives.
In this paper the quality of rapeseed meal obtained during the biodiesel production was assesed and its use as a nutrient in domestic animals was discussed.

CONTROL OF PRODUCTION HYGIENE IN MEAT AND MEAT PRODUCTS INDUSTRY

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Hygiene maintance has a purpose of removing all hazards that could result in food contamination. Performance of hygiene procedures is monitored and controlled. By testing the samples from the working areas on certain microorganisms, efficiency of the hygienic procedures is verified and also the evaluation of the hygienic criteria in production process is supported. Direct methods of working area sampling, like smear method are the most practiced. The goal of this research is to evaluate the efficiency of the applied hygienic procedures. In this paper microbiological safety of equipment, tools and working areas after disinfection during the certain steps of the technological procedure of meat processing and production is investigated. Smears were taken from the same slaughterhouses during monthly routine controls from 2009 till 2011. By means of microbiological analysis following microorganisms were tested: Salmonella sp, Escherichia coli, coagulase-positive Staphylococcus, sulphidoreducing Clostridium, Enterobacteriaceae as well as the total number of bacteria. Research has been done according to acknowledged ISO methods. From the total of 100 smears taken from the working areas, tools and equipment in each year of research, 83% and 97% of the results in 2009-th and in 2011-th respectively were graded as acceptable. However the results of the 17% of the smears from the 2009-th and 3% from the 2011-th were graded as unacceptable, due to the increased total count of bacteria and/or presence of Escherichiae coli and Enterobacteriaceae, as indicators of fecal contamination. By comparing the period from the year 2009 until year 2011, tendency of reducing numbers of the smears that indicate unacceptable microbiological criteria is evident. This type of trend confirms application of good manufacturing and hygienic practice, as well as the use of the standard manufacturing procedures focusing on maintaining hygiene safe products.

Key words: microbiological safety, hygiene of manufacturing plant, meat industry

IMPROVING THE EFFICIENCY OF THE WHEAT SUPPLY CHAIN

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Abstract: Food production is the basis for country development. On the global market will always do well food producers whose costs are lower. Today, consumers demand of food requirements are increasing in quality, taste, healthy and cheaper price. The attention is also on environment of food production.
The competition in market are focused on value for consumers where corporate various actors in food production. Suppliers, manufacturers, distributors, and retailers are all have various industry initiatives to gain competitive advantage. Whether these initiatives take the form of better service, lower prices, or some combination of both, they all share a common essence: integrating the supply chain. All of this has consequences for the way in which the various actors in the food chain cooperate.
Investments must be taken place in the area of freezing foods, storage, packaging, fruit processing. It is also good to investing in new equipment and production lines for vegetable processing, greenhouse primary production and modern irrigation systems. However, the investments in our country are usually relatively small and may also stay relatively small in the future.
This paper provides a general overview of the Serbian wheat supply chain, and the associated infrastructure and processes of the key elements of the export wheat supply chain. The export wheat supply chain producing Serbia is then summarized, including the participants in each segment of the chain.
In this paper we give some basic guidelines for improving and increasing the efficiency of the supply chain for wheat with special emphasis on the qualitative and quantitative parameters of silos for wheat storing.

Keywords: supply chain, wheat, efficiency, improvement, silos.

THE VARIATIONS IN QUALITY OF MAIZE BIOMASS IN DIFFERENT ENVIRONMENTS

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Successful maize cropping in rein-fed conditions depends mainly on meteorological factors and in lesser extent on substrate (soil). The trial with 5 maize hybrids was set up during period of 2005-2010 on alluvium and hydromorphous black soil with aim to examine productive traits and silage quality from the energetic point of view. Biomass yield, stover and cob mass were measured, as well as total energy of biomass, as calculated parameter. The silage was determined nutritive units, total energy and metabolisable energy.

Lower yields were obtained in years with unfavourable meteorological conditions: whether there were seasons with high temperatures and low precipitation level or seasons with lower temperatures and high precipitation level. The biomass yield and total energy had similar trend and the highest energy was obtained in year with the lowest temperature. Positive correlation was observed between stover mass and precipitation amount, as well as between cob mass and temperature. Moreover, nutritive units and total energy of silage had the highest values in years with high average temperatures, with inversely proportional trend of metabolisable energy. In most of seasons, biomass yield, stover and cob mass, total energy of biomass and silage were higher on hydromorphous black soil, compared to alluvium, while the nutritive units and metabolisable energy were lower on the same soil during unfavourable seasons.

Concluding on based achieved results, meteorological factors influence biomass and silage quality from different aspects: total energy of silage is more influenced by temperature, while the precipitation amount is more important for biomass energy and metabolisable energy, indicating importance of additional water supply. Hydromorphous black soil, compared to alluvium is better substrate for forage maize production particularly in unfavourable seasons, with poorer quality of produced silage, on energy basis.

WASTEWATER FROM THE MEAT INDUSTRY

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Food industry is an important industrial segment that represents about 11 percent of all manufacturing industries in Serbia. The meat industry is a branch of the food industry, which causes degradation of the environment to a large extent. It is a significant water consumer and a major contributor of loads discharged into the water bodies. In meat processing, water is used primarily for carcass washing after hide removal from cattle, calves, and sheep or hair removal from hogs and again after evisceration, for cleaning, and sanitizing of equipment and facilities, and for cooling of mechanical equipment such as compressors and pumps. Characterization and the treatment of wastewater from the meat processing industry have to be one of the greatest concerns of the agro-industrial sector.

During the preliminary screening of wastewater from the selected meat industry plants, increased concentration levels of a few quality parameters were detected. The aim of the study was to establish the eco-status of the output wastewater streams in the meat industry, prior and after the treatment. Collection of samples was performed in Vojvodina region.

THE SAFETY MANAGEMENT SYSTEM OF FOOD CHAIN

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Production and circulation of alimentary products are one of the most important activities, and food is an important category of consumer's goods. It can be said that the risks related to the food chain are present in our lives on daily basis.
Therefore, health regularity is the first and unconditional request to meet every alimentary product.
Healthy safe food is important and from aspect of lowering costs of population healthy treatment, whose diseases are arising from unsafe food usage. It is expected that, by introducing the safety management system of food and by food market regulation, these costs will decrease in the near future.
The aim of implementation of the Standards is that, at the global level, these set of common rules will harmonize requirements for safety food management, for all of the jobs in the food chain.
System ISO 22000 sets requirements for the safety management system of food, determining necessary hygienic conditions for the production of correct and healthy safe food.
By implementing standards for the safety management system of food chain, it is acting preventable, and identification of production process problems is doing. By this means enterprises get more efficient and more cost-effective protection from unwanted consequences.

Key words: food, quality, ISO Standards 22000, satisfaction, cost-effectiveness

THE STUDY OF SUPPLY AND DEMAND OF ORGANIC PRODUCTS IN THE EUROPEAN UNION AND SERBIA

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One of the phenomenons that marked twentieth century is rapid technology progress. This process did not avoid food production and processing. Thanks to rapid development of technology, there has been a development of conventional food production, as well as appearance of genetically modified food. As a consequence of this trend, as well as the concern among some part of human population for their health, we had the return to natural food production in the form of the development of organic food production. One of the characteristics of organic food market in the European Union is the constant growth of demand for this product group, and insufficient quantities of organic products available in this market. These information led to the conclusion that organic food represents an opportunity for less developed countries, i.e. that countries like Serbia can manufacture and sale these products on the market with the highest purchasing power in the world - the European Union market. In this paper the characteristics of supply and demand for organic foods in the European Union where presented, then it was explained in detail why are these products export chance of Serbia, as well as reasons why is the export of organic food from Serbia to the EU very low at the time being. At the end some recommendations that could help Serbia to increase export of organic product to EU countries were proposed.

SUSTAINABLE DEVELOPMENT OF THE RIVER SAVA ECO-SYSTEM FROM THE ASPECT OF CONTAMINATION WITH POLYCHLORINATED BIPHENYLS (PCBS)

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Environment protection, rational utilization of natural resources, reduction of pollution and use of natural resources, in a way to preserve and make them available for future generations, are some of many goals of sustainable development concept. The burden imposed on river ecosystems by polychlorinated biphenyls (PCBs) has great impact on sustainable development of our rivers. Properties of PCBs (resistance to photolytic, biological and chemical degradation) provide their broad distribution within the aquatic eco-system. Exposition to PCBs can cause harmful effects on aquatic biodiversity and, consequently, on animal and human health.

Objective of our study was to determine the level of contamination of fish by PCBs as bio-indicators of the contamination of the aquatic eco-system of river Sava.

In the period September-December 2011, 75 samples of river fish were collected (carp, pike, perch, beam and sturgeon) in the river Sava, upstream and downstream from Belgrade. Polychlorinated biphenyls were determined by GC/ECD on Thermo TG5MS capillary column (30m x 0.25mm i.d. x 0.25µm film thickness). Method detection limit is 0,001 mg/kg.

In the investigated fish samples the quantities of PCB residues ranged from 0,002–0,246 mg/kg (mean value 0,023 mg/kg). Compared to values obtained for 75 sea fish samples (hake, mackerel, sprat, sea bass, sea bream, etc), studied in 2011, where quantities of PCB residues ranged from 0,001-0,104 mg/kg (mean value 0,006 mg/kg), quantities of PCB determined in fresh water fish were four times higher, compared to sea fish.

The obtained results indicate that, the eco-system of river Sava, on the territory of the city of Belgrade, is compromised, and consequently it is necessary to implement measures for environment protection. These measures include strict prohibition on disposal of PCB into the river, collection and safe disposal of utilized oils (machine oil, transformer oil and oil used in the electronic industry, etc.), according to the National Strategy of Sustainable Development of Republic of Serbia.

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RESISTANCE PROBLEM TO ANTIBIOTICS IN THE CULTIVATION OF WARM-WATER FISH

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In Serbia there are about 17 hectares of ponds for growing trout and 8.940 hectares for the cultivation of carp and other warm-water fish. In these productive areas, according to statistics production in 2010. amounted to about 7.000 t of carp and about 1.200 t of other fish species. The key obstacle to intensive fish production is diseases which etiology is bacterial, parasitic and less virologic. Reproduction and growth of bacteria in poor conditions of growing fish (insufficient water changes and the presence of toxic gases, overcrowding of fish per unit area, poor zoohygienic and hydromeliorative conditions in the preparation of facilities for hatching), are the main disease condition. Conditionally pathogenic bacteria from the group Aeromaonas are common causes of disease, and due to lack of monitoring and laboratory examination, the antibiotics used to combat bacterial diseases without using antibiograms and determination are often inadequate doses. All this has resulted in the development of resistance to used antibiotics. Sensitivity analysis of isolates to antimicrobial drugs showed the presence of significant resistance to Flumekvin and Oxitetraciklin over 35% and 40%, while resistance to Olaqvindox was about 20% of case on. Resistance to Flurfenikol is still very low and it goes around 2%. This situation shows us that the antimicrobial drugs used in an inadequate manner and in the future can be expected further increase of pathogen resistance and reduce number of drugs that may be effective. Given that these are micro-organisms (Aeromaonas hydrophila) which could endanger human health, the transmission characteristics of the reduced sensitivity to antibiotics can endanger people.

Key words: fish, antibiotics, resistance, environment.

THE SPECIFICS OF THE HACCP SYSTEM APPLICATION IN HONEY PRODUCTION

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INTRODUCTION:
Gradual change of orientation of agricultural policies towards sustainable and integrated agricultural development through concepts and instruments of multifunctional development at the same time presents a chance for the development of beekeeping in the Republic of Croatia.
Thus the purpose of this paper is to present the implementation of HACCP system, as a system which ensures the product safety, in the field of honey production of a Primorje-Gorski Kotar County agricultural cooperative which engages in production of its own honey.
METHODOLOGY:
The implementation of the HACCP system in honey production - in jars and catering packaging - is presented through the process steps, the risk analysis, and the using of methodology for the detection of critical control points (CCPs) and control measures, which resulted in the HACCP plan design.
RESULTS AND DISCUSSION:
During the implementation of the HACCP system, all the elements of prerequisite programs for good production and hygienic practice were taken into consideration.
The methodology used for the determination of CCPs and control measures takes into consideration the probability of hazards and the amount of danger.
The flowchart presents 22 process steps, 4 of which demand the control measures to be carried out to secure the food safety. HACCP plan presents the type and description of identified hazard, critical limits, corrective measures and the way of implementing monitoring through procedures, frequency and responsibility.
CONCLUSION:
Honey, because of its intrinsic characteristics, especially the sugar content, represents a rewarding type of food when it comes to ensuring safety. The demanded approach to the implementation of the HACCP system indicates the inexistence of CCPs; the abovementioned control measures are sufficient for the production of a safe product.
In the Republic of Croatia honey and other bee products, satisfy quantitative and qualitative domestic market.

Keywords: honey; HACCP; food safety

THE IMPORTANCE OF CONTROL MEAT HANDLING EQUIPMENT IN RETAIL

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During transactions in retail, fresh meat and meat products come into direct contact with numerous equipment (slicing machine, grinder) and tools (knife, tongs, fork).
The aim of this study is to determine the level of microbiological risk that exists on the equipment and is transmitted to the meat and meat products during the sales.
Monthly for a period of two years the swabs were taken from the meat handling equipment during operation.
A total number of 923 swabs were taken. Examination of swabs was performed by a modified method of Kelch in accordance with the Rules on the methods of performing microbiological analysis and superanalysis of food (,,Sl. list SFRJ", no. 25/82).
In total 256 swabs (28%) showed the presence of microorganisms such as: elevated number of aerobic mesophilic colonies of microorganisms (208 swabs, 23%), fecal streptococci (174 swabs, 19%) and E. coli (21 swabs, 2.3%).
The results clearly indicate the importance of planning the implementation of maintenance and sanitation equipment in the retail store as one of the key factors of risk management in trade of meat and meat products.

EFFECT OF CUT, STAGE OF GROWTH AND CULTIVAR ON ACID DETERGENT LIGNIN, PERMANGANATE LIGNIN AND KLASON LIGNIN IN RED CLOVER (*TRIFOLIUM PRATENSE* L.)

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With advancing growth and maturity, forage cells insert a non- carbohydrate material, known as lignin, into the primary and secondary walls. Lignin can be thought of as the primary skeleton of the plant cell. It is important from a nutritional perspective because it is a non-digestible substance and its presence will inhibit the availability of the cellulose and hemicellulose portions of the forage. The experiment was designed as three factorial trials by randomized block system in three replicates. Three stages of growth of red clover (*Trifolium Pratense* L.) cv K-27 and K-39 were examined in the second and third cut. Three methods- acid detergent lignin (ADL), permangante lignin (PerL) and klason lignin (KL) for determining lignin concentrationin red clover were compared. Each of these methods gave different lignin values for the same typeof forage sample. For all samples KL values were higher ($P< 0.01$) than ADL and PerL values. The KL residue concentrations were on the order of 1.60 to 2.20 times greater than the ADL and PerL residues. All three methods reflected maturity trends, although the magnitude of the change was different.

EFFECT OF THE LEVEL OF FAT IN FEED ON BODY DIMENSIONS AND GROWTH RATE OF CARP

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Nutrition is an important factor in the technological process of fish production, both from the economic point of view, and from the aspect of obtaining a quality final product. Recently, in Southeast Europe, the more practiced semi intensive system of fish production concerns substitution of cereals with compound feed, in order to intensify production, but also to improve the quality of carp (Cyprinus carpio) meat. The aim of this study was to investigate the impact of different level of fat in diets on body dimensions and growth rate of carp fry. The experiment was carried out in triplicates, (3 tanks per treatment, 9 tanks in total) for 90 days at the Laboratory for Fish Nutrition, at the University of Belgrade, Faculty of Agriculture. Fish diets contained 38% protein and 8, 12 or 16% of fat. Every tank has a usable volume of 120 gallons of water and water flow of 0.34 Lmin-1. After adjusting fish to laboratory conditions, every tank was stocked with 29 fish, average weight 15.4 g.

Based on data of body length and height of fish, obtained in 30-to daily intervals, statistical analysis showed that there were differences among fish from different treatments. Fish fed diets with 8% fat achieved 46.8% higher individual growth than fish fed with food containing 12% fat and 65.4% higher individual growth than fish fed with feed containing 16% fat. Additionally, fish fed with less fat in diet had a more elongated body form and less pronounced body height as well as lower values for fish condition.

Based on obtained results, it can be concluded that the diet with lower level of fat is justifiable to use, both from an economic and consumer perspective.

Key words: carp fry, fat level, growth rate

FOOD SAFETY REGULATIONS - COMPLIANCE, ADAPTATION AND ENFORCEMENT

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Serbia has adopted a number of laws and regulations dealing with food safety. Basis for the adoption of these regulations are the EU directives No. 852, 853 and 854/2004. and regulations based on them. The constant adoption of new regulations and amendments to existing ones, by tightening the prescribed measures, in order to produce safer foodstuffs demonstrates the importance of food safety.
Opening markets to the free flow of goods, hides a danger for selling of unsafe food products. All regulations are, therefore, aimed at entities that participate in production and trade of food products and increase their responsibility to protect consumers.
The authors discuss compliance of Serbian and EU food safety regulations. State regulations enacted and that should be adopted. Discusses their applicability in practice, what needs to change in practice that they would fully implement.
The conclusion is that regulations generally conform to EU requirements relating to food safety. It is very short term to adopt all regulations that are required, bearing mind desire to Serbia this year to become a candidate for EU membership. In practical application of regulations, there are difficulties as a result of certain habits and resistance in the industry, lack of understanding of obligations in the application, but also somewhat benevolent attitude of the competent authorities that they fully implement.

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IMPROVEMENT OF TECHNOLOGY OF PRODUCTION OF MIXED FEED FOR CHICKENS

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Theoretically and experimentally expediency of enrichment of grain raw materials as a part of mixed feeds by proteins of animal origin is proved. It is connected with essential decrease in nutritious value of grain components which are made in Ukraine often with agrotechnology infringement.
Analytical and mathematic-statistical methods have been used in the work.
The technological way of enrichment of grain raw materials by proteins of animal origin provides a premix recipe of the crushed corn grain and egg mass without a shell of sub-standard eggs in the ratio 1:1, mixing of the premix with the crushed corn that remained and extruding the received mixes. The optimum quantity of egg mass in the mix is 10 %. The recipes of starting mixed feeds are developed on the basis of studying requirements in nutritious and biologically active substances for young growth of poultry. They satisfy to norms of feeding and restrictions of introduction of components.
The improved basic technological scheme of manufacturing starting mixed feeds for poultry provides manufacture possibility of the extruded feeder additive on the existing equipment of the mixed feeder factory with installation of the additional equipment. It is experimentally established that for uniform distribution of micro components in the mixed feeder taking into account weight of single consumption of a forage of poultry it is expedient to get premixes of micro components and extruded feeder additive by their two-phases mixing in the ratio of 1:1 at the first stage of mixing and 1:2 at the second stage.

INGREDIENT PROFILE AND NUTRITIVE VALUE: CORN DRIED DISTILLERS' GRAINS (DDGc) VS. CORN DRIED DISTILLERS' GRAINS WITH SOLUBLES (DDGSc)

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The aim of this study was to characterize and conduct comparative analysis of corn dried distillers' grains with / without solubles (DDGc and DDGSc). These two animal feedstuffs are the main by-products of bioethanol industry. Representative samples of these subproducts were taken from the largest Bulgarian distilleries and analysed for DM, CP, EE, CF, NFE, ash, nutritive value (energy and protein nutritive value), aminoacid profile (relative and absolute value) and mineral content (macro- and microelements). The chemical analyses were made following AOAC, 2002. The nutritional assessment of both feeds included calculation of energetic and protein values by total or particular chemical composition. Based on the results of the conducted analyses it was concluded that corn dried distillers' grains with solubles (DDGSc) is superior to corn dried distillers' grains (DDGc). Potential correlations should be searched between protein (CP, PDI and BPT) and energy (FUG and FUM) nutritional value of both feeds and the expected animal performance.

Key words: DDGc / DDGSc, nutritive value, amino acids, energy, protein

EFFECT OF THE HIGH POLYUNSATURATED FATTY ACIDS LAYER DIETS SUPPLEMENTED WITH ANTIOXIDANTS ON THE CHOLESTEROL LEVEL OF EGG

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The paper presents the results of a trial conducted for 8 weeks on 90 Lohmann Brown layers (43-51 weeks of layer age) assigned to 3 groups (3 layers per cage). The control group (C) received a basal corn (53.35%), corn gluten (1%) and soybean meal (26%) diet. The diets for the experimental groups (E1 and E2) has the same basal diet as C group but included flax seeds (7%), buckthorn oil (1%) and antioxidants, as follows: 250 ppm vitamin E (E1), and 250 ml/kg marigold extract (E2). Feed intake and egg production were monitored throughout the experiment. Egg samples (15 eggs/group) were collected on weeks 2, 5 and 8. Average samples (3 eggs/sample) were formed from the collected eggs for each variant and assayed for the gross chemical composition and yolk cholesterol. There are different results ($p \leq 0.05$) regarding feed intake (105,616±1,085 g) for group E1 compared with C group (111,198±1,037g) and E2 (110,769±0.924). Also, are different results ($p \leq 0.05$) regarding the egg weight (63,109±0,527 g) for group E1 compared with C group (62,027±0,209037g) end E2 (61,744±0,104 g). The yolk cholesterol decreased throughout the experimental period (43-51 weeks of layer age) in all groups, which shows that this fact was not related to the diet. Thus, the decrease was 18.27% for C group (0.559 ± 0.13 g col/fresh yolk in the end of the experiment, compared to 0.684 ± 0.048 g col/fresh yolk, initial value), 7.15% for E1 (0.519 ± 0.053 g col/fresh yolk in the end of the experiment, compared to 0.559 ± 0.07 g col/fresh yolk, the initial value) and 8.45 % for E2 (0.520 ± 0.034 g col/fresh yolk in the end of the experiment, compared to 0.568 ± 0.042 g col/fresh yolk, initial value).

Keywords: layers, cholesterol, marigold extract, antioxidants, egg

ANTIOXIDANT EFFECT OF MARIGOLD EXTRACT (CALENDULA OFFICINALIS) ON LAYER END EGG GUALITY

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The antioxidant properties of the marigold (Calendula officinalis) alcohol extract were tested in a 42 days trial on 120 Shaver layers (aged 68 weeks). The hens were housed in cages (3 layers/cage) and assigned to two groups (C and E). Feeding was ad libitum. The basal diet, similar for both groups, contained corn (60.68%), soybean meal (23%) and flax seeds (3%), with 16.67 % crude protein; 20.09 MJ/kg metabolisable energy; 59.97 g polyunsaturated fatty acids % fat. The high percentage of polyunsaturated fatty acids in the diets requires the use of antioxidants. Diet C was supplemented with 80 ppm vitamin E (control) and diet E was supplemented with 1.2 ml/kg alcohol extract of marigold. Samples of 18 eggs per group were collected during the final week of the trial, as well as blood samples from 18 layers/group. In the end of the experiment, no significant differences were noticed between the intakes and egg production of the two groups. The analyses showed that the activity of superoxide dismutase enzyme was higher in the hens from group E (36.00 % inhibition) compared to group C (19.97% inhibition). The alcohol extracts of egg yolk (1:10, w/v) from the hens of group E had a higher capacity to annihilate the synthetic radical 1,1-difenil-2-picrilhidrazil (DPPH) (9.045% inhibition) compared to those from group C (6.32% inhibition). The results show that the use of the marigold extract in layer diets improved the antioxidant status of the hens and increased the antioxidant activity of the yolk.

Keywords: layers, fatty acids, marigold extract, antioxidants, egg

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EFFECT OF THE DIETARY CAMELINA MEAL ON LAYER PERFORMANCE

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A 60 days test on 90 Lohmann Brown layers aged 40 weeks was conducted to evaluate the effect of the dietary Camelina meal on layer performance. The hens was housed in cages (3 layers/cage) and assigned to three groups (C, E1 and E2). Feeding was ad libitum with one meal per day. The control diet (C) had as basal structure: corn (57.47%), soybean meal (15%), corn gluten (4 %) and sunflower meal (9.5%). Part of the sunflower meal was replaced in the diet formulations for the experimental groups by 3 % (E1) and 6% (E2) Camelina meal. Throughout the experimental period the feed intake, egg production, egg weight and egg quality parameters were recorded on a daily basis. The results show that the feed conversion ratio (g feed/g egg) of group C (1.908±0.10) was significantly (P≤ 0.05) higher than in E1 (1.883±0.10) and E2 (1.817±0.15). However, egg production of E2 (93.68±2.26%) was significantly (P≤ 0.05) lower than in the other 2 groups (97.22±1.76% for C; 97.99±1.99 for E1). The weight of E2 eggs (64.00±2.31 g/egg) was comparable with the weight of C eggs (64.61±2.48).

Keywords: layers, Camelina, meal, intakes, egg

IX
FEED AS CHALLENGES FOR FOOD SUPPLIER CHAIN

TOWARDS SUSTAINABLE FISH FEED PRODUCTION USING NOVEL PROTEIN SOURCES

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Evaluation of feed ingredient functionality plays a vital role in modern fish feed manufacturing practice. The aim of this study was to examine the extrusion behaviour of blends containing alternative protein sources from plant origin to fish meal (FM), such as wheat gluten (WG) and soy protein concentrate (SPC), and the consequences for the physical attributes of the resulting feed extrudates. A mixture design was applied, varying the levels of protein sources included in the formulation from 50 to 450 g kg−1. Each diet was produced with added feed moisture content of 20, 26 and 32 g/100 g (wet basis). The partial least squares regression models were fitted and their performance was evaluated on the basis of R2 and the root mean squared error of cross-validation over the complete data set. A higher inclusion level of FM in the diet decreased the values of the extruder system parameters, such as torque, pressure at the die and melt temperature. In contrast, inclusion of SPC significantly increased the values of these extruder-related parameters. The viscoelastic properties of WG gave higher radial expansion; FM showed the opposite effect. The results show that the feed moisture was the dominant factor for extrudate density and oil absorption capacity. Products with higher breaking strength were observed with increasing levels of WG and SPC. Combining the product requirements for both extrudate density and hardness showed that the largest optimal compositional range is available at low feed moisture content. However, maximum FM replacement is possible at high feed moisture content.

EFFECT OF DIFFERENT CONCENTRATION OF LINSEED OIL IN THE DIETS ON CONTENT OF ESSENTIAL FATTY ACIDS OF COMMON CARP, CYPRINUS CARPIO, L

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Common carp fingerlings were fed five diets in triplicate containing 0, 2, 3, 4 and 5% linseed oil (LO) for 24 weeks to determine effect of different concentration of LO on chemical and fatty acid composition of fish during growing season. Fish, average initial weight 400 ± 18 g, were stocked in 15 cages. Chemical analysis and fatty acids content determinations were carried out in the Institute of Hygiene and Meat Technology, Belgrade. Statistical analysis was performed using the Statistica 10 program. Fish fed the 3, 4 and 5% LO diets had significantly better growth compared to fish fed the 0 or 2% LO diets. Survival rate ranged from 79 to 85% and did not seem to be related with diets. Lipid content in muscle increased from 1,11% in the 0% LO, to 1,45%;1,98 %; 2,19% and 2,24% in the 2, 3, 4 and 5% LO treatments, respectively. Fatty acid profiles in muscle tissue reflected the diet concentrations with significant increases ($p < 0,01$) in 18:3n-3 in fish fed the 2, 3, 4 and 5% LO diets. Other fatty acids showing significant ($p < 0,01$) muscle concentration increases in fish fed the LO diets were: C20:3n-3, C20:5n-3, C22:5n-3, C22:6n-3, as well as polyunsaturated fatty acids (PUFA), total n−3 fatty acids, and the n-3/n-6 ratio. Fatty acids showing significant decreases ($p<0,01$) were saturated fatty acids (SFA). Fish fed the 5% LO diets had twice much n−3 fatty acids (5,74%) than those without LO (2,56%). N-3 fatty acid content was 4,71; 4,26; 3,95% in fish fed 4%,3% and 2% LO diets, respectively. N-3/n6 ranged from 0,16 in fish fed without LO to 0,28 in fish fed 5%LO. Inclusion of 5% LO in diets showed the most favorable effects on content of essential fatty acids in tissue of carp as well as on other tested parameters.

THE INFLUENCE OF FEEDS ON FATTY ACID COMPOSITION OF MEAT FATTENING PIGS

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The aim of this study was to investigate the possibility of using different feed compound for pigs in order to increase content of n-3 fatty acids in adipose tissue, as well as improving relation n-6/n-3 fatty acid that is known to be disordered in the modern way peoples diet.
In this trial to view this crossbred pigs were used (Yorkshire x Landrace), with an initial body weight of 60 kg. The pigs were divided into two groups of 10 pigs and fed standard diets for fattening pigs of 60-100 kg (finisher), provided differences between groups only in the S experimental group which had a full-fat soybean in feed mixtures (S), and a second group enriched linseed (L) in the recommended amount of 2.5% in the feed mixture (Vitalan, Vitalac, France). Vitalan contained 85% of extruded linseed and the rest were wheat bran and antioxidants. The mixtures were balanced and fully meet the requirements of the animals at this stage of fattening. Samples were collected for testing of complete mixtures of chemical composition and fatty acid content. Pigs were kept until weight of 105 kg. At the end of the experiment, after slaughtering, processing and cooling carcass samples of adipose tissue (back) were taken of each pig in both groups. The adipose tissue was examined of fatty acid composition.
Chemical analysis of fatty acid composition (a gas chromatograph GC/MSD GC 6890, MS 5972/73) complete feed mixtures showed that the feed with linseed (L) had significantly lower ($P < 0.001$) content of SFA, and significantly higher content ($p<0.01$) PUFA from feed mixtures with full-fat soybean (S). Also the ratio of n-6/n-3 in feed mixture in L group (5.567) was lower compared to feed mixture in S group (11.00) which is statistically highly significant ($P<0.001$).
By analyzing the fatty acid composition of pigs fat statistically significant differences were found between experimental groups. In adipose tissue of pigs in the groups with linseed (L) in mixtures was achieved significantly ($p<0.001$) higher content of n-3 fatty acids, or 1.97% compared to 1.42% in groups receiving full-fat soybean (S) in feed mixtures, and significantly ($p<0.001$) lower content of n-6 fatty acids, or 20.09% compared to 24.91%. Ratio n-6/n-3 in adipose tissue for the L group was significantly lower ($p<0.001$) or 10.23 relative to the group S (17.74).

Key words: pigs, feed, linseed, fatty acid

EFFECT OF DIFFERENT SELECTION CRITERIA ON GROWTH TRAITS AND CARCASS QUALITY IN PIGS

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Research has included four breeds (Landrace and Yorkshire as fertile) and (Pietrain and Duroc as a terminal) pigs. Selection criteria are significantly different due to the negative genetic correlation between milk yield and meatiness and positive heads between capacity and production capabilities. The aggregate genotype are five properties that are interconnected in a particular genetic dependence and are of importance for the effects of indirect selection. The test involved 558 animals of both sexes who are descended from the 43 father and 282 mothers. Carcass quality tests were performed on 144 animals, also of both sexes. The average weight of animals at the end of the fattening period was 103 kg and a standard deviation of 2.6 kg. Bone density did not differ significantly between Landrace, Yorkshire and Duroc. Pietrain bones were significantly easier. This demonstrates the viability of lower growth in this race compared to the other and longer feeding for 24 to 32 days. The bones are not so easily able to produce a heavier meat ham and optimal quality, especially with prolonged fattening. When it comes to the only growth was significantly lower in Pietrain animals were compared to their peers of other races. The content of meat in the carcass was approximately 57.6% in fertile breeds and Duroc 58.9%. It was not significantly different. Pietrain had 62.1% of meat in the carcass which is significantly higher than in other races. Intramuscular fat content was: 0.8% of Pietrain, Duroc 2.6% 2.0% Landrace and Yorkshire 1.8%. These parameters are important for technological processing of meat products and significantly the lowest in the Pietrain. The level of protein as the most important parameter of meat quality was the lowest in Pietrain (20.1%), Landrace and Yorkshire were 21.8% and 22.5% and 22.9% Duroc. Slekcije criteria relate to the last eight generations of selection and the effects show the expected trends.

Key words: pigs, growth traits, carcass and meat quality

BENEFIT OF MOISTURE REMOVAL FROM FEED MANUFACTURED SOLIDS WITH VACUUM TECHNIQUE

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Vacuum dehydration technique (VDT) is known as a rapid evaporative technique for moist and porous solid or semi-solid products. Known advantages of VDT is short processing time, extension of products shelf life and improvement of product properties related to safety issues. In this study, animal feed wheat-based diets with different particle size distributions, ground by hammermill, through 1, 3 and 5mm screen size was manufactured through different pellet-die hole diameters (2, 3.5 and 5mm). Moisture was removed by traditional air dehydration technique (ADT) or VDT. Measuring the moisture percentage was done immediately after the dehydration of the manufactured pellets. Analysis related to pellet durability index (PDI %), hardness and the presence of moulds were done 30 days after the production of the diets.
Successive dynamics of water loss was performed better while using the VDT compared to ADT where VDT appeared to reach industrial equilibrium moisture level much faster.
It was not observed a clear pattern of influence on dehydration efficiency of different feed structure represented by particle size distribution. The volume of the product confirmed to have the influence on moisture removal from the feed pellets when conventional ADT was subjected whereas no clear outline was confirmed for VDT between more compacted and structurized feed pellets. This explains that increase of the feed pellets diameter can limit the moisture removal for both, VDT and ADT. The VDT has demonstrated positive influence on the PDI % when compared to traditional ADT, while that was not the case for pellet hardness analysis. The presence of moulds was also analyzed for all the diets dehydrated by VDT and ADT. The influence of the dehydration technique on the presence of molds was not observed.

STUDY FOR CHLORELLA VULGARIS USE IN ANIMAL HUSBANDRY

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Algal suspension of Chlorella Vulgaris is used as an ecologically pure food supplement which allow to increase the weight gain, prevent mortality, increase productivity and improve animal, poultry, fish and bees breeding farm properties. Chlorella Vulgaris high biological activity is because of the dry matter contained large amounts of protein (up to 60%) vitamins, macro-and microelements, which gives way to short-term use at low doses with high efficiency.
Using Chlorella Vulgaris does not require significant changes in technology and maintenance of animal feeding.
Research conducted on calves has involved three groups of animals, selected by analogy principle, taking into consideration breed, body weight, age and sex.
Maintenance and food conditions were identical in all groups, except the use of algal suspension included in the mixed fodder grain throughout the investigations (5% by weight) in group III and algal suspension sollution (0,5 L head / day for first 30 days) in group II, group I was a control.
Research for Chlorella Vulgaris use in chicken rations were performed on two groups (control and experimental) with 200 heads in each, starting with the age of 1 day and up to 42 days. The differences were only in food. Chicken of the experimental group received in addition to the basic ration the algal suspension in quantities of 5 ml / head / day first 7days, 15ml / / head / day from 8 to 21 days and 30ml/cap / day 22 up to 42 days.
For bees algal suspension was used in sugar syrup 1:1, replacing the water in this way.
In the study for calves with addition of Chlorella Vulgaris suspension to the basic ration, calves resulted in 10,2 to 12,13% absolute increase growth and decrease feed consumption for 1 kg from 10,73% to 8,72.
Addition to the basic ration of the algal suspension for chickens result to total and average growth of 13,80 higher than in the control group and lower consumption of food to 12,10%.
Chlorella vulgaris algal suspension used in feeding of bees had positive impact to quantity of honey produced in the experimental group which was to 17,20% higher than in the control group.

BIOLOGICAL FEED PROCESSING

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Biological feed processing imply its exposure to the influence of exogenous enzymes in digestive system of the animals, or exposure to the fermentation process under influence of microorganisms „pre digestion“ in fermenting units. The main reason for endogenous enzymes supplementation in animal diets is the adjunct activity of existing enzymes, or the enhancement of feed digestion process as well as the reduction of undigested nutrient materials in environment. Feed „pre digestion“ technology implies its exposure to the activity of supplemented enzymes in fermenting units which enables the smooth and successful fermentation process. Ruminal microorganisms have the ability to digest cellulose, hemicelluloses and lignin by the action of their enzymes and to utilise digestion products (simple sugars) for the synthesis of microbial proteins of high biological availability (digestion of 85 to 90%). These microbes use nitrate and nitrite form of nitrogen from feed and simultaneously synthesise vitamins B, D, PP, K, E and B12. Beside mentioned these enzymes take part in mycotoxin degradation and therefore reduce the detrimental effect of mycotoxin contaminated feed.

Feed fermentation by the action of microorganisms from „Biofermix®“ preparation which was investigated in Russian scientific institutes can increase percentage of proteins in feed. In exp. protein content of wheat bran can be increased from 13 to 25% and the content of cellulose decreased from 8 to 2 %, which contribute to the higher efficacy in feed utilisation, improvement in production and reproduction efficiency and environmental protection. In order to gain new experiences and provide with additional arguments for use of microorganisms in feed fermentation process it is necessary to conduct further research with raw materials' used as feed in Serbia.

Key words: Enzymes, Feed, Fermentation, Microorganisms.

SUSTAINABILTY AND EFFICIENCY IN THE FOOD SUPPLY CHAIN UNDER A GLOBAL PERSPECTIVE

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Sustainable food supply chains are largely based on sustainable agricultural production and food processing schemes. They employ efficient production, processing, distribution systems that protect quality, assure safety, promote fair/transparent distribution of created value, consumer access to wholesome-healthy food at acceptable prices and sustainable development of rural communities.

Ensuring a safe and abundant food supply, and contributing to healthier people everywhere poses a double challenge with great impact on future developments in food process technology and food sciences in general. There is need to formulate, design, process and label food to help the average consumer live on a healthier diet, moving away from obesity and diet related diseases. There is also need to reconsider and upgrade the role and impact of Food Sciences in the sustainable food supply chain, so as to increase visibility, responsibility and effectiveness on feeding the starving population groups all over the world, including the "developed" countries.

Securing safe food at primary production level requires re-orientation of production schemes towards sustainable methods, moving away from intensification-induced food crises (i.e. BSE, dioxins, antibiotics, growth hormones).

Sustainable processing calls for minimal (often non-thermal) processes with low energy inputs and minimal mass/quality losses, with due respect to environmental issues. Osmotic preconcentration of fruits and vegetables has attracted extensive research interest due to substantial advantages with respect to low energy demand, quality preservation and new product possibilities; at the same time, direct osmosis of prime quality juices offers a minimal processing alternative in the area of liquid food.

At consumer level there is need to help improve consumer awareness of real values in food (nutrition, quality, safety).

Finally, there is a great deal of corporate responsibility for proper design and fair marketing of foods that promote consumer health and well-being.

Sustainability and efficiency in the food supply chain is part of a universal need for sustainable development, based on:

- Respect to Nature
- Recognition of the special role of plants as the only organisms that bind energy, entropy and pollutants (CO_2) to create order (chemical compounds)
- Respect to man and human values (democracy, equality, justice, fraternity, cooperation)
- Use of regenerated resources (i.e. regenerative agriculture)Understanding that man and nature are bound and interrelated
- Respect to our roots (heredity), tradition and culture (civilization)Social control of production, distribution and resource management

Sustainability of food supply chains can only be assessed against the above requirements; otherwise a very descriptive and useful term is bound to lose its real content and value.

PRESENCE OF CONSTITUENTS OF ANIMAL ORIGIN IN FEED

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Monitoring of feed for the presence of ingredients of animal origin is performed in order to prevent transmissible spongiform encephalopathies (TSE). The best known of these diseases is bovine spongiform encephalopathy which, due to the size of the crisis it caused, launched a series of preventive measures, including regular monitoring of animal feed. When it was found that the source of infection was feed, i.e. infectious ruminant protein processed in meat and bone meal (MBM), legislation which prevented these nutrients to enter a food chain was introduced all around Europe and also appropriate control of implementation of these regulations was established. Today in Serbia, as well as in EU, use of MBM is completely banned for all farm animals. But, until 2011 usage of these nutrients had been officially banned just in the diets for ruminants. Such a partial limitation in Serbia still gave the possibility for cross contamination of feed for ruminants with prohibited ingredients, which were used for feeding other animal species. Therefore, the facilities for the production of animal feed were obligated to separate lines for feed for ruminants, or otherwise, to eliminate use of feedstuffs of animal origin (MBM and fish meal). Control of these conditions is carried out by laboratory testing of feed for ruminants, as well as feed for pigs and poultry, for the presence of the MBM using classical microscopy (Regulation (EC) No 152/2009 Annex VI). During year 2010 among 162 feed samples for different categories of cattle, it was found 3.09% of positives. In the feed for pigs and poultry average percentage was 16.13%. But the result for 2011 (1.85% of positive samples of cattle feed) represents an improvement comparing to previous years and it is a signal of more serious compliance to European standards in the domestic feed industry.

SUCCESSFUL COMPLETE SUBSTITUTION OF FISH MEAL WITH PLANT PROTEIN INGREDIENTS IN DIETS FOR COMMON CARP, CYPRINUS CARPIO L

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Inclusion of fish meal in the diet increases the cost of fish production and this problem can be overcome with replacement of it with local available plant ingredients. The aim of the study was to determine the impact of the complete replacement of fish meal with soybean meal and sunflower meal in the diet of two years old common carp on the growing parameters and proximate composition. Fish were grown in two groups with three replicates in the six earthen ponds each of 1 ha. In the diet 1 was not added feedstuffs of animal origin, while in the diet 2 fish meal was included. The both diets were manufactured using a twin screw extruder. Twelve samples of two years old carp were taken from each group during the harvesting. Also, samples of both extruded diets were taken for analysis. Chemical analysis of carp meat was done at the Institute of Meat Hygiene and Technology, Belgrade and the diets were analised in Laboratory of Feedstuff Factory Komponenta, Ćuprija. The differences between the mean values of the studied determinants were calculated with one-way analysis of variance at 0,01 significance. The calculations were performed with the Statistica 10 program. At the end of the rearing period the average harvesting weight was 1622,12 and 1719,2 g; survival rate was 82 and 85%, total stocking density was 300 and 300 kg/ha and harvesting density was 3325,35 and 3612,5,45 kg/ha; feed conversion ratio was 2,3 and 2,1 in common carp fed with diet 1 and diet 2, respectively. The chemical composition was not significantly different between groups ($p>0,01$). These results support the use of adequately processed plant protein sources as important replacement for fish meal in extruded feeds for common carp.

EFFECTS OF ARTEMISIA ABSINTHIUM ON COCCIDIA INFECTIONS IN CHICKENS

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This report was designed to compare the afficacy of Artemisia absinthium L. powder and amprolium on the basis of weight gain feed conversio ratio, oocyst count and mortality rate. A total of 90, day-old broiler chicks of both sexes were randomly divided into six groups (A to F). From first day onward, ration was supplemented with 1; 2 and 3% Artemisia absinthium L. powder in groups B and D, respectively, group A received amprolium: 60 ppm in drinking water, while groups E and F kept as infected un-medicated controls. First five groups were infected with Eimeria tenella sporulated ooccysts: 30.000/chick at the age of 20th. Maximum coccidiostatic effect was observed with Artemisia absinthium L. (3%) showing mild bloody diarrhea as compared to other infected groups receiving A. absinthium L.containing rations. Anticoccidial effect of used herb and coccidiostatic- amprolium, suggests that further studies should be carried out to determine the possible maximum safe levels with least toxic effects to be used as coccidiostat.

Key words: Artemisia absinthium L., coccidiosis,amprolium, broilers.

INFLUENCE OF GASTROINTESTINAL HELMINTHS TO GOAT HEALTH AND PRODUCTION

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Goat's gastrointestinal helminths infection was of great importance to health status of goats and performances. No systematic studies had been previously made to determine the endoparasitic fauna of goats in Serbia.In the present study we performed an extensive examination of parasitic fauna of goats at various parts of Serbia during a two year period (2010-2011) obtained during realization of project TR 31053. We examined 231 goat flock (usualy breed together with sheep). Total of 1450 faeces samples were examined using routine coprological methods. A total of 67 goats were slaughtered for post-mortem examination. we found next helminth species: Ostertagia circumcincta, O.trifurcata, Trichostrongylus axei, T.colubriformis, Nematodirus spathiger, N. filicolis, Haemonchus contortus, Marshallagia marshalli, Skrjabinema caprae, Chabertia ovina, and Oesophagostomum venulosum. Goars infection had high prevalence, moderate morbidity and low mortality rate. Animals with clinical sign of infection had abdominal pain, anemia, lost of appetite, weakens and lost of weight. Clinical signs are greenish or yellow diarrhea with smell, and some time is presented a blood. Consequence is significant increase of kid accrescense, its weakens and less growth. The best preventive measure a goat producer can take is to use a feed with a anthelmintic drugs added. With careful management and sound preventive measures, the losses associated with this disease can be reduced to minimal levels.

IMPROVING NUTRITIVE VALUE OF BROKEN WHEAT KERNELS

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In the technological process of either trade or seed wheat cleaning before drying and storage, organic and inorganic impurities are separated. The amount of separated impurities depends on various factors and can range up to several percent. In the structure of organic impurities, beside broken, shrunken and other cereals kernels, also weed seeds, moldy and smutty grains are present. According to the Serbian Chamber of Commerce, last year 2.093.198 tons of wheat is gathered form 492.989 hectares. In case 2-3% of wheat organic impurities are valorized as feed, this quantity amounts between 42 and 63 thousand tons. It is also important to emphasize that by extrusion process this waste material can be turned into nutritionally and hygiene safe product. Prior extrusion, total count, Coagulase-positive Staphylococci and Clostridium perfringens were 160.000, <100 <10 cfu/g, respectively. Salmonella was not detected in 50 g of the sample, while the total number of yeasts and molds and Sulphite-reducing clostridia were 100 and <10 cfu/g, respectively. After extrusion of broken wheat kernels, total count decreased to 17.000 cfu/g, while the number of Coagulase positive Staphylococci, Clostridium pergringens, Salmonella spp, the total number of yeasts and molds, as well as the number of sulphite-reducing Clostridia were below the limited value. Extrusion process contributes to physico-chemical changes in the material, primarily in the structural change of starch which is reflected in the increase of sucrose and reducing sugar content in the extrudates. Prior to extrusion, wheat broken kernels were grinded in a hammer mill with screen hole of Ø 4mm, then moisture content of ground material was adjusted to 14.80%. Extrusion was performed on single screw extruder “METAL-MATIK” Beočin, at 90ºC, capacity 150-170 kg/h of grain extrudates. Extrusion head had 8 dies of Ø 10mm. Extruded wheat broken kernels were characterized with moisture, crude ash, crude fiber, crude fat and starch content of 11.81%, 1.68%, 4.43% 1.99% and 69.39%, respectively.

Key words: wheat broken kernels, organic impurities, extrusion, extrudates

PREDICTION OF BIOAVAILABLE ENERGY OF FEEDS FOR POULTRY BY ESTIMATION OF ORGANIC MATTER DIGESTIBILITY

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One of the most important parameters of feed quality is energy. Not all energy of feed (gross energy) will be utilized by the animal, but only its bio-available portion, i.e. metabolisable energy (ME). The accepted method for direct determination of ME of feeds is by in vivo trials. These are often time-consuming and expensive why there has been a need for in vitro methods for predicting the in vivo ME values of feeds. The aim of this study was to develop linear equations to predict the in vivo true metabolisable energy (TME) of poultry feeds based on digestibility of organic matter as determined by an in vitro method.
Sixting diets and fifty seven samples of feedstufs for poultry were used. In vivo determination of TME was based on digestibility of nutrients, by use of the adult rooster assay. Same feed samples were analysed by an enzyme incubation based laboratory procedure for estimating the enzymatic digestible organic matter (EDOM).
Obtained EDOM values were regressed against the in vivo TME results, which generated the prediction equation TME = 0.191 x EDOM, with R2 = 0.704 (RSD = 0.127). When other predictors were included, prediction was improved and the following equations and R2 have been generated: TME = 0.177 x EDOM + 0.168 x FAT, with R2 = 0.766 (RSD = 0.113) and TME = 0.191 x EDOM + 0.209 x FAT – 0.044 x ASH, with R2 = 0.830 (RSD = 0.098).
The conclusion was that in vivo ME of feeds for poultry can be sucessfully predicted by use of organic matter digestibility.

BROILERS PERFORMANCE AND GUT VISCOSITY AFFECTED BY DIFFERENT INCLUSION LEVEL OF SUNFLOWER MEAL WITH AND WITHOUT EXOGENOUS ENZYME

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A trail were carried out to evaluate the effects of different inclusion levels of sunflower meal (SFM) with and without exogenous enzyme supplementation in broiler diets in grower and finisher phases on broilers performance and gut viscosity. A total 1200 birds were used in completely randomized designed, six treatments, five replicates and 40 bird per replicates. Diets of the control groups was based on corn and soybean meal with and without enzyme supplementation, experimental groups contain 8, 10% in grower, 10 and 16% of SFM in finisher phase, with and without enzyme supplementation.

Broilers bird performance were most affect by adding of exogenous enzymes in grower period, feed conversion ratio was statistically significant improved by enzymes, as well as average weight gain. Enzyme supplementation in both phase increased feed intake per bird but not significantly. Effects of added enzymes were present in finisher phase also, but to mach less extend.

Inclusion of sunflower meal in 8 and 10% in grower period did not affected on broilers performance, while inclusion in finisher phase in 10% and 16% reduced significantly average weight gain of bird but not affected feed conversion ratio.

Gut viscosity were significantly increased by inclusion of sunflower meal in 10% and 16% in ileum, while in jejunum increases of gut viscosity was evident but statistically not significant.

Key words: sunflower meal, exogenous enzyme, broilers performance, gut viscosity

MODIFICATION OF IN VITRO ENZYMATIC METHOD FOR DETERMINING THE ORGANIC MATTER DIGESTIBILITY OF FEEDS

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An in vitro enzymatic method for determination of organic matter digestibility (OMD) of feeds for ruminants has been described by Pojić et al. (2008). One of the enzymes used in this method was Novozym 51054, but it is no longer produced. Therefore the aim of this study was to find new enzyme to replace Novozym 51054, as well as to verify that the values of OMD obtained using two enzymes do not differ significantly. New enzyme chosen was Mannanase FFE-2010-00167 (Novozymes, Denmark). Ten samples (complete feed, barley, sunflower meal, straw, maize, wheat bran, sorghum, soybean meal, rapeseed, sugar beet pulp) were analyzed in 10 replicates. Determined OMD values ranged from 32,60 % for straw to 97,60 % for soybean meal. Comparison of mean OMD values obtained for each sample using old and new enzyme showed that the difference in results was not statistically significant (p=0.976). Good fit of the results is also confirmed with the low value of standard deviation of the residuals (SD=0.39). It could be concluded that Novozym 51054 may be replaced with mannanase FFE-2010-00167 in in vitro enzymatic method for determination of OMD in feeds for ruminants.

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CHANGES OF CRUDE PROTEIN CONTENT IN LUCERNE PLANT DURING THE FIRST THREE VEGETATION CYCLES

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Investigation was performed to observe the changes of crude protein (CP) content in lucerne plant during the first three vegetation cycles within one vegetation season, with the aim to optimize the lucerne utilization in ruminant nutrition. A total of 143 samples were collected from 7 April 2010 (the start of the spring vegetation) to 9 August 2010 (the end of the third vegetation cycle). The sampling was done by cutting a randomly chosen area of 0.1 m^2. Crude protein (CP, expressed in dry matter) analysis was analyzed in all samples with standard Kjeldahl procedure. Samples were collected in all stages of the three vegetation cycles, from early vegetation to ripe pod phase.

There were large differences in plant protein content changes during different vegetation cycles. During the first vegetation cycle, which has the highest yield of plant green mass, there was sudden drop in protein content which is coinciding with optimal cutting moment. In absolute value, this drop was more than 8 percent points of CP during the 10 day period. Second and third vegetation cycles had slower and more uniform decrease in CP content during vegetation. Postponing the cutting moment in order to obtain higher yield, during the first vegetation cycle may lead to radical decrease of nutritive value in lucerne. Adequate and rapid evaluation of the right moment for lucerne cutting is very important in order to obtain quality forage rich in protein.

Key words: lucerne, crude protein, cutting

CONTEMPORARY ASPECTS OF USING OF ALFALFA IN ANIMAL NUTRITION

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In paper are presented the current trends in using of alfalfa in animals' rations in different forms: fresh alfalfa, preserved alfalfa - hay and haylage, or a component of mixtures as dehydrated alfalfa and protein-carotinoide concentrate of alfalfa juice.
The nutritive value of alfalfa is directly affected by the stage of maturity, method of preservation, processing and utilization in animals' diets. Based on morphological changes, the chemical composition of alfalfa plants can be estimated with high correlations (above 90%). Due to numerous factors that affect on chemical composition of alfalfa hay, the nutritive value is highly variable, and using of alfalfa hay in rations for ruminants is minimal, according to requirements for optimal digestion and ruminal function. The cut length of alfalfa haylage affects on average particle size of total mixed rations for ruminants. The physical form and effectiveness of ration are significant parameters for regular rumen function, digestibility of nutrients, and production performances of ruminants, particularly high-yielding lactating cows. The largest difficulties in preserving alfalfa as haylage are high buffer capacity, an insufficient content of fermentable sugars and fast degradation of nitrogen compounds. The most favorable results were obtained with simultaneously using of carbohydrate supplements with homofermentative lactic acid bacteria for wilted plant material.
In spite of relatively high content of crude fiber, alfalfa may be significant for nonruminants' nutrition after specific treatment and processing, particularly for hens nutrition in purpose of yolk color modification. For this purpose may be of particularly importance a protein-carotinoide concentrate of alfalfa juice.
It can be concluded that despite the huge progress in field of animal nutrition, alfalfa still remains one of the main feed due to high nutrition value and exceptional biologic characteristics.

Key words: alfalfa, preserving, processing, ruminants, nonruminants, nutrition

THE IMPORTANCE OF COPPER AND SELENIUM IN NUTRITION ON HEALTH STATUS AND PRODUCTION CHARACTERISTICS OF GOATS

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Minerals in the body of the animal are mostly in inorganic, but can occur in organic form, too. This is very important because of the form in which the animals are fed with. The minerals can be found in both forms in the meal - inorganic form usually in the nutrients in the feed and the inorganics are usually given in the appendix (premix). Feeding goats with diets that are deficient or unbalanced with excessive amounts of minerals, leads to changes in function or concentration of these in body tissues and fluids. In such cases, the amounts of these elements decreases or increases above physiological limits that are allowed.

The satisfaction of animal need for mineral elements depends on the climate and soil that grows forage crops, as well as on stage of maturity of plants and their parts. In order to prevent deficiencies of some mineral elements in the diet of goats, there are numerous possibilities and application of specific procedures and methods for their elimination. These are primarily: treating of forages with different preparations, adding of elements while processing land used for production of fodder, the usage of ready-made and complete mineral mixture in the diet, and ultimately increase of the organic reserves in the body of animals-goats can be made by giving injections or capsules with a slow and prolonged action. As for the trace elements Cu and Se, goats are very tolerant to high doses with no obvious ill effects on their health. However, their absence causes numerous problems related to health. Diet with higher levels of Cu addition of 100 mg per day has effect on daily weight gain in younger categories and contributes to improved immune function of goats. The lowest minimum of goats need in selenium, depending on the stages of production, ranges from 0,1 to 0,2 mg/kg of ration dry matter. Therefore, adequate nutrition of goats requires maximum balance of nutrients, which is achieved by usage of different feed and the usage of mineral premix.

EFFECT OF RAPESEED MEAL ON NUTRIENT DIGESTIBILITY IN BROILER CHICKENS

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Rapeseed meal is a good protein source for animal nutrition, but there are some concerns about its effect on digestibility and gut health, especially in young animals such as broiler chickens. Study was carried out to determine the effect of rapeseed meal (RSM) in broiler chicken diets on nutrient digestibility. Three groups of chickens were formed and fed either with corn-soy based feed (control group) or feed with inclusion of 10% (RSM 10%) or 15% of rapeseed meal (RSM 15%). Rapeseed meal was with low glucosinolate and low erucic acid content. Feed was composed to meet nutritional requirements of Ross 308 strain and balanced to same energy and crude protein level. To determine digestibility, 20 male chickens of average weight were used per treatment. Acid insoluble ash was used as a marker. At 21 days of age, chickens were sacrificed to obtain samples for determination of ileal digestibility. Digestibility of dry matter, crude protein and energy was determined. No significant differences ($P>0.05$) were observed in any measured digestibility parameter. The results of this trial indicate that addition of up to 15% of rapeseed meal in well balanced diets of young broiler chicken does not have an adverse effect on digestibility of nutrients.

AMINO ACID COMPOSITION OF THE MIXTURE FOR GILTS ON A FARM IN VOJVODINA

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This paper is an analysis of amino acid composition mixture for feeding gilts, with 9 major pig farms in Vojvodina. The aim of this study was presentation of the situation on the ground in terms of quality meal amino acid composition of gilts. Amino acid composition analysis was performed using the procedure that involves hydrolysis and evaporation of samples using React-ThermTM (Thermo Scientific, USA). The analysis itself was performed using the Agilent 1260 Infinity Liquid Chromatography System, Zorbax Eclipse-AAA column and 1260 DAD detector. Terms of chromatography were in accordance with the Agilent method. Since the recipes and their composition available due to trade secrets, it was possible only by comparing amino acid composition of the total protein. As a result of this review state levels of the protein mixture is significantly influenced the levels of amino acids in the mixtures.

EFFECT OF DIET ON LIPID CONTENT AND FATTY ACID PROFILE OF COMMON CARP (CYPRINUS CARPIO L.)

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In the last few years there have been taken measures which might contribute to intensification of aquaculture by improving breeding technology. The increased nutritional value of fish by using complete feed mixtures as fish diets enables to improve production quality and increase economic yields in fishponds. The aim of this study was to compare the fatty acid profile of carp (Cyprinus carpio) raised in fishpond with a traditional breeding technology based on grain and carp fed complete feed.
Eight samples of marketable fish (weight ~1900g) were randomly collected from two fishponds during October 2009. In the first fishpond maize was used as supplementary feed (8.58% proteins, 4.50% fats). In the second one, fish was additionaly fed complete feed mixture consisting of maize, soybean meal and fish meal (23.81% proteins, 6.97% fats).
Lipids were extracted from fish muscle by Dionex ASE 200 instrument. Determination of fatty acids as methyl esters was carried out by gas-liquid chromatography (GLC/FID Shimadzu 2010) on capillary HP-88 column.
Significant differences in the total lipid content were determined as well as in the fatty acid profile of carp from two semi-intensive rearing systems. Carp fed maize contained higher amounts of total fat (8.59%) compared to carp fed complete feed (4.71%). MUFA content was higher in carp fed maize (61.8 %) than in carp fed complete feed mixture (42.4 %). Higher amounts of PUFAs (32.6 %) and higher levels of n-3 (4.6%) and n-6 (27.99%) PUFAs were determined in carp fed complete feed than in carp fed maize (12.99%, 1.24% and 11.75%, respectively). Better n-3/n-6 ratio, which is one of the indices used when comparing nutritional value of fish, was found in carp fed complete feed.

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THE EFFECT OF DIFFERENT TRITICALE ON THE PRODUCTION DATA IN FATTENING CHICKENS

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The aim of this research, was to determine how to forage triticale mixtures for fattening broilers affects the production and slaughter characteristics of broiler chickens. The research was carried out on 200 for feeding chickens, hybrid Ross 308th On that occasion, formed two groups of chickens, or treatment, with 100 chickens in each group, namely K-group (classic mixture for fattening broilers) and O-group (mixture with genotype Favorit). The experiment lasted eating chicken 49nd days.
As criteria for utilization of triticale in the present study, production traits, and body weight and weight gain. The results showed that the O-group chickens that were fed a mixture of triticale (triticale genotype Favorit), achieve better production results ($P < 0.05$).

Key words: growth, feeding chickens, triticale

INFLUENCE OF MYCOTOXINS IN SWINE FEED ON THE HEALTH STATUS OF PIGLETS

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Mycotoxins are secondary metabolites of fungi that can contaminate animal feeds at all stages of food production chain. Consumption of feed contaminated with mycotoxins may result in immunosuppresion, which represent a factor predisposing livestock to infectious diseases. The influence of mycotoxin on immune system is of great importance to pig production. The technology on swine farms demands frequent vaccinations, which may be a problem in the case of an immunocompromised animal. On the other hand, young animals are much more sensitive to the effects of mycotoxins comparing to adults. From the epidemiological point of view, it is important to note that mycotoxins may cause breakdown of active immunity and occurence of disease even in properly vaccinated animals. The aim of the paper was to evaluate the influence of mycotoxins on the health status of piglets. The material for this research included the samples from five swine farms, where health disorders in suckling and weaned piglets were detected. Depending on the specificity of each evaluated case and available material, the applied research methods included: epidemiological and clinical evaluation, pathomorphological examination, standard laboratory testing for detection the precence of aerobic and anaerobic bacteria, virological testing and microbiological feed testing, in order to examine the presence of fungi and mycotoxins by the method of thin layer chromatography. In our research the persistant presence of various infections, which react poorly or do not react on the applied antimicrobial therapy was discovered. The presence of mycotoxin in feed can be directly connected to the detected health disturbances in piglets on the examined swine farms (vulvovaginitis, pneumonia, gastroenteritis).

Key words: mycotoxins, swine feed, piglets diseases

THE EFFECT OF FEED QUALITY AND FEEDING METHODS THAT INFLUENCE THE OCCURENCE OF DISEASES IN POULTRY AND CONTROL MEASURES

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Modern poultry nutrition presents a precise satisfaction of needs that are extremely demanding in new poultry provenance in order to achieve profitable production of food of animal origin. High productivity, which is increasingly approaching biological maximum of animals, also means setting higher demands, first of all with regard to nutrition and health protection, that is also more difficult to achieve. The conditions that are present in our country are accompanied by numerous problems and serious violations in production of high quality products and animal health. The resulting problems are characterized as nutriopathy.

In this paper the most common causes and consequences of nutriopathy in poultry production are pointed out with the aim of their reducing or eliminating.

In order to estimate the impact of feed quality and feeding modes on occurence in poultry production regular monitoring was carried out including: the conditions of feeding, care, housing and health surveillance.

We have encountered nutriopathy in all types of poultry: in all age groups and categories. Most frequent causes and consequences of nutriopathy were related to feed, feed premises and feed distribution, professional and technical mistakes in complete feed mixture and their components, and the consequences of using freshly harvested grain.

Adequate and timely eliminating of nutriopathy in poultry production, that is directly or indirectly related to feed or feeding technology, presents an important key to successful production.

Key words: poultry, complete diet, diseases, control measures

BACTERIA IN ANIMAL FEED AND THEIR SUSCEPTIBILITY TO ANTIMICROBIAL DRUGS

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Control of microbiological safety of animal feed is regulated by a regulation. The regulation is based on methodological standard for estimation feed. Those methods are permanently amanded in the sense of constant imroving microbiological safety of feed intended for animal. Whether the presence or absence of some bacterial species enough for right estimation of safety feed? The answer for that question we can find to examination not only quantitatively presence of bacteria in animal feed but with qualitatively analised presented microorganisms. The sensitivity of bacterias isolated from animal feed to antimicrobials drugs is the one of qualitative characteristics of microorganisms that can affect to safety food no metter what meet standards in according with allowable limits value. The subject of our work is to determinate the presence of bacterias in animal feed with a purpose to examine if they possess lower sensibility to antibiotics or not. To check bacterial sensitivity to antimicrobials we used isolates which we got from routines microbiological feed controle. The animal feed was analysed by the standard methods for the isolation and identification of bacteria and determination of susceptibility isolates was done using disc diffusion method according to (CLSI). These bacteria have been isolated: Escherichia coli, Enterobacter sp., Staphylococcus sp., Micrococcus sp., Bacillus cereus, Bacllus sp. The results show the presence of some isolates of reduced susceptibility to certain antimicrobial drugs. This findings can give reason for further examination of certain characteristic or ecological meaning of bacteria from animal feed.

Key words: aninal feed, bacteria, antimicobial drugs

TRADITIONALLY REARED DOMESTIC PIGS EXPOSURE TO PROTOZOON TOXOPLASMA GONDII

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Toxoplasmosis is a disease caused by invasion of feline intestinal protozoon T. gondii. Other warm – blooded animals can serve as intermediary hosts. Beside oocist oral invasion and diaplacental transfer, insufficient heat-treated meat from domestic and wild animals contaminated by the bradyzoites pose the greatest threat to human health. It is assumed that human exposure to this protozoon is especially large in traditionally pig breading areas in Croatia, where the traditional way of preparing of meat products is still maintained. The European Food Safety Authority has indicated the risk of toxoplasmosis in its report of 2009 when 1253 human cases were reported, while in Croatia 22 cases has been reported. There is not enough data to determine the incidence both in humans and animals. This is especially true when it comes to domestic pigs reared in traditional manner and thus exposed to possible sources of invasion.

This article aims to contribute to the knowledge of the frequency of toxoplasmosis in pigs on the basis of the antibody IgG blood presence results. 400 blood samples, approximately 80 per county were collected on a randomly selected pig population on the family farms. Blood samples were examined with commercial enzyme-linked immunosorbent assay (Prionics, Switzerland). At the same time, family farm owners were interviewed in order to collect data about their Toxoplasma perception.

Research has demonstrated a very high protozoon exposure that somewhere ranged up to 75%. It should be stressed out that this information is inconsistent with the epidemiological reports on the occurrence of toxoplasmosis in humans. The results show a need for additional research that should further define human seroprevalence in the area affected by this study. To understand the problem a detailed genetic typing of Toxoplasma, isolated from seropositive pigs will be needed. As expected, analyzed data of farmers' responses show a very low level of Toxoplasma knowledge.

NITROGEN FERTILIZATION AND MYCOTOXIN ACUMULATION INFLUENCE UPON PROTEIN AND AMINO ACID CONTENT OF CORN GRAINS

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Corn or maize is one of the most popular cereals in the world. Because they make up a large part of diets, corn grains cannot be considered only as a source of energy, as they provide significant amounts of protein as well. It is also recognized that cereal grains have a low protein concentration and that protein quality is limited by deficiencies in some essential amino acids, mainly lysine.

The nutritional quality of corn is determined by the amino acid makeup of its protein. For a balanced nutrition is important not only the amount of amino acids taken over, but the ratio between them, because the disproportion in feed of amino acids composition leads to a complex disorder of protein metabolism. The content of amino acids, important N-containing compounds, in plant biomass isaffected by N nutrition.

In this paper the protein content, and amino acid composition of corn grains was determined. Corn (Zea mays L.) was grown in a series of field plots which received various rata of applied nitrogen:50 kgN ·ha-1, 100 kgN ·ha-1, 150 kgN ·ha-1and 200 kgN ·ha-1 . Amino acid composition, after subjecting samples to conditions which would hydrolyze protein, was determined by ion chromatographic method. The analisys were made on samples with and without mycotoxins accumulation. The amino acid content obtained after fertilization treatements varied significantly with protein content of the samples. Nitrogen rate that have a significant effect on the maximal accumulation of valine, isoleucine,leucine, phenylalanine, histidine, and alanine was 150 kgN ·ha-1 . Higher nitrogen application rates alter the amino acid balance thereby reducing the nutritional value. Mycotoxins accumulation took place in samples fertilized with 200 kgN ·ha-1, which had lower amino acid content that samples without mycotoxins.
Key words: corn, protein, amino acids, mycotoxins

THE IMPORTANCE OF BROKEN CORN KERNELS EXTRUSION

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The feed industry has a target to produce variety feed that fully satisfy the nutritional needs of certain types and categories of animals. Complete feed meals for animal feeding have to fully meet the nutritional needs of certain types and categories of animals. The energy level of a feed meal can be achieved by adding appropriate amounts of fat and grains. In the production of feed, in relation to other cereals, corn is the leader due to its high energy (about 16 MJ/kg) and starch and low fiber content. In comparison to other cereals, corn is attributed with the best digestibility and taste. Before drying and storage, in the technological process of either trade or seed corn cleaning, significant quantity of broken grains is separated. Complete feed meals for animal feeding and feed have to fully satisfy Regulations concerning hygiene and quality. Improving hygiene and nutritive value of broken corn grains can be achieved by extrusion. In this research, broken corn grains were processed in the single screw extruder at a temperature of 90ºC. Total count and total number of yeasts and molds decreased from 270.000 to 12.000 and from 540.000 to 10.000 cfu/g, respectively. Due to extrusion process, certain physico-chemical changes occurred in raw material, primarily manifested in structural changes of starch, which is reflected in the increase in sucrose (from 2.28% to 5.19%) and reducing sugars (3.36% to 5.88%) content in extrudates.

Key words: broken corn grains, extrusion, hygiene

SOURCES AND EFFECTS OF DIFFERENT LEVELS OF OIL ON PRODUCTION PERFORMANCE AND BROILERS CARCASS QUALITY

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This paper investigates the effect of soybean oil, flax and rapeseed on production parameters and on the broilers carcass quality. At the beginning of fattening six groups of 40 one-day-old chicks hybrid Ross 308 were formed, with five replications. The control group was based on two levels of soybean oil, 4% and 8% and in the experimental groups were included 4% and 8% flax, or 4% and 8% rapeseed oil. Experiment lasted for 42 days. At the end of fattening period, 10 chickens from each group were sacrificed for the purpose of testing carcass quality. Including various types of oils in the diet did not result in statistically significant differences in body weight of chickens. At the end of the experiment, the control has achieved a body mass of 2704.0 g and 2695.0 g, experimental group with flax oil 2734.0 g and 2671.0 g and with rapeseed 2735.0 g and 2670.0 g. Feed conversion was the lowest in groups with rapeseed oil and the highest in groups with flaxseed oil. The difference in the carcass quality of control and experimental groups were not significant. Significant differences are manifested in the content of abdominal fat in groups with the addition of 8% oil. The highest amount of abdominal fat was in the group with flax oil and the lowest in the group with soy oil. Using the 4% oil in the mixtures, does not manifest statistically significant differences between the groups.

Key words: nutrition, flax oil, rapeseed oil, soy oil, chicken, carcass quality

PHYTASE AS ADDITIVE TO ANIMAL DIET AND ITS INFLUENCE TO DRESSING TRAITS OF MEAT

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Introduction
Application of mineral sources of phosphorus in animal diets takes risk to health of animal and human race. They are qualified as great canse of environmetal pollution. They also have significant influence to the price on animal products, because they are expensive. Besides that, lately the new approach was established considering application of mineral sources of phosphorus. The ail of that is decreasing or complete leaving it out of animal diets. In these kinds of diets formulation, enzyme phytase has been added which with its hydrolisis effects, makes available phytinic sources of phosphorus from herbs diets for monogastric animals and poultry. Diets which have additional phytase and have been used for feeding fattening chickens have positive influence to production traits and improvement of meat and bones quality. The aim of these examinatins was to complete scientifical determination of data about the influence of phytase added into the diets for fattening chickens by lower level of mineral source of phosphorus to the finishing body weights and dressed carcass traits of meat.
Material and methods
Experimental examinations have been done during experiment of feeding fattening chickens of Arbor Acres strain. In experiment was 220 chickens divided into two groups: K-control (110 chickens) and experimental O-group (110 chickens). Groups were divided into two boxes, considering to different formulations of phosphorus source. K-group, gained per diet dicalcium-phosphate (DKF) at level of 2%, O-group – DKF 1% by addition of 0,1% of phytase. Chickens were fed with mixture of some raw material composition. Feeding experiment lasted for 42 days. At the end of the experiment out of each group 14 chickens were sacrificed (7 male and 7 female). Before slaughtering, body weight was measured, weight of hot dressed carcass, weight of the basic parts of dressed carcass. Dressing percentages were calculated as well as yield and share of the basic parts in dressed carcass (per each chicken) – (measuring was done with precision balance ±0,1gr.
Results
The results of examinations show that: the chickens of O-group (1% DKF+0,1% fitaze) gained better average finishing body weights (2006,5g) in comparison to K-group (2% DKF) (1875,63g) ($P<0,05$). Also, O-group had better percentages (65,,66%) K-group (63,16%) ($P<0,05$). The yield of the first meat category by O-group (771,56g), K-group (694,79g) ($P<0,05$).
Conclusion
We have came to decision that addition of phytase into diets for fattening chickens, by lower level of mineral source of phosphorus, had positive effects to the examined traits in our experiment. Also, the ecological demands are fulfilled, considering decrasing of environmental pollution.
Key words: chickens, mineral sources of phosphorus, phytase, production, meat quality.

IMPORTANCE OF ZOOPLANKTON AS LIVE FEED FOR CARP LARVAE

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Zooplankton is a very important source of natural food for larvae of many aquaculture species cultured in extensive, semi-intensive and intensive systems. In semi-intensive systems, which are the dominant type of carp production, many fish species feed on both zooplankton and zoobenthos as adults, while larvae and fry, because of their small dimensions, rely mostly on zooplankton. It provides them with high quality proteins, amino acids, lipids, fatty acids, minerals and enzymes, but also proteolitic enzymes, hormones, or their regulators, and some growth factors which support digestive processes in immature larval gut.
Larviculture, especially start feeding of early larval stages, appear to be a critical point in fish culturing. However, artificial diets formulated for larvae show poor digestibility, but live feed of small dimensions, good nutritive characteristics and locomotion that provides visual stimulus for larvae, overcome that problem. Zooplankton species commonly used for mass production as live feed for fish larvae are two species of Rotifers (Brachionus plicatilis and B. calyciflorus) and brine shrimp (Artemia salina).
Shortly after hatching, carp larvae are transferred to nursing ponds for further rearing. Ponds are previously prepared through agrotechnical measures in order to provide nutrient enrichment and stimulate production. During the first days of exogenous feeding, larvae consume only the smallest zooplankters such as Rotifers and naupliar larvae of Copepods, while later they move on to bigger pray as Cladocerans. By use of insecticides, larger zooplankters may be removed from the ponds, thereby stimulating growth of small species preferred during first feeding.
However, due to variable environmental conditions, predation, competition or infections in earthen ponds, mortality in nursing ponds is often very high, reaching over 90%. Thereby, modern approach suggests rearing in indoor tanks in controlled systems and use of automatic feeding systems to provide precise portions of zooplankton.

THE EFFECT OF BROKEN CORN INCLUSION IN BROILER NUTRITION ON CARCASS QUALITY

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In this paper the influence of broken corn and extruded broken corn addition in broiler diet on carcass quality was investigated. The experiment was conducted on broiler hybrid ROSS (n = 720) divided in three groups. The first group (control - C) was fed with commercial broiler feed mixture, while second and third groups were fed with commercial mixtures where 25% of corn was substituted with broken corn (experimental group E1) or extruded broken corn (experimental groups E2). Broiler fattening lasted 35 days, and food and water were provided ad libitum in the floor fattening system.

The obtained results indicate that the substitution of corn with broken and extruded broken corn did not affect significantly ($P > 0.05$) the broiler live weight, as well as mass of cold carcasses. Also, shares of carcass main parts (breast, whole legs, back portion and tail end and wings) showed no significant ($P > 0.05$) differences between all three groups. The only significant difference ($P < 0.05$) was determined for mass of abdominal fat between control C (14.4 g) and experimental group E2 (21.2 g). Differences of meat yield in breast and whole leg of broilers from different groups were not registered as significant ($P > 0.05$).

Based on the results obtained in this study it can be concluded that the use of 25% of broken or extruded broken corn in broiler diet did not have significant influence on carcass quality.

WATER AND NATURAL FEED GIVES HIGH CONCENTRATION OF IODINE IN LOCAL ANIMAL MILK IN THE SAHARA DESERT

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Introduction:
Animal milk is an important part of Saharawi food culture. Previous reports from the Saharawi refugee camps have shown a high prevalence of goitre caused by excessive intakes of iodine. The objective was to assess the iodine concentration in the milk.

Methods and material:
In October-November 2009 a cross-sectional survey from 5 refugee camps in the Tindouf area in South West Algeria and Tifariti in the Liberated Zone of Western Sahara, was conducted. Water samples (n=72), milk samples from goats (n= 147), sheep (n=61) and camel (n=18), and feed intake questionnaires from 219 families were collected. The determination of iodine in milk was carried out using ICP-MS and for water the Sandell-Kolthoff method was used.

Results:
The median iodine concentration in water was 108µg/L (min-max 55-545). There were significant correlations between iodine values in animal drinking water and milk, and the iodine concentration in milk was higher in all the samples. The concentration of iodine in goats' milk was median 994µg/L (101-9323), sheep 1194µg/L (136-8284) and in camel milk 2471µg/L (357-7799), the latter was significantly higher than the others. All goats and sheep ate food waste; 65 % ate garbage, 84% carton, 13% fresh greens and 33% ate hay. Among the camels, 53% ate food waste, 12 % ate garbage, 65% carton, 56% greens and 88% ate hay. 17% of the animals had eaten fresh greens and the iodine concentration (median 2003µg/L (147-7799)) was significantly higher than in those that had not eaten greens (median 989µg/L (101-9323)).

Conclusion:
Both water given to the animals and intake of fresh greens elevated the iodine concentration in the milk, and camel milk was most affected.

DEVELOPMENT OF A HEME IRON FEED SUPPLEMENT FOR PREVENTION AND THERAPY OF ANEMIA IN DOMESTIC ANIMALS

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Introduction:
Animal blood produced in slaughterhouses as a by-product of the meat industry represents serious biohazard. Transformation of wasted slaughterhouse blood to the highly valuable product(s) may partially solve the problem of disposing slaughterhouse blood wastes and at the same time, isolated heme concentrates can be used to fortify feed. The aim of this study was to optimize the isolation process of bovine hemoglobin by gradual hemolysis in a membrane bioreactor.
Materials and Methods:
Bovine blood was collected at the slaughter house, using 3.8% trisodium citrate solution as the anticoagulant. Standard methods were used for determination of hematological parameters, osmotic fragility, osmotic swelling index and extent of hemolysis of bovine erythrocytes. The purity of hemoglobin solution was analyzed by SDS-PAGE.
Results:
35 mM Na-phosphate / NaCl buffer solution of pH 7.2-7.4 was identified as the optimal external medium providing effective gradual osmotic hemolysis with an extent of hemolysis of 88%. The hemoglobin purity of >80% was confirmed by SDS-PAGE. Kinetic studies showed that maximal concentration of hemoglobin was reached after 40 min, but the process cycle at which recovery of 83% was achieved lasted for 90 min. The dynamic of both steps, (1) transport through the membrane of erythrocytes during process of hemolysis and (2) transport through the reactor filters was evaluated.
Conclusion:
This investigation demonstrates an optimized process of gradual hemolysis of bovine erythrocytes originating from wasted slaughterhouse blood in originally designed membrane bioreactor. Process parameters were optimized to produce highly purified hemoglobin 83 ± 12 % (mainly oxyhemoglobin derivate). In order to produce ready-to-use feed additive for prevention of iron deficiency anemia in domestic animals, future studies should be oriented toward development of down-stream processes, such as tangential flow filtration and lyophilization.

Key words: slaughterhouse blood; bovine hemoglobin; gradual hemolysis; membrane bioreactor

EFFECT OF DIETARY TREATMENTS ON THE FATTY ACID COMPOSITION AND SENSORY CHARACTERISTICS OF CHICKEN MEAT

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The research was carried out on in two repetitions on Ross 308 male hybrid chickens. Chickens were divided into five groups (five dietary treatments differing in source and concentration of plant oil and fish oil). Feeding chickens with diets of determined composition from 22nd to 42nd day of fattening resulted in altered fatty acid profile in breasts and thighs, and in significantly lowered n-6/n-3 PUFA ratio in breasts. The respective ratio was lowered from 10.85 to 2.67 in breasts, and from 12.14 to 3.27 in thighs. Trained panel was assessing the samples within scale from 0 (does not smell) to 9 (smells strongly), according to the intensity of the following sample characteristics: smell and taste of chicken, smell and taste of fish, and smell and taste of oxidized oil. Overall impression was assessed by scale from 1 (poor) to 5 (typical). Characteristics of smell and taste of chicken were graded as of moderately high intensity in meat of thighs and breasts, and there was no difference determined between the control and experimental treatments. Barely noticeable smell and taste of oxidized oil was determined in all meat samples, however the differences were not statistically significant ($P>0.05$). Although all experimental samples were assessed as having more smell and taste of fish than the control sample, samples of red meat exhibited statistically significant difference only for taste ($P<0.05$). In repetitions, upon altering the feeding treatment (without fish oil), and seven days prior to slaughtering of chickens, the intensity of smell and taste of fish was assessed with "does not smell" to "barely noticeable", and differences between meat samples were not statistically significant ($P>0.05$). This research proved that, if applying certain dietary treatments, it was possible to produce chicken meat of satisfactory sensory characteristics enriched with n-3 PUFA, with n-6/n-3 PUFA ratio of 4.48 in breast meat and of 4.57 in thighs.

SIGNIFICANCE OF CARP (*Cyprinus carpio*) FEEDING WITH CHIRONOMIDAE LARVAE FOR MEAT QUALITY IMPROVEMENT IN THE SEMIINTENSIVE PRODUCTION SYSTEM

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Fish nutrition based on combination of natural food (zooplankton and bottom fauna) as main protein source, and added food, mostly cereals, as energy supply, is one of the main features of the world prevailing, semi-intensive farming system. In the recent years in several countries of South East Europe instead of cereals pelleted and extruded feed is used in carp nutrition in periods of depression of natural food. This is the way to overcome the lack of proteins and lipids, of required amino and fatty acids composition.
Bottom fauna organisms represent natural food of greatest importance for fry and cultured consumable carp. Because of its mass development in spring and lesser in autumn, Chironomidae larvae are particularly rich source of nutrients for carp. They are an easily noticeable pray because of their body dimensions (till several centimeters) and clear red color (coming from hemoglobin). Chironomidae larvae are invaluable protein source of adequate amino acid composition for carp body growth. Also, this is a source of lipids, particularly rich in omega 3 and omega 6 fatty acids. High omega 3 fatty acid content is present in Chironomidae, especially in *Chironomus plumosus,* the most frequently observed species in fish ponds. In *Chironomus plumosus* larvae, omega 6 fatty acids content compared to omega 3 content is higher. This is of particular importance providing higher needs in omega 6 for carp.
Considering that omega 3 and omega 6 fatty acids ratio in farmed fish is lower compared to natural populations; that the consumption of farmed fish is increasing together with requirements to increase omega 3 content, and optimally balance omega 3/omega 6 ratio; research in carp meat improvement are of utmost importance. Stimulation of natural food development particularly Chironomidae larvae in carp ponds is one of the approaches for enhancement of farmed carp meat quality.

Keywords: Chironomidae, bottom fauna, carp, semiintensive farming system, meat quality

USEFULNESS OF UREA AND PROTEIN CONCENTRATIONS IN MILK AND BLOOD AS INDICATORS OF NITROGEN UTILIZATION IN THE SIMMENTAL AND HOLSTEIN-FRIESIAN LACTATING DAIRY COWS

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The aim of this study was to determine the protein status in Simmental and Holstein-Friesian cows, as well as use possibilities of milk and blood urea values as indicator of nitrogen utilization. The digested N is mainly absorbed as free amino acids and is used by the animals for protein synthesis, or as ammonia, which needs to be detoxified by the liver into urea. The forms in which N is absorbed are critical in determining the proportion of digested N that is available to support protein synthesis. Investigation has been conducted on 17 lactating Simmental cows and 10 Holstein-Friesian lactating dairy cows divided into groups regarding to milk production (under 15 kg (S<15; H<15) and over 15 kg (S>15; H>15) and to lactating stages (under 100 days S<100d; H<100d and over 100 days). Blood pH and electrolytes (Na^+, K^+, Cl^-) have been determined by the RapidLab 348 (Bayer, Germany) analyzer. Blood metabolites (BUN, TP and albumin) have been measured by Beckman AU400 automatic analyzer. MUN (milk urea nitrogen), protein and fat content have been determined by infrared spectrophotometric method on Combi-Foss analyzer FT 6000.
Simmental cows (S<100d) had the lowest BUN and significantly lower MUN concentrations and lower MUN has been noticed also in H<15kg. Significantly higher TP concentration was noticed in H<15kg group and H>100d due to raised globulin count, probably because of inflammation. H>15kg had the lowest rumen pH, but blood pH was in referent interval in all groups. There was no correlation between BUN and MUN (r=0.32 in S>15L) which is related to the ratio of dietary CP to energy, because of excess of microbial requirements.
In the condition of low milk production as a consequence of low dietary protein and energy, MUN concentration is not relevant enough as an indicator of protein/energy supply.

Key words: milk urea concentration, dairy cows, low protein diet

FORAGE FIBER AND CELL WALLS IN DIFFERENT MAIZE HYBRIDS

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Analysis of the fiber or cell wall present in forages is of major concern in ruminant nutrition because diets often contain large amounts of forage, and the fiber fraction affects both feed intake and animal performance. Research has revealed that plant genetics can affect the quality and digestibility of whole plant maize silage. All carbohydrates in plant nutrients are grouped into: 1. Structural carbohydrates (carbohydrates of cell walls) including NDF (neutral detergent fibers-hemicellulose+cellulose+lignin), ADF (acid detergent fibers-cellulose+lignin), ADL (lignin), and 2. Non-structural carbohydrates-NFC (carbohydrates located inside the plant cell) made of starch, sugars and pectin. The aim of this present study was to observe quality parameters of ZP hybrids biomass with different genetic background for silage and to determine the relationship of these parameters, as well as, their effects on the digestibility of maize biomass dry matter. The contents of lignocelluloses fraction were determined by the modified Van Soest detergent method while in vitro digestibility of the whole plant was done by the Aufréré method. Obtained results showed that the NDF, ADF and ADL contents in the whole maize plant of the observed different ZP hybrids varied from 42.6% to 50.9%, 19.3% to 25.7%, and 1.6% to 2.5%, respectively. The difference in the digestibility of the dry matter of the whole plant between hybrids amounted to 10.4%. The differences in the contents of lignocelluloses fraction affected the differences in digestibility of dry matter.

Key words: NDF, ADF, ADL, digestibility, maize hybrids

MILK QUALITY AND PROCESSING IN RELATION TO POLYMORPHISM OF CAPA CASEIN AT BLACK AND WHITE HOLSTEIN CATTLE

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Capa casein genotyping was performed on 36 cows, bull dams, and based on the analysis of DNA from blood using PCR – REFL techniques and methods. Served for the identification of allelesand genotypes capa casein. Using the identified allels (A and B) and genotypes (AA, AB and BB) capa casein evaluated their frequency in the examined population of cows. Frequency capa casein genotype were: 0,450 AA +0,494 AB + 0,056 BB = 1,00. Furthermore, the frequency of allels A and B which is derived from frequencies of genotypes was 0,66 for allele A and 0,34 for allele B. This reletionship expresses the preliminary information about presence of different genotypes capa casein in Holstein cattle in our population. The contribution capa casein and total casein genotype on milk coagulation rate, determined by LS method, model 1, the coagulation of milk was highly significant. Using model 2, the coagulation of milk, the amount of calcium present in milk had a high impact significantly and lactation order significant impact on the speed of coagulation milk. Other factors from the model evaluation were not significantly influenced the test characteristics of milk. Physical and chemical composition of fresh milk casein genotypes of different hats, meets the current criteria for the quality of fresh milk. Acceptable rennet – coagulation properties of k-BB groups are reflected in a shortetime of coagulation of milk with rennet. In particular it is a significant relatioship that manifests increased content of casein and total protein in milk. The analysis showed that reflect the time making chesse milk k-BB group was almost three times faster than k-AA milk about 2 times faster than k-AB milk.

Key words: genetic, polymorphsiam, k-casein, quality of milk

POLYMORPHISM AND EFFECT OF CAPA CASEIN ON TECHNOLOGICAL QUALITY MILK FOR TRAPIST CHEESE PRODUCTION AT RED AND WHITE HOLSTEIN CATTLE

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The main objectives of this study were to evaluate the impact of milk polimorphism significantly protein, k-casein, and to investigate whether it is possible to use this influence to improve milk production. The purpose were to examine how technology and in terms of milk processing can take advantage of these impact. The K-casein genotyping was performed in 18 cows (bull dams). Isolation of DNA was performed in all 18 blood samples. Determination of k-casein polimorphism in Red and White Holstin cattle based on analysis od DNA using PCR-RFLP methods. We have analyzed the chemical composition and physical properties of milk obtained from cows of different k-casein genotypes (AA, AB, BB) and the aggregate of milk for production of cheese trappist. Genotyping of cows, has been identified 8 animals with AA, 9 with AB and 1 with BB k-casein genotype. The frequencies of genotypes were: 0,44 AA + 0,500 AB + 0,056 BB = 1. Frequency of allels A and B were estimated from frequencies of genotypes, so the frequency of allel A was 0,69 and the frequency of allel B 0,31. It was found that the physical-chemical composition of fresh milk that was used to produce trappist according to the criteria for the quality of fresh milk. However, there were significant differences in milk fat content that are over the values for milk fat used to produce trappist cheese. In neither sample of milk or aggregate milk not found the remains of mycotoxins and antibiotics, or E. Colli. The total number of microorganisms and somatic cells satisfying our standards.

Key words: polimorphism k-casein,tehnological quality of milk, trappist cheese

THE INFLUENCE OF BREEDS AND SEX ON TISSUE DISTRIBUTION IN PIG CARCASSES

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The aim of this study was to determine differences in the distribution of certain tissues (muscle and adipose tissue and bone) in major parts of carcasses of male and female animals. The paper included two fertile breeds: Yorkshire and Landrace and Hampshire breeds a terminal. Carcass dissection was performed by model EU 1992. The study included 327 randomly selected pig carcasses, of which 191 Landrace breeds (German, Danish and Dutch), 59 Yorkshire breeds and 77 Hampshire breeds. During dissection data were collected: weight of slaughtering animals, weight hot and cold carcass, less valuable parts , weight and proportion of the length, the neck, thigh, belly, shoulders the carcass, and share certain tissues (muscle, fat and bone) in major parts of the carcasses. Measured the length of carcass, and the average values of fat thickness measured at the withers, back and middle of the middle three-point cross. The average weight at slaughter of female animals was 102.20 kg, while the male was 103.22 kg. The results showed that the proportion of meat in the carcass of female animals 56.94%, 26.73% fat, bone, 9.53% and less valuable parts of 6.80%, as opposed to female animals, males had a lower percentage meat in the carcass (54.82%), higher percentage of body fat (29.15%), percentage of bone was 9.25% and less valuable parts of 6.78%. Comparing the proportion of muscle tissue in the carcass of male and female animals was statistically highly significant difference ($P < 0.01$). The average length of carcass was 97.15 cm for women and 96.52 cm for males. Fat thickness was greater in males (30.58 mm) to 3.87 mm compared to female animals (26.71 mm). Comparing within the race, no statistically significant differences ($P > 0.05$) in the percentage of meat between two fertile breeds (Landrace and Yorkshire), while there is a statistically highly significant difference ($P < 0.01$) between the two races and terminal fertile Hampshire.

Key words: pigs, sex, quality carcasses

FEED AS CAUSE OF ASPERGILLOSIS IN FLOCK OF TURKEY POULTS

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Aspergillosis is frequent fungal disease of different avian and mammal species, caused by fungi of genus Aspergillus. The disease is characterized by inflammatory changes in the respiratory system and sometimes has generalized onset when more organ systems are affected. These fungi are well known aflatoxin producers which, besides other microorganisms, can also be found in feed raw materials. However, the presence of fungi is not a proof of mycotoxins contamination, because they are produced in specific conditions. In this paper are presented results of examination of a flock of turkey poults, 21 days old, at one farm in Serbia. Clinical signs of central nervous system disorder in the form of ataxia, torticollis, paresis and paralysis of legs and wings were observed. The mortality rate in the flock was 7,2 %. In ten out of twelve necropsied turkey poults multiple yellowish-white granulomas on lungs, one to three millimeters in diameter, were found. In nine out of twelve necropsied turkey poults solitary yellowish-white granuloma, three to five millimeters in diameter on sagital section of the cerebrum or cerebellum were found. Mycological finding revealed fungi Aspergillus fumigatus. For the evaluation of histopathological changes in lung and brain and demonstration of fungal hyphae, three stain methods were used: haematoxylin-eosin (HE), Grocott methenamine silver and periodic acid Schiff (PAS) method. Microscopic examination of lung and brain has revealed the presence of granulomatous foci and caseous necrosis with surrounding region of proliferation including giant cells, macrophages, heterophils and lymphocytes and outer capsule of connective tissue. The fungal hyphae were hardly visible or not in HE stained sections, while septed and arborized hyphae were easily demonstrated by Grocott and PAS predominantly in central parts of granuloma. Mycological examination of feed showed the presence of Aspergillus fungi, as well as detectable level of aflatoxin by ELISA testing (3.00μg/kg).

THE IMPACT OF IRON AND MANGANESE CONCENTRATION IN WATER AND FEED ON THEIR PRESENCE IN TISSUES OF FATTENING BULLOCKS

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From January to June 2011 the content of iron and manganese in water, hay, complete feeds and muscular tissue, liver and kidneys of fattening bullocks after slaughtering was monitored with the aim of determining the correlation between the concentration of these elements in tissues and their quantity in water and complete feeds. The bullocks were bred on a mini farm in Kraljevo. Water and hay samples were collected on a fifteen-day basis. Ten samples of water, hay, complete feeds, muscular tissue, liver and kidneys were processed.
Apart from water, all the samples for the analysis were prepared by dry ashing and decomposition in a microwave oven (simultaneously), while Mn and Fe were determined by atomic absorption spectroscopy (AAS) (AOAC 1990). The method of sample preparation did not affect the values of obtained results.
The average quantity of iron in water amounted 1.92 mg/L, 185.52 mg/kg in hay, 137.43 mg/kg in complete feeds, 38.87 mg/kg in muscular tissue, 67.60 mg/kg in liver and 78.83 mg/kg in kidneys. The average content of manganese was 1.57 x 10^{-2} mg/L in water, 76.01 mg/kg in hay, 12.64 mg/kg in complete feeds, 0.34 mg/kg in muscular tissue, 2.37 mg/kg in liver and 1.12 mg/kg in kidneys.
Our results showed that the intake of iron through water was significantly above MAC *(*maximum allowable concentration), whereas the quantity of manganese was substantially lower. The determined quantity of Fe in complete feeds was above minimal needs of bullocks as opposed to the quantity of Mn that did not comply with the proscribed limited quantity. The highest content of iron was determined in kidneys, and manganese had the highest value in bullocks liver.

Key words: bullocks, feed, water, iron, manganese, tissues

THE EFFECTS OF ANIMAL AND VEGETABLE FATS ADDED TO BROILERS'NUTRITION ON THE CHEMICAL CONTENTS OF MEAT AND OFFAL

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The purpose of this experiment was to establish the effects of the addition of animal and vegetable fats to broilers' nutrition on the chemical contents of red, white meat, liver and gizard after 42 days of breeding. The Cobb 500 broiler was used in this experiment, in total 240 animals, placed in four separate treatment. In chickens' nutrition, there was increased content of fats by 3% (treatment I – lard; treatment II – soybean oil; treatment III – tallow; and treatment IV – sunflower oil). With analysis of chemical parameters we comprised analyisis of contents of water, total ash, crude protein and crude fat. Highly significant difference ($p<0.01$) was found in the red meat for the contents of total ash, while the other parameters of chemical contents showed no statistically significant difference ($p>0.05$). Highly significant difference ($p<0.01$) was found in the white meat for the contents of water, total ash, crude protein; for crude fat is established statistically significant difference ($p<0.05$). Analysis of liver showed highly significant difference ($p<0.01$) for the contents of crude protein and crude fat, while highly significant difference ($p<0.01$) was established for the all chemical parameters in gizzard. Addition of sunflower oil to broilers' nutrition resulted with higher contents of total ash in the red and white meat, as well as of crude proteins and crude fats in the white meat, liver and gizard of broilers.

Key words: broiler meat, liver, gizard, chemical contents, vegetable fats, animal fats

POST-HARVEST FUNGI PRODUCTION IN DIFFERENT STORAGE CONDITIONS OF THE CEREALS

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Crops are exposed to fungal contamination both on the field before harvest, and especially during storage for longer periods of time in improper conditions. Concerning the origin of fungi contamination can have the following sources: contamination from the warehouse or silo dispersion, the predominant fungi are Aspergilius and Penicillium, contamination remaining from the field before harvest with: Clamidosporium, Fusarium, Mucor, Rizopus and advanced alteration, that associates more rare types in remanent contamination.
In this paper it was study the influence of storage conditions on the fungi growth and mycotoxins production in cereals.
It was analysed cereals samples (wheat, maize, barley and oats) collected from warehouse, individual silos and storage cells from the west side of Romania. The cereals were sampled from private producers, which reported the information regarding storage conditions. The storage period ranged between 6 months and over 1 year. The main measures of conditioning applied to samples before storage were related to: drying, pest removal, aeration and cleaning. Also, were monitored storage main parameters (temperature, humidity, ventilation) being prevented also the toxins production.
The method used for fungal species with mycotoxigen potential identification was microbiological assay.
The experimental results indicated that the fungus species isolated and identified were Aspergillus (flavus and terreus, Fusarium roseum, Penicillium sp., Chaetomium sp. and Cladosporium sp. The most frequent Fusarium fungal species in cereal samples were identified F. culmorum, DON mycotoxin producers, F subglutinans, fumonisin producers and F. acuminatum, non mycotoxin producer. Fusarium species was identified in 45 % maize samples, 25% wheat samples, 100% triticale and barley samples and 0% in oats samples.
In order to avoid the production of mycotoxins after harvest, it is advisable to dry the grain and bring to optimum moisture retention, less than 14%. Also, can be avoid post-harvest contamination by monitoring grain storage optimal conditions.

INFLUENCE OF FERTILIZERS AND GROWTH REGULATORS ON NUTRITIONAL QUALITY OF *ALLIUM CEPA* IN DIFFERENT STAGES OF MORPHOGENESIS

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The aim of this paper was to study the effect of growth regulators in connection with diversified fertilization (concerning the form, the doses and kind of fertilizer) on the nutrients content (Vitamin C and protein) in Allium cepa (*onion)* culture, in different stages of morphogenesis. Field trials were conducted during the early seasons of 2011, on a black Chernozem soil. The experiment was a randomized complete block design with four replications. The experimental site was prepared in 28 beds of 1 x 1 m^2 each in size and the variants used were: $N_0P_0K_0$, $N_{60}P_{45}K_{45,}$ $N_{90}P_{60}K_{60,}$ $N_{120}P_{60}K_{60}$, $N_{60}P_{60}K_{60}$ + Aqzyme 1 l/ha, $N_{60}P_{60}K_{60}$ + 2 x Pervaide 1 l/ha, Manure 20 t/ha.
The protein content analyses were performed in the Laboratory of Soil Science and Plant Nutrition, Faculty of Agriculture, USAMVB Timisoara.
The protein content % was determined with the help of Kjeldahl unit (Velp Scientific 127) and Vitamin C (mg/100 g) content was done according to STAS 6182/15-87.
NPK fertilizers dose not influence the Vitamin C accumulation with highest value being registered in variant v2 – $N_{60}P_{45}K_{45}$, in all morphogenesis stages, 13 mg/100 g (1^{st} stage), 14 mg/100g (2^{nd} stage) and 18 mg/ 100g (3^{rd} stage). Growth regulators and manure does not influence the vitamin C accumulation**.**

FEEDING VALUE ESTIMATION OF NEW INTRODUCED FORAGE PEA (*PISUM SATIVUM* L.) VARIETIES

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The general composition, plant cell walls fiber components content, in vitro digestibility and general feeding characteristics in forage quality evaluation of green mass of forage pea (*Pisum sativum* L.) spring forms in field trial – competitive variety testing, carried out at the Institute of Forage Crops – Pleven, Bulgaria (2009-2011) were studied. Four new introduced Ukrainian high productive varieties Kamerton, Glyans, Modus, Svit and Bulgarian standard variety Pleven 4 were harvested at the three vegetative stages – budding, flowering and full pod formation. Forage quality of the whole pea plants was evaluated by the parameters of general composition, plant cell walls fiber components content, digestibility, protein and energy feeding value. The standard variety Pleven 4 characterized by highest forage quality – highest protein content 18,0%, highest digestibility 74,9% and lowest plant cell walls fiber components content: NDF 36,4%, ADF 29,02%, ADL 4,57%. The new introduced Ukrainian varieties, Glyans and Kamerton show higher forage quality: higher protein content 13,3% , lower fiber content: crude fiber 23%, NDF 42-41%; ADF 30-31,5%; ADL 5,2-5,4%, respectively and digestibility 71% in comparison with varieties Svit and Modus. Energy feeding value of standard variety Pleven 4 is highest but in the group of Ukrainian varieties the highest energy value characterized Modus and Kamerton. The standard Pleven 4 distinguish highest protein feeding value: mean values for three stages – TDP 135 g kg^{-1}, PDIN 113,2 g kg^{-1}, PDIE 101,2 g kg^{-1}, and for Ukrainian varieties – variety Kamerton: TDP 89,4 g kg^{-1}, PDIN 83,4 g kg^{-1}, PDIE 89,6 g kg^{-1}, followed by variety Glyans and variety Svit.

Key words*: Pisum sativum L.,* varieties, protein, fiber, digestibility, energy and protein feeding value

OBTAINING AND CHEMICAL CHARACTERISATION OF *CAMELINA SATIVA* MEAL USE IN ANIMAL NUTRITION

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Recently *Camelina sativa* has been cultivated in demo trials in several locations of Romania. The main product, Camelina oil, is studied for sustainable biokerosene jet-fuel production. Camelina meal is the by-product that remains after seed oil extraction, and has the potential to be used in livestock feed due to its nutritive value. In 2011, BIOTEHGEN (through the use of cold seed pressing facility from Giurgiu district) obtained 5545 l of crude oil and 9640 kg of meal after crushing 15610 kg of Camelina seeds. The chemical analysis performed by IBNA (Institute of Biology and Animal Nutrition), Laboratory of Chemistry and Nutrition Physiology-Balotesti, showed that the meal obtained has a rich content(between 23% and 27%) of α linolenic acid (omega-3), and about 24% linoleic acid (omega-6), essential fatty acids necessary for improving the quality of animal products by the inclusion of Camelina meal in experimental diets. Also, the fatty acids profile includes a low content of erucic acid (<3%) and saturated fatty acids(< 12%). A small quantity of ash (5,96%) was found. In addition, the high content of dry matter (91,37%), crude protein (33,35%), and cellulose (12,64%) make Camelina meal a valuable product in animal feeding. Considering its benefits, it is necessary to carry out new research in this field.

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TYPICAL AGRICULTURAL PRODUCTS AS A WAY OF DIVERSIFICATION OF RURAL ECONOMY IN BOSNIA AND HERZEGOVINA - CASE STUDY "GRAH POLJAK"

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Typical agri-food products diversify the rural economy, contributing to a decrease in unemployment of rural population and provide greater employment opportunities for vulnerable rural populations - women and youth. The rural economy of B&H is characterized by high level of rural poverty. Typical agri-food products provide a developmental perspective to small farms to better valorize their potential. Valorization of local, traditional agri-food products is a complex process involving many actors, among which is necessary to achieve compliance values and goals. In B&H there are a numerous agri-food products that may be characterized as typical products. Among the three products that are made by Slow Food and has been recognized as typical products of B&H, in this paper grah poljak from the area of Petrovo polje, municipality Trebinje is analyzed that currently has the status Convivium. Based on data collected from producers in the field showed that the profitability of grah poljak as a typical product (profit of 17,440 KM / ha) was significantly higher compared to conventional production of beans as a vegetable culture (profit 6,510 KM / ha). Grah poljak production is more than efficient and the main barriers to this production may be some other elements of the entire production cycle. This primarily refers to the sale and achieves other marketing elements into a whole (distribution and promotion).

Key words: a typical agri-food product, diversification, rural economy, grah poljak

THE OPTIMIZATION OF BEER PRODUCTION TECHNOLOGY BY ASSESSMENT OF MALTS PRODUCED BY VARIOUS EUROPEAN TERRITORIES, AIMING TO IMPROVE THE PROPERTIES OF BEER

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Given the overall demand for savings and quality improvement of beer, this study aimed optimizing of the production technology based on the evaluation of malts produced in Europe being reflected in the improvement of properties of beer in the factory "Birra Peja". The comprehensive study was carried out for the entire beer production chain, in close cooperation with the factory's production and laboratory staff.

The study was focused on malts produced in three European countries, Ukraine, Croatia and Serbia, as well as beer produced by these malts. These malts were analyzed in all stages of production, including chemical and microbiological analysis, as well as sensorial evaluation. Beer tasting for this study was done by two taster panels; panel of "Birra Peja" and the panel of Agricultural University of Tirana. We consulted with the working and laboratory staff at the "Union" brewery. Chemical and microbiological tests have been conducted based on European Beer Convention and MEBAK methods.

Based on the conducted analysis and assessments of the beer quality, it was concluded that the beer produced with malts from Croatian origin, corresponds to a better quality of beer, which already is under production.

Key words: Malt, Beer, production technology, EBC, MEBAK.

X INTERNATIONAL PROGRAMMES AND PROJECTS IN FOOD SCIENCE

TRUEFOOD-Traditional United European Food

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Website: www.truefood.eu

Programme Acronym: FP6-FOOD **Contract No**: FOOD-CT-2006-016264

Basic Objective of the Project:
The TRUEFOOD project was aimed at putting values on traditional food products. The research was directed towards traditional foods such as cheese, dry-cured ham, smoked salmon, beverages as beer, some fruits (olive, clementine, tomato), sausage.

Major outcomes:

- Insight into the consumer perceptions, expectations and attitudes related to traditional foods,
- Use of microbial ecosystems as barriers to pathogens in dairy products,
- Improved control methods and modelling tools for process induced chemical hazards,
- Development of methods for practical application of predictive microbiological modelling and industrial risk profiling,
- Increasing the added value of traditional foods through reducing salt content in ham and salmon; increasing polyunsaturated fats, including fatty acids such as omega 3 in milk and cheese; promoting the formation of bioactive peptides in cooked pressed cheeses; increasing the antioxidant content in some plant products.
- New concepts for the use of the food chain management methods on traditional foods and methods for their practical application for SMEs.
- Testing some of the results at pilot scale and demonstrating them to the industry to enhance their transfer.
- A network of industry based mediators established in 11 countries at the national food and drink industry federations. Developing a set of methods for knowledge transfer to food SMEs,
- A best practice guide on knowledge transfer to food SMEs,
- Large scale dissemination activities, focused mainly on the industry, more than 300 publications, 28 000 stakeholders reached including 23 500 involved into the knowledge transfer activities. Dedicated training courses organised for 6078 attendants.

Keywords: traditional foods, knowledge transfer to food SMEs, food chain management, predictive microbiology

Integrated Monitoring and Control of Foodborne Viruses in European Food Supply Chains (VITAL)

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VITAL's Goal
VITAL aimed to provide to Europe a framework for monitoring, for risk modelling, and for procedures for the control of foodborne virus contamination, which will be applicable to any virus that poses the danger of being transmitted by food. Implementation of such a framework of preventive or proactive virus contamination management should form a first line of defence against transmission of foodborne viral diseases in Europe.

Project structure
VITAL involved 14 institutes from 11 countries. The project's structure was based around three areas - Data-Gathering, Data Analysis, and Delivering Impact. In each of these areas there was at least one dedicated Workpackage. The outcomes of each area integrated to produce the final VITAL information on risk and how to control it. The dissemination of this information will deliver the project's impact.

Major outcomes
VITAL produced a portfolio of standard operating procedures to monitor four food supply chains - salad vegetable, soft fruit, pork, and shellfish. The first three chains were monitored in their production, processing and point of sale phases, whilst the shellfish supply chain was monitored only at point of sale. The principal viruses monitored were norovirus, hepatitis A virus, and hepatitis E virus. VITAL also monitored for viruses which would indicate that a route of contamination existed from humans or animals to the food supply chain. Data on virus prevalence revealed vulnerability to contamination at several points in each chain. Risk assessments showed that estimated health risks were significant in some cases. VITAL performed fact-finding missions to examine food safety management practices where data on virus contamination was gathered. The information showed that key areas of concern were non-compliance with prerequisite safety management practices. Notably, in primary production of soft fruit and salad vegetables, a correlation between poor quality irrigation water, poor sanitation, and poor hand hygiene, and contamination of produce was apparent. VITAL determined that compliance with prerequisite programs, such as the forthcoming Codex Guidelines, is essential to reduce the risk of contamination of food supply chains with viruses. With clear recommendations on regaining control through compliance, and the monitoring procedures which VITAL has outlined, the aim of integrated monitoring and control of foodborne viruses in food supply chains can be fulfilled.

Key words: Virus, food, detection, monitoring, control, guidelines
Project web site www.eurovital.org

RESPIA

UPSCALING THE MEAT, DAIRY AND BREWERY PILOT PLANTS AT THE FACULTY OF FOOD SCIENCE AND ENGINEERING- AN INFRASTRUCTURE PROJECT DEVELOPED BY DUNAREA DE JOS UNIVERSITY OF GALATI

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Basic Structure of The Project

This project aimed at restoring the old tradition of the Faculty of Food Science and Engineering from Galati, Romania of having pilot plants. Pilot plants are ensuring the practical training of the students, implementing applied research contracts with local SMEs and organizing training programs offered for teachers in high schools and personnel from the industry.

The funding for the project was ensured from European Structural Funds (80%), from Romanian government (18%) and with Dunarea de Jos University contribution (2%). Rebuilding the meat and dairy pilot plants was finished after the first two years of the program and in the last year the brewery pilot plant will be restarted.

Together with the equipment for applied research, a unit for extraction with supercritical fluids and a unit for high pressure treatment were already bought from the same project and a new GC/MS was purchased.

New PhD projects and one postdoc project has been developed using the supercritical extraction unit and the high pressure unit, and the results will be soon ready for publication.

The new infrastructure developed at the Faculty of Food Science and Engineering from Dunearea de Jos University of Galati will bring new opportunities and allow starting international research programs that will contribute to the development of the existing resources.

Major Outcomes Until Now

- Meat pilot plant of 2 t capacity
- Dairy pilot plant -400 l capacity
- GC/MS – studies of the flavor profile of edible films with thyme, studies on the flavor of the peach puree high pressure treated
- High pressure equipment with 4 vessels of 100 mL working up to 10.000 bar and from -20 to 120°C- studies on the PPO and POD inactivation kinetics in peach puree; studies of the properties of high pressure thermal treated polymeric materials used for food packaging
- A supercrital fluids extraction equipment- with cosolvent pump- characterization of onion extracts

KEY WORDS Food engineering, pilot plants, applied research, infrastructure, training

CAPACITY DEVELOPMENT IN FOOD AND NUTRITION IN CENTRAL AND EASTERN EUROPE

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Basic structure of the projects:

The Network for Capacity Development (CD) in Nutrition in Central and Eastern Europe (NCDNCEE) (http://www.agrowebcee.net/ncdn/) was established in 2005 and chaired by the Centre of Research Excellence in Nutrition and Metabolism, Serbia. The purpose was to initiate and support CD activities in developing research and training in public nutrition based on country specific needs in CEE countries working towards the enhancement of individual, institutional and organizational capacity in food and nutrition including development of a framework. NCDNCEE has joined several EC funded projects, including FP6 NoE EuroFIR (www.eurofir.org),2006-2010, FP6 NoE EURRECA (www.eurreca.org) 2007-2012, FP7 NoE EuroFIR–Nexus (www.eurofir.net) 2011-13 and FP7 BaSeFood (http://www.basefood-fp7.eu/) 2009-2012.The general objectives have been CD in the CEE area; to identify food and nutrition challenges; evaluate current status of nutritional education; to foster an exchange of knowledge and experience with European countries.

Major Outcomes until Now:

The NCDNCEE results are published in scientific journals and the reports are available at the website: www.agrowebcee.net/ncdn/.Matters of the utmost importance was an insufficiency of nutrition training (e.g. tailor-made training). NCDNCEE meetings were arranged for identifying specific challenges in CD; it included implement workshops on nutritional tools/skills. Therefore, CD workshops (2006-2012) conducted the activities described above. Also the development of regional FCDB Balkan platform is underway. Thus, an impressive amount of CD activities was achieved in each country, guided by the plans, frameworks, leadership aspects and the implementation of CD activities.

1. ***Capacity Development in research, education and training and dissemination***:
    - 7 Network meetings, 15 Workshops/trainings/courses; 4 publications in international journals; 102 oral and 26 posters presentations at 20 international meetings;
    - Website: http://www.agrowebcee.net/ncdn/
    - Video film: http://www.youtube.com/watch?v=OGAaVs3po-c
2. ***Capacity Development in Food and Nutritional tools:***

- **NUTritional PLANning**, user friendly software programme with multiple functions (individual and group nutrition planning, recipe calculation, creating food labels, diet planning)
- **Web based application-Food Comp Data Management (FCDM)** for creating national/regional FCDB
- The FP7 EuroFIR-Nexus project and NCDNCEE initiated **Balkan platform and regional food composition data base** further development.
- **Nutri-RecQuest** is a user-friendly software webtool that allows easy access of data on current recommendations for 29 different micronutrients from 37 European countries, eight key non-European countries/regions as well as recommendations set by the European Commission and World Health Organisation/Food and Agriculture Organisation.
- **Web tool for extraction of data on nutritional adequacy and its determinants**

Conclusions:
Nutritional trainings, exchange of information and cooperation with European projects and networks are excellent opportunities for CD. The network was a source to new scientific knowledge in food and nutritional, a tool to foster regional involvement and identify needs and opportunities in regional CD, involvement in education, research, innovation and knowledge transfer in CD in food and nutrition in CEE. Further attention should be given to similar activities including NCDNCEE practise.

Key words: capacity development, EC projects, Central and Eastern Europe, Nutrition

LINKS to be permanently informed: (http://www.agrowebcee.net/ncdn/); (www.srbnutrition.info)

FOOD SCIENTIST TRAINING – A GLOBAL APPROACH BY THE MONIQA NOE

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In its Green Paper on “Promoting the learning mobility of young people” the European commission outlines the importance of mobility for young people in order to strengthen their professional development. Also senior staff of both, industry and science, have to keep up with an increasingly globalized food market. Hence, training was considered to be an integral part of the EU funded MoniQA Network of Excellence and also of its successor organization – the recently established MoniQA Association. The overall aim of the MoniQA Network of Excellence was to harmonize food quality and safety monitoring and control strategies in the food supply chain on a global scale. In order to overcome gaps in knowledge and skills, a set of international training activities was implemented within and beyond the network.

Identified training needs for different regions and for different target groups have been considered during the development of MoniQA training courses. In order to increase the accessibility and usability of food scientist training, MoniQA offered not only traditional face to face training but also web seminars and developed an E-Learning platform. A quality assurance concept for training was implemented in order to verify the quality of developed training courses.

MoniQAs distance learning tools, as well as face to face training in combination with the MoniQA bursary scheme (available to trainers as well as trainees), helped experts throughout the whole food supply chain to overcome their knowledge deficiencies and thus can be considered as a useful means to cope with the future and a world of constant change

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THE ROLE OF THE ISEKI-FOOD NETWORK IN FOOD SCIENCE AND TECHNOLOGY

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The need for food professionals with the right skills and competencies, is a continuous challenge. A multidisciplinary and global view and sound knowledge on safety, health and preference and environmental aspects are important. Actual conceptions of Lifelong Learning are focused on employability, flexible career and qualifications paths.
ISEKI-Food was designed as a network of University and Research Institutions, Professional and Students Associations, Industrial partners to foster collaboration. Several European and global academic networks projects received funding between 1998 and 2014 from the European Commission. To ensure the sustainability of the network activities the ISEKI-Food Association was founded in 2005. The main objectives of the network are to contribute to the Higher Education Area by internationalization, enhancement of food studies quality and fostering of innovative developments.
Important outcomes of this network are e.g. the EQAS_Food award for accredited Food Study Programmes, innovative teaching materials and methods including the ISEKI-Food book series published by Springer, a training platform including taylor made e-learning courses, web seminars and workshops facilitating Lifelong Learning, a platform to support international cooperation and mobility (PICAM_Food), several web databases for curricula, teaching materials and stakeholders. The aim of the latter is to maintain a worldwide network of all stakeholders in the food supply chain, who could be searched and contacted, to promote synergies between research, education/teaching and industry and to stimulate the development of joint projects or trade opportunities. The International Journal of Food Studies is an international peer-reviewed open-access journal featuring scientific articles for education, research and industry.
Today the ISEKI-Food Network is already a very successful Network, that is managing to achieve a great impact through its internationalization and communication to a large audience of stakeholders from all over the world.
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PROGRESS OF THE GLOBAL HARMONIZATION INITIATIVE (GHI)

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Basic Structure of The Project:

Founded in 2004 as a joint activity of the U.S.-based Institute of Food Technologists (IFT) International Division and the European Federation of Food Science and Technology (EFFoST), the Global Harmonization Initiative (GHI) is a network of scientific organizations and individual scientists working together to promote harmonization of global food safety regulations and legislation. Registered as a nonprofit association headquartered in Vienna, Austria, GHI is today supported by nearly two dozen international scientific organizations, academic research institutes and publishers.

Major Outcomes Until Now:

GHI facilitates global discussion about the scientific issues that support decisions made by national governments and international regulatory bodies by providing a foundation for sound, sensible, science-based food safety regulations; creating a forum for scientists and technologists to interact with regulatory authorities on a global basis; and offering industry, regulators, public health authorities and consumers an independent, authoritative information resource.

GHI has established a number of ways in which scientists can make progress in developing strategies to find the shortest route to achieving global harmonization in concert with international public health and food safety authorities, including the WHO, the FAO, the Codex Alimentarius Commission (CAC) and the International Organization for Standardization (ISO).

KEY WORDS

independent network of scientific organizations, global food safety regulations and legislation

Research in Europe between now and 2020 as envisaged by the European Technology Platform *Food for Life*

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The European food industry faces many demanding challenges if it is to maintain its competitiveness and stop the current decline in its market share. To do this it must address some key research questions that will enhance its competitiveness and lead to greater innovation within a fragmented industry of close to 400,000 enterprises, many of them small and medium sized enterprises.

Without doubt it will require a complex range of new technologies if it is to meet the society driven demands for healthy, safe, sustainably produced foods that are convenient, perhaps individual, promote healthy aging and are perceived as natural. If scientists are to succeed in enhancing European competitiveness, there will be a need to have food items tailor-made for Europe that respect sustainability, that are functionally enhanced, that reduce waste, water use and packaging and, in all probability, show a shift from meat to plant based protein sources.

The detailed future research needs as defined by the European food industry through the European Technology Platform *Food for Life,* are outlined under the headings:-

- Health, well-being and longevity;
- Safe foods the consumer can trust;
- Sustainable and ethical production;
- Food processing, quality and packaging;
- Food and consumers;
- Food chain management;
- Communication, training and technology transfer.

How these themes fit with the published goals of the European Commission and its Horizons 2020 programme are also outlined.

DREAM-Design and development of REAlistic food Models with well-characterised micro- and macro- structure and composition

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Web site: http://dream.aaeuropae.org/

Basic Structure of The Project:

DREAM is a trans-disciplinary research project funded by the European Framework Programme 7 whose ambitious objectives are set towards mimicking food complexity that arises from its structure and composition. For this purpose the DREAM project develops realistic, either physical or mathematical, food models. These food models are going to be used by food research institutes and industry as tools for the assessment of the risk & benefit balance and the nutritional quality. Models that are being developed are: Basic Knowledge Models – BKMs (descriptions and guidelines), Integrated Knowledge Models – IKMs (Software packages) and Generic Model Foods – GMFs (standards of operating procedures). The DREAM project is an example of a trans-disciplinary approach that combines partners from private and public sectors from nine European countries, which makes this project a multicultural project. To achieve a good visibility, the DREAM project is being disseminated via existing channels and national platforms, federations and regulatory bodies. The DREAM project also pays special attention to its young members by giving them the opportunity for skill development necessary for their career development within the European Research Area.

Major Outcomes Until Now:

- Methods to characterize and identify selected microorganisms, and mycotoxins and relevant derivatives or biomarker
- Cereal food models of open solid foams with varying target properties by combination of specific ingredients, enzymes and unit operations, and protocols to design those
- Test of a procedure to assess from microscopic images the mean and variability of structural characteristics of a heterogeneous meat tissue
- Validated concepts for strategy of integration of pieces of knowledge available for the food models
- Scientific workshop

KEY WORDS

food models, food structure-function relationships, generic food matrices, trans-disciplinary approach, 7FP

LINK to be permanently informed:

http://dream.aaeuropae.org/ProjectOverview/tabid/56/ctl/Register/Default.aspx?returnurl=/ProjectOverview/tabid/56/Default.aspx

EU FP7 Veg-i-Trade : Fresh produce puts safety first
Impact of climate change and globalization on safety of fresh produce - governing a supply chain of uncompromised food sovereignty-

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Web site : www.Veg-i-Trade.org

Basic Structure of The Project:

Veg-i-Trade unifies 23 international partners from universities, research institutes, SMEs and large industrial partners from Norway, Netherlands, Belgium, Spain, India, Egypt, Brazil, South-Africa & Switzerland.It focuses on the fresh produce global market and on the development of control measures for microbiological and chemical hazards.

Major Outcomes Until Now:

- Selection of the case-studies: lettuce, leafy fresh herbs, strawberries, raspberries, tomatoes, bell peppers, onions, apples, pears, mangos, grapes, carrots and derived products such as fresh-cut produce, (frozen) pulp and concentrates.
- Development of self-assessment tools, sampling plans and methods for microbial (VTEC, Norovirus, protozoa) analysis to measure performance of food safety management in fresh produce supply chain: farm, processing & trade
- Training Program in Sampling and Microbial Analysis in Oslo (July 2011)
- A review of the current state-of-the-art of pre- and post-harvest preventive measures and interventions along the farm-to-fork continuum to prevent or reduce microbial contamination of leafy greens has been prepared.
- Characterisation of available water treatment technologies and definition of selection criteria to support their fitness to use for water disinfection in irrigation practices, and produce processing washing and cooling operations.
- Risk assessment: model development to link modified atmosphere packaging, global logistic chain to fresh produce quality and

microbiological safety. The model includes advanced inventory control policies, as well as microbial growth models: the case study for strawberries & lettuce.

- Risk assessment: hazard identification of emerging mycotoxins in fresh produce
- Risk assessment: impact of food processing/ preparation practices on pesticide residues
- Climate change: impact of climatic conditions and plant water availability on the visual quality and microbial contamination of crops and fresh-cut lettuce
- Discussion Forum on “Dealing with food safety issues for fresh produce” (Ghent, 28/01/2011) : report available at www.Veg-i-Trade.org/News

KEY WORDS

sampling plans, detection methods, Salmonella, VTEC, Norovirus, protozoa, pre- and post-harvest practices, quality assurance, modelling, risk assessment, communication.

CHANCE- Low Cost tecHnologies and traditional ingredients for the production of Affordable, Nutritionally correct, Convenient foods enhancing hEalth in population groups at risk of poverty

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Basic Structure of The Project:

According to Eurostat statistics, there is a robust need to better understanding the nutritional existing barriers to healthy nutrition of 79 million EU-27 citizens at-risk-of-poverty. These European sub-clusters and ethnic populations have in common low purchaising power, limited education and the highest risk of diet-related diseases due to sub-optional nutrition.

The CHANCE project's aim is to address poor nutrition in the most significant populations at risk of poverty in Europe by developing attractive, affordable and nutritious food products using low-cost technologies and traditional ingredients.

CHANCE intends to adopt a new multidisciplinary approach, leading to nutritional strategies for the prevention of malnutrition in population groups at risk of poverty. CHANCE aims at considering a new health value-added diet as a whole by developing food products which could act in concert.

The synergic collaboration of nutritionists, food chemists, economists and technologists allow a robust strategy to by pass all barriers to healthy nutrition by the lab-scale development of affordable but nutritionally-rich food products, new packaging and portioning. The R&D activities planned in the enlarged European Union facilitate a proactive collaboration among food research centers and food processing and packaging SMEs that will be further transferred with the generated foreground.

The CHANCE specific objectives are to:

1. Identify the main nutritional criticalities and barriers to healthy eating
2. Select ingredients and raw materials
3. Develop CHANCE foods
4. Produce CHANCE food prototypes

Major Outcomes Until Now:

- Identification on population groups at risk of poverty;

- Guidelines to conduct focus group and survey interviews;
- Reports on food chain industries and retailers' perception of barriers;
- Analysis of the existing knowledge of diet-related problems among risk of poverty groups;
- Website of the project;
- Dissemination material – project leaflet;
- Scientific meetings;

KEY WORDS

Low income, nutritional strategy, metabonomic, nutritional criticalities, food technology, consumer, acceptability, barriers to healthy nutrition, diet-related diseases.

LINK to be permanently informed:

http://www.chancefood.eu/news_3.html

SAFE FOOD FOR EUROPE (FOODSEG) -- COORDINATION OF RESEARCH ACTIVITIES AND DISSEMINATION OF RESEARCH RESULTS OF EC FUNDED RESEARCH ON FOOD SAFETY

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FOODSEG is a Coordination and support action and has the overall objective to disseminate state-of-the-art research results in food safety and quality topics through a series of symposia, expert working group meetings, an online platform with best practise examples and coordination of cooperation and a plan for the preparation of future activities.
The secure handling of food has main impact onto the safety of food products and the European consumers. Furthermore, detailed plans and actions to foster food safety research in Europe are part of the workplan and objectives.
FOODSEG is connecting research and policy actors in the enlarged European Union and the Candidate countries, in order to fill transitional gaps and achieve a broader network and deeper collaboration between them.
The FOODSEG project brings together experts form academia, industry and decision-makers to exchange know-how not only to discuss and prepare for the future policy development but also to identify the most promising future research fields and topics in food safety.
FOODSEG involves a series of strategic and measurable objectives in order to support the research activities carried out in the field of safety for food. FOODSEG has set itself the following key objectives listed as follows:

- Establishing expert working groups to coordinate research activities and to support policy development at EU level and to contribute by identifying research agendas for future community research in the field of food safety and quality, along the whole food chain.
- FOODSEG aims at supporting the European Commission in formulating suggestions for political consequences and relevant research topics. The expert working groups will elaborate policy recommendations to the European Commission and make suggestions for coming up research topics in the field. The consortium has the objective to co-operate and contribute to the following technology Platforms, especially those which have food safety as part of their Strategic Research Agenda: Food for Life; Plants for the Future; Global Animal Health; Farm Animal Breeding and Reproduction; Water Supply and Sanitation.
- To integrate experts from New Member States and associated countries
- To disseminate research results through an online platform and to establish new project consortia for FP7 and FP8
- To initiate and set-up a researchers exchange programme

The European Research Area should make it possible to consolidate the intellectual, scientific and cultural community and reduce the fragmentation of research within the EU which should be able to share its expertise and know-how with other countries such as Accession Candidate Countries.
FOODSEG will support the implementation of the European Research Area (ERA) through dissemination of research results, stimulation and facilitating the establishment of new project consortia and research projects in FP7 and Horizon 2020. Furthermore, it will generate policy recommendations to improve policy support

Project website: www.foodseg.eu

Key words: *food, feed, safety, dissemination*

agINFRA - A data infrastructure to support agricultural scientific communities Promoting data sharing and development of trust in agricultural sciences

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Web site : http://www.aginfra.eu/

Basic Structure of The Project:

agINFRA is an Integrated Infrastructure Initiative (I3) project that will try to introduce the agricultural scientific communities into the vision of open and participatory data-intensive science. In particular, agINFRA aims to design and develop a scientific data infrastructure for agricultural sciences that will facilitate the development of policies and the deployment of services that will promote sharing of data among agricultural scientists and develop trust within and among their communities. agINFRA will try to remove existing obstacles concerning the open access to scientific information and data in agriculture, as well as improve the preparedness of agricultural scientific communities to face, manage and exploit the abundance of relevant data that is (or will be) available and can support agricultural research.

Ultimately, agINFRA will demonstrate how a data infrastructure for agricultural scientific communities can be set up to facilitate data generation, provenance, quality assessment, certification, curation, annotation, navigation and management.

Major Outcomes Until Now:

- Stakeholders meetings in all countries to identify needs and requirements for scientific data management and integration in agricultural sciences
- Planning and prototyping of the agINFRA technological platform based on the Grid and Cloud computing resources
- Inventory, development and integration plans of agINFRA components, integrated services and infrastructure services to be provided to the community

KEY WORDS

scientific community-driven policy development and service deployment for data generation, provenance quality assessment, certification, curation, annotation, navigation, and management.

LINK to be permanently informed:

http://www.aginfra.eu/en/news-and-achievements/news

COST OPPORTUNITIES FOR FOOD AND AGRICULTURE

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COST is an intergovernmental framework for European Co-operation in the field of Scientific and Technical Research, allowing the co-ordination of nationally funded research on a European level. COST Actions cover basic and pre-competitive research as well as activities of public utility. The goal of COST is to ensure that Europe holds a strong position in the field of scientific and technical research for peaceful purposes, by increasing European co-operation and interaction in this field. COST has developed into one of the largest frameworks for research co-operation in Europe and is a valuable mechanism co-ordinating national research activities in Europe. COST Food & Agriculture is one of the 9 COST domains. It covers all aspects of research in the field of agricultural and food sciences in its widest sense. This naturally encompasses a very wide number of subjects, and relates to a large number of areas of human activity. It includes all aspects of research of food and non-food chains, including primary agricultural and horticultural production and processing, development and downstream processes for edible and non-edible production derived from agriculture in its widest sense. The domain deals with both plant and animal sciences and food sciences, and the technologies relevant to these. We see the most advanced progress in following areas: **The Biological Functions of Organisms**, **Human Nutrition and the Food Chain**, **Agriculture as a Human Activity, and Agriculture and Environment.** Since food and agriculture involve so many scientific disciplines, it is anticipated that successful proposals will vary widely in nature from closely focussed topics of a fundamental nature using the most innovative and up-to-date techniques (such as tools for genomics, proteomics and metabolomics) to interdisciplinary projects having a more holistic approach (such as new farming systems for the production of quality food).

The aim of this paper is to present the COST networking system in the field of Food and Agriculture and to give some advices how to prepare the new COST Action/Project, and also how to join an ongoing COST Action/Project.

For more see http://www.cost.eu/domains_actions/fa/in_detail

FA0802: THE HUB FOR FEED FOOD AND HEALTH

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Food of animal origin contributes significantly to the total nutrients in the current EU diet. The latest review of livestock production and trade (FEFAC, 2010) indicates that more than 45 million tonnes of meat, and more than 135 million tonnes of milk and 7 million tonnes of eggs were produced in the EU in 2010. To sustain this scale of livestock production, about 470 million tonnes of feedstuffs are required each year within the EU-27. Clearly, ensuring such high outputs of these traded products conform to adequate quality standards is a major undertaking and it is fair to say that the EU has made significant progress in defining standards and promoting legislation in this area. As a consequence the explicit and detailed formulation of the concepts of food/feed safety and food/feed quality, has given rise, within the EU, to legislation on the traceability, control and labelling of both feed and food. However nowadays both feeds/and foods must be considered not only in terms of their nutritional properties but also in terms of their ability to promote health and protect against disease. As a consequence, the role of animal nutrition in designing foods closer to the optimum composition for long-term human health are becoming increasingly important. This feed-to-food approach makes it possible to re-position animal products as key foods for the delivery of important nutrients to humans. However for this to happen a much greater understanding is needed of the complex interactions between animal feed supply, animal nutrition and healthy animal products for humans that consumers will be willing to purchase. Any associated effects on animal health also need to be understood. During its lifespan the COST Action FA0802 promoted the acquisition and facilitated the dissemination of knowledge in these areas and encouraged cooperation between various research fields.

COST FA1001
THE APPLICATION OF INNOVATIVE FUNDAMENTAL FOOD-STRUCTURE-PROPERTY RELATIONSHIPS TO THE DESIGN OF FOODS FOR HEALTH, WELLNESS AND PLEASURE

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Basic Structure of The Project:

Action Fa1001 is an example of a trans-disciplinary approach that combines partners from private and public sectors from 29 European countries and one non COST Country (New Zealand) which makes this project a multicultural project. The network covers a multidisciplinary food research domain (food engineering, biophysics, applied soft matter, food technology, applied and molecular human nutrition) Activities of ACTION FA1001 are strategically designed in the frame of a integrated process & product design approach for creating innovative products with real health benefits and optimal sensory characteristics.

Main objectives are:

- development of process-structure-property relationships in order to deliver new real multiphase structured foods (foams and emulsions) with health benefits (bioavailability/efficacy of nutrients) and optimal sensory characteristics;
- involvement of Early Stage Researchers in the new product/process design approach;
- management of the process of sharing knowledge and technologies for healthy foods design among academic institutions and other institutions and private enterprises (mainly SMEs) or services.

Major Outcomes Until Now:

- A scientific breakthrough has been the identification of a reverse engineering approach for new product developments starting from food properties required, progressing to formulation or structure engineering and finally deriving the appropriate processing.
- A special interest is directed to the health supporting food functions with development of relationships between food structure and its health benefits.
- Action FA1001 is focusing on the Gastro-Intestinal Engineering which takes the food structure disintegration processing steps into account and derives the optimal functional food manufacturing by a reverse engineering approach.

Ultimately this ensures a food product is created with opitimised functionality and targeted release within the body to maximize its health benefits.

KEY WORDS
integrated process & product design; healthy functionality; optimal sensory characteristics; Reverse Engineering Approach; Gastro-Intestinal Engineering; Technology Transfer

LINK to be permanently informed:
http://www.cost.eu/domains_actions/fa/Actions/FA1001

TU_Be_Safe: An International ATLANTIS cooperation program in higher education between Romania and US

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Basic Structure of The Project

'Tu_Be_Safe' is a project started in 2010 and run by consortia made of four universities: two from the European Union (Dunarea de Jos University of Galați, Romania and University of Ljubljana, Slovenia) and two from the US (Iowa State University and Cornell University) that addressed food safety as a policy oriented measure. This two year project's activities are to stimulate university-industry-regulator cooperation to better define the competences and skills that a graduate should acquire to quickly find a job and be successful in the food industry. Based on food industry needs, academics could highlight the critical areas in food safety educational programs and better train the students. The aims of this project is to increase the understanding (transparency), to encourage the harmonization and normalization of EU-US food safety regulations, and to improve student's education in food safety. This is accomplished by tuning the education curricula in food safety for Bachelor of Science and by including international case studies in lectures and tutorials. New teaching materials for lectures and tutorials are being produced that will serve both students and food safety professionals. One of the project´s goals was to provide a forum for international exchange of ideas through three international conferences where a number of regulators, educators, industries, and students were involved. This project has already allowed the academics involved in the program: mobility, industry visits, discussions with food safety regulators from US and EU, and opportunities to work with students from the partners` countries.

Major Outcomes Until Now

- Questioners for testing students` knowledge on food safety
- Industry Visits in USA and Slovenia within project mobility activities
- Food safety case studies portfolio
- Classes with students in Slovenia held by international team of lecturers
- Attending two Atlantis conference – Berlin -2010 and in Brussels in 2012
- Chairing a educational workshop in Maribor, Slovenia at the **9th Slovenian Biochemical Society and 5th Slovenian Microbiological Society**

KEY WORDS Food safety, education, competencies, knowledge, skills, training

Innovative Tools and Strategies for the Implementation of Food Professional Skills and Expertise - the TRACKFAST project

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Web site : https://www.trackfast.eu/

Basic Structure of The Project:

The food and drink industry is the largest manufacturing sector in Europe, being 50% of the annual turnover generated by SMEs and microenterprises. The sector is highly fragmented, being 99% SMEs. The European food industry is in the lower part of the innovation performance ranking, and is losing relative importance in the global food market.
TRACK_FAST is a consortium, funded by the European Framework Programme 7, which strongly believes that the restoration and maintenance of EU's food industry leadership in the global economy can only happen through promoting a higher degree of innovation and competitiveness in the food sector.
This, in turn, can only be achieved by a profound change in Europe's food workforce (who must to be updated on the most recent skills and issues in the industry) and in its employers (who need to select the most skilled candidate for each function). The combined experiences of the members of the consortium consider that these profound changes must be based on: 1) An awareness and understanding of personal skill requirements of the different segments (functional and size segments) in food sector job market; 2) The establishment of a framework for continued professional training and retraining, and for career development for the food professional; 3) Regulation of food science and technology professions in Europe. 4) Motivation of young people to enter and pursue of a career in food science and technology in Europe.

Major Outcomes Until Now:

- Identification and definition of personal skills requirements in food job market

- Food profession regulations, where existing, were analyzed and recommendations were proposed
- A framework for continual professional training and career development (CPD) for the FST professional was established (www.foodcareers.eu)
- Motivation of young people to enter and pursue of a career in food science and technology in Europe (www.foodgalaxy.org)

KEY WORDS

food professionals, skills, careers, innovation, continual professional development, regulation, motivation, 7FP

LINK to be permanently informed: https://www.trackfast.eu/node/284

CAPINFOOD-Improving the enabling environment and public awareness for innovation in the South-East-European food sector through transnational collaboration

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Main Objectives of the Project:

The CAPINFOOD project is funded by the South East Europe Transnational Cooperation (SEE) programme **(EOI Ref. No**: SEE/ B/0027/1.3/X). It is aimed at improving the enabling environment for food innovation in SEE countries by capacity building of the supporting institutions, by reducing the barriers of innovation, by promotion of public awareness on benefits of food sector innovation through transnational collaboration. Specific objectives are: to develop/upgrade national food innovation strategies for the food sector in 9 SEE countries, to improve the coordination of the related institutional framework at both national and SEE regional level, to develop skills of innovation promotion institutions in using comprehensive tools for supporting SMEs, to promote the use of ICT based tools for fostering innovation in the food sector, to develop pilot systems for institutions for provision of collective innovation support services for food SMEs, to improve the social appreciation of food innovation and entrepreneurship, to disseminate the results of the project to a wider community – especially to young people- and also beyond the food sector, to integrate non EU countries into the development of south East Europe, to concert efforts and share successful approaches related to food innovation by establishing a regional forum in the South East European area for exchanging experiences and successful practices of the National technology Platforms of the ETP Food for Life and other voluntary initiatives of the stakeholders..

Major outcomes until now:

- Development of the concept for a campaign to increase the public appreciation of food innovation in 9 SEE countries,
- Development of tools for analysing the system and innovation supporting capacity of institutions and the environment of food innovation.

- Carrying out 2-2 focus group discussions in 6 SEE countries and in a neighbouring country on food innovation supporting capacity and innovation environment
- Preparation of a conceptual framework for the development or upgrading of national food innovation strategies by application of a food chain management approach of innovation and exploitation of the opportunities in a transdisciplinary collaboration with other sectors particularly with ICT
- Development of the first draft of modular training materials on knowledge transfer to food SMEs and on food chain management, starting the development of a training material on using ICT based solutions for enhancing innovation in the food sector,
- Starting the development of a guideline on dialogue with policy makers
- Designing an intelligent knowledge distribution management tool

Keywords: Food innovation strategies, collective support for SMEs, capacity building of innovation supporting institutions, food chain management, ICT for food innovation

FEED-PRO-FOOD: Research cooperation on developing fish **FEED** for **PRO**motion of healthy **FOOD** in the region

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Web site: http://feed-pro-food.uns.ac.rs

FEED-PRO-FOOD is a research project funded by the European Instruments for pre-accession (IPA).

Animal feed research in Serbia is well established and Hungary has significant research background in both animal and human nutrition and it is reasonable to link research on feed quality in Serbia with food quality and health effect research in Hungary. The south-eastern part of Hungary and Vojvodina share the same agro-environmental conditions, with well developed fish production. It is therefore important to introduce a new product, in the form of fish feed with superior physical and nutritional properties, which will be used for producing healthy food. By use of contemporary technological processing, a floating type of fish feed, with added health beneficial omega-3 fatty acids, will be produced and tested in feeding trials with common carp. The quality of fish meat will be assessed in trials with mammalian model animals (rats) and specific physiological effects, having significance in human nutrition, will be evaluated.

It is expected that the meat of carp fed newly developed feed will have ratio of omega-6/omega-3 acids narrowed closer to the marine fish ratio. As common carp is widely consumed in both Hungary and Serbia, this will lower the risk of cardiovascular deceases in the region. Furthermore, by addressing feed and fish quality and production, this project will indirectly enhance the innovative capacity of SMEs in the region. It is expected that the floating feed developed in this project will bring benefits to feed and fish producers through improved income/expense ratio, as this feed will be more efficient than the standard feed. Added-value of this project will be a positive environmental effect. As it is possible to monitor the consumption of floating feed by fish, its wasting and decomposition in ponds and consequent pollution of environment, will be prevented.

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IMPROVEMENT OF SAFETY OF CORN-BASED FEEDSTUFFS THROUGH USING MORE RESISTANT HYBRIDS AND MANAGEMENT OF CORN PROCESSING

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The project under the name of "Improvement of safety of corn-based feedstuffs through using more resistant hybrids and management of corn processing" is approved under the Instrument for Pre-accession Assistance (IPA) within the 2007-2013 European Union financial framework (www.hu-srb-ipa.com). The project acronym "TOX-FREE-FEED" suggests the main aim of the project, which is to reduce the mycotoxin content in feed for farm animals.

The South-Eastern part of Hungary and Vojvodina share the same agro-environmental conditions, which are highly favorable for corn production. However, the cultivated corn hybrids differ on the two sides of the border, in spite of the similar weather conditions. Mycotoxin contamination of corn is a worldwide threat to both safety of human food and animal feed. One of the aims of the project is to examine the resistance level of the most frequently cultivated corn hybrids in the region to get information on their safety as feed ingredients, and to clarify which cultivars are suited best to these climatic conditions. Another aim is to examine the mycobiota and mycotoxin contamination of corn hybrids during harvest and after storage to get insight into their effects on animal welfare. The project also aims to investigate the influence of various treatments (mechanical, physical and chemical treatments, as well as usage of various absorbents) on reduction of mycotoxin content in corn and feed for farm animals.

Identification of corn hybrids more resistant to mycotoxin accumulation will enable farmers to use these hybrids, leading to improved animal welfare, and consequently improved human health. Identification of the methods which are optimal for preparing mycotoxin-free feed from corn will be of great importance for feed manufacturers.

The four project partners in this project are: University of Szerged (Hungary), Faculty of Agriculture (University of Novi Sad, Serbia), Cereal Research Non-profit Ltd. (Szeged, Hungary) and Institute of Food Technology (University of Novi Sad, Serbia). More information about project can be seen on web site: www2.sci.u-szeged.hu/microbiology/TOXFREEFEED/index.php

Key words: IPA, corn, mycotoxins, feed

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FOOD SCIENCE AND NUTRITION RESEARCH IN FP7 CALL 7 AND HORIZON 2020

Dr Jürgen Lucas

European Commission

EU-funded research and innovation has been covered from 2007 to 2013 by the Seventh Framework Programme and is expected to be covered from 2014 on by Horizon 2020. The future strategies and programmes related to food and nutrition will be presented._

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The planned approach for 2013 in Food, Agriculture and Fisheries, and Biotechnology (FAFB) and "Fork to farm": Food (including sea-food), health and well-being is shown in the Orientation Paper 2013, which is a non-binding document presenting priorities and orientations for the 2013 calls of FP7._

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The period from 2014 is based on the Commission Communication on Horizon 2020, which is a proposal under political discussion._

XI EDUCATION, INNOVATION AND KNOWLEDGE TRANSFER

INNOVATIVE CONTENTS OF FUTURE SPECIALISTS TRAINING OF FOOD INDUSTRY

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The modern stage of food industry development requires the high-skill specialists training, who can solve complex production problems constructively, arising in the conditions of tough competition on economic market of country. The higher educational establishments play the main role in personnel training. Nowadays they have to orientate the future specialists of food industry to implement the modern developments of foodstuffs, technologies, techniques in production process. The modern engineer-technologist of food industry must have: systematic knowledge, practical abilities and skills, professional important qualities and competencies; abilities to solve production problems constructively.

The instructional content plays an important role in the vocational training of specialists. The basic directions of instructional content improvement are information presenting concerning arrival of new foodstuffs, innovative technologies of production, the development of new equipment and improvement of existing one of food industry. The selection and foundation of ingredients are carried out in accordance with medical-biological, technological and clinical aspects in instructional content of new foodstuffs. In the instructional content of innovative technologies of food output production the modern tendencies are presented on the following directions: the selection and foundation of optimum technological conditions and regimes of food output production; the technological cycles reduction of output production; the intensification of technological processes at the expense of modern enzymatic agents using, temperature regimes, impulse oscillations of heatagents, coldagennts, electromagnetic and ultrasonic influence etc.; the new stabilizing systems using; the improvement of technologies with using of nontraditional sources of energy (biogas, energy of sun, wind etc.,), the improvement of energy-saving technologies, the technologies of recirculation of streams (hot steam, water, smog gases, drying agent); the improvement of non-waste technologies.

The instructional content of technological equipment of food industry is formed from educational elements concerning equipment classification learning, the designation of environment, raw material, products, conditions, the influence of external and internal factors, the acquaintance with structure and principle of operation of the most typical equipment, the detection of problem elements in equipment structure, the search of improvement directions of equipment structure considering functional, economic and human criteria.

The systematic approach to vocational training content development, the considering interdisciplinary connections, the teaching of modern training material will allow to train high - skill creative specialists of food industry.

Key words: food industry, vocational training of specialists, innovative contents of training, modern foodstuffs, innovative technologies and equipment.

POTENTIALS AND LIMITATIONS OF ENTERPENOURSHIP AMONG ACADEMIC INSTITUTIONS REPRESENTATIVES IN AGRO FOOD SECTOR IN SERBIA

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In innovative society as European strives to be, entrepreneurship based on innovations originating from academic research gains permanently in importance. One of the possibilities for achievement of this goal is initiation of start-ups and spin-offs by the representatives of the research community itself.
Attitudes, personalities, cultural characteristics, knowledge and skills are only some of the personal features related to the probability and potential of initiation of entrepreneurial projects by representatives of academic community.
The research based on the questionnaire targeted to collecting of data related to mentioned characteristics among academics involved in agro-food research was conducted was conducted in academic Institutions in Serbia.
The relations among potential features of researchers and probability of initiation of enterprise ware analyzed and the most influential factors supporting entrepreneurship among academics were detected.
Based on conducted research recommendations for improvement of potential for entrepreneurship among academics are provided.

MARKETING ORGANIZATION ACTIVITIES IN LEADERSHIP COMPANY FOR PURCHASE, PROCESSING AND MARKETING OF NON-WOOD FOREST PRODUCTS IN VOJVODINA

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In addition to the traditional use and a range of benefits they have for local communities, non-wood forest products (NWFP) occupy a significant place in the market, particularly given the expansion of organic production and consumption. The wealth of natural diversity of Vojvodina creates an exceptional foundation for the development of entrepreneurship based on the purchase, processing and marketing of NWFP. Regardless of company size, organizational structure adequately organized, in relation to market conditions and general environment, makes one of the key determinants efficiently and effectively operations. The goal pursued in this paper is to examine and analyze the organizational leadership of an enterprise system for processing and marketing of medicinal plants, primarily with the marketing aspect. Focusing on the leading companies in the industry, in Vojvodina, the research is conducted with the purpose of gaining insight into the functioning of organizational structures and ways of organizing marketing activities in it. The subject of this study was to flow from the moment of purchase of raw material base and distribution of finished products. As a research technique, used a survey that included questions about how to organize the department in the company, personnel structure and other internal features of the company. On that basis formed a SWOT matrix, in which they are confronted by the weak and strong companies with external opportunities and threats. The maximum capacity utilization of the developed distribution network and price competitiveness, contribute to the leading position of the surveyed companies. The increasing demand for organic plant products, creating huge potential for growth and development of the company in the future.

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