Arhiv za higijenu rada i toksikologiju

Archives of Industrial Hygiene and Toxicology

2018;69(Suppl. 1)

Abstracts of the 2nd International Congress on Food Safety and Quality

"Food Life Cycle"

Opatija, Croatia, 13-16 November 2018

Cover page: *Opatija*

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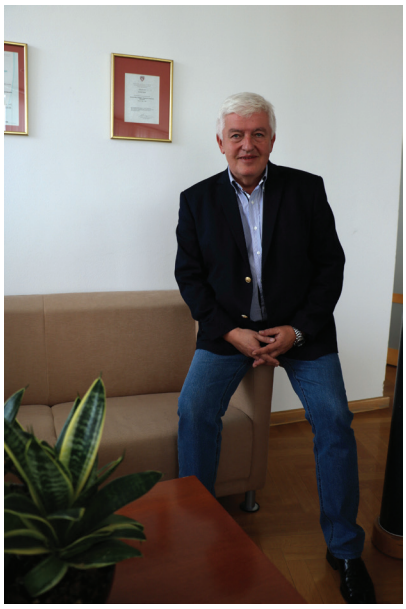

Distinguished colleagues, dear friends,

It is my great honour and pleasure to welcome you on behalf of the Organizing and Scientific Committee of the **2nd International Congress on Food Quality and Safety - "Life Cycle of Food"**, held in beautiful Opatija from 13th to 16th November 2018.

The great interest with which the First Croatian Congress on Food Safety and Quality with International Participation was met inspired us to organise an even better and more educational Congress this year, with the aim of fostering an exchange of experiences between Croatian and international experts, as well as raising awareness on the topic of food health and safety.

The Second Congress will include current topics in the field of food safety and quality, with an emphasis on effects on human health, as well as discussions on new technologies, crisis communication and risk management, organic food production and GMO, management systems, testing, certification and accreditation, and development and application of analytical methods. In addition, there will be also discussions on the microbiological safety of food, the safety of materials coming into contact with food and potable water, geographical origin and food adulteration, prevention of diseases and food borne diseases, health tourism, trends in food supplements, online sales of food, news in the field of nutrition in kindergartens, and many other important and related topics. The World Health Organization supports the organisation of the round table on Food Waste Management and Food Donation, while the European Regional Development Fund funds the "Centre for Food Safety and Quality" International Conference.

The organisers and co-organisers of the Second International Congress on Food Quality and Safety are the Andrija Štampar Teaching Institute of Public Health, the Croatian Metrology Society, the SEES-FSQC South-East European Network for Food Safety and Quality Control, the Croatian Institute of Public Health, the Ruđer Bošković Institute, the Faculty of Agriculture and the Faculty of Food Technology and Biotechnology of the University of Zagreb, the National Laboratory for Health, Environment and Food, Maribor, the Institute of Public Health of Vojvodina, Novi Sad, the Institute of Health and Food Safety Zenica, and the Institute of Public Health of the Republic of Srpska, Banja Luka, in cooperation with other distinguished institutions from the country and abroad.

Touching upon the key assumption that food safety is a shared responsibility of the state, producers, distributors, professionals, but also consumers, this year's Congress welcomes distinguished speakers and interlocutors presenting professional and current topics in this field. In addition to plenary lectures, whose lecturers have kindly accepted our invitation, the Congress will include oral presentations, satellite symposia, workshops, and posters. In the poster section, you will have the opportunity to meet the posters' authors and discuss their work and the latest findings in the field of food safety and quality. In total, 73 lectures and 51 posters from the country and the world have been announced, and we expect the attendance of more than 350 participants.

This Book of Abstracts is a supplement to the journal "Arhiv za higijenu rada i toksikologiju-Archives of Industrial Hygiene and Toxicology", published by the Institute for Medical Research and Occupational Health, Zagreb. We are thankful to the Archives' editor-in-chief and editorial board for accepting the publication of lecturers' presentation abstracts, as well as other oral and poster presentations from the Congress.

On this occasion, I would also like to extend my gratitude to the Mayor of the City of Zagreb Milan Bandić, for having accepted the Congress' organisation under his high auspices, and the Ministry of Science and Education, the Ministry of Health, the Ministry of Agriculture, the Ministry of Tourism, the Croatian Food Agency, the Croatian Accreditation Agency, the State Institute for Metrology, the University of Zagreb, and the Croatian Society for Quality for agreeing to act as patrons. We also thank the World Health Organization for their support and active participation in the realisation of this congress.

We sincerely thank the sponsors who, with their support, contributed to the organisation of this Congress.

Finally, once again, I thank all the participants for their contribution to a common goal, which is to provide credible information on food safety and quality, and to give guidance and advice for improving the system of food safety and quality, "from field to table".

Sincerely,

Zvonimir Šostar, MD
Congress Chairman

ABSTRACTS

INVITED SPEAKERS

The Ruđer Bošković Institute: food for thought

Smith DM**, Mihaljević B, Maltar Strmečki N, and Balog T

Ruđer Bošković Institute, Zagreb, Croatia

The Ruđer Bošković Institute (RBI) is the largest and most multidisciplinary scientific research institution in the Republic of Croatia. While the RBI is primarily concerned with fundamental research in fields ranging from theoretical physics to environmental research, its presence in applied science is currently expanding. The present contribution will demonstrate how fundamental concepts in physics and chemistry can be applied to the areas of food safety and quality. For example, the RBI's historical expertise with ionising radiation can be harnessed for the purpose of controlled sterilisation. Such treatments, as well as other processes can, however, lead to the formation of free-radical species with unpaired electrons. High-sensitivity detection of free radicals is possible in the presence of strong magnetic fields using electron paramagnetic resonance (EPR) spectroscopy, a technique which the RBI has used for fundamental research for many years. On the other end of the spectrum, the demand for products low in sugar is increasing markedly in recent times. This has led to an increased use of artificial sweeteners. Such substitutions, however, can have a dramatic influence on the physical and chemical properties of certain preparations. This situation opens new ways of leveraging RBI's fundamental knowledge of physical chemistry for concrete applications in the food industry.

KEY WORDS: *artificial sweeteners; EPR; free radicals; radication; sterilisation*

**dsmith@irb.hr*

Plan for crisis management in the field of food and feed safety

Petričević A*

Ministry of Agriculture, Veterinary and Food Safety Directorate, Department for Incidents Management and Rapid Alert System for Food and Feed (RASFF), Zagreb, Croatia

The European Union as a large common market is exposed to many challenges in terms of Food Safety and consumer protection. In order to protect the common market and consumer health in the last fifteen years, a number of regulations have been adopted to reach the highest standards of food safety in the world. Nevertheless, individual major or minor incidents involving certain Member States can still occur sporadically. Fortunately, a system in place such as the Rapid Alert System for Food and Feed has proven effective and put many food safety risks under the control. In cases when the existing systems are not in a position to overcome a crisis, in accordance with Regulation 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety, the Commission adopted Decision 2004/478 concerning the adoption of a General plan for food/feed crisis management. Pursuant to this Decision, the Republic of Croatia, in accordance with the Food Act (Official Gazette 81/13, 14/14) and the Act on Official Controls carried out in accordance with the Food, Feed, Animal Health and Animal Welfare Regulations (Official Gazette 81/13, 14/14, 56/15) developed, and adopted a crisis management plan in the field of food and feed safety. The Plan establishes a national and regional crisis headquarters with the aim of taking swift, effective, and co-ordinated activities and measures to eliminate the existing risk or alleviate it to the fullest extent possible.

KEY WORDS**:** *consumer protection; incident; national and regional crisis headquarters; risk*

Communication in crisis – when every word counts

Vitale K**

Andrija Štampar School of Public Health, School of Medicine, University of Zagreb, Zagreb, Croatia

Communication in crisis is one of the steps in the reducing and prevention of secondary risks in emergency situations. Communication is not just informing and raising awareness, adequate communication at the same time could reduce population vulnerability and material damage. Crisis communication in emergency situations regarding food consumption, supply and production is structured in three main levels. First is vertical, bottom up that involves communication within institutions starting with the first one recognising the elements of crisis like health care institutions up to the ministries and state departments. At the same time lateral communication involves jurisdiction institution like police and state attorney's office. Third structure of communication is communication with media and population that requires particular skills and knowledge, because only efficient communication with the social environment is raising chances for success in emergency situations. Appropriate crisis communication can help make population safer and promote changes from culture of reaction to a culture of prevention.

KEY WORDS: *culture of prevention; emergency situations; levels of communication*

**alen.petricevic@mps.hr*

***kvitale@snz.hr*

Organic production and interpretation of results in analytical laboratory

Jurak G* and Krivohlavek A

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

The aim of this work was to present different EU guidelines and legal regulations in the interpretation of residues in organic food. The use of pesticides is limited in organic production. Only a few natural substances have been authorised according to Regulation (EC) No 889/2008. Synthetic pesticides, which make up the largest share, are banned. Pesticide residues in the food may indicate deliberate use on the part of producer or the food processor (intentionally mixing food from a different method of production). The important control tool is pesticide residue analysis in the analytical laboratory. They are carried out in conventional as well as in organic foods. Existing EU legislation for organic food gives very little guidance with regard to the handling of pesticide residues and especially interpretation results in the analytical laboratory. What is the maximum residue level (MRL) in analyses of pesticide residues in organic food, and what about positive analyte exceptions? Can we use measurement uncertainty in the interpretation of results? There are different opinions between experts regarding this problem. In the absence of official guidances from the EU, organic food processors, merchants, as well as the certification body and authority relied on inofficial guidance of their own design. In the EU, there are several guidances from the German Organic Processors and Traders Association (BNN), Bio Suisse, International Federation of Organic Agriculture Movements (IFOAM), European Organic Certifiers Council (EOCC), etc. It is crucial that in the period until the EU official guide for the interpretation of the analytical results is provided, the opinion of experts be harmonised and a national guide created.

KEY WORDS: *EU regulation; maximum residue level (MRL); measurement uncertainty; pesticide residues*

ACKNOWLEDGEMENTS

The activity is carried out within the “Food Safety and Quality Center” project funded by the European Regional Development Fund.

**gordana.jurak@stampar.hr*

METROFOOD-RI as a reality to support harmonisation and standardisation in food quality and safety

Zoani C*

ENEA – Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Rome, Italy

Measurements play a key role in every aspect of process control and the evaluation of quality and safety of products: from the determination of nutritional value, bioavailability and biological value of nutrients, to the evaluation of freshness, nutraceutical properties and sensory characteristics, up to chemical and microbiological safety checks, detection of food adulteration and frauds, food authentication, and control of raw material and product traceability. In the food sector, measurement reliability is a key factor to effectively address technological innovation, sustainability, food safety, and security actions. In order to generate more effective European food chain systems, promote scientific excellence, integrate and harmonise scientific research in the field of food quality and safety, and promote metrology in food and nutrition, a new research infrastructure has been designed and is now under development; the METROFOOD-RI "Infrastructure for promoting Metrology in Food and Nutrition" (ESFRI Roadmap 2018 – Domain "Health & Food"). It has been designed to establish a strategy to allow reliable and comparable analytical measurements in foods along the whole value chain, from primary production until final consumption. In full harmony with the Responsible Research & Innovation principles, it will provide high-quality metrology services, comprising an important cross-section of highly inter-disciplinary and inter-connected fields throughout the food value chain, including agrifood, sustainable development, food safety, quality, traceability and authenticity, environmental safety, and human health. All this should take place acting on the real plan of measurement reliability and procedure harmonisation and adopting the FAIR (findability, accessibility, interoperability, and re-use/reproducibility) approach on data management. The scientific offer is addressed to a broad set of users and stakeholders, such as public and private labs and groups engaged in research activities for food data collection and measurement reliability and basic frontier research in food and nutrition; Food Business Operators and producer associations; policy makers, food inspection and control agencies; consumers/consumer associations, and citizens.

KEY WORDS: *FAIR data; food and nutrition; food integrity; metrological traceability; research infrastructure*

Food Safety and Quality Control Center

Šostar Z**, Šikić S, and Krivohlavek A

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

The Andrija Štampar Teaching Institute of Public Health initiated the establishment of the Food Safety and Quality Control Center, the aim of which was to strengthen the research and analytical capacity in the food safety area as support to strengthening the competitiveness of food producers in the Republic of Croatia. The Center will provide food producers and consumers with the latest information on public health and scientific achievements. The Center's task will be to connect public health and scientific institutions with the population and medium and small businesses to align production with the highest European standards. Furthermore, the mission is to improve the existing quality of food production and products with the aim of increasing the competitiveness of domestic products. Unambiguous proof on the geographical origin of foods will lead to the recognition of quality and safe food products on domestic and foreign markets. The Center will establish unambiguous control of food safety based on the isotope ratio of the characteristic elements, food analyses, and environmental samples necessary for the protection of the origin and geographical origin of the product, and analysis of food and soil and water samples for organic food production. Within the Center scientific research projects will be implemented along the following themes: 1. "Determination of origin and geographical origin of foodstuffs", 2. "Control of nutrition of food products", 3. "Valorisation and Control of Organic Food", and 4. "Evaluation of sensory properties of Croatian original agricultural and food products".

KEY WORDS: *geographical origin; isotope ratio; organic food; public health*

ACKNOWLEDGEMENTS

The activity is carried out within the "Food Safety and Quality Center" project funded by the European Regional Development Fund.

**claudia.zoani@enea.it*

***zvonimir.sostar@stampar.hr*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):13-14

Laboratories, the new ISO/IEC 17025, and the digital transition

Silva Ribeiro A*

European Federation of National Associations of Measurement, Testing and Analytical Laboratories, Brussels, Belgium

Laboratories have made significant progress, accompanying the increasing complexity that has led to today's world. The speed of change requires a dizzying adaptation that addresses the challenges of technology, consumer, and citizen expectations and social change. The impact of all changes means that the backing of laboratory activity needs to be revisited so that it is not a barrier to development. Standardisation is no exception, and as such, the revision of ISO/IEC 17025 that supports accreditation has undergone a profound change when analysing its new approach and concepts. This standard introduces a broad view of laboratory management, with less constrains, where the model has more variables and no longer has a linear and conventional perspective of the laboratory activity. There are a number of changes that should be highlighted, including the most obvious ones, risk-based thinking and decision rules, as well as focus on the customer (aligning it with ISO 9001). However, one aspect is particularly evident; the orientation towards a digital-based management model. This fact is strongly associated with the current and future practices of laboratories, where the digital transition plays a fundamental role. Thus, this paper aims to address the challenges and risks that this transition has and how laboratories should address this subject with particular caution.

KEY WORDS: *accreditation; laboratory management; standardisation*

**asribeiro@lnec.pt*

High resolution accurate mass spectrometry using sequential mass window data acquisition for identification of emerging migrants in baby food packaging

Rodríguez Fernández-Alba A[1]*, Bauer A[1], Jesús F[2], Gómez Ramos MJ[1], and Lozano A[1]

Chemistry and Physics Department, University of Almeria, Agrifood Campus of International Excellence (ceiA3), Almería, Spain[1], Grupo de Análisis de Compuestos Traza, Polo de Desarrollo Universitario "Abordaje holístico", CENUR Litoral Norte Sede Paysandú, Universidad de la República, Paysandú, Uruguay[2]

There is increasing concern over safety assessments of food packaging. EU legislation requires hazardous chemicals in food contact materials containing complex mixtures of known compounds, monomers, additives but also unknown degradation products and impurities not to taint food or affect human health. Plastic multilayers are widely used for baby food packaging applications. Adhesive materials applied for bonding the layers provide compounds that can affect the migration impact of the packaging. The identification of all potential migrants of both intentionally and non-intentionally added substances is required to assess the safety of these materials. Using high resolution accurate mass spectrometry with data independent acquisition method with sequential windowed acquisition of all theoretical mass spectra (SWATH) enables the automated detection of all peaks in MS and MS/MS mode with corresponding deconvoluted fragment mass spectra. Identification of unique non-targeted peaks in food simulants, followed by formula and structure elucidation, combined with in-house libraries, open databases, and bibliographic search were performed. This approach allowed the identification of 42 potential migrants in baby food, presenting three common migrating compounds and 39 non-intentionally added substances. The non-targeted approach in combination with these techniques was proven to be a powerful tool for the characterisation of baby food packaging materials.

KEY WORDS: *EU legislation; food safety; migration impact; SWATH*

**amadeo@ual.es*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):16-17

Connection of sensory properties of traditional food products and protected names of agricultural and food products

Mikulec N*, Antunac N, and Mioč B

Faculty of Agriculture, University of Zagreb, Zagreb, Croatia

The Republic of Croatia has a large number of traditional food products recognised by consumers. Consumers associate food specific characteristics with a particular region. The European Union has recognised the importance of distinguishing quality products at regional level through labels such as *Protected Designation of Origin* (PDO), *Protected Geographical Indication* (PGI), and *Traditional Specialties Guaranteed* (TSG). In order to register the product under one of the aforementioned labels it is necessary, within the analytical methods such as determining the isotope ratio of the characteristic elements, to determine the sensory properties of the product. Assessors with their senses of vision, touch, hearing, smell, and taste perceive a particular product, critically evaluate it, and interpret its sensory properties. Specific technologies for the production of traditional food products are closely related to a specific geographic position and habits of the population which result in the variability of the final product. Therefore, it is necessary to establish a system for evaluating the sensory properties of traditional food products in Croatia and develop models for calculating their connection with technological factors in production. For this purpose, within the Center for Food Safety and Quality, a Laboratory for Sensory Properties of Agricultural and Food Products will be established at the University of Zagreb, Faculty of Agriculture.

KEY WORDS: *quality labels; system for evaluating sensory properties; traditional agricultural and food products*

ACKNOWLEDGEMENTS

The activity is carried out within the "Food Safety and Quality Center" project funded by the European Regional Development Fund.

Food fraud and the food fraud network

Gutić S**

Ministry of Agriculture, Veterinary and Food Safety Directorate, Zagreb, Croatia

Food fraud is a collective term that covers cases where there is a violation of EU food law committed intentionally to pursue an economic or financial gain through consumer deception. Although there is no EU harmonised definition for "food fraud", the lack of one does not prevent the European Commission and the Member States from taking coordinated action against "fraudulent practices" in the food supply chain. In recent years, the fight against food fraud has become an EU priority aimed at keeping the highest food safety standards. In July 2013, for the purposes of ensuring cross-border administrative assistance and cooperation, where action is required in more than one Member State, on matters that relate to potential fraudulent deceptive practices, the EU Food Fraud Network (FFN) was established. FFN is composed of contact points from 28 Member States including a contact point from Switzerland, Norway, Iceland, and the Commission. These national contact points are called food fraud contact points (FFCPs). The FFN enables exchanges on potential food fraud cases and also serves as a forum for discussion on the coordination and prioritisation of action at EU level on "food fraud" matters. The fact that the number of detected food fraud cases grows year after year is certainly due to the fact that this activity brings significant benefits to the one who deals with it. In 2014, interaction on 60 cases took place through the FFN while 178 cases were exchanged in 2017 at Member State level.

KEY WORDS: *assistance; coordination; detection of consumer deception; EU Member States; violation of EU food law*

**nmikulec@agr.hr*

***sandra.gutic@mps.hr*

Food fraud from laboratory perspective – yesterday, today, tomorrow

Lasić D*, Bošnir J, Brkić D, Prskalo I, and Stjepanović B

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Today, food authenticity is one of the most demanding issues for consumers when purchasing foodstuffs. Globalisation has its negative side, and proving food fraud is becoming increasingly demanding for laboratories. This study explored the known ways of counterfeiting food through history and some pathways of counterfeiters today and provides a short guidance for the future. Sometimes scams are manifested in the wrong presentation of the product, either intentional or unintentional, so the study will include some examples from practice. The aim of the study was to examine several different categories of food (honey, fruit juices, olive oil, milk, meat products) on selected types of analytical parameters that may indicate food fraud. This will give a critical review of the advantages and limitations of each method, as well as open up future perspectives.

KEY WORDS: *advanced analysis; food authenticity; food counterfeiting, food safety; mislabelling*

ACKNOWLEDGEMENTS

The activity is carried out within the "Food Safety and Quality Center" project funded by the European Regional Development Fund.

**dario.lasic@stampar.hr*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):18-19

Application of stable isotope ratio analysis for olive oil and honey

Krivohlavek A*, Šikić S, Bošnir J, Ivešić M, Petrović M, and Šostar Z

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Olive oil and honey are natural products whose quality is defined both by its botanical and geographical origin. Their consumption by humans began thousands of years ago. Consumers demand certain varieties with premium prices. The versatile use of olive oil and honey has always been thought to be part of a healthy lifestyle. At the same time, they are the most commonly adulterated ingredients, olive oil on the first and honey on third place. Olive oil is adulterated with cheaper oils and honey with high fructose corn syrup (HFCS). These problems could easily be detected by liquid chromatography using an elemental analyser isotope ratio mass spectrometer (LC/EA-IRMS). Isotopes of an element have different numbers of neutrons and different masses. Stable isotopes of an element are those isotopes that do not decay through radioactive processes over time. Some of these elements are hydrogen, carbon, nitrogen, oxygen, sulfur, strontium. A significant fraction of stabile isotopes always occurs in food. The carbon ratio tells us about feeding habits and the nitrogen ratio about available nitrogen in soil and atmosphere. A stable isotope ratio of hydrogen and oxygen provides information about the climatic conditions of the region, sulfur about the surface geology of the area. All these data can give us information about olive oil and honey adulteration and geographical origin.

KEY WORDS: *adulteration; element; geographical origin; healthy lifestyle; isotope*

ACKNOWLEDGEMENTS

The activity is carried out within the "Food Safety and Quality Center" project funded by the European Regional Development Fund.

Legislation and official controls for pyrrolizidine alkaloids, ergot alkaloids, and tropane alkaloids in the Republic of Croatia

Ivančev J**

Ministry of Health of the Republic of Croatia, Zagreb, Croatia

Over the past few years, some known dangers in the area of agricultural contaminants, which were not previously regulated by legislation (e.g., ergot alkaloids), were given great attention, as well as some new dangers such as pyrrolizidine alkaloids and tropane alkaloids. Food manufacturers should focus more on these dangers because, due to some, such as tropane alkaloids, food can be withdrawn from the market simply on the basis of a risk assessment, without any legal framework being adopted. Ergot alkaloids are well known mycotoxins that produce several types of fungi of the *Claviceps* genus, the most abundant type in Europe being *Claviceps purpurea* (rye ergot fungus, ergot). Out of the 50 known types of ergot alkaloids, the arrangement on the level of the EU is to monitor and report on the maximum levels of the sum of 12 *Claviceps purpureae* ergot alkaloids. Commission Regulation (EU) 2015/1940 prescribes the maximum levels of ergot sclerotia as a first step, including gathering further data on the presence of ergot alkaloids in cereals and cereal products, which is being discussed with regard to the expansion of the legal framework on other food groups. Tropane alkaloids are secondary metabolites that naturally occur in plants of several families. The most studied tropane alkaloids in food are atropine, hyoscyamine, and scopolamine. Based on information from the EFSA, the dietary exposure of toddlers could significantly exceed the group Acute Reference Dose (ARfD). That is why a maximum level for atropine and scopolamine in cereal-based foods for infants and young children containing millet, sorghum, and buckwheat has been established under Commission Regulation (EU) 2016/239. After Regulation (EU) 2016/239 was adopted, EFSA researched other food groups, and based on the found data, there were issues with starch-based food, as well as several different food groups. Pyrrolizidine alkaloids (PA) are natural toxins that are created as secondary metabolites in over 6000 plant species and are considered the most widespread natural toxins. The main issue drawn from the EFSA report conclusion is the long-term concern for the health of young children and children up to 3 years of age due to the presence of PA in honey and teas, as well as the health of people who consume teas and herbal preparations in large quantities. This should also be the concern of a large number of food business operators and requires an introduction of analyses of these alkaloids in the self-control system.

KEY WORDS: *agricultural contaminants; dietary exposure of children; fungi; mycotoxins; self-control system*

**adela.krivohlavek@stampar.hr*

***jasminka.ivancev@miz.hr*

Food consumption data in service of risk assessments

Sokolić D*

Croatian Food Agency, Osijek, Croatia

Risk assessment is the scientific evaluation of known or potentially adverse health effects due to human exposure to food-borne hazards. For such a risk assessment, it is necessary to know what is in the food, in terms of quality and quantity, and how it can or is affecting people's health. In addition, it is crucial to know by whom and in what quantities certain types of foods are consumed, so that the estimation may be as appropriate to the population for which the assessment is being made as possible. Therefore, the Croatian Food Agency (HAH) conducted the first national research of food consumption of the adult population in Croatia. The first national survey of food consumption of infants and young children in collaboration with the Faculty of Food Technology Osijek, Faculty of Food Technology and Biotechnology Zagreb, and the Croatian Institute of Public Health is currently in progress. Food consumption is influenced by a number of factors such as age, gender, region of residence, tradition, education level, economic status, seasonality, lifestyle, physical activity, and many others. Taking this into consideration, it can be concluded that food consumption is subject to change through time, therefore research of this type needs to be carried out at least every five years, in order to observe the trends and changes that arise. In carrying out surveys of food consumption, as well as when using the obtained data, it is extremely important to correctly and unambiguously tag/encode food. Therefore, the FoodEx2 classification is used in the EU, which is also implemented at national level in Croatia, for official controls of food and feed in the field of food safety.

KEY WORDS: *Croatia; food classification; food safety; national survey of food consumption*

Towards food safety via bio-stimulated increasing of nutritional value of selected tomato varieties

Bulska E**, Kurek E, Michalska-Kacymirow M, and Tomiak A

Biological and Chemical Research Centre, Faculty of Chemistry, University of Warsaw, Warsaw, Poland

The aim of the presentation was to discuss the process of bio-stimulation of various plants towards increasing their nutrition value, with the example of selected tomato varieties. The project was conducted under the largest food-related initiative worldwide, EIT food pan-European partnership, with a consumer-centered approach to empower innovators, entrepreneurs, and students to develop world-class solutions to societal challenges, accelerate innovation, create jobs, and increase Europe's competitiveness. The aim of the project was to develop an on-field approach to the increasing nutritional value (bio-stimulated) of selected performant tomato varieties to be cultivated in areas with a temperate climate. It should be stressed that in temperate climates, the average yield per ha of tomato is significantly lower than international standards. Multiple trials were implemented to study physiological and agronomical performance under a wide range of growing conditions, with an improved eco-footprint. To increase the nutritional value of processed tomato, new bio-stimulants which increase mineral bioavailability for humans, will be developed. The procedure for enriched tomato with various biologically active substances, produced *in situ* by growing plants enriched with carefully selected bio-stimulants were developed firstly under laboratory scale conditions and, after proof-of-concept approach, transferred to be used in field conditions.

KEY WORDS: *agronomical performance; bio-stimulation; temperate climate*

ACKNOWLEDGEMENTS

The project was financed by the project "Increasing nutritional value (bio-stimulated) of selected performant tomato varieties to be cultivated in areas with temperate climate" funded by European Institute of Innovation and Technology (EIT), under EIT Food pan-European partnership (2017-2018). The study was carried out at the Biological and Chemical Research Centre, University of Warsaw, established within the project co-financed by the European Union from the European Regional Development Fund under the Operational Programme Innovative Economy (2007-2013).

**dsokolic@hah.hr*

***ebulska@chem.uw.edu.pl*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):20-21

Food supplements adulterated with erectile dysfunction drugs – pharmacological and toxicological health risk

Žuntar I[1]*, Krivohlavek A[3], and Putnik P[2]

Faculty of Pharmacy and Biochemistry[1], Environmental Protection and Health Ecology, Faculty of Food Technology and Biotechnology[2], University of Zagreb, Andrija Štampar Teaching Institute of Public Health[3], Zagreb, Croatia

The use of herbal remedies and dietary supplements has greatly increased worldwide. A survey based on the EU rapid alert system for food and feed (RASFF) showed adulterations of plant food supplements (PFSs) with a complex range of foreign substances. Among the most frequently noticed were sildenafil and its analogues, classified as phosphodiesterase type 5 inhibitors (PDE5Is). Sildenafil with vardenafil, tadalafil, avanafil, udenafil, mirodenafil, and lodenafil are the best-known compounds intended for medical treatments of erectile dysfunction (ED). Although all PDE5Is drugs are similar in their mechanism of action, their pharmacokinetics differ. Even though the addition of PDE5Is or theirs analogues are forbidden in foods and dietary supplements, they are widely available on the (illegal) market. This includes online stores and sales of various undeclared adulterants in PFSs. Because of falsely declared formulation in PFSs, they are often advertised as being "natural". Hence, many consumers perceive these products as being "healthier" and safer in comparison to conventional pharmaceuticals. PFSs adulterated with analogues pose a pharmacological and toxicological health risk as unapproved analogues are mostly of unknown pharmacokinetics and safety profile, thus putting consumers' lives at risk from different drug-drug and herbal-drug interactions with unpredicted adverse effects. Therefore, to protect public health it is necessary to enforce legal measures supported by adequate analytical methods and monitoring of the market. Additionally, it is critical to inform the public of possible health risks. This requires the involvement of the government, law enforcement, media, medical and pharmaceutical professions, and others.

KEY WORDS: *dietary supplements; herbal remedies; phosphodiesterase type5 inhibitors; public health risk; sildenafil*

Dietary supplements in athletes

Šalaj S*

Faculty of Kinesiology, University of Zagreb, Zagreb, Croatia

Dietary supplements are defined as commercially available products consumed as an addition to the usual diet and they are frequently used by elite athletes, to a greater extent than by non-elite athletes. Between 40 and 100 % of athletes typically use supplements, depending on the type of sport, level of competition, and the type of supplement. Athletes involved in different sports are expected to use different dietary supplements depending on the nature of the sport and for different purposes; for example, muscle building, immune system boosting, or energy. Two main question arise; what do athletes use and is there scientific proof of what enhances athlete's capacities and, in particular, performance? In a recent meta-analysis, supplements did not show statistically significant effects when compared to placebo in more than 48 % of papers. The most investigated dietary supplements are creatine, carbohydrates, beta-alanine, and proteins. Protein and creatine supplementation have both been demonstrated to increase strength and lean body mass, creatine has an ergogenic effect on anaerobic capacity improving performance in short duration and high intensity exercise, carbohydrates reduce fatigue and improve recovery during intense aerobic training, while beta-alanine positively improves high intensity cycling capacity, decreases fatigue rate, and enhances performance in rowers and wrestlers. The main concerns regarding sport supplements are related to the manufacturing, advertisement, and marketing of different products as well as efficacy and safety. There are good examples in some countries where sporting organisations or institutions make policies or programmes for supplement use.

KEY WORDS: *athletes' diet; athletic performance; creatine; immune system*

**izuntar@pharma.hr*

***sanja.salaj@kif.hr*

Foods and supplements – is the focus on prevention or treatment?

Banjari I*

Department of Food and Nutrition Research, Faculty of Food Technology, J. J. Strossmayer University of Osijek, Osijek, Croatia

We all know the famous quote by Hippocrates "Let food be thy medicine, and medicine be thy food", but the way we perceive our food has changed drastically in the meantime. Under the influence of globalisation and technological advancement, many aspects of our lives have changed immensely, and when it comes to our diet, these changes were not all good. We start to think of the health component food has only when our health is at risk. Yet, studies have shown that around 90 % of people advised to change their lifestyle after a serious medical event such as a heart attack fail to do so. Chronic diseases are and will continue to be the major burden to our society and they ask for a life-long commitment to our diet. We need actions that are more explicit, because basic recommendations for a healthy diet and a lifestyle are simply not enough. The number of new products, especially in the segment of functional foods and dietary supplements, accompanied with new technologies might be the solution we need.

KEY WORDS: *functional foods; supplements; prevention; treatment; new technologies*

**ibanjari@ptfos.hr*

High sensitivity analysis of acrylamide in potato chips by LC/MS/MS

Potkrajčić M*

SHIMADZU – SPONSORED LECTURE
Shimadzu d.o.o., Zagreb, Croatia

Acrylamide is formed unavoidably in starch-rich food in cooking and processing at high temperatures as with preparing potato chips, French fries, cereals, and roasted coffee via the so-called Maillard reaction of asparagine and glucose (reducing sugar). The health risk of acrylamide present in many processing foods became a concern immediately, because it is known that the compound is a neurotoxin and a potential carcinogen to humans. Shimadzu presents a novel liquid chromatography-tandem mass spectrometry (LC/MS/MS) method for the quantitative determination of acrylamide in potato chips using a modified QuEChERS procedure for sample extraction and clean-up, achieving high sensitivity and high recovery. This analysis method can be used to monitor the levels of acrylamide in processing food accurately and reliably. The QuEChERS method has proven to be fast and effective in the extraction of acrylamide from potato chips. The excellent performance of the method in terms of sensitivity, linearity, repeatability, and recovery is related to the outstanding efficacy of the LC/MS/MS used which features ultra fast mass spectrometry (UFMS) technology. The high sensitivity of the method allows the analysis to be performed with a very small injection volume (1 μL or lower) to reduce the potential contamination of samples to the interface of an MS system, which would be a great advantage in running food samples with high matrix contents and strong matrix effects. The maintenance of the interface of a mass spectrometer could also be reduced significantly.

KEY WORDS: *liquid chromatography; QuEChERS; ultra fast mass spectrometry*

The influence of lab water quality on liquid chromatography

Rumpl Tunjić S**

LABENA – SPONSORED LECTURE
Labena d.o.o., Zagreb, Croatia

High-performance liquid chromatography (HPLC) is one of the most widely used analytical techniques in laboratories. HPLC is applicable in the pharmaceutical, food, and beverage industry, scientific research, clinical trials, etc. HPLC techniques have been advancing greatly in recent years in their accuracy, speed, repeatability, and reliability. To maximise the benefits of all the advantages of HPLC techniques, it is of the utmost importance to have good laboratory water, which is the most commonly used reagent in laboratories. Consequently, the systems and techniques for water purification have been developed. The two main purposes of the water system are: (i) to prevent interference with the sample and (ii) optimisation of the performance of the analytical method of HPLC. This can be achieved by removing impurities in laboratory water.

KEY WORDS: *analytical techniques; high-performance liquid chromatography; laboratory water*

**matea.potkrajcic@shimadzu.hr*
***sladjana.rumpl-tunjic@labena.hr*

ORAL PRESENTATIONS

Arh Hig Rada Toksikol 2018;69(Suppl. 1):24-25

Gamma irradiation as a method for preserving and improving the safety of food

Mihaljević B*

Ruđer Bošković Institute, Zagreb, Croatia

Food irradiation is a physical method for food treatment comparable to processing food by heating or freezing it. Processing of food with low levels of radiation has the potential to contribute to reducing both spoilage of food during storage and the high incidence of food-borne diseases. The process involves intentionally exposing food, either prepackaged or in bulk, to gamma rays, X-rays, or electrons. The most common and approved sources of gamma rays for food and industrial processing are radioisotope sources of cobalt-60 or caesium-137 and linear acceletarors of electrons. Different doses of gamma radiation can be used for different purposes in food preservation. At present, the dose of radiation recommended by the FAO/WHO Codex Alimentarius Commission must not exceed 10 kGy, at which irradiated food is considered safe for human consumption. This is actually a very small amount of energy equal to the amount of heat required to raise the temperature of water by only 2.4 °C. Food processing by irradiation can solve specific problems of food losses and could complement other established technologies, in improving the quality and wholesomeness of food as well as in expanding trade in certain foods and agricultural products. In this lecture the effects of irradiation on the physicochemical properties of food will be described. The legislation and control mechanisms required to ensure the safety of food irradiation facilities will also be discussed. Education is seen as the key to promoting the understanding of the benefits that irradiation can provide.

KEY WORDS: *food irradiation; gamma facility; Gray; irradiation dose; radiation treatment*

Food waste generation and treatment in Slovene households

Vidić T**, Ferfila N, and Jevšnik M

Faculty of Health Sciences, University of Ljubljana, Slovenia

Most food waste is generated in households; however, measuring these amounts is difficult because of different ways of handling waste. The aim of this study was to obtain data on food waste generation and treatment in households and based on that determine the share of food waste that ends up outside the public waste treatment system, determine the composition of food waste by type of food, and test the selected method. An experimental method was used and a pilot survey was carried out. Within the latter, data were obtained from 122 randomly selected households with a self-survey method (filling in a kitchen diary). On the basis of the questionnaire, for seven consecutive days, households had to weigh their food waste and define the method of treatment. The households included in the survey disposed 39.9 % of food waste outside the public waste treatment system. The edible part of generated food waste accounted for 32.4 % and the inedible part for 67.6 % of total food waste. The survey method was evaluated by households as simple and fast. The added value of the study is the analysis of the impact of socio-demographic characteristics of surveyed households on food waste generation and treatment. The quantitative evaluation of food waste is essential for developing effective policies and evaluating the effectiveness of achieving goals.

KEY WORDS: *kitchen diary; public waste treatment; questionnaire*

**mihozeg@irb.hr*

***tanjagarbas@gmail.com*

Application of artificial intelligence in the biotechnology field

Gluhak Spajić D*, Spajić B, and Maričić S

RED FORK j.d.o.o., Zagreb[1], Juraj Dobrila University of Pula, Pula[2], Croatia

Artificial intelligence (AI) can be described as the ability of a computer or robot-controlled computer to perform tasks commonly associated with intelligent creatures, or specifically, a "scientific discipline that involves building computer systems whose behavior can be interpreted intelligently". The aim of this review was to present what AI is, to describe its basic elements, explain the difference in development and application, and present the common development of AI through the biotechnical field, including the production and processing of food. Combining a large amount of available data with cheap processor power provided a fertile ground for developing algorithms that support new machine learning techniques. The development of the biotech field is turning to AI, which is supported by data from biotechnology research and development. Although there are interesting examples of AI, there is still no fully-fledged AI model in the biotechnical working environment. Over the next 15 years, we expect a significant improvement in robotised systems that will not only perform tasks faster and more accurately, but more importantly, will have a much greater learning ability and development stage than currently.

KEY WORDS: *food technology; Internet of Things; neural networks; production and processing of food*

Elements influencing the food safety culture among food handlers in Slovenia

Jevšnik M[1]**, Bobnar S[1], Sraka M[2], Zajc N[3], and Raspor P[1]

Faculty of Health Sciences, University of Ljubljana[1], Sava turizem d.d.[2], Ljubljana, Pekel, Trebnje[3], Slovenia

The importance of food safety culture has become important in the past few years, because many authors established that food safety behavior does not always follow food safety knowledge. The study was designed to ascertain the elements that influence food safety culture among food handlers in catering facilities throughout Slovenia. Data were collected using translated and validated questionnaire. Statistical analysis of the data gathered through the questionnaires was performed using SPSS software. The elements of food safety culture with the highest assessed level of agreement were self-satisfaction and the environment, whereas work and risk exhibited the lowest level of agreement. Analysis of the results showed that there were statistically significant differences between participation in training courses "Hygiene Minimum" and elements of food safety culture, management, communication, and work. An important statistically significant difference was observed in correlation between the number of years spent on the current workplace and the environment as the element of food safety culture. Those who attended the "Hygiene Minimum" course showed a higher level of agreement for the management element (AS 5.79; SD: 0.81) compared with those who did not attend the training (AS 5.41; SD: 0.72). We established how demographic characteristics of the respondents affect the shaping of food safety culture among food handlers in catering facilities in Slovenia. The questionnaire that was used proved to be an effective tool in the assessment of food safety culture among workers in the catering establishments in Slovenia.

KEY WORDS: *catering; "Hygiene Minimum" course; questionnaire*

**diana@redfork.hr*

***mojca.jevsnik@zf.uni-lj.si*

Official control systems on pesticide residues and risk assessment in service of safer and quality food in market

Pavlinić Prokurica I*, Sever Z, Haltrich K, and Solina N

Croatian Center for Agriculture, Food and Rural Affairs, Zagreb, Croatia

Almost all pesticides are classified into a specific group of poisons (carcinogenic, toxic, reproductive toxic and with a harmful effect on the environment and groundwater) and are therefore potentially harmful to human health, which is why great caution and strict adherence to application instructions are needed. In recent years, especially since the Republic of Croatia became a full member of the EU, the control of food and feed intensified and the number of laboratory analyses on pesticide residues increased considerably. In order to protect consumers, an annual monitoring program of pesticide residues is carried out with a view to ensure compliance with good agricultural practices and with Maximum Residue Levels (MRLs) as well as consumer exposure assessments of pesticide residues in and on food of plant and animal origin. Products are selected considering their importance in the nutrition in RC, determined pesticide residues in previous programmes or products that have not been covered by the program so far. Some other controls on a personal initiative of retail chains and other subjects in food production, other official controls and controls on call are also carried out. By establishing a national Rapid Alert System for Food and Feed (HR RASFF) as part of the EU RASFF, which also includes pesticides, faster information flow and data delivery within the system are provided, quickly and efficiently taking necessary actions and/or measures. From the point of view of food safety, certain types of food are considered safe for the consumer if the estimated intake of harmful substances does not exceed the Acceptable Daily Intake (ADI) or Acute Reference Dose (ARfD) toxicological values. Significant progress has been made in the quality of monitoring and number of analyses, the control system is more extensive and better, with the aim of protecting consumers and improving the quality and health safety food on the market.

KEY WORDS**:** *consumer protection; exposure assessment; official control systems; pesticides; RASFF*

Monitoring recommendations for non-regulated mycotoxins – contributions to food safety

Ivešić M**, Krivohlavek A, Ladiš A-M, and Šikić S

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Monitoring of mycotoxins is imperative for the purpose of protecting human and animal health with regard to daily food intake. Approach to monitoring of mycotoxins is changing, not only because of the variety of parent mycotoxins but also regarding the modified forms of mycotoxins and so-called "emerging mycotoxins". Modified mycotoxins, often called "masked", are metabolites of the parent mycotoxin and they are products of the plant defence mechanism due to caused fungal infections or as a fungal primer outcome. Sometimes, they can also be formed during food processing, handling and storage. Up to now, modified forms have been indentified for zearalenone, ochratoxin A, fumonisins, *Alternaria* toxins, and trichothecenes. The term "emerging mycotoxins" has not been clearly defined but these mycotoxins usually were defined as mycotoxins which are neither routinely determined nor legislatively regulated. Usually mentioned in this group are ergot alkaloids, enniatins, beauvericin, moniliformin, and aflatoxin precursors. Accessible data of modified and emerging mycotoxins toxicity is still insufficient considering the lack of toxicological experiments that can be related to the absence of reliable analytical methods and the fact they are not routinely analysed. Therefore, the total mycotoxin content of the sample may be underestimated. In order to enhance awareness of these potentially hazardous mycotoxins, monitoring of their presence is essential for ensuring food safety and protection of human health. All recommendations indicate a need for comprehensive study and further research of legally non-regulated mycotoxins to provide toxicological data and assist food regulatory agencies in setting maximum permitted levels for food control purposes.

KEY WORDS**:** *emerging mycotoxins; maximum permitted levels; modified mycotoxins*

**iva.pavlinic.prokurica@hcphs.hr*

***martina.ivesic@stampar.hr*

The economics of beekeeping – conventional *vs*. ecological production

Šakić Bobić B*, Očić V, Grgić Z, and Čop T

Faculty of Agriculture, University of Zagreb, Zagreb, Croatia

According to the number of honeybee colonies, as well as the number and size of beekeepers, Croatia is ranked 12th, while the production of 2,900 tons of honey per honeybee colony classifies it among countries with the lowest average production. A survey of 850 beekeepers showed that the largest number of respondents have 6-30 years of experience in beekeeping and possess more than 60 honeybee colonies. Their products are sold on the doorstep (over 60 % of respondents). The highest average production was 29.54 kg (eco-honey), regarding 23.82 kg per honeybee colony (conventional). The prices of multiflowered honey ranged from 18 to 80 HRK per kg (conventional), or 30 to 65 HRK per kg (ecological). The average price for uniflower eco honey was 33.25 HRK per kg, and 28.86 for conventional. The cost of production per unit ranged from 30 to 750 HRK (ecological production) and 17 to 991 (conventional), but respondents did not include their own work and depreciation in the cost calculation (only energy and materials). According to the research sample, it can be concluded that ecological production is carried out by very few beekeepers (13 out of 850 respondents), which shows unused potential. Most conventional beekeepers mentioned good current production and honey prices as well as insufficient incentive price of eco-honey as the main reasons for not venturing into ecological beekeeping. If they were not to transfer to ecological beekeeping, they would most likely produce honey with pollen, bee venom, honey in the honeycomb, and then propolis. The biggest economic differences between conventional and ecological beekeeping are in sales channels and the average cost.

KEY WORDS**:** *beekeepers; costs; sales channels; survey*

Organic agriculture in Croatia before and after accession to the European Union

Grgić I**, Zrakić M, Hadelan L, and Jurjević P

Faculty of Agriculture, University of Zagreb, Zagreb, Croatia

The organic products market is rapidly growing due to increased care for personal health and growing incomes. Croatia follows this trend with approx. 4,000 entities in the Register of Organic Producers which carry organic production to more than 100 thousand ha of used area. Organic production is a chance for farmers in Croatia who are not economically competitive in conventional farming in comparison to farmers in developed countries. This is also an opportunity for the development of agriculture and rural areas in Croatia, but the precondition is to overcome certain limitations for further the presence of organic production in total agricultural production. The main constraint to growth is the consumers' economic power on the Croatian market, which is not at the level of developed countries and is often flooded with low-demand quantities with high average distribution costs. Organic products are a challenge for the distribution chain because of the ban on the use of protective chemical agents during storage. It is also a challenge for scientists and experts in the selection and genetics of new or adaptation of forgotten varieties, breeds, etc. Finally, it is also a challenge for administration because organic production is regulated much more than conventional ones. The aim of this paper was to (a) estimate how Croatia responds to these opportunities and challenges, (b) present the state of organic agriculture development in Croatia, and (c) determine changes after Croatia joined the European Union.

KEY WORDS**:** *challenges; Croatian market; organic production; Register of Organic Producers; responses*

**bsakic@agr.hr*

***igrgic@agr.hr*

The role of beta glucan in health – a glance on novel food and food supplements

Pollak L*

Croatian National Institute of Public Health, Zagreb, Hrvatska

Beta glucans were ranked first in the category of food supplements, immunomodulators, based on their health impacts. There are various sources and a wide biological availability of beta glucan from fungi, cereals, and yeasts. Based on increased awareness of self-healing, the development of technologies and new formulations allows different ingredients to be ultimately added to the finished product. The primary categorisation of the product in question is also dependent on both the source and biological availability of beta glucan. The categories are as follows: (1) Food supplements – regulated by directives and their corrigendums; (2) Novel food – by the new EU Regulation No. 2015/2283 on novel food and ingredients of novel food, new legislative provisions and regulations have been introduced. In order to improve health with a possible physiological effect on human health, the lecture will give an overview of the various sources of beta glucans, legislative framework, labelling, and possible health claims.

KEY WORDS**:** *European Union; food labelling; immunomodulators; legislative frame; Republic of Croatia*

GMOs and genome editing – a need for new detection strategies

Ferenčak I** and Fiolić I

Croatian National Institute of Public Health, Zagreb, Croatia

In light of the recent ruling by the Court of Justice of the European Union that organisms obtained by new mutagenesis plant breeding techniques are genetically modified organisms (GMO), we give some insight into what this means for current detectability strategies. These new breeding techniques, mainly genome editing by oligo-directed mutagenesis and CRISPR-Cas, result in specific targeted alterations in the genome of an organism without introducing foreign DNA. Conventional mutagenesis techniques are exempted from GMO regulations, even though mutations induced by genome editing technologies cannot be distinguished from mutations induced by conventional mutagenesis or natural occurring mutations. This verdict raises multiple questions for official control laboratories, as well as competent authorities about the detection of food products obtained by gene editing techniques. The main questions to be answered are: Do food products originate from natural, spontaneous mutations or from mutagenesis? In case of mutagenesis, which technique is used, conventional or genome editing? The current method of choice is real-time polymerase chain reaction (real-time PCR). Laboratories have diverse screening strategies targeting common sequences used in introducing transgenic DNA in a plant genome. For genome editing, sequence based screening is needed, which is more time consuming, expensive and requires genome data management services and bioinformatics expertise. For products of genome editing to be detected and identified by control laboratories, prior knowledge of the altered sequence is needed, together with a validated method and a reference material. Also, pan-genome databases of all sequence variation in a species is needed to compare with the detected sequences.

KEY WORDS: *EU legislation; laboratories; mutagenesis; new breeding techniques; real-time PCR*

**lea.pollak@hzjz.hr*

***ivana.ferencak@hzjz.hr*

Laboratory tests as a service to certification (control) bodies for organic production and certification of agricultural and foodstuffs with protected designation of origin and protected geographical indications

Španić Ciceli N* and Čop A

Croatian Accreditation Agency, Zagreb, Croatia

For the purpose of certification decision making and surveillance activities, certification (control) bodies evaluate the results of laboratory tests. Such tests reports have the purpose to prove the absence of active substances not allowed by legislation relevant to the organic production or test reports and are proof that product requirements from published product specifications are fulfilled (e.g., olive oil specifications, etc). According to the legislation, the required sampling (soil, cereals, processed products, etc.) is performed by competent personnel of the certification (control) body. Laboratories performing this type of test and certification (control) bodies performing certification activities in accredited scopes are authorised by the Ministry of Agriculture. One of the criteria for authorisation is a valid accreditation status for both laboratories and certification (control) bodies. Experience in performing accreditation of laboratories and certification bodies triggered frequent discussions concerning responsibilities for defining the scope of required tests, interpretation of criteria for applicable limit of quantitation (LOQ), influence of measurement uncertainty, and formulation of statements of compliance. This presentation will highlight the relevant requirements of (HRN EN) ISO/IEC 17025, (HRN EN) ISO/IEC 17065, and applicable legislation as well as criteria for the selection of testing laboratories and changes in new (HRN EN) ISO/IEC 17025 relevant to reporting.

KEY WORDS: *accreditation; agriculture; certification activities; food; testing laboratories*

Quality features and health standards of cinnamon on the Croatian market

Šerifović J[1]**, Šušnić S[1], and Uršulin-Trstenjak N[2]

Šušnić d.o.o., Rijeka[1], University North, University Center Varaždin, Varaždin[2], Croatia

Cinnamon represents one of the best-selling spices on the Croatian market, most likely due to the positive effects on consumer health highlighted through the media and the alternative medicine, phytotherapy, and dietitian prudence that they propagate. Although cinnamon represents a traditional spice in our region and is most commonly used in preparing dishes that require heat treatment, in the past few years it is very often consumed untreated (beverages, syrups, tinctures, etc.). Precisely because of the increase in the consumption of this spice and the fact that it is produced in plantations of third countries and then imported to the Republic of Croatia, the aim of this paper was to examine the legal aspects of import legislation and cinnamon quality control in the Republic of Croatia with the purpose of ensuring the highest qualitative features and health standards of the final product. Consequently, in emphasizing the positive properties and the final choice of the consumer, attention should be paid to two varieties of cinnamon, of which the classical cinnamon (*Cinnamomum cassia*) may have a potentially toxic effect on one's health when consumed in larger quantities, therefore it is recommended to use Ceylon cinnamon (*Cinnamomum verum*).

KEY WORDS: *consumer protection; market of the Republic of Croatia; qualitative characteristics; spice*

**nives.spanic@akreditacija.hr*

***jasmina@susnic.hr*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):29-30

Monitoring of radioactive contamination of food in the Republic of Croatia

Franić Z*

Institute for Medical Research and Occupational Health, Zagreb, Croatia

Monitoring of radioactive contamination of the human food chain and animal feedstuffs by fission products as well as natural radionuclides in the Republic of Croatia has been carried out by the Radiation Protection Unit of the Institute for Medical Research and Occupational Health since 1959 as part of an extended monitoring programme. Today it is harmonised with EU practice and the Euratom Treaty. The main methods used are gamma-spectrometry and beta counting after radiochemical treatment of samples. Long-term data allow using some radionuclides as tracers for estimation of various radioecological parameters, such as radioecological sensibility, possible vulnerability of environmental compartments, mean residence time of respective radionuclides in various foodstuffs, activity ratios, etc. The main sources of radioactive contamination of the Croatian environment by fission products are fallout from atmospheric nuclear weapon testing conducted in the 1960s and nuclear accidents (Chernobyl in 1986 and Fukushima-Daiichi in 2011). Knowledge about levels of various radionuclides in various foodstuffs is essential for radiation dosimetry, i.e., performing risk assessments on humans. In addition, radioecological characterisations of various foodstuffs are not only essential for food quality control and assurance but are also a useful tool in the process of obtaining protected geographical origin marks. The activity concentrations of fission products are closely related to activity concentrations in fallout as well as dependent upon the environmental characteristics of a location under consideration. In addition, the presence of some radionuclides (radiocaesium, ^{40}K) is a useful tool for control of food fraud and adulteration, the best example being honey.

KEY WORDS: *Euratom Treaty; quality control/assurance; radioactivity; radioecology; radiotracers*

LIMS – a crucial part of an integrated quality management system

Raos D** and Zirdum I

Pardus d.o.o., Zagreb, Croatia

As companies develop an integrated approach to quality management, the need arises for a tight integration of laboratories and their laboratory information management system (LIMS) software into the IT environment of the company. This paper examines the optimal division of responsibilities, knowledge holders, and decision makers. The flow of work, information, and control within the integrated quality management system of an industrial entity are also considered. The natural source of quality criteria and production and testing procedures is outside traditional LIMS systems; laboratory systems hold much richer information than needed for simply go/no-go decisions. Firm integration of quality management (QM) modules within enterprise resource planning (ERP) software, product development systems and industrial process control software with LIMS system in laboratories that test raw materials, samples from the factory floor, and finished products enables the optimal use of rich information collected in the laboratory. This leads to agile reactions to drifting manufacturing processes on one hand and changing market environments on the other.

KEY WORDS: *food industry; integration; knowledge; software*

**franic@imi.hr*

***draos@pardus.hr*

Biochemical mechanisms of sex hormones synthesis in domestic animals

Samardžija M[1]*, Butković I[1], Gamulin E[1], and Pleadin J[2]

Faculty of Veterinary Medicine, University of Zagreb[1], Croatian Veterinary Institute[2], Zagreb, Croatia

Sex hormones and their secretion and roles are the basis for reproduction management. The aim of the current study was to describe steroidogenesis and sex hormones role and their effect on animal organism. Sex hormones are steroids synthesized by gonads through multiple biochemical mechanisms. In mammalian systems, there are six families of steroid hormones that can be classified on both a structural and a biological (hormonal) basis. They are the oestrogens and progestins (female sex steroids), androgens (male sex hormones), mineralocorticoids (aldosterone), glucocorticoids (cortisol) and vitamin D. They are all derived from cholesterol. The parent ring structure for cholesterol is the fully saturated ring structure cholestane. Steroid hormones are fat-soluble so they can enter all body cells because lipid cellular membranes are not a barrier for them. Regulatory cognitive production of sex hormones is a complex process, and all mechanisms take place through the hypothalamus-pituitary-ovarian linkages. The hormone biosynthesis determines the sex cycle of the animals, but also depends on the sex cycle of the same individuals, therefore the biosynthesis in pregnancy is different from the one in the reproductive age. Pregnancy is characterised by a massive increase in the production of both progesterone and oestrogen. The increase in progesterone and oestradiol production occurs only in the placenta. Male sex hormones (androgens) are steroids with 19 C-atoms, and female with 18 C-atoms (oestrogens) and 21 C-atoms (progesterone). Androgens are synthesised in Leydig's cells from cholesterol, progesterone in the corpus luteum, and oestrogen in the ovaries and corpus luteum, while smaller amounts are produced in the testicles and the adrenal gland. In the mitochondria, cholesterol is converted into pregnenolone, the precursor steroid required for the synthesis of all steroid hormones. The reactions catalyse enzymes such as P450scc, StAR, 5α-reductase. The most active oestrogen is 17β-oestradiol, and testosterone 5α-dihydrotestosterone (5α-DHT). Progesterone, testosterone, and oestradiol have multiple roles in sex cycles, and their function will depend on the physiological synthesis of the hormones themselves.

KEY WORDS: *androgens; biochemistry; oestrogens; progesterone; steroidogenesis*

Determination of total and inorganic arsenic in food

Šabarić J**, Kuharić Ž, Bošnir J, Krivohlavek A, and Ivešić M

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

The most common reasons for the presence of arsenic in the environment are human activity or geological sources. It deposits in soil, water, and air and over time accumulates in the plant and animal world and thus enters the human food chain. The International Agency for Research on Cancer (IARC) ranked arsenic in the group of carcinogenic compounds. Its toxicity depends on the chemical form in which it is present. Therefore, the health risk is estimated not only based on the concentration of total arsenic in the product but is determined by its species. In this study, fish and rice samples were analysed for the presence of total arsenic and its species (inorganic arsenic). The amount of total arsenic was determined by ICP-MS and inorganic components of arsenic were determined by HPLC-ICP-MS. During 2017 and 2018, 184 fish samples and 23 rice samples and rice-based products were analysed. The analysed fish samples contained 0.21 to 3.82 mg kg^{-1} of total arsenic, while two samples of sharks contained arsenic at 20.2 and 35.6 mg kg^{-1}. In the analysed rice samples, the concentration of total arsenic ranged from 0.52 to 1.05 mg kg^{-1} and the concentration of inorganic arsenic ranged from <0.03 to 0.28 mg kg^{-1}. All of the analysed rice samples and rice-based products were rated as compliant. The maximum allowed concentration for total arsenic in fish is prescribed in some non-EU countries and is 2.0 mg kg^{-1}. In the European Union, there are no legal regulations that set the maximum allowed concentration of total arsenic in food. A legal regulation exists only for inorganic arsenic in rice and rice-based products. Values range from 0.10 to 0.30 mg kg^{-1}, depending on the product type. All of the analysed products, which contain total arsenic and do not have prescribed maximum allowed concentrations, must be subjected to a risk assessment to determine their safety for consumption. From the results obtained by this study, we concluded that there is a need to determine the maximum allowed concentrations of total and inorganic arsenic in fish products in order to quickly determine compliance and safety of consumption, without further risk assessments.

KEY WORDS: *arsenic species; fish; HPLC-ICP-MS; ICP-MS; maximum level; rice*

**smarko@vef.hr*

***jasenka.sabaric@stampar.hr*

New tools for tea and spice safety – importance of macro- and microscopic row material quality control

Božin B[1]*, Gavarić N[1], Jeremić K[2], Bekut M[2], Čorbo D[2], Lakatoš I[3], and Kladar N[1]

Center for Medicinal and Pharmaceutical Investigations and Quality Control[1], Department of Pharmacy[2], Faculty of Medicine, University of Novi Sad, Novi Sad, Melissa d.o.o., Apatin[3], Serbia

Commercially available teas and spices can be used as food and medicinal products, but also as food for infants. The requirements for medicinal herbal tea are higher and more precisely specified than those for food. In addition to obligatory safety issues, the provisions of the European Pharmacopoeia for the active principles quantification, the evaluation of macro- and microscopic confirmation and appearance of the potential impurities and adulterations is described. Furthermore, for herbal tea as a baby food, for example fennel tea (*Foeniculum vulgare*, Apiaceae), much more stringent legal requirements apply to pesticide residues and other contaminants. However, macro- and microscopic control showed that aniseed (*Pimpinella anisum*, Apiaceae) is often present as an adulteration, or is even sold instead of fennel tea. For St. John's wort tea (*Hypericum perforatum*, Hypericaceae) the exact biological origin is mainly not specified, although it has four subspecies described, chemically different from one another. For bilberry fruits, the biological source is mainly not specified, so consumers do not know whether they are buying the fruits of bilberry (*Vaccinium myrtillus*, Ericaceae) or the northern high-bush blueberry (*V. corymbosum*, Ericaceae). Instead of the common bearberry (*Arctostaphylos uva-ursi*, Ericaceae) often leaves of bilberry or mountain cranberry (*V. vitis-idea*, Ericaceae) are present. The adulterations and impurities can be mainly directly noticed by macro- or microscopic control, so these tools should be the first step and one of the obligatory methods for the evaluation of the quality of teas and spices available on the market.

KEY WORDS: *adulterations; food; macro/microscopy; medicinal herbal teas*

Development of the first stable isotope assisted quantification of multiple urinary mycotoxin exposure biomarkers

Šarkanj B[1]**, Ezekiel CN[2,4], Turner PC[5], Abia WA[2,6], Rychlik M[7], Krska R[2], Sulyok M[2], and Warth B[3]

Department of Food Technology, University North, Koprivnica, Croatia[1], Center for Analytical Chemistry, Department of Agrobiotechnology (IFA-Tulln), University of Natural Resources and Life Sciences[2], Department of Food Chemistry and Toxicology, Faculty of Chemistry, University of Vienna[3], Vienna, Austria, Department of Microbiology, Babcock University, Ilishan Remo, Ogun State, Nigeria[4], MIAEH, School of Public Health, University of Maryland, College Park, MD, USA[5], Laboratory of Pharmacology and Toxicology, Department of Biochemistry, Faculty of Science, University of Yaounde I, Yaounde, Cameroon[6], Analytical Food Chemistry, Technical University of Munich, Freising, Germany[7]

Mycotoxins are unavoidable contaminants of numerous agricultural commodities and are always present in our diet. To be able to determine exposure to regularly occurring mycotoxins in our diet, a very sensitive method had to be developed due to high food safety legislation standards. The developed method was validated for a total of 12 of the most important mycotoxin biomarkers: aflatoxin M1, ochratoxin A, deoxynivalenol, zearalenone, fumonisin B1, citrinin, dihidrocitrinon, nivalenol, de-epoxy-deoxynivalenol, α- and β- zearalenol, and alternariol. To ensure precision of results and avoid errors caused by matrix effects, ^{13}C-labeled internal standards were used for aflatoxin M1, ochratoxin A, deoxynivalenol, zearalenone, fumonisin B1, citrinin, nivalenol, and deuterated [$^{2}H_{4}$] alternariol. By using β-glucuronidase pre-treatment, simple solid phase extraction (SPE) clean-up and high precision tandem mass spectrometry (MS/MS) device the instrumental limits of detection for aflatoxin M1 and ochratoxin A reached ppq levels (300 fg mL^{-1}). After method validation, results were compared with already published results on 120 Nigerian urine samples. The results showed an increased occurrence of positive results for all of the tested mycotoxins: from 50.8 to 100 %, with highest occurrence of zearalenone (82 %), ochratoxin A (76 %), aflatoxin M1 (73 %), and fumonisin B1 (71 %). In addition, the presence of alternariol in urine was confirmed for the first time, although only in 7 % of the tested samples with the highest concentration of 202 pg mL^{-1}.

KEY WORDS: *biomonitoring; method validation; mycotoxin biomarkers; stable isotope dilution assay*

**biljana.bozin@mf.uns.ac.rs*

***bsarkanj@ptfos.hr*

Mercury and methylmercury levels in fish on the Croatian market

Marciuš B*, Benutić A, and Pongračić J

Croatian National Institute of Public Health, Zagreb, Croatia

It is known that fish consumption has beneficial effects on human health due to its nutrients, especially long chain n-3 polyunsaturated fatty acids (LC n-3 PUFA) that have beneficial effects on the neural development of children and significantly decrease risk of fatal coronary heart disease (CHD). However, the drawback is that they also contain the most toxic mercury species, methylmercury, which is known to cause adverse developmental effects to prenatal children. Methylmercury is produced from inorganic mercury by anaerobic organisms that live in the aquatic environment and since fish have limited ability to eliminate it from their organism it bioaccumulates at the highest concentrations in muscle tissue. In 2012, the European Food Safety Authority (EFSA) set the value of the total weekly intake (TWI) of methylmercury to be 1.3 μg kg^{-1} bw per week. Age groups that exceed the TWI at the smallest number of meal servings per week are usually toddlers and other children but that depends on the species of fish that is served. In 2015, EFSA gave a recommendation that each country considers their pattern of fish consumption and carefully assesses the risk of exceeding the TWI. The aim of the present study was to show survey data collected in the last few years for mercury and methylmercury in a variety of fish such as tuna, sardine, mackerel, and sprat on the Croatian market. Analysis was done using cold vapor atomic absorption spectrometry with an AMA 254 mercury analyser.

KEY WORDS: *mackerel; mercury analyser; sardine; sprat; total mercury; tuna*

**bernardo.marcius@hzjz.hr*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):34-36

Mushroom metabolites in the control and detoxification of mycotoxin contamination in food and feed

Lončar J[1,3]*, Reverberi M[1], Cescutti P[2], Rizzo R[2], Parroni A[1], and Zjalic S[3]

Department of Environmental Sciences, University Sapienza, Roma[1], Department of Life Sciences, University of Trieste, Trieste[2], Italy, Department of Ecology, Agronomy and Aquaculture, University of Zadar, Zadar, Croatia[3]

Due to their toxicity, mycotoxins represent a serious threat for food and feed safety. None of the control strategies applied in the last five decades have definitively solved the problem of mycotoxin contamination. The raising awareness that different chemicals could cause both environmental problems and a health hazard led to large limitations of their use in agriculture. Today the EC pushes research to investigate more environmental friendly "green" approaches. Mushroom metabolites could represent an excellent tool in mycotoxin control, as they demonstrated the ability to prevent the synthesis of different mycotoxins and detoxify already contaminated food and feed stuff. Laccases from the mushroom *Trametes versicolor* showed the possibility of degradation up to 90 % of aflatoxin B1 present on corn seeds, after 72 hours of incubation. Polysaccharides extracted from the same mushroom demonstrated almost complete and long lasting inhibition of biosynthesis of different mycotoxins at the same time (i.e. aflatoxins, OTA), both in liquid cultures and on seeds. Polysaccharides of more than 100 mushroom strains were assayed for toxin inhibition and three of the most effective, produced by *Lentinula edodes, Trametes versicolor,* and *Schyzophyllum commune*, were purified. The characterisation of these water-soluble mushroom polysaccharides is under study in order to establish if there is some common structure involved in mycotoxin control.

KEY WORDS: *aflatoxin; inhibition; ochratoxin A; polysaccharides; toxin*

Tourism and food safety from the perspective of the City of Dubrovnik: a five-year field study

Ljevaković-Musladin I** and Lakić M

Institute of Public Health of Dubrovačko-Neretvanska County, Dubrovnik, Croatia

In 2017, the City of Dubrovnik achieved record tourism results. According to the Croatian National Tourist Board, in the same year there were 1,174.800 arrivals and 3,886.000 overnights. This makes Dubrovnik the city with the highest intensity of touristic traffic in Croatia. Such mass tourism puts special significance on food safety for public health reasons, especially during summer months. The aim of this study was to review the safety of food offered by local food business operators in the city of Dubrovnik in the period 2013-2017. A total of 7,429 samples, randomly sampled in hotels, restaurants and stores, were analysed according to Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs and Croatian National Guidelines on microbiological criteria for foodstuffs. The results showed that 675 (9.1 %) samples were unsatisfactory, mostly because of the high levels of aerobic mesophilic count and *Enterobacteriaceae*. In 565 (7.6 %) samples, the aerobic mesophilic count was above the prescribed microbiological criteria. Unsatisfactory levels of *Enterobacteriaceae* were found in 384 (5.2 %) samples. Pathogens like *Salmonella* spp. and *Listeria monocytogenes* were detected in only 4 [raw poultry (3) and cheese] and 3 samples [cheese (2) and salsa], respectively. Coagulase-positive staphylococci were found in 67 (0.9 %) samples, but the contamination levels were below critical 10^5 cfu g^{-1}. *E. coli* was very rarely found, in only 19 (0.3 %) samples. We consider the food offered in the city of Dubrovnik relatively safe since in a 5-year period pathogenic bacteria have been isolated in only 7 (0.09 %) times out of 7,429 samples. Epidemiological data are also in favour of that conclusion since there had been no larger foodborne outbreaks in relation to the city's food offer.

KEY WORDS: *foodstuffs; local food business operators; microbiological quality; public health*

**jloncar@unizd.hr*

***ivana.ljevakovic-musladin@zzjzdnz.hr*

Microbiological contamination in fresh squeezed juices

Kovaček I* and Mlinar Z

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Juices, especially freshly squeezed, are very healthy food and provide many important vitamins and nutrients. In these modern times many people want to eat and drink so-called "superfoods", and among them especially drink fresh squeezed fruits and vegetables, but inappropriately treated foodstuffs and juices can be contaminated and pose health risks. The aim of the study was to investigate microbiological threats in fresh squeezed juices sold in the city of Zagreb. In this study, 117 samples of fresh squeezed juice from restaurants, bars, supermarkets and healthy food stores in Zagreb during the period from 2015-2018 were analysed according several microbiological parameters. Methods used in this work were traditional ISO methods by cultivation, for Enterobacteriaceae ISO 21528, for yeasts and moulds ISO 21527, for *Listeria* spp. ISO 11290-2, *E. coli* ISO 16649-2, and for total count ISO 4833-2. The detection method used for *Salmonella* spp. was ISO 6579. The results obtained show the condition of fresh squeezed juices on the Zagreb region markets. Around 37 % of the samples exceeded one or more microbiological parameters – 34 % of the samples exceeded Enterobacteriaceae levels, 40 % aerobic mesophilic bacteria and 45 % of yeasts and moulds deemed not acceptable by food regulations in Croatia. These results call for better hygiene in handling fruits and vegetables used in fresh juice production. As fresh squeezed juices may contain harmful bacteria and can cause illness, our results call for better control of critical points in the production process.

KEY WORDS: *bacteria; control; food; fruits; HACCP; vegetables*

Detection, enumeration, and morphology characteristics of *Campylobacter* spp. in commercial broiler flocks and chicken meat samples originating from the same flocks

Mlaćo M[1]**, Bulaja N[1], Spahić B[1], Ibrahimagić A[2], Uzunović S[2], Cerić L[2], Zeković F[2], Kunarac M[2], Gladan M[2], Dizdarević J[2], Kapidžić A[2], Fajković A[2], Hodžić B[2], and Fetahagić M[2]

Brovis d.d. Visoko, Visoko[1], Institute for Health and Food Safety Zenica, Zenica[2], Bosnia and Herzegovina

Poultry and poultry products are known as important sources of human campylobacteriosis. The incidence of human campylobacteriosis is increasing worldwide. The aim of this study was to detect, enumerate, and present the morphology of *Campylobacter* spp. in commercial broiler flocks and chicken meat samples originating from the same flocks in different phases of fattening and production. Sixty faecal samples, 20 surface samples (10 swabs of crates for transport of broilers and 10 swabs from different surfaces in slaughterhouse) and 30 samples of chicken meats (10 chicken skins, 10 chicken livers, and 10 chicken breasts) were analysed according to the Ordinance, which is in accordance with international standards (EU directive 2017/1495 and ISO 10272-1:2017). Faecal samples were collected at six different phase of fattening. Chicken samples were obtained after chilling. All samples were enriched in a Bolton broth, followed by streaking on selective media and suspected colonies were tested for morphology, catalase test, indoxil reaction, hippurate hydrolysis, and Gram-staining. Fifteen faecal samples were negative (25 %), whereas 45 faecal samples (75 %) were positive to *Campylobacter* spp. All swabs of craters for transport of broilers were negative to *Campylobacter* spp. Ten *Campylobacter* spp. (out of 30; 33.3 %) were isolated from different meats samples (seven from chicken skins and three from chicken livers). In hippurate hydrolysis test, four samples (40.0 %) were evaluated as positive and six samples (60.0 %) as negative. Enumeration of *Campylobacter* spp. were in the range 360-1400 cfu g^{-1}. Two samples showed a higher number of *Campylobacter* spp. (more than 1000 cfu g^{-1}). Surface samples were negative to *Enterobacteriaceae*, Aerobic mesophilic bacteria, *Salmonella* spp., and *Campylobacter* spp. Detection, morphology characteristics, and enumeration results of *Campylobacter* spp. in various samples showed good hygiene in the technology process, but this was a small number of isolates, indicating the importance of countinuous monitoring and control of technology production.

KEY WORDS: *control of technology production; food; human campylobacteriosis; hygiene; poultry*

**ivancica.kovacek@stampar.hr*

***merjem.mlaco@akovagroup.com*

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Arh Hig Rada Toksikol 2018;69(Suppl. 1):34-36

FoodSimplex – a new food safety methodology in mass catering

Baltazar A[1,2]*, Ferreira A[1], Manyes L[2], and Mañes J[2]

Coimbra Health School-IPC, Coimbra, Portugal[1], University of Valencia, Valencia, Spain[2]

The mass caterer sector has grown in recent decades, and several factors have been identified, such as increased number of individuals living in urban areas, distance from home/work, increased percentage of women in the workplace, greater financial power, and dietary concerns. Foodborne diseases have a negative impact on the health and little consideration is given to such conditions because the symptoms are often moderate and self-limiting. The microbiological contamination of meals by catering systems is one of the main issues and it must be assessed to ensure safer meals. The aim of this study is to assess the application of new food safety methodology (FoodSimplex) in Portuguese restaurants through audit data and microbiological sampling of the meals. The FoodSimplex provides a strategic methodologic tool with means to implement and monitor a food safety system in small and medium restaurants with little resources to ensure the safety of the meals to the consumers. The results of the audits were structured according to the FoodSimplex checklist and showed a stagnation or improvement in the compliance with hygiene requirements. The ready-to-eat food samples presented regarding the total mesophilic aerobes a positive change from a satisfactory condition of 61.8 to 85.3 %; *Listeria monocytogenes* a significant and positive evolution (p-value <0.0001) and for *E. coli,* coagulase-positive *Staphylococci,* and *Salmonella* all the food samples presented satisfactory results. At the end of the study period, we observed a decrease in microbial populations of examined samples and an improvement of the audit results which indicated that the FoodSimplex methodology improved the food status in these establishments.

KEY WORDS: *catering systems; foodborne diseases; microbiological contamination of meals; public health*

**ana.santos@estescoimbra.pt*

Silver in nano and bulk form differently affects photosynthesis and photosynthesis-related proteins in leaves of tobacco plants

Balen B[1]*, Tkalec M[1], Peharec Štefanić P[1], Biba R[1], Cvjetko P[1], Šabarić J[2], and Šikić S[2]

Department of Biology, Faculty of Science, University of Zagreb[1], Department of Ecology, Andrija Štampar Teaching Institute of Public Health[2], Zagreb, Croatia

Nanotechnology has many applications in all stages of production of agricultural products. Among the different types of available nanomaterials, the most frequently used are silver nanoparticles (AgNPs) due to silver antimicrobial properties. As plants have a significant role in accumulation and biodistribution of many environmentally released substances, they can be influenced by AgNPs, serving as a potential pathway for transport and bioaccumulation of AgNPs into food chains. In this study, we investigated the effects of silver nano- and bulk-form on photosynthesis and leaf proteome of tobacco. Adult plants were exposed to 100 μmol L^{-1} citrate-coated AgNPs and $AgNO_3$ and after 7 days of Ag accumulation, chlorophyll fluorescence and photosynthetic pigments as well as changes in leaf ultrastructure, and protein expression were analysed. Both types of treatments resulted with a similarly increased Ag uptake. AgNPs significantly decreased photochemical quenching and increased the concentration of violaxantin. On the contrary, treatments with $AgNO_3$ did not significantly influence fluorescence parameters but had a negative effect on the majority of photosynthetic pigments. Moreover, after exposure to AgNPs, chloroplasts were smaller compared to chloroplasts in the control cells and somewhat swollen and ruptured, while those found in leaf cells of $AgNO_3$-treated plants were bigger than the control ones. Majority of the identified proteins with differential expression were photosynthesis-related and down-regulated, although almost half of the proteins exhibited different expression levels between AgNPs and $AgNO_3$ exposure. The obtained results indicate that the AgNPs effects observed in tobacco leaves were not simply due to the release of Ag ions.

KEY WORDS: *chlorophyll fluorescence; chloroplast ultrastructure; nanosilver; photosynthetic pigments; proteomics*

Compliance testing of non-harmonised food contact materials in Slovenia

Zorič A**

National Laboratory of Health, Environment and Food, Maribor, Slovenia

Food contact materials and articles (FCM) can influence food safety and quality throughout the whole food supply chain. According to the basic requirements of framework EU Regulation 1935/2004, food contact materials should not endanger human health or bring about an unacceptable change in the composition of food or a deterioration in the organoleptic properties of food. Specific EU measures are in place for plastics, ceramics, recycled plastics, regenerated cellulose film, and active and intelligent materials and articles. For other types of FCM, national provisions can be used. The approach used for testing and assesment of compliance of some types of non-harmonised materials in Slovenian national reference laboratory for FCM is given in the presentation. Paper and board for direct or indirect food contact applications, especially if manufactured from recycled fibres, may contain contaminats such as phthalates, printing ink substances, and primary aromatic amines. As national measures for paper and board have not been adopted in Slovenia, compliance is assessed with reference to the German Federal Institute for Risk Assessment (BfR) recommendations. Testing is performed according to CEN (European Committee for Standardisation) standards. The metals and alloys used in FCM can release metal ions into food. Testing and evaluation of compliance of these FCMs is carried out according to the Council of Europe Resolution CM/RES (2103)9 with Technical Guide. From the results of testing of paper and metalic food contact materials, it is evident that control of certain contaminants or components is needed and official control including analytical testing is important in support of ensuring food safety.

KEY WORDS: *contaminants in recycled paper; food contact paper and board; metals and alloys for food contact; release of metals; safety of food contact materials*

**bbalen@biol.pmf.hr*

***andreja.zoric@nlzoh.si*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):37-38

Assessing the compliance of materials intended to come into contact with drinking water in Slovenia

Labović A[1]*, Golja V[2], Miljavac B[2], Kosec T[3], Gartner N[3], and Kopar T[3]

The National Laboratory of Health, Environment and Food, Maribor[1], National Institute of Public Health[2], Slovenian National Building and Civil Engineering Institute[3], Ljubljana, Slovenia

Materials and products coming into contact with drinking water may release various substances into the water, which may change the composition and deteriorate the quality of the water. Whether all impacts are verified depends on the procedures for determining and checking the suitability of materials and products. In Slovenia, in 2014, at the initiative of the Ministry of Health and the Ministry of Economic Development and Technology, the starting points for assessing the suitability of materials intended to come into contact with drinking water were prepared by the Slovenian National Building and Civil Engineering Institute, National Institute of Public Health, and the National Laboratory of Health, Environment and Food. The first draft of recommendations was submitted by the Ministries to the European Commission in March 2016, where it has been published as information on the online portal. On the basis of experience and knowledge of the problem, a number of questions was addressed: which documents prove the suitability of materials, what are the standards that determine requirements, what is the methodology for evaluation of results and/or documents, how to take into account the diversity of materials in connection with locally conditioned composition of water resources, the legal basis for mutual recognition proofs. The basis for the preparation of recommendations was the "4MS" scheme, but information from other countries was considered as well. The Recommendations describe the procedure for assessing the suitability of materials and products and the methodology for testing their chemical and microbiological properties. Recommendations deal with metal, cement, organic, and other materials and their products. The document is not a statutory document and is intended to assist stakeholders in verifying and assessing compliance with the foregoing regulations, as well as those that manufacture, import, distribute, or otherwise place on the market or put into use for their intended purpose materials and products coming into contact with drinking water. It is a "live" document, which, according to new knowledge, will be revised and updated.

KEY WORDS: *materials and products; recommendation in the Republic of Slovenia; release of substances into water*

Safe packaging for food safety

Baričević L** and Barušić L

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Observing food and its packaging as a whole leads to the development of new materials and technologies to ensure healthy and quality food with a long shelf life. To fulfil these requirements, an obligation of the business operators with materials and items intended to come into direct contact with the food is the implementation of Good Manufacturing Practice (GMP) and ensuring compliance to EU Regulations evaluated in accordance with the latest toxicological findings of the European Agency for Food Safety (EFSA). In the EU, materials and items that come in contact with food including active and intelligent materials and articles are defined by Regulation (EC) No 1935/2004 whose basic requirements are that all materials must be sufficiently inert to prevent the transfer of substances into food at quantities that may endanger human health or cause unacceptable changes in food composition or alter its organoleptic properties. There are over 6,000 substances used in the manufacturing of containers and packaging that can migrate into food; for example amino compounds, esters, easily volatile compounds, epoxy compounds, nano particles, heavy metals, and others. Migrations depend on the inertness and type of material, the type of food that is in contact, storage temperature, contact time with the packaging, the composition and amount of substance in the material. Overall migration (OM) and specific migration (release of monomers and contaminants) are determined. In the interest of consumer safety, cooperation of manufacturers with authorized testing bodies is required to establish a traceability system from production to distribution.

KEY WORDS: *EFSA; food contact materials; overall migration; specific migration*

**alenka.labovic@nlzoh.si*

***lidija.baricevic@stampar.hr*

Physicochemical and microbiological characteristics of domestic and imported honey samples collected from markets in Zenica, Bosnia and Herzegovina

Čoloman-Horić L[1]*, Ibrahimagić A[1], Cerić L[2], Kunarac M[2], Hasanbašić DŽ[1], Kovač Č[1], Salkić A[1], Jonjić M[1], Agić A[1], and Uzunović S[3]

Department for Chemical Diagnostics[1], Department for Food Microbiology[2], Department for Clinical Microbiology[3], Institute for Health and Food Safety Zenica, Zenica, Bosnia and Herzegovina

Honey is used for nutritional, medicinal, and industrial purposes and it is an important commodity in the international market. The aim of the study was to investigate physicochemical and microbiological characteristics of domestic and imported honey samples collected from markets in the city of Zenica, Bosnia and Herzegovina. All honey samples were analysed according to the International Honey Commision, 2009 and Revised Codex Standard for Honey (Codex Stan 12-1981, rev. 2, 2001). All samples were analysed for pH, conductivity, moisture, ash, free acids, diastase activity, glucose/fructoce, sucrose, hydroxymethylfurfural (HMF), mineral content, unsoluble matters in water, total aerobic masophilic bacteria, total coliforms (Enterobacteriaceae) count, moulds and yeasts and *Clostridium* spp. Enzyme-linked immunosorbent assay (ELISA) was used to detect residue of tetracycline. Among 31 samples, 17 (54.8 %) were domestic (four of acacia honey, three floral, three meadow, two lime, two mountain, one of each sage, chestnut, and forest honey), and 14 (45.2 %) were imported (four floral, three meadow and one of each acacia, mint, sage, chestnut, mountain, forest, and heather honey). Among domestic and imported samples, glucose/fructose were in the range 65.34-74.38/67.91-75.43 (%), sucrose 0.27-9.67/0,13-3.97 (%), moisture 13.10-16.91/13.55-17.56 (% m/m), unsoluble matters in water 0.00-0.04/0.01-0.06 (% m/m), conductivity 0.09-0.72/0.13-0.71 (μS cm^{-1}), free acids 6.5-30.0/8.0-29.5 (meq kg^{-1}), HMF 4.03-1549.01/6.57-107.22 (mg kg^{-1}), and mineral content 0.0-0.4/0.1-0.4 (% m/m), respectively. The HMF, sucrose and moisture values showed statistically significant difference ($p<0.05$) between domestic and imported honey (0.04/0.02/0.04). Positive correlation between sucrose and HMF concentration ($r=0.7$) between domestic and imported samples was found. Four domestic honey samples from the same manufacturer showed the highest HMF in the range 844-1550 mg kg^{-1}. Tetracycline were found in two samples (one domestic and one imported) in small concentrations (0.293 and 1.178 μg kg^{-1}, respectively). Mesophilic aerobic bacteria count varied within <1-2300 cfu g^{-1} in domestic and 40-4100 cfu g^{-1} in imported samples. Coliforms, *Clostridium*, moulds and yeasts were not detected. Physicochemical and microbiological characteristics showed much better quality in imported than domestic honey, indicating the importance of continuous monitoring and control of domestic honey production.

KEY WORDS: *bee product; fraud; hydroxymethylfurfural; quality; tetracyclin-ELISA*

Resolving food authenticity challenges – using advanced isotopic ratio and Orbitrap high resolution mass spectrometry tools in practice

Godula M**

Thermo Fisher Scientific, Praha, Czech Republic

In recent years, adulteration has become an increasing problem globally in the food industry and for consumers. Determining if the product has been adulterated or is declared to come from a specific destination is important for many reasons. Is the product pure; does it contain any contaminants; has it been adulterated in any way for economic reasons? The traditional approach using accurate stable isotope analysis has evolved into the golden standard of the identification of geographic origin as well as adulteration practices. With recent developments, it became feasible to analyse not only bulk stable isotope ratios but to allow coupling of separation techniques like gas chromatography (GC) or liquid chromatography (LC) to perform highly accurate compound specific isotope analysis. This approach significantly improves the sensitivity and accuracy of measurements in diverse areas of food testing. With the introduction of Orbitrap™ mass analyzer in 2006, a completely new area of mass spectrometry has opened and allowed routine laboratories to obtain highly accurate mass spectrometric information also in hyphenation with chromatography separation. In addition, high resolution (up to >450,000 FWHM) allowed the development and application of ambient ionisation techniques such as desorption electrospray ionisation (DESI™) or direct analysis in real time (DART™). Such techniques allow to obtain characteristic fingerprints of samples by direct introduction and ionisation of samples with or without pre-treatment. By using advanced mathematical tools, these fingerprints can be used for fast and reliable sample characterisation and classification. Furthermore, the ultimate goal can be the identification of characteristic markers that can be used by routine laboratories in daily practice.

KEY WORDS: *authenticity; characteristic markers; fingerprints of samples; geographic origin; isotopic ratio*

**coloman.lejla@gmail.com*

***michal.godula@thermofisher.com*

Cancer risk assessment from exposure to trihalomethanes in tap water and swimming pool water

Bijelović S[1,2]*, Torović S[1,2], Živadinović E[2], and Dragić N[1,2]

Faculty of Medicine, University of Novi Sad[1], Institute of Public Health of Vojvodina[2], Novi Sad, Serbia

The objective of the present study was to investigate the concentration of trihalomethanes (THMs) in tap water (TW) and swimming pool water (SPW) and to assess the cancer risk among citizens living in the city of Novi Sad. During 2017, 931 TW samples and 146 SPW samples were analysed by the Institute of Public Health of Vojvodina according to accredited, standardised, and proposed national methodology. Static headspace sampling and gas chromatography coupled to mass spectrometry (reference method ISO 10301) was used for the determination of the THMs and its four compounds: chloroform ($CHCl_3$), bromodichlormethane ($CHCl_2Br$), dibromochlormethane ($CHClBr_2$), and bromoform ($CHBr_3$). The cancer risk assessment was done for average and highest concentrations of THMs by applying the United States Environmental Protection Agency methodology. The concentrations of total THMs, $CHCl_3$, $CHCl_2Br$, $CHClBr_2$ and $CHBr_3$ in TW were 23.99±11.35, 9.79±5.94, 6.98±3.49, 6.80±3.19, and 6.80±3.19 μg L^{-1}, respectively, whereas those in SPW were 130.85±135.58, 128.27±136.40, 3.66±3.33, 0.64±1.60 and 0.00, respectively. The concentration of THMs in TW did not exceed the national limit value (100 μg L^{-1}), but did in 40 % of SPW samples. The total cancer risk, both from the average and the highest concentration of THMs in TW and SPW, was found to be unacceptable (1.56E-03 and 6.66E-03, respectively). The dominant compound in total THMs in TW was $CHClBr_2$ (51 %), not classifiable as to its carcinogenicity to humans, whereas in SPW, $CHCl_3$ was dominant (74 %), known as possibly carcinogenic to humans. The adequate risk management for reducing the risk, as in TW, but dominantly in the SPW, is necessary.

KEY WORDS: *bromodichlormethane; bromoform; chloroform; dibromochlormethane; environmental medicine; public health*

Analysis of salt content in bread on the market of the city of Novi Sad, Serbia

Popović M[1,2]**, Torović LJ[1,2], Velicki R[1,2], Dragić N[1,2], Bjelanović J[1,2], and Bijelović S[1,2]

Faculty of Medicine, University of Novi Sad[1], Institute of Public Health of Vojvodina[2], Novi Sad, Serbia

Excess salt intake may lead to increased risk of the cardiovascular diseases. Salt content in the bread, traditionally consumed in large quantities among Serbian population, significantly contributes to the total daily salt intake. For this very reason, it is important to monitor salt content in bread on the market. The aim of the research was to determine the salt content of bread in the market of the City of Novi Sad, Serbia, both in industrial and domestic production. Sodium-chloride in 69 samples of bread, sampled from the market in Novi Sad was determined, using a potentiometric method. The mean salt content was 1.37 g per 100 g (SD: 0.20) with a minimum value of 0.75 and a maximum of 1.91. The mean salt content was similar in industrial (1.35 g per 100 g) and domestic production (bakery market) (1.39 g per 100 g). Regarding provisions for food labeling of the Food Standard Agency of the United Kingdom, 77.9 % bread items could be labeled as food with a medium salt content (0.3-1.5 %) and 22.1 % as food with a high salt content (≥1.5 %). White breads were saltier than other bread types in the survey, with an average salt content of 1.40 g per 100 g, compared to mixed grain breads and brown breads which had the average salt content of 1.33 g per 100 g. It is essential to make the national program and set national goals and recommendations on salt intake reduction. Multisectoral cooperation in achieving these goals is required.

KEY WORDS: *cardiovascular diseases; daily salt intake; monitoring; potentiometric method; sodium chloride*

**sanja.bijelovic@izjzv.org.rs*

***popovic.minja@gmail.com*

Food wastage – moral degradation of mankind

Racz A*

University of Applied Health Sciences, Zagreb, Croatia

The FAO estimates that each year approximately 1.3 billion tonnes of food, which amounts to approximately one third, by weight, of all food produced for human consumption in the world, is lost or wasted. Food wastage in the world where 800 million people suffer from hunger is not only an agricultural, economical or sociological issue, but above all the moral failure of the entire western society. This paper critically analyses European Parliament document (A8-0175/2017) and policies on food wastage. Food wastage happens along the entire food supply chain, but the sector contributing the most to food waste in the EU are households (53 %). This contributes to climate change, with a global carbon footprint of about 8 % of total anthropogenic global greenhouse gas (GHG) emissions. In Europe, the approximately 89 megatonnes of wasted food generate 170 Mt CO_2 eq. per year. The production of the 30 % of wasted food is responsible for an additional 50 % of water resource irrigation use and a large loss of biodiversity. At the same time, almost 793 million people in the world are malnourished and more than 700 million live below the poverty line. It is unquestionable that unsufficient nutrition is responsible for approximately 3.1 million of all deaths in children under five. Facing that fact, any irresponsible use of natural resources and any food wastage should therefore be considered morally unacceptable. Any effective action to reduce food waste requires a comprehensive rethinking of how we produce, market, and consume food at each step in the food supply and consumption chain. Action should not only focus on the change in consumers habits, but go deep into radical destruction of neoliberal capitalistic paradigm based on immoral and perverted overproduction and overconsumption with unfair distribution of wealth in the world.

KEY WORDS: *carbon footprint; consumer behaviour; ecological footprint; policy on food wastage*

Contamination of foodstuffs from Slovenia with toxic elements and safety considerations

Kirinčič S[1]**, Šömen Joksić A[1], Zupan M[2], Ivanoš I[3], Rep P[3], Rotter E[3], Ivartnik M[1], and Grčman H[2]

National Institute of Public Health[1], Biotechnical Faculty, University of Ljubljana[2], Ljubljana, National Laboratory for Health, Environment and Food[3], Maribor, Slovenia

The aim of this study was to evaluate the occurrence of regulated toxic elements in foods from the Slovenian market and to estimate the potential health risks for the population. The concentrations of heavy metals were determined in an accredited laboratory with atomic absorption spectrophotometry or inductively coupled plasma mass spectrometry. Arsenic (As), mercury (Hg), and tin (Sn) were analysed in a limited number of samples and only in particular food groups like rice products, fish, and canned food, respectively, and food for children. The results on total As and Sn did not show a high share of non-compliance with Regulation (ES) No 1881/2006, which was not the case for total total Hg in fish. Multi-annual statistics of lead (Pb) results showed relatively lower mean concentrations in most foods comparing the EU and other studies. Among all of the studied toxic elements, cadmium (Cd) seemed to be one of the most problematic concerning chronic health risks. The highest contribution to dietary Cd exposure came from cereal based foods and vegetables, although the highest mean concentrations of Cd were found in the groups of fish and seafood and meat and edible offal. Potatoes were also an important contributor to Cd exposure. Higher than average concentrations of Cd in grain and potato samples, which were grown predominantly in Slovenia, could be attributed to the characteristics of the Slovenian soil. Infants, toddlers, and other children are in the whole population, together with high consumers, the most exposed to toxic elements.

KEY WORDS: *arsenic; food; health risks; mercury; tin*

**aracz@zvu.hr*

***stanka.kirincic@nijz.si*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):40-43

The impact of food quality on patients' health conditions

Rotim C*, Vrkljan P, and Šostar Z

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Food is a basic human need, but also the pleasure that gives humans energy for life. Nutrition is part of the culture and customs of every person, inseparable from his/her worldview and lifestyle. Food is not considered a medicine, but it greatly affects the course and success of treatment, the length of stay in hospitals, and the prevention of illness. It is an inescapable form of therapy, which means that it saves organs, relieves symptoms, and contributes to the acceleration of the treatment process. Nutrition knowledge is often neglected by health professionals, and insufficient awareness of dietary nutrition is a threat to every patient, no matter the institution. Healthy or proper nutrition is a diet that provides the body with an optimum intake of calories, vitamins, minerals, and fluids and an optimal ratio of proteins and carbohydrates to ensure the body's energy and protective properties. Nutrition in healthcare institutions is specific, unlike the food intake in one's home. It must be versatile, prepared under controlled conditions with specially trained specialists from specific areas, tailored, economically viable, and compliant with statutory regulations. It is often referred to as a pyramid of healthy eating that many rely on in the illness and maintenance of health when the question arises: "Who and what not to eat?" The Pyramid of Healthy Food directs one what to eat and in what quantities, but also points to the importance of a varied diet because no food contains absolutely everything needed for the normal functioning of the body. Most commonly, when we speak of nutrition, we immediately think of the usual intake of food and fluid through the mouth (*per os*), but it encompasses enteral and parenteral nutrition, especially when we talk about clinical nutrition that is almost always applied in institutions, which requires the collaboration of many professionals from different areas: doctors, dieticians, nutritionists, chefs, nurses who play a major role in food and fluid intake, as they are always present during this process as a patient, in the enteral diet, and in the application of various parenteral solutions and in parenteral diets. The aim and purpose of this presentation was to demonstrate that the role of a nurse in the diet of a patient requires a radical, systematised, complete, and individualised nursing approach as well as applying quality and standardised nursing documentation and procedures, and educating patients and their families.

KEY WORDS: *diet; health; medical nurse; nutrition knowledge; Pyramid of Healthy Food*

Microbiological assessment of ice from ice making machines in Dubrovnik area

Jadrušić M**, Grilec D, Ljevaković-Musladin I, Matijašević I, and Lakić M

Institute of Public Health of Dubrovačko-Neretvanska County, Dubrovnik, Croatia

The aim of this study was to assess the microbiological quality of ice used for food and drinks in food premises of the Dubrovnik area. Analyses were conducted according to Croatian National Guidelines on microbiological criteria for foodstuffs, by using ISO standard methods for aerobic plate count, *Escherichia coli, Enterococcus* spp., *Pseudomonas aeruginosa* and sulphite-reducing Clostridia. In 2018, 685 samples were collected from 217 ice making machines. A total of 65 out of 217 (30 %) ice making machines were unsatisfactory. The assessment showed that 197 samples of ice (28.8 %) had unsatisfactory microbiological quality due to high levels of aerobic plate count and the presence of *Pseudomonas aeruginosa* and *Enterococcus* spp. High levels of aerobic plate count were found in 172 samples (25.1 %). The presence of *Pseudomonas aeruginosa* and *Enterococcus* spp. was detected in 110 samples (16.1 %) and 28 samples (4.1 %), respectively. Poor hygiene of ice making machines, mishandling of ice scoops, along with bottle cooling on ice, are the most common reasons for unsatisfactory results. The poor microbiological quality of water for ice making also had an adverse effect on ice. Frequent and regular cleaning and desinfection of ice making machines and ice scoops, control of the source water alongside with educating food handlers is the key to a satisfactory microbiological quality of ice.

KEY WORDS: Enterococcus *spp.; microbiological quality;* Pseudomonas aeruginosa*; water for ice making*

**cecilijarotim@gmail.com*

***marija.jadrusic@zzjzdnz.hr*

Comparing results of the analysis of salt in white bread and data on the quantity of salt in white bread from food labelling information

Lazić V[1]*, Marjanović M[2], and Rudić Grujić V[2,3]

Public Health Institute of the Republic of Srpska, Regional Centre Zvornik, Zvornik[1], Public Health Institute of the Republic of Srpska[2], Faculty of Medicine, University in Banja Luka[3], Banja Luka, Republic of Srpska, Bosnia and Herzegovina

The aim of this study was to determine the diference between the results of the analysis of salt in white bread and data on the quantity of salt in white bread from food labeling information.The research was conducted as a cross-sectional study with specific geographical distribution patterns (forming three regions). Samples were collected from subjects who conduct regular controls of health safety (N=24). Determining the analysis of salt in white bread was conducted using Mohr's method. Determining the data on the quantity of salt in white bread was conducted using a simple mathematic model. Descriptive statistical indicators were used in the survey (the number of samples, the minimum and maximum values, standard deviation). The results indicated that there was a statistically significant difference between the result of analysis of salt in white bread and the data of the salt quantity from the food labelling information at regional level. A comparison of the data from the region and the Republic of Srpska showed no statistically significant difference. For people who care about salt intake through white bread, food labels are not a reliable tool that can be used in diet planning.

KEY WORDS: *cross-sectional study; declaration; health; salt intake; survey*

Parental perception of school meals in Zagreb elementary schools

Petričević N** and Miletić Činić L

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

The new national standards for school meals in elementary schools was released in 2013 by the Croatian Ministry of Health, but so far it has been loosely implemented, due to opposition to healthier meals among students, parents, and school staff. The aim of the study was to investigate parents' perception of school meals. Data were obtained from seven elementary schools in Zagreb. The method was an anonymous voluntary questionnaire for parents whose children were attending 5th and 6th grade. A total of 565 parents (81 % women, mean age 40.7±5.68 years) participated in the study, response rate 69 %. Most students (73.6 %) eat school meals. Almost half of the parents (45.5 %) perceived school food to be unhealthy and many parents (54 %) thought that the meals are too small. As many as 41.7 % of parents thought that there was not enough fruit and not enough vegetables (56.2 %) in school menus, and that there was too much bread (58.6 %), and too much fast food (35.9 %). Most parents (75.5 %) agreed that school meals affect a child's behaviour and attention during classes. Half of the parents (49.2 %) agreed that school meals did not meet guidelines for healthy meals and that these needed to be changed (69.2 %). With increasing obesity among children, we need to be protective of childrens' health and active in educating and partnering with parents and school staff in implementing new standards so children can develop healthy eating habits.

KEY WORDS: *children eating habits; food; parents; questionnaire*

**lazicdrvesna@hotmail.com*

***nina.petricevic@stampar.hr*

Environmental health approach – risk assessment and adaptation to the needs in health tourism

Jergović M*, Kovaček I, Tolić S, and Hrga I

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

An assessment of future Croatian health tourism development aligned with a comprehensive and preventive environmental health approach was conducted. The results of the conducted preventive or corrective environmental monitoring in specific health tourism objects were evaluated. Environmental monitoring was carried out at the Andrija Štampar Teaching Institute of Public Health during 2014-2018 relying on the institutional database. Simultaneously, public database searches were conducted in order to retrieve original articles related to literature on health tourism and public health compliance, related to the determinants of environmental health in facilities of this purpose. Results of the analysis of different environmental samples (water, food, air, or objects of common use) in specific facilities of health tourism were processed. In conclusion, a very narrow set of the critical risk assessment points could be proposed at this moment due to the inadequate datasets available on the institutional level. For an accurate and efficient health risk assessment, the most optimal health and environmental indicators must be proposed based on continuous monitoring and a more significant number of monitoring results. Further development of the sustainable health tourism infrastructure with consultant and analytical support of preventively orientated public health institutions and their wide network of the project partners represents a superior ecosystem suitable for the future growth of value-added health tourism in Croatia.

KEY WORDS: *environmental monitoring; food normative; IoT tools; public database searches; quality control*

Food waste: a comparison between domestic food waste habits in Portugal and Croatia

Kalambura S[1]**, Saramagio J[2], and Rocha B[2]

University of Applied Sciences Velika Gorica, Velika Gorica, Croatia[1], Escoula Superior De Tecnologia De Coimbra, Coimbra, Portugal[2]

Many factors contribute to food waste, involving such diverse aspects of the production chain as the adopted intensive production models, inadequate storage and transport conditions, or even promotions that encourage consumers to buy in excess. Recently, various studies have been carried out on food waste, recognising it as a very good example of unsustainability considering the social, environmental, and economic consequences it entails. Several facets of the problem are related to choices and consumer behaviour, not only in terms of the quantities they buy or the conservation strategies they use, but also in terms of the consumption criteria that guide their purchases. For the accomplishment of this investigation, questionnaires about domestic food waste were used, both for the Portuguese and the Croatian population. For participants from Portugal, the questionnaire was launched online while Croatian participants answered the questionnaire on paper. In all, 258 responses were collected (129 from Portuguese and 129 from Croatians). According to our findingd, Portugal produces a greater amount of biological residues, around 18 L per person per week, while Croatia produces around 10 L. This result can be explained by a study carried out regarding the food waste produced in the houses of Portuguese families, wherein it was possible to conclude that the highest percentage refers to "fruit peels, lumps, etc." (76 %) and "vegetables" (stalks, or spoiled, etc.), which is in line with the results of our study (taking into account that Portugal is a major consumer of this type of food compared to Croatia). The majority of the Croatian and Portuguese populations do not separate organic waste and once again Portugal has an average production of waste per person higher than Croatia. A Portuguese inhabitant produces about 188 L per week while a Croatian inhabitant produces 132 L, on average.

KEY WORDS: *consumer behavior; environmental; questionnaires about domestic food waste; unsustainability*

**matijana.jergovic@stampar.hr*

***sanja.kalambura@vvg.hr*

Research on food waste handling and awareness in tourist hotels in Croatia

Kalambura S[1]*, Toth I[1], Jovičić N[1], Saramagio J[2], and Rocha B[2]

University of Applied Sciences Velika Gorica, Velika Gorica, Croatia[1], Escoula Superior De Tecnologia De Coimbra, Coimbra, Portugal[2]

In recent years, several factors have contributed to the growth of tourism. In developed countries, the economy has allowed people to have greater purchasing power, allowing travel to become an increasing phenomenon. In this way, tourism has been growing in Croatia for several reasons: a long coastal area, immense natural and green spaces, and a pleasant climate. Tourists want everything to match perfectly to what they are buying, including food services. This way, hotels are expected to offer huge varieties of food and different meals, corresponding to the requirements of their guests. For this reason, tourism is currently a major source of food waste. For the most part, more food is served than what is really needed just to meet the standards that a hotel must offer. In the development of this research, deep interviews were conducted with four different hotels in some of the most visited areas of Croatia (three of them classified with 4 stars and one with 3 stars) and one restaurant that also provides catering services. The interviews were guided through a questionnaire with 24 questions, however the goal was to collect as much information as possible. The results collected show that the type of food most wasted in hotels are vegetables (20 %), followed by fruits (15 %) and bread (15 %). On the strategies that hotels have implemented to reduce food waste, the most chosen options were "separate food waste bin" (37 %), "use surplus food as by-product" (25 %) and "use surplus food for staff meals" (25 %). Some hotels have recycling methods implemented and this could be a way of reducing even a small percentage of the food waste in the hotel and restaurant world.

KEY WORDS: *green management; questionnaire; restaurants; strategies implemented to reduce food waste; tourism*

**sanja.kalambura@vvg.hr*

Salt as a functional food – iodine

Đulović Š[1]*, Jašić M[2], and Đulović-Jusić Z[3]

Solana d.d. (Salt Factory)[1], Faculty of Technology, University of Tuzla[2], Health Centre Tuzla[3], Tuzla, Bosnia and Herzegovina

Iodine deficiency and excessive salt intake are global problems for the world's population. In terms of nutrition, table salt is the main source of Na and Cl ions for humans and animals. Its proper intake is vital for life. Salt plays a significant role as a nutrient necessary to maintain the homeostasis of the human body. Except in diet, salt is also used in medicine and the chemical and food industry. Every person needs different amounts of salt depending on age, weight, climate, humidity, physical activity, health status, the amount of the potassium intake, and other factors. Average consumption per capita on a global scale is 10 grams per day or 3.5-4.5 kg per year. Out of total daily salt intake, 20 % is from foods that contain salt, 15 % is from subsequent addition of salt to food and 70 % is from so called "hidden salt". Industrial production of salt, its relative low cost and the modern lifestyle have created habits of consuming foods with increased amounts of salt, which results in increased death rates by stroke and heart attack, hypertension and heart, kidney and stomach diseases. All of these are reasons why WHO recommends consuming no more than 5-6 grams of salt per day. Salt substitution is also recommended, among which the use of KCl salts is preferred. About 2 billion people have insufficient iodine intake. Low iodine intake can lead to goiters, retardation, and cretinism. Sufficient iodine intake prevents the development of cancer (breast, ovary, uterus, prostate, and thyroid) and enhances the immune response of the body to fight bacteriological, viral, parasitic, and fungal infections. By nutritional fortification with iodine, table salt has become the main source of iodine. The chemical compounds used for iodination are KJ, NaJ, and KJO_3. The daily iodine intake, recommended by International institutions (WHO, UNICEF, and ICCIDD), is 150 μg and they also recommend adding 20-40 mg per kilogram of salt during iodination. Bearing in mind all these problems with excessive salt intake on the one hand, and the fact that it is one of the most important sources of iodine whose intake is often insufficient on the other hand, the recommendation of salt intake should be in line with the iodination guidelines of salt so that solving one problem does not result in the escalation of the other.

KEY WORDS: *iodinated salt; iodine deficiency; recommendations; salt consumption*

**seval.djulovic@solana.ba*

POSTER PRESENTATIONS

Effect of the process of flaking of einkorn (*Triticum monococcum* L.) on some basic chemical properties and biologically active compounds in the flaked product

Nakov G[1]*, Dimov I[2], Ivanova N[1], and Stamatovska V[3]

University of Ruse "Angel Kanchev" Branch Razgrad, Razgrad[1], Trakia University – Stara Zagora, Faculty of Technics and Technologies, Yambol[2], Bulgaria, "St. Kliment Ohridski" University of Bitola, Faculty of Technology and Technical Sciences, Veles[3], Macedonia

Nowadays, flaked product have become quite popular. The main technological operations applied for their production are: cleaning of the corn, sorting, peeling, treatment of corn surface with brushes, heating, drying, fractionation, and flaking. The aim of the present paper was to study the effect of the process of einkorn (*Triticum monococcum* L.) flaking on some basic chemical properties, the biologically active substances, and the antioxidant activity of the flaked product. The samples were prepared for analysis according to AACC Method 62-20A, the moisture content in the samples was determined according to ISO 5984:2002, the amount of fats according to ISO 6492:1999 and the protein content by the method of Lowry. The following biologically active compounds were also determined: total amount of polyphenols by the method of Folin-Ciocalteu reactant, antioxidant activity (% DPPH), and total carotenoids. The analyses carried out showed that flaking had a certain effect, although to a small extent, on the values of the properties of the flaked einkorn. The moisture content and the total amount of carotenoids were found to decrease while the amounts of fats, proteins, and total polyphenols increased. The results obtained from the analyses of the flaked product were compared to those of wholegrain einkorn flour and the differences were seemingly insignificant although some were statistically significant. It was also found that the process of flaking does not affect the amount of mineral substances and the antioxidant activity of the flaked einkorn compared to einkorn flour.

KEY WORDS: *antioxidant activity; carotenoids; mineral substances; polyphenols; wholegrain einkorn flour*

ACKNOWLEDGEMENTS

The study was supported by a grant from the University of Ruse "Angel Kanchev", № BG05M2OP001-2.009-0011-C01, *Support for the development of human resources for research and innovation at the University of Ruse "Angel Kanchev"*. The project is funded with support from the Operational Programme "Science and Education for Smart Growth 2014-2020" financed by the European Social Fund of the European Union.

Acesulfame potassium

Baltazar A**, Baptista A, Martins A, Duarte M, Matos C, and Joaquim J

Coimbra Health School-IPC, Coimbra, Portugal

High-intensity sweeteners (HIS) are used to sweeten and enhance flavour. As they are much sweeter than table sugar, smaller amounts of HIS are needed to achieve the same level of sweetness in food. Only six high-intensity sweeteners are FDA-approved as food additives: saccharin, aspartame, acesulfame potassium (Ace-K), sucralose, neotame, and advantame. Our aim is to identify the benefits and malfunction of Ace-K and possible therapeutic purposes, as well identify their presence in food in relation to current legislation. We based our research on scientific articles using the search engines Google, PubMed, PubChem, and SciELO and analysed articles since 2013. Ace-K is authorised in the EU for food use with the exception for foods for young children. It is typically used in frozen desserts, candies, beverages, and baked goods. It is about 200 times sweeter than sugar and is often combined with other sweeteners. It enters the organism by oral intake and is absorbed in the small intestine. It is primarily excreted by the urinary system and secondly by feces of the same composition as ingested, because it had not been metabolised. This sweetener was re-evaluated by the European Union Scientific Committee on Food in 2000 who confirmed an acceptable daily intake (ADI) of 9 mg kg^{-1}. In conclusion, although being consumed in less quantity than sucrose, both cases can lead to obesity and other health problems. Although the fact that the maximum dose recommended of Ace-K is legislated is an advantage that helps control its ingestion, excessive consumption is unavoidable.

KEY WORDS: *acceptable daily intake; artificial sweeteners; E950; food additive; pharmacokinetics*

**gnakov@uni-ruse.bg*

***ana.santos@estescoimbra.pt*

Burger carbon footprint

Jovičić N*, Kalambura S, and Galić S

University of Applied Sciences Velika Gorica, Velika Gorica, Croatia

The food we eat is responsible for almost a third of our global carbon footprint and food waste represents one of the biggest challenges in waste management. In the EU, around 88 million tonnes of food waste is generated annually but wasting food is not only an ethical and economic issue but also an environmental issue. Food production is a major cause of changes in land use, loss of biodiversity, and increased greenhouse gas emissions. Nowadays fast food restaurants have become a way of life throughout the world for many people and burgers are common food items for most people in the developed world. The environmental impact of burger is recognised during growing, farming, processing, transporting, storing, and ultimately disposing. This paper will define a burger's carbon footprint throughout its whole life cycle.

KEY WORDS: *environment; fast food restaurants; food impact; food safety; food waste*

Validation of effects of γ-irradiation on characteristics of standard microbiological media

Šimić M[1]**, Tartaro Bujak I[2], Mihaljević B[2], and Šuto S[1]

Department of Clinical Microbiology, Andrija Štampar Teaching Institute of Public Health[1], Division for Material, Ruđer Bošković Institute[2], Zagreb, Croatia

Gamma irradiation is an efficient, safe, and fast method for the inactivation of all biological contaminants at all stages of their life cycle. This method is based on the ability of high-energy photons generated by radioactive ^{60}Co to induce chemical DNA damage in biological contaminants such as insects, moulds, yeasts, and bacteria. Therefore, γ-irradiation finds its use in the sterilisation process of different materials such as medical supplies, pharmaceuticals, and food quality preservation. The aim of this study was to investigate the physicochemical parametars and microbiological characteristics of Tryptone soya and Sabouraud Dextrose agar media on Petri dishes after irradiation in dependence on the irradiation dose. Microbiological media (20 Petri dishes) packed in termal-shrinking foil were put in cardboxes (20x20x10 cm) in the presence of seven biological indicators (spores of *Bacillus pumilus*). The three irradiation cycles were performed on a panoramic ^{60}Co source at Ruđer Bošković Institute. Dosimetry was established with an ethanol-chlorobenzene dosimetry system (ISO/ASTM 51538:2017). Quality control of microbiological media was perfomed before and after irradiation according to HRN EN ISO 11133. The physicochemical parameters (appearance, colour, homogeneity, agar consistency) and microbiological characteristics of culture media (sterility and productivity) were tested. The results of the performed tests after γ-irradiation met requirements in accordance with EU guidelines and corresponding standards and these microbiological plates may be used for microbiological methods and validation of aseptic procedures control of safe operation under clean conditions.

KEY WORDS: *microbiological tests; radiation dose; Sabouraud Dextrose agar; Tryptone soya agar*

ACKNOWLEDGEMENT

This study is the result of a collaboration between the Radiation Chemistry and Dosimetry Laboratory and the Department of Clinical Microbiology of the Andrija Štampar Teaching Institute of Public Health in Zagreb.

**nives.jovicic@vvg.hr*

***mirjana.simic@stampar.hr*

Consumer acceptance of flaxseed oil blends rich in omega-3 fatty acids

Radić B*, Lužaić T, and Romanić R

University of Novi Sad, Faculty of Technology, Novi Sad, Serbia

The quality of a finished product is characterised by a number of factors, and one is the level of sensory acceptance. In addition to good nutritional characteristics, due to the presence of omega-3 fatty acids, it is of great importance to ensure the placement of new products on the market with knowledge of how they are accepted by consumers. The aim of this study was to examine the acceptability of blended vegetable oils enriched with omega-3 fatty acids by adding cold pressed flaxseed oil to refined sunflower oil. The initial samples were examined, cold pressed oil of flax seed (CPFO) and refined sunflower oil (RSO), their blends in the mass ratio (CPFO:RSO) 30:70, 50:50, and 70:30 and the obtained results were compared with the one blended vegetable oil present on the Serbian market. Randomly selected consumers (N=15) tested the acceptability of blended oils using a point system of analytical descriptive tests with grades of 0 (unacceptable quality) to 5 (optimum quality). Also, the oil colour, CIE L*a*b* and transparency (%T) were also determined instrumentally. The average sensory score of the acceptability of blended oils by consumers was 3.38 points (at 70:30) to 3.76 points (at 30:70). In lightness (L*), samples of blended oils were relatively small. L* values were 24.97 % (at 30:70) and 25.00 % (at 70:30), while the values of the transparency of blended oils ranged from 2.40 % (at 70:30) to 12.63 % (at 30:70). It can be concluded that there are differences in the sensory quality of the investigated blended vegetable oils, but despite all this, the products have good sensory acceptance of colour, odour, and taste by consumers.

KEY WORDS**:** *CIE L*a*b*; colour lightness; sensory evaluation; transparency*

**bojanaradic994@gmail.com*

Integrated quality management system in a social care institution

Župan A* and Radulović N

The City of Zagreb Institution "Dobri dom", Zagreb, Croatia

The Dobri Dom institution of the City of Zagreb unifies the social care system provided by the city to citizens of lower income status. The institution prepares about 3500 meals a day, or more than 20 million meals since its inception in 2004. The purpose of this paper was to outline the effects ensuing from the integration of a quality management system in maintaining and improving service quality. This paper summarises the evaluation of the system for a three-year period. The following parameters were considered: feedback trends and beneficiary satisfaction based on questionnaire results, incompliance trends, corrective and preventive measures, and data on quality and health suitability of meals, swabs and water. Beneficiary satisfaction showed negligible differences over the study period and exceeded the planned criteria and targets for each year. A total of seven incompliances were determined, and corrective measures were implemented. Sampling of prepared meals, swabs and water was carried out in accordance with regulations at intervals set by the HACCP system. Based on the results, it can be concluded that the implementation of the integrated management system is justified. Hazard analysis included all parameters that ensure the proper health status of meals, which is also a goal of the business policy of the institution – healthy, safe and high-quality meals, and satisfied beneficiaries.

KEY WORDS**:** *beneficiary satisfaction; HACCP system; health care; meal quality; quality of service*

Quality management in sterilisation processes

Rakić A** and Jurčić K

Teaching Public Health Institute of Split and Dalmatia County, Split, Croatia

Among public health activities is microbiological testing and isolation of microorganisms from food, water, general purpose goods, medical products, etc. In order to ensure quality control of the health of food in healthcare institutions, the importance of sterilisation of microbiological media and laboratory equipment and utensils is of great importance. The aim of this study was to check the conditions under which dry and humid sterilisation is performed. Regular maintenance of equipment is necessary to prevent work stoppages and two procedures are used to check this: 1. calibration – refers to the control of the quantification of results after setting the instrument for operation under certain conditions; 2. validation – which indicates the general validity of the instrument. Each cycle of sterilisation used chemical indicators with the appropriate certificate in accordance with ISO standards. The test strips were placed on critical points inside the steriliser and their number and layout depended on the size of the steriliser. Based on the supervision of sterilisation procedures in routine work from 2009 to 2014, over nine devices (two for dry and seven for wet sterilisation devices) it can be concluded that all required conditions for each sterilisation cycle have been achieved. The testing laboratory in the health institution is accredited according to EN ISO/IEC 17025, which is a testament to the professional and technically competent staff to perform certain tests. To this end, it is necessary to carry out education of health and non-health workers participating in sterilsation procedures and point to the importance of monitoring the operation of the appliances used in sterilisation processes. All of this is covered by quality management procedures in sterilisation processes.

KEY WORDS: *chemical indicators; healthcare quality assurance; test equipment*

**ravnatelj@dobri-dom.hr*

***anita.rakic@nzjz-split.hr*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):51-52

Experience in accreditation of conformity assessment bodies in the food sector

Buntak K*, Španić Ciceli N, Čop A, and Stefanović M

Croatian Accreditation Agency, Zagreb, Croatia

Reliable information related to food safety and quality is an important issue for all interested parties in the chain of food production, distribution, storage and marketing, as well as for regulators who prescribe requirements and perform market surveillance of food. A credible assurance system of food safety and quality is based, among other elements, on reliable data delivered by laboratories and other conformity assessment bodies that declare their competence by accreditation according to internationally recognised criteria. Activities of the Croatian Accreditation Agency (HAA) in accreditation of laboratories and other conformity assessment bodies in the food sector are presented, as are accredited scopes and statistics about accredited conformity assessment bodies in Croatia, application of flexible scope of accreditation, applicable European Co-operation for Accreditation (EA) and HAA documents on accreditation, and cooperation of Croatian accreditation body with regulators in implementation of food regulation.

KEY WORDS**:** *certification; food quality; food safety; laboratory; statistics*

**katarina.buntak@akreditacija.hr*

Comparison of gas chromatography and near infrared spectroscopy for determination of butter adulteration

Mikulec N[1]*, Kazazić S[3], Gajdoš-Kljusurić J[2], Radeljević B[1], Plavljanić D[1], and Špoljarić J[1]

Faculty of Agriculture[1], Faculty of Food Technology and Biotechnology[2], University of Zagreb, Ruđer Bošković Institute[3], Zagreb, Croatia

Milk fat is one of the most expensive edible fats on the market and is often replaced with cheaper oils and fats of plant or animal origin. The aim of this study was to compare the effectiveness of the time-consuming gas chromatography and near infrared (NIR) spectroscopy in detecting the presence of a foreign fat in milk fat in order to provide faster and better system of quality control and correct labeling of butter. Calibration samples with known butter proportions of 0; 0.5; 1; 2; 5; 10; 25; 50; 75 and 100 % (v/v) of added margarine or pork fat were prepared, also samples of butter and margarine from retail trade network were analysed. The application of chemometric techniques enabled the qualitative separation of butter samples as a grouping of butter depending on whether the added foreign fat. Also, there was possible quantitative validation and therefore the prediction of the share of added margarine or pork fat, based on the NIR spectrum. In the qualitative analysis of the samples the principal component analysis method (PCA) was used, while the partial least square regression method (PLSR) was applied for the quantitative prediction. The spectra were also associated with the content of polyunsaturated fatty acids (PUFA) and the following fatty acids: C12:0; C18:1n9, and C18:2n6 which showed linear trend changes depending on the added share of margarine or fat. On the basis of results it can be concluded that the applied methods in comparison with gas chromatography have great potential in monitoring the quality of butter control. NIR spectroscopy has proved to be a suitable technique for the rapid determination of butter adulteration, and may be applied in rapid "screening" control of correctness labelling.

KEY WORDS: *butter labelling; chemometry; fatty acids; milk fat; PUFA*

Development of an analytical method for LC-MS/MS determination of DON, 3-AcDON, and 15-AcDON in food

Ivešić M**, Ladiš A-M, Krivohlavek A, and Šikić S

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Mycotoxins are well-known as metabolites, among others, of *Fusarium* fungi witch have a strong impact on human health while consuming food. Deoxynivalenol (DON) as a mycotoxin can also be found in the acetylated forms [known as modified (masked)] forms of DON: 3-Acetyldeoxynivalenol (3-AcDON) and 15-Acetyldeoxynivalenol (15-AcDON). DON acetylated forms may be found afer metabolisation of some plants, animals, food production process, and etc. Even though DON is constantly monitored in food, alertness for 3-AcDON and 15-AcDON still is not high enough. The reason for that may be interpreted by the lack of reliable analytical methods. The aim of this paper was development of analytical method for high performance liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS) determination of DON, 3-AcDON, and 15-AcDON. Samples of cereals and cereal products after homogenisation were purified through immunoaffinity columns (IAC). Samples were contamination free from DON, 3-AcDON, and 15-AcDON and spiked with different amounts of DON, 3-AcDON, and 15-AcDON verifying suitability of developed method. The concentration amounts of DON, 3-AcDON, and 15-AcDON in the samples were determined by LC-MS/MS. Validation parameters of developed method (selectivity, recovery, precision, linearity, accuracy, limits of detection and quantification and robustness) were completely fulfilled. Sample recoveries were ranging from 62.0 up to 95.5 % for concentrations 100-1250 μg kg^{-1}, limit of detection was 100 μg kg^{-1} while limit of quantification was 200 μg kg^{-1} for all analytes furthermore proving method is validated for determination of DON and its acetylated forms in cereals and cereal products.

KEY WORDS: *cereals and cereal products; contamination; food safety, masked forms; mycotoxins*

**nmikulec@agr.hr*

***martina.ivesic@stampar.hr*

The effects of irradiation on vitamin C content in dried mango, papaya, and pineapple

Maltar-Strmečki N* and Štajner L

Ruđer Bošković Institute, Zagreb, Croatia

The application of ionising radiation to food is a process that improves the safety and extends the shelf life of food by reducing or eliminating pathogenic microorganisms and insects. It is known that vitamins show different sensitivities regarding treatment with ionising radiation in fresh fruits. The most sensitive one is vitamin C. Nowadays, dried fruits have become very popular as a delicious and healthy snack in the busy everyday lifestyle. Therefore, in this study, the effect of different radiation dose on vitamin C in dried mango, papaya, and pineapple was monitored. Quantification of vitamin C was determined by spectrophotometry utilising potassium permanganate. Electron paramagnetic spectroscopy (EPR) was used for dose determination as an established technique for detecting gamma-irradiated foodstuffs containing sugar, bone, and cellulose. The obtained results show that dose irradiation treatments up to 3 kGy did not cause significant alterations in vitamin C contents in dried papaya and pineapple. In dried mango, a decrease of vitamin C was observed. However, its sensitivity was also related to several factors (water content, exposure to oxygen, storage temperature, pH modifications). Therefore, further investigations on the drying process and storage conditions are necessary. In general, low dose irradiation treatments, up to 1 kGy, did not cause a significant change in the vitamin C contents of the selected dried fruits.

KEY WORDS: *dried fruit; EPR spectroscopy; quantification of vitamin C; radiation; sterilisation*

Method development and validation of method for the determination of dithiocarbamates in food

Mandić Andačić I**, Palac Bešlić I, and Krivohlavek A

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Dithiocarbamates (DTCs) are fungicides used against a wide spectrum of microorganisms. They can be classified into three groups: dimethyldithiocarbamates (DMDCs) such as ziram, thiram, and ferbam; ethylenebisdithioocarbamates (EBDC) such as maneb, zineb, and mancozeb; and propylenebisdithiocarbamates (PBDC) such as propineb. Because of their low stability, they cannot be directly extracted or analysed, but in contact with acidic plant juices they degrade and decompose into carbon disulphide (CS_2). At the Andrija Štampar Teaching Institute of Public Health, a GC-MS method for the determination of total DTCs expressed as CS_2 in food was developed and accredited. The method is based on the conversion of dithiocarbamate to CS_2 in the presence of tin (II) chloride. The resulting CS_2 is absorbed into iso-octane and analysed using GC-MS. Method validation was carried out according to the requirements of SANTE 11945/2015. Validation included determination of limit of quantification (LOQ), trueness, precision, specificity, sensitivity and linearity. Since certain vegetables (onions, broccoli, cabbages) contain naturally occurring sulfur compounds, the established LOQ for those samples is 1.0 mg kg^{-1} and for other fruits and vegetables and infant foods 0.04 mg kg^{-1}. The method is characterised by good precision (RSD<20 %), recoveries (74-102 %) with RSD<15 %, at LOQ, sensitivity and accuracy, and is suitable for routine analysis. So far, 895 samples have been analysed, of which 89 samples had DTCs above the LOQ, but none exceeded the maximum residue limits (MRLs).

KEY WORDS: *carbon disulphide; GC-MS; fungicides; maximum residue limits; vegetables*

**nstrm@irb.hr*

***ivana.mandicandacic@stampar.hr*

Fungal contamination of Croatian honey

Kiš M[1]*, Furmeg S[1], Jaki Tkalec V[1], Zadravec M[2], Sokolović J[1], and Majnarić D[1]

Veterinary Centre Križevci, Križevci[1], Croatian Veterinary Institute, Zagreb[2], Croatia

Food contamination by fungi poses a serious human health risk, especially in vulnerable populations, and represents a challenge to global food security. Although honey is considered to be a relatively safe foodstuff with antifungal properties, the presence of some mycotoxin-producing fungi genera in honey indicates the need for regular analyses of microbiological characteristics. The objective of this study was to investigate honey used in Croatia from the mycological point of view, and thus contribute towards the knowledge on the genera of molds present in honey. In this study, 30 honey samples collected in various parts of Croatia during the period 2012-2017 were tested for the presence of yeasts and molds. The amount of yeasts found in honey samples ranged from 0.00 to 3.11 log cfu g^{-1} of sample, with an average 1.58 log cfu g^{-1}, whereas the mould count ranged from 0.00 to 2.26 log cfu g^{-1}. In 16 samples incompatible due to high mold count, 19 isolates representing nine genera of moulds were found. The mycological identification showed that *Cladosporium* was the most frequent genus, followed by *Penicillium* and *Alternaria*, being found in 47.37, 10.53, and 10.53 % of samples, respectively. In addition, the genera of *Mucor*, *Aureobasidium, Acremonium, Botrytis, Stachybotrys,* and *Paecylomyces* were isolated in 5.26 % samples. The results showed that most of the moulds identified in this study are commonly found in honey and represent natural honey mycobiota.

KEY WORDS: *bee products; microbiological analysis; moulds; mycobiota; yeasts*

Detection and antibiotic resistance in bacteria collected from raw milk (suspective bovine mastitis) in Zenica-Doboj Canton, Bosnia and Herzegovina

Ibrahimagić A**, Dizdarević J, Gladan M, Kapidžić A, Fajković A, Fetahagić M, Hodžić B, and Haurdić B

Department for Veterinary Public Health, Institute for Health and Food Safety Zenica, Zenica, Bosnia and Herzegovina

Detection of pathogens associated with bovine mastitis is helpful in treatment and management decisions. The aim of this work was to detect antibiotic resistance in bacteria collected from suspective mastitis (raw milk) in the Zenica-Doboj Canton. The milk samples were collected from cow suffering with suspected mastitis. The milk samples were inoculated into the blood nutrient agar and MacConkey agar, and incubated at 37 °C. All the pure cultures obtained from MacConkey agar slant were subjected to Gram-staining and standard biochemical tests. Antibiotic susceptibility of all isolates was determined using the disk diffusion method. The production of extended-spectrum beta-lactamases (ESBLs) was determined by double-disk synergy test. Among the raw milk samples (N=445), 39 (8.8 %) were positive and among them 24 (out of 39; 61.5 %) were detected as Gram positive isolates, and 15 (out of 39; 38.5 %) as Gram negative isolates. The most prevalent Gram-negative bacteria isolated from milk samples were *Escherichia coli* (N=10; 66.7 %), and *Klebsiella* spp. (N=5; 33.3 %), while between Gram positive isolates *Staphylococcus aureus* were the most prevalent bacteria (70.8 %) and *Streptococcus* spp. (29.2 %). Methicillin-resistant *Staphylococcus aureus* was not detected. Two isolates of *E. coli* and one isolate of *Klebsiella* spp. produced AmpC beta-lactamases. Vancomycin resistant *Streptococcus* spp. (*S. dysgalactiae, S. agalactiae*, respectively) were detected in the samples. Resistance rate to amoxicillin-clavulanic acid in *Klebsiella* spp. and *E. coli* was 40 and 70 %, respectively. More than 70 % of *S. aureus* isolates were resistant to ampicillin, and a high precent of *Streptococcus* spp. were resistant to tetracycline and doxycycline (71.4 and 28.6 %). All isolates were negative in phenotypic test for ESBLs, but two isolates were positive for AmpC beta-lactamases. Microbiology laboratories must be able to detect, follow, and recognise antimicrobial resistance, ESBLs and AmpC-carrying isolates in a timely manner, especially those that are falsely susceptible *in vitro* to drugs that may be considered for therapy of infected animals. Also, it is very important to have national monitoring in order to suppress the possibility of an emergence and spread of multiple resistance isolates between animals, as well as between animals and people.

KEY WORDS: *AmpC beta-lactamases; antimicrobial resistance; cow; disk diffusion method; multiple resistance isolates*

**kis.vzk@veinst.hr*

***ibrahimagic.amir@gmail.com*

β-glucan as a bio-fixator for aflatoxin M1

Jakopović Ž[1]*, Čanak I[1], Frece J[1], Bošnir J[2], Kuharić Ž[2], Pavlek Ž[2], Ivešić M[2], and Markov K[1]

Faculty of Food Technology and Biotechnology, University of Zagreb[1], Andrija Štampar Teaching Institute of Public Health[2], Zagreb, Croatia

Aflatoxin M_1 (AFM_1), a hydroxylated metabolite of aflatoxin B_1, is a relatively stable molecule in raw and processed dairy products and cannot be inactivated by heat treatments such as pasteurisation or sterilisation. Due to the fact that the presence of AFM_1 in milk can be dangerous to human health and presents an enormous economic problem, there is increasing emphasis on the development of methods for AFM_1 reduction. One of the strategies is the use of various types of mycofixators (alumino-silicates, clay, zeolites, etc.) that have the ability to bind mycotoxins and are removed from food after use. Despite the use of mycofixators in feedstuffs, AFM_1 contaminated milk does occur. Therefore, the aim of this work was to determine the binding parameters of AFM_1 in milk by β-glucan isolated from oats and yeast. Several concentrations of β-glucan were incubated in AFM_1-contaminated milk during 24 hours. Binding efficiency was determined by quantifying the unbound AFM_1 using the (UP)LC-MS/MS method. Depending on these adsorbents, the percentages of bound AFM_1 varied from as low as 8.2 % to as high as 65 %. Results also showed noticeable non-linearity during 24 hours when binding AFM_1 with β-glucan from yeast compared to β-glucan from oats, which can be the consequence of the reversible reaction of AFM_1- β-glucan complex formation. β-glucan from oats has shown slightly better ability (65 %) to bind AFM_1 from artificially contaminated milk compared to β-glucan isolated from yeast (63.6 %). These differences in binding ability are most likely due to the different structure and molecular branching of β-glucans.

KEY WORDS: *biological method; milk; mycotoxin; oat; yeast; (UP)LC-MS/MS*

Aflatoxins as a climate change related public health hazard

Bijelović S[1,2]**, Dragić N[1,2], and Torović LJ[1,2]

Faculty of Medicine, University of Novi Sad[1], Institute of Public Health of Vojvodina[2], Novi Sad, Republic of Serbia

The aim of this paper was to explore the relationship between the occurrence of aflatoxins (AFs) in corn and weather conditions in Serbia during 2010-2016. Data related to the occurrence of aflatoxins in corn harvested from Serbian fields were acquired from published literature: percentage of corn samples contaminated with AFs, percentage of corn samples with AFs above maximum allowed limit (MAL), and mean concentration of AFs. Weather condition data were taken from the Republic Hydrometeorological Service of Serbia annual agrometeorological reports: deviation of temperature from long-term period (1981-2010), number of days with temperatures higher than 20, 30, and 35 °C, precipitation amount, and number of rainy days from April to September. Possible association between AFs occurrence and weather was investigated by statistical means, using linear regression. During seven examined years', percentages of corn samples contaminated with AFs, as well as percentage of samples with AFs contamination above MAL, were significantly positively associated with deviation of temperature from long-term period (R^2=0.77; $p<0.01$), (R^2=0.78; $p<0.05$), number of days with temperatures higher than 30 °C (R^2=0.73; $p<0.05$), (R^2=0.73; $p<0.05$) and 35 °C (R^2=0.83; $p<0.01$), (R^2=0.85; $p<0.01$), respectively. Precipitation amount and number of rainy days did not show significant coefficient for the percentage of contaminated samples (either in general or specifically above MAL). Mean concentration of AFs did not show significant association with meteorological data. Occurrence of AFs in corn in Serbia is associated with weather conditions and may indicate alert for potential adverse effects on human health as a consequence of climate change.

KEY WORDS: *contamination; maximum allowed limit; mycotoxins; weather;* Zea mays

**zjakopovic@pbf.hr*

***sanja.bijelovic@izjzv.org.rs*

The importance of testing for bacteria of the genus *Listeria* in environmental samples

Vasiljević A*, Landeka V, Findrik K, Kovaček I, and Mlinar Z

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Bacteria of the genus *Listeria* are widely distributed in the environment and can easily reach food, and because of their high resistance to temperature and disinfectants, they can survive on work surfaces, floors, machines, and hands of employees in manufacturing plants in the food industry. The aim of this study was to emphasize the importance of sampling of environmental samples, for the purpose of reducing the risk of food contamination, and thus the risk to human health. According to the new standard ISO 11290-1:2017, in addition to *Listeria monocytogenes*, the presence of other species of *Listeria* spp. is proven by means of isolation and detection in environmental samples. The sampling procedure was carried out on working surfaces and equipment in the food industry according to the guidelines of the European Union Reference Laboratory for *Listeria monocytogenes*. This study presents the results in the period from 2016 to 2018 whereby the presence of *Listeria monocytogenes* and *Listeria* spp. in the environmental samples was demonstrated. The results show that the number of bacteria has been reduced over the years by taking appropriate corrective measures according to the HACCP plan. Our study suggests that, based on a more frequent sampling of environmental wipes, sanitation, and hygiene in the industrial manufacturing plants and the monitoring of the HACCP guidelines, the number of the *Listeria* genus has gradually decreased by 2018, thus reducing the possibility of contamination of the final product.

KEY WORDS: *bacteria; environmental samples; HACCP; isolation; sampling*

Citrinin in endemic nephropathy

Čulig B[1]**, Ban B[1], Peić A[1], Momirović A[1], and Jelaković B[2]

Andrija Štampar Teaching Institute of Public Health[1], University Hospital Centre Zagreb[2], Zagreb, Croatia

Balkan endemic nephropathy (BEN) is a tubulo-interstitial nephropathy associated with upper urinary tract cancers. Recently it was confirmed that aristolochic acid is a causative agent and BEN is considered an environmental form of aristolochic acid nephropathy. Citrinin (CTN) is a mycotoxin produced by several species of the genera *Aspergillus, Monascus,* and *Penicillium* and occurs mainly in stored grains. It was speculated that mycotoxins might play an additive role to aristolochic acid in etiophatogenesis of BEN. So far, that claim has not yet been proven. The aim of this study was to analyse urine CTN concentrations in residents of endemic villages. In this study we enrolled 38 patients who were diagnosed with BEN and another 38 subjects from non-endemic villages as the control. CTN was determined in spot urine by ELISA (enzyme-linked immunosorbent assay). For the statistical analysis of the data we used Student's t-test. Our preliminary data show that CTN urine concentrations is higher in BEN than in non-BEN households, which might indicate poorer storage of harvested grain. This result should be confirmed on a larger number of subjects to determine the putative role of CTN in the etiophatogenesis of BEN.

KEY WORDS: *Balkan endemic nephropathy; ELISA; mycotoxins; spot urine*

**ana.vasiljevic@stampar.hr*

***borna.culig@stampar.hr*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):58-59

Cysteine can alleviate silver nanoparticle-induced phytotoxicity in tobacco seedlings

Biba R[1]*, Cvjetko P[1], Peharec Štefanić P[1], Tkalec M[1], Domijan A-M[2], Šabarić J[3], Jukić M[3], Šikić S[3], Lyons DM[4], Babić S[5], and Balen B[1]

Department of Biology, Faculty of Science[1], Department of Pharmaceutical Botany, Faculty of Pharmacy and Biochemistry[2], University of Zagreb, Department of Ecology, Andrija Štampar Teaching Institute of Public Health[3], Center for Marine Research[4], Division of Materials Chemistry[5], Ruđer Bošković Institute, Zagreb, Croatia

Silver nanoparticles (AgNPs) are a commonly used nanomaterial because of their antibacterial and antifungal properties that are exploited in numerous consumer products and agriculture. Increased AgNP utilisation results in their significant discharge into the environment and many studies have already revealed their toxic effects on living organisms. Plants, which possess an important role in the bioaccumulation and distribution of environmentally released substances, could serve as a potential route for AgNPs into the food chain. To analyse how different coatings affect AgNP phytotoxicity, the effects of 25, 50, and 100 μmol L^{-1} polyvinylpyrrolidone (PVP) and cetyltrimethylammonium bromide (CTAB)-coated AgNPs on tobacco seedlings' (*Nicotiana tabacum* L.) oxidative stress response were compared. To examine if AgNP-toxicity is nanoparticle-specific or it derives from dissolved Ag^{+}, 125, 250, and 500 μmol L^{-1} cysteine, a strong silver-complexing ligand, were applied. Ag content was measured using ICP-MS. A dihydroethidium test was used to determine the ROS level. For oxidative damage evaluation, malondialdehyde (MDA) and protein carbonyls content and the activities of antioxidant enzymes [pyrogallol peroxidase (PPX), ascorbate peroxidase (APX), catalase (CAT) and superoxide dismutase (SOD)] were spectrophotometrically determined. The results showed increased Ag uptake and elevated ROS levels in both AgNP treatments compared to the control, although no significant difference in MDA and protein carbonyl content was detected. AgNP-PVP decreased APX and PPX activities, while AgNP-CTAB increased CAT and decreased PPX activity. Cysteine in combination with AgNPs significantly reduced ROS formation, probably due to alleviated activities of antioxidant enzymes. These results show that AgNPs phytotoxicity partially derives from dissolved silver.

KEY WORDS: *antioxidant enzymes; ICP-MS; lipid peroxidation; nanosilver, protein carbonyls; reactive oxygen species*

Migration formaldehyde from food contact materials

Barušić L** and Baričević L

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Formaldehyde is a chemical that is used in the plastic resin manufacturing industry. Previous research has shown that exposure to formaldehyde can cause adverse effects on human health (International Agency for Research on Cancer; IARC) and is particularly concerned about exposure to higher levels in professional environments associated with some types of cancer and leukemia. Unfortunately, exposure to small quantities is not considered harmless, although it has not been fully clarified. People are exposed to multiple forms of formaldehyde by air, clothes, furniture; varnishes, coatings, cosmetics, cleaning agent, and containers that come into contact with food. In the case of food and food packaging, even high temperatures can increase the migration of formaldehyde. Directive 2002/72/EC provides a limit for formaldehyde in foodstuffs of 15 mg kg^{-1}. The method for determination of formaldehyde in containers and packaging is spectrophotometric and the sample is processed by extraction with a 3 % acetic acid solution according to the requirements of HRN CEN/TS 13130-23:2005. A total of 74 plastic samples were analysed, of which 11 (14.9 %) samples of melamine plastic and 63 (85.1 %) samples of other plastics. In 17 (23.6 %) samples, the presence of formaldehyde is quantified in the range of 1.6-7.4 mg kg^{-1} (multilayer packaging, PET bottles, closures, and melamine tanks). No sample contained formaldehyde above the maximum permissible value. Very low levels of formaldehyde can have irritating effects on humans. Particular attention should be paid to small children who are more sensitive to certain toxic substances in the environment due to their size and underdeveloped immune system. Crawling and playing on the floor and consuming food in which formaldehyde is present can in children increase the negative effect and contribute to the development of asthma in the childhood.

KEY WORDS: *carcinogenicity; maximum permissible value; packaging; plastics; utensils*

**renata.biba@biol.pmf.hr*

***lidija.barusic@stampar.hr*

Chemical characterisation of non-intentionally added substances in food contact materials by analytical approaches based on HRMS

Hernando D[1]*, Martínez-Bueno MJ[2], Uclés S[2], Rajski Ł[2], Cimmino S[3], and Fernández-Alba A[2]

National Institute for Agricultural and Food Research and Technology, INIA, Madrid[1], European Union Reference Laboratory for Pesticide Residues in Fruit & Vegetables (EURL-F&V), Agrifood Campus of International Excellence (ceiA3), Department of Physics and Chemistry, University of Almeria, Almería[2], Spain, Institute for Polymers, Composites and Biomaterials (IPCB), Consiglio Nazionale delle Ricerche (CNR), Pozzuoli, Italy[3]

This study describes a methodology for the chemical characterisation of NIAS (non-intentionally added substances) that potentially may migrate from food contact materials (FCMs). This methodology has been used for the development of two new materials for food packaging. The materials consisted of (i) monolayer film with polylactic acid (PLA), (ii) polypropylene (PP)-based nanocomposite; both with polylimonene (PL) and functionalised with zinc oxide nanoparticles (ZnO NPs). This approach incorporates the use of HRMS systems GC-QTOF-MS, LC-QTOF-MS, GC-Orbitrap-MS, and LC-Orbitrap-MS for the characterisation of the chemical structure of NIAS using accurate mass acquisition of both the full-scan and fragmentation spectra. In addition, ICP-MS (inductively coupled plasma mass spectrometry), was used to determine whether there is transference of ZnO NPs used as antimicrobial agent. The study of migration was carried out according to the standard protocols established by EU regulations for FCMs. During the process of developing these new materials, the following compounds were characterized: DEP (diethyl phthalate); alpha-tocopherol acetate; 2-propenoic acid (1-methyl-1,2-ethanediyl)bis[oxy(methyl-2,1-ethanediyl)]ester; 10-heneicosene; 2,4,6 triamino-1,3,5-triazine; azepan-2-one; (2E)-3-phenylprop-2-enal; N,N-diethyldodecanamide; N-[(9Z)-9-octadecen-1-yl]acetamide; 1-palmitoylglycerol; and glycerol stearate. Out of the nanopolymers evaluated, the films consisting of PP, PL and ZnO NPs in wt % (92/5/3), and PLA with ZnONPs in wt % (95/5) proved to be the most suitable FCMs with improved functionality.

KEY WORDS: *food contact materials; ICP-MS; migration; nanocomposites; new materials for food packaging*

**hernando.dolores@inia.es*

Quality assessment of Croatian honey between 2012 and 2017

Hrg Matušin Ž*

Croatian Agricultural Agency, Križevci, Croatia

The quality of 1001 honey samples collected from various regions of the Republic of Croatia in the period from 2012 to 2017 was assessed according to the International Honey Commission regulatory standards using accredited analytical methods according to ISO 17025. Based on physicochemical, melisopalinological, and sensory analyses, samples were classified into fifteen groups of honey: acacia, castanea, floral, lime, sage, honeydew, amorpha, meadow, Christ's thorn, heather, rape, winter savory, mint, buckthorn, and sunflower. The following physicochemical properties were tested: water content, electrical conductivity, hydroxymethylfurfural content, and diastase activity. Eleven samples did not meet the criteria for moisture content (<20 %) and ranged from 13.0 to 21.7 %. Hydroxymethylfurfural concentrations ranged from <0.1 to 82.0 mg kg^{-1} and three samples did not meet the prescribed value (<40 mg kg^{-1}). The highest electrical conductivity value were measured in a honeydew sample with a mean of 2.24 mS cm^{-1}, while the lowest values were measured in the acacia honey sample with a mean of 0.09 mS cm^{-1}. Increased conductivity was determined for chestnut, honeydew, and buckthorn honey, with average values of 1.33, 1.14 and 0.95 mS cm^{-1}, respectively. Diastase activity show the average diastase number (DN) for all types of honey studies was higher than 8, which is in accordance with the Regulation (diastase activity >8.0 DN). The lowest DN was determined in acacia honey with a mean of 8.2 DN and the highest in honeydew, with a mean of 68 DN. After the survey, it was found that 98.6 % of honeys tested were within the limits of acceptability prescribed by Croatian regulations.

KEY WORDS: *diastase activity; electrical conductivity; hydroxymethylfurfural; water content*

Family farming *Robinia* honey

Stjepanović B**, Hrga I, Večenaj A, Krivohlavek A, Lasić D, and Prskalo I

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Family farming is widely spread in Croatia. This study focuses on *Robinia* honey harvested in such farms. Melissopalynological and sensoric analysis of *Robinia* honey samples from Croatian family farms in 2017-2018 was used to determine the botanical origin of honey. The analysis showed the presence of 18 different pollen types. *Robinia* was present at an average of 33 %. The other mostly represented pollen types were Brassicaceae and *Amorpha fruticosa*. Pollen types which varied from sample to sample were Castanea, Rosaceae, Asteraceae, Fabaceae and Cornaceae. Sensoric analysis showed characteristic organoleptic features for *Robinia* honey, such as slow crystallisation under usual conditions of storage at room temperature, very light colour, pleasant warm odour, and a fruity, light, and refreshing aroma. In conclusion, all samples adhered to applicable regulations.

KEY WORDS: *botanical origin; mellissopalinology; pollen; sensoric analysis*

**zhmatusin@hpa.hr*

***barbara.stjepanovic@stampar.hr*

Quality of honey samples collected from association of beekeepers in Zenica-Doboj Canton, Bosnia and Herzegovina

Čoloman-Horić L[1]*, Ibrahimagić A[1], Cerić L[2], Zeković F[2], Hasanbašić DŽ[1], Kovač Č[1], Salkić A[1], Jonjić M[1], Šut A[1], and Agić A[1]

Department for Chemical Diagnostics[1], Department for Food Microbiology[2], Institute for Health and Food Safety Zenica, Zenica, Bosnia and Herzegovina

Honey is used for nutritional, medicinal, and industrial purposes and it is an important commodity in the international market. The aim of the study was to investigate physicochemical and microbiological characteristics of domestic and imported honey samples collected from markets in the city of Zenica, Bosnia and Herzegovina. All honey samples were analysed according to the International Honey Commision, 2009 and Revised Codex Standard for Honey (Codex Stan 12-1981, rev. 2, 2001). All samples were analysed for pH, conductivity, moisture, ash, free acids, diastase activity, glucose/fructose, sucrose, hydroxymethylfurfural (HMF), mineral content, unsoluble matters in water, total aerobic masophilic bacteria, total coliforms (Enterobacteriaceae) count, moulds and yeasts and *Clostridium* spp. Enzyme-linked immunosorbent assay (ELISA) was used to detect residue of tetracycline. Among 31 samples, 17 (54.8 %) were domestic (four of acacia honey, three floral, three meadow, two lime, two mountain, one of each sage, chestnut, and forest honey), and 14 (45.2%) were imported (four floral, three meadow and one of each acacia, mint, sage, chestnut, mountain, forest, and heather honey). Among domestic and imported samples, glucose/fructose were in the range 65.34-74.38/67.91-75.43 (%), sucrose 0.27-9.67/0,13-3.97 (%), moisture 13.10-16.91/13.55-17.56 (% m/m), unsoluble matters in water 0.00-0.04/0.01-0.06 (% m/m), conductivity 0.09-0.72/0.13-0.71 (μS cm^{-1}), free acids 6.5-30.0/8.0-29.5 (meq kg^{-1}), HMF 4.03-1549.01/6.57-107.22 (mg kg^{-1}), and mineral content 0.0-0.4/0.1-0.4 (% m/m), respectively. The HMF, sucrose, and moisture values showed statistically significant difference ($p<0.05$) between domestic and imported honey (0.04/0.02/0.04). A positive correlation between sucrose and HMF concentration ($r=0.7$) was found between domestic and imported samples. Four domestic honey samples from the same manufacturer showed the highest HMF in the range 844-1550 mg kg^{-1}. Tetracyclines were found in two samples (one domestic and one imported) in small concentrations (0.293 and 1.178 μg kg^{-1}, respectively). Mesophilic aerobic bacteria count varied within <1-2300 cfu g^{-1} in domestic and 40-4100 cfu g^{-1} in imported samples. Coliforms, *Clostridium*, moulds and yeasts were not detected. Physicochemical and microbiological characteristics showed much better quality in imported than domestic honey, indicating the importance of continuous monitoring and control of domestic honey production.

KEY WORDS: *bee product; fraud; hydroxymethylfurfural; quality; tetracyclin-ELISA*

**coloman.lejla@gmail.com*

Evaluation of preservatives in liquid dietary supplements

Milojević Miodragović G[1]*, Bijelović S[1,2], and Torović LJ[1,2]

Institute of Public Health of Vojvodina[1], University of Novi Sad Faculty of Medicine[2], Novi Sad, Serbia

A survey was conducted to determine the actual usage levels of preservatives in dietary supplements. Additionally, exposure assessments were carried out based on analytical data and product usage instructions given by manufacturers. All of the selected supplements (31), purchased in Novi Sad in 2018, were liquid products in application forms of syrup, with either sorbates or benzoates on ingredients list, and claims related to support of the respiratory system due to the presence of various plant extracts. The method of analysis was HPLC-UV, and results were expressed as free acid. Not one of the syrups contained level of sorbic or benzoic acid in excess of the maximum permitted level of 2000 mg kg^{-1}. Two samples of one manufacturer contravened the food regulation by containing potassium sorbate, instead of sodium benzoate, as labeled. Regarding the daily intakes of sorbates and benzoates, results were expressed as percentage of acceptable daily intake (ADI) (3 and 5 mg kg^{-1} bw per day, respectively). Maximum intakes recorded for adults, adolescents, children from 4 to 12 years, children from 3 to 6 years, and children up to 4 years and infants, were 45, 67, 35, 29, 28 and 0 % for sorbic, and 31, 45, 35, 34, 59, and 70 % for benzoic acid, respectively. In conclusion, the most realistic approach using analytical data did not exceed the ADI group in any population group. However, during the usually short period of their usage, these products considerably contribute to the overall intake of sorbates and benzoates, which are widely used food preservatives.

KEY WORDS**:** *additives; benzoates; exposure; HPLC-UV; Serbia; sorbates*

Risk of ochratoxin A in wine

Torović LJ[1,3]**, Pintać D[2], Majkić T[2], Simin N[2], Lesjak M[2], and Beara I[2]

Faculty of Medicine[1], Faculty of Sciences[2], University of Novi Sad, Institute of Public Health of Vojvodina[3], Novi Sad, Serbia

Wine is recognised as one of the main contributors to the dietary intake of ochratoxin A, a widely known mycotoxin produced by fungi belonging to the genera *Penicillium* and *Aspergillus*. Once produced on grapes, ochratoxin A is not appreciably degraded during wine production. In order to assess population exposure to ochratoxin A, 91 bottled wines, produced in 24 wineries from Fruška gora, were subjected to analysis comprising immunoaffinity and liquid chromatography separation with fluorescence detection. Quantifiable amounts of ochratoxin A (above 0.01 µg L^{-1}) were found in 52 % of the samples. The overall mean level of ochratoxin A was 0.021 µg L^{-1} (0.024, 0.028, and 0.017 µg L^{-1}, in red, rose, and white wines, respectively). The highest determined concentration, 0.153 µg L^{-1} in a rose wine, was only a minor fraction of the legally established limit of 2 µg L^{-1}. Very low levels of ochratoxin A found in wine, in combination with low wine consumption in Serbia (mean 0.077 L per week for adult population), strongly indicated low exposure. Range of ochratoxin A concentrations between the 50 and 100 percentile would correspond to an exposure of 0.01-0.13 % of the tolerable weekly intake (120 ng kg^{-1} bw). Even if moderate wine consumption, a glass per day, was assumed, the ochratoxin A intake would exceed 1 % of the tolerable level only if wine containing ochratoxin A at the 97.5 percentile of concentration is consumed. Thus, the potential health benefits of responsible wine consumption, related mostly to the prevention of cardiovascular and neurodegenerative diseases, clearly outweigh the risk caused by the exposure to ochratoxin A.

KEY WORDS**:** *bottled wine; exposure; HPLC-FLD; mycotoxins; Serbia*

**gordana.miodragovic@izjzv.org.rs*

***ljilja.torovic@mf.uns.ac.rs*

Bisphenol A, packaging labelling

Đermanović M[1,2]*, Zrnić K[1], Bojanić LJ[1,2], and Marjanović M[1]

Public Health Institute of Republic of Srpska[1], Department of Pharmacy, Faculty of Medicine, University in Banja Luka[2], Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Today, in the production of polycarbonate plastics and epoxy resins, a large number of synthetic substances are used, among which is bisphenol A (BPA). Bisphenol A is one of the most produced chemicals in the world. It is used for the production of polycarbonate, epoxy resins, thermal paper, and as an antioxidant in PVC plastics. This is why it often occurs in various products for everyday use such as reusable bottles, children's bottles and toys, plastic dishes, various electronic equipment, and paper. A small amount of BPA may be released from food and beverage containers and thus enter the human body. The EU allows a specific migration limit of 0.6 mg kg^{-1} of food, while this year the European Commission proposed to reduce this value to 0.05 mg kg^{-1} of food. This study investigated the labeling of the presence of bisphenol A in plastic packaging for food and water. By randomly selecting 20 products from the market, a review was made for the presence of tags in the absence of BPA. Only 45 % of the products were labeled BPA free. Due to the presence of BPA in almost every sphere of life, exposure to BPA is very common. The best way to avoid BPA is to reduce the use of plastics, or to avoid plastics containing label 3 or 7.

KEY WORDS: *epoxy resins; food packaging; migration limit; polycarbonate plastics; toxicity*

Levels of mercury in canned fish

Đermanović M[1,2]*, Bojanić LJ[1,2], Zrnić K[1], and Marjanović M[1]

Public Health Institute of Republic of Srpska[1], Department of Pharmacy, Faculty of Medicine, University in Banja Luka[2], Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Mercury is a metal that is naturally present in the Earth's crust, and its presence in the environment mainly originates from anthropogenic sources. Mercury reaches the food chain through fish meat. The highest concentrations of mercury, especially methyl-mercury, the most toxic of its forms, can be found in fish predators. These levels are significantly higher than the concentration of mercury in seawater. All types of fish contain methyl-mercury, even in trace amounts. The neurotoxic effect of methyl-mercury is well known, and more and more data indicate that it has a harmful effect on the cardiovascular, immune, and reproductive system. The foetus in development is most sensitive to the toxic effects of methyl-mercury and therefore the pregnant women, breast-feeding women, and small children are the most vulnerable target group. The aim of the present study was to explore the contents of mercury in samples of canned fish. Determination of mercury content was performed with a direct mercury analyzer (DMA) in marine cans from traffic; 25 products were analysed. Mercury is present in canned fish, which was confirmed by determination. But the mercury content was in accordance with current legislation (≤0.005 mg kg^{-1}). Mercury levels ranged from 0.005 to 0.085 mg kg^{-1}. Since fish is a significant source of nutrients, we cannot suggest excluding fish from one's diet; however, only a well-balanced diet will reduce exposure risks and increase the benefits of protein-rich fish meat consumption.

KEY WORDS: *direct mercury analyzer; fish intake; food chain; legislation; toxicity*

**mirjanadjermanovicbl@gmail.com*

The importance of potassium and its content in natural mineral drinking water

Bojanić LJ[1,2]*, Đermanović M[1,2], Zrnić K[1], Vučić B[1], and Marjanović M[1]

Public Health Institute of Republic of Srpska[1], Department of Pharmacy, Faculty of Medicine, University in Banja Luka[2], Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Potassium (K^+) is the basic element of each cell. The amount of K^+ in cells is about 150 mmol L^{-1}, and in blood only 4-5 mmol L^{-1}. The Na^+/K^+ pump keeps membrane action potential which is the basic mechanism of neuromuscular stimulation and impulse transmission. Hypokalemia and hyperkalemia are two very dangerous conditions. An excessive amount of K^+ in the blood causes poor stimulation, and hence the weakness of the heart and other muscles. Due to the weakness of the cardiac muscle and inadequate pumping of blood through the lungs, difficulty in breathing occurs. Muscular weakness, paralysis, nausea, and fatigue are just consequential symptoms of cardiovascular disorders. Insufficient amounts of K^+ cause a disorder of the heart and muscles. Hypokalemic arrhythmias are particularly prone in patients taking a digitalis drug. In muscles, hypokalemia causes cramps, constipation, weakness, fatigue, and paralysis. Due to all of the above, it is very important to monitor the intake of K^+. The blood K^+ concentration should be maintained at very narrow limits, usually 3.8-5.8 mmol L^{-1} or 149-227 mg L^{-1}. The aim of the present study was to determine the content of K^+ in natural mineral drinking water. K^+ content was determined by atomic absorption spectrometry on an Agilent Technologies 200 Series AA, using standard method BAS ISO 9964-2:2002. The measurements were made in duplicate without pre-sample preparation, at a wavelength of 766.5 nm with the flow of acetylene at 2.0 cm^3 min^{-1}. The results were read directly from the standard curve and ranged from 0.2 to 75.4 mg L^{-1}. From the obtained results it can be concluded that natural mineral water can be an important source of K^+ and maintenance of its homeostasis for the normal functioning of the organism.

KEY WORDS**:** *heart failure; intake; muscle; spectrophotometry*

Peanut allergens in samples of cookies and tea biscuits

Marković K**, Tolvajčić M, Panjkota Krbavčić I, Šatalić Z, Rumora Samarin I, and Vahčić N

Department of Food Quality Control, Faculty of Food Technology and Biotechnology, University of Zagreb, Zagreb, Croatia

In order to detect allergens as hidden food ingredients, the ELISA (Enzyme-Linked Immunosorbent Assay) method was used in this study to detect peanut allergen presence in a total of 28 samples of cookies and tea biscuits from the Zagreb market. Ten samples were taken from supermarkets, ten from bakeries, and eight from pastry shops. The obtained results were also compared with available food information about peanut presence in the analysed products. Among the 28 samples of cookies and tea biscuits, peanut allergens were detected in 27 (average of 0.37 mg kg^{-1} in samples from supermarkets, 0.38 mg kg^{-1} in samples from bakeries, and 0.28 mg kg^{-1} in samples from pastry shops) of which only two samples from supermarkets had a declared advisory label about the presence of peanut allergens. Food information on the analysed samples of cookies and tea biscuits from bakeries and pastry shops did not provide any indication of the presence of peanut allergens. Taking into account that peanut consumption is often associated with severe reactions among the population with nutrition allergies, unintentional exposure to peanut allergens is their biggest concern. The results of this study pointed out the importance of controlling unintended peanut allergen presence in food and properly informing consumers to protect their health.

KEY WORDS**:** *ELISA; food information; hidden food ingredients; nutritional allergy*

**farmacija@phi.rs.ba*

***kmarkov@pbf.hr*

Botanical dietary supplement safety assessment – elemental contaminants

Lukić D[1]*, Srdjenović-Čonić B[2], Popović M[1,2], Bijelović S[1,2], and Torović LJ[1,2]

Institute of Public Health of Vojvodina[1], Faculty of Medicine, University of Novi Sad[2], Novi Sad, Serbia

Dietary supplements were evaluated considering compliance with food safety legislation, as well as consumer exposure to elemental contaminants, based on the elements concentration values and dosage indicated on the label. Based on their popularity and frequent usage, 31 syrups claiming support to the respiratory system due to the presence of various botanicals, with no elements labeled as active substances, were selected for the study. The analysis comprising microwave digestion followed by ICP-MS included 23 elements: Be, B, Al, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Sr, Ag, Cd, Sn, Sb, Te, Ba, Hg, Tl, and Pb. No samples contravened the food regulation regarding the content of Pb, Cd, and Hg. The most frequently found elements were Mn and Cu, followed by Zn, Ni, and Sn, while the most abundant were Fe and Zn, followed by Al, B, and Mn. The toxicity risk assessment, focused on the elements that are the most toxic but also have a reasonable probability of occurrence, showed that the oral permitted daily exposures (PDE), as established by the United States Pharmacopeia (USP) Advisory Panel and International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human use (IHC) guidelines, were not exceeded with a daily dose of the tested supplements. The highest contribution to PDE for adults, adolescents, children from 4 to 12 years, children from 3 to 6 years, children up to 4 years and infants, were always recorded for Pb: 18, 27, 14, 20, 38, and 46 %. Therefore, exposure to elemental contaminants through the tested dietary supplements is not expected to affect human health.

KEY WORDS: *exposure; ICP-MS; metals; Serbia; syrup*

Accumulation of mercury in wild edible mushrooms from the Croatian coastal area

Širić I**, Držaić V, and Kasap A

Faculty of Agriculture, University of Zagreb, Zagreb, Croatia

The aim of this study was to determine the concentrations of mercury in ten wild edible mushrooms and the substrate, and to assess the role of individual species as biological indicators of environmental pollution. In this study we analysed five saprophytic species [*Agaricus campestris* (L) Fries, *Armilariella mellea* (Vahl. ex Fr.) Karst., *Clitocybe inversa* (Scop. ex Fr.) Pat., *Clitocybe nebularis* Batsch. ex Fr., *Macrolepiota procera* (Scop. ex Fr.) Sing.] and five ectomycorrhizal species [*Boletus aestivalis* Paulet ex Fries., *Boletus edulis* Bull ex Fries., *Lactarius deterrimus* Groger., *Tricholoma portentosum* (Fr.) Quelet, *Tricholoma terreum* (Schff. ex Fr.) Kummer]. The concentration of mercury in ten edible mushrooms and soil substrate were determined using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES). Significant differences were found in the concentrations of mercury between analysed saprophytic and ectomycorrhizal species of mushrooms ($p<0.05$). The highest mean concentration of mercury was determined in *Boletus aestivalis* species in the area of Krk Island (2.01 mg kg^{-1}) and the town of Labin (2.02 mg kg^{-1}). The average distribution rates of mercury in anatomical parts of the fruiting body were different. A significantly higher concentration of mercury was determined in the cap in relation to the stipe of the analysed mushrooms ($p<0.001$). Bio-accumulation features were established in all of the investigated mushroom species (BCF>1), whereby the best bio-indicators of environmental pollution of mercury mushrooms were from the genus *Boletus*. By comparing the concentration of mercury in mushrooms and legal provisions, it can be concluded that consuming them does not have a negative impact on human health.

KEY WORDS: *ectomycorrhizal species; food safety; ICP-OES; saprophytic species; toxicological risk*

**danijela.lukic@izjzv.org.rs*

***isiric@agr.hr*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):62-72

Colour-coded (traffic light) simplified front of the pack nutrition labelling empowers consumers to choose healthier products

Zupan A*, Kremić N, Šmid U, and Bevc J

Slovene Consumers' Association, Ljubljana, Slovenia

The aim of our study was to analyse if consumers read the "back of pack" information and if traffic light labelling could help Slovenian consumers to understand the products nutritional profile and motivate them to choose a healthier product. An online questionnaire was published on our website and anonymously filled in by 1063 consumers. Consumers were asked about their purchasing decisions and to compare different products based on their ingredients and nutritional value, challenging them with different information presented (a product's front of pack picture, nutritional table with the list of ingredients, and traffic light profiling). Front of pack information together with nutritional table and list of ingredients were usually read by 71.9 % respondents. Buying decision was mostly influenced by the product's price, ingredients (35.4 %), origin, and place of manufacturing (29.3 %). Nutrition information was considered important by only 9.8 % of respondents. Consumers responded correctly when guessing the amount of sugar (low, medium, high) in 3 different cereal products presented only by picture, but the amount of fats and saturated fatty acids was harder to guess. Even with the help of a nutritional table they were not able to correctly evaluate these values. When traffic light nutritional profile was presented, the responses were correct. This study has shown that colour coded simplified nutrition information helps consumers understand the products nutritional value and choose a healthier product. To help consumers understand the nutritional value of different foods and beverages, the Slovene Consumers' Association has developed a mobile app and the *http://www.veskajjes.si* web page with colour-coded information.

KEY WORDS: *nutrition information; purchasing decision; questionnaire*

Vending machines content on Slovenian faculties – do they offer a healthy choice?

Zupan A*, Kremić N, and Bevc J

Slovene Consumers' Association, Ljubljana, Slovenia

Vending machines are often a convenient choice for a quick snack between lectures and may influence students' or employees' diet and nutrient intake, which could consequently affect their health. With our research we evaluated the content of vending machines located on Slovenian faculties and suggested changes toward a healthier choice. In 2017 and 2018, 36 vending machines were reviewed at 23 faculties in three cities (Ljubljana, Maribor, and Koper). The field work was carried out by graduate students of food science and nutrition. Research was part of the project *Veš kaj ješ Študent?*, supported by the Slovene Ministry of Health. Each vending machine had 48 compartments and contained different foods and beverages. On average, 35.4 % of its content were sweetened drinks, water represented only 10.6 %. Sweet and savoury snacks represented around 33 %, on average weighing more than 50 g a piece. Most sandwiches contained salami or boiled sausages, only 8.7 % were vegetarian. The percentage of dried fruits and nuts was very small (3.4 %); mostly they were packed in too large quantities (up to 250 g). Of the 36 reviewed vending machines, only 13 contained fresh fruits (apples or mandarins). Of the dairy products, most were chocolate or fruit flavoured and contained a lot of sugar. The reviewed content of vending machines at Slovenian faculties did not offer a healthy choice for students and employees. To encourage a healthier choice in vending machines, the Slovene Consumers' Association has developed guidelines with content recommendations for faculties and vending machine providers.

KEY WORDS: *beverage; diet; food; nutrient intake; quick snack*

**anjazupan.bf@gmail.com*

The anitioxidative potential of strawberry tree (*Arbutus unedo* L.) leaf and fruit tea

Jurica K[1]* and Brčić Karačonji I[2]

Ministry of the Interior[1], Institute for Medical Research and Occupational Health[2], Zagreb, Croatia

Antioxidants in herbal infusions and decoctions play the main role in preventing cell damage caused by free radicals. Strawberry tree (*Arbutus unedo* L.) is a wild evergreen Mediterranean shrub whose leaves and fruit are rich in antioxidants such as phenolics. The aim of this study was to compare total phenolic content (TPC) and antioxidative capacity of *A. unedo* infusions (prepared by adding boiling water to the dried leaves, freeze-dried fruit or their combination and left to stand at room temperature for 5 or 10 min) and decoctions (prepared by adding boiling water to the samples mentioned above and futher boiled for 5 or 10 min), with or without addition of *A. unedo* honey. TPC was determined by the Folin–Ciocalteu method and antioxidant activity was estimated by DPPH (2,2′-diphenyl-1-picrylhydrazyl) assay. Decoctions with longer boiling time showed the highest TPC (59.5-199.5 mg gallic acid equivalents per cup) and the strongest antioxidant activity (521.5-934.3 μmol Trolox equivalents per cup). Strong correlation between TPC and DPPH (r=0.847) indicated that polyphenols are mainly responsible for the radical scavenging properties of *A. unedo* preparations. Tea temperature on which the honey was added (50 or 70 °C) did not affect TPC and antioxidant activity. Our results also point to a similar total phenolic content and stronger antioxidant activity of *A. unedo* leaf tea compared with green tea (*Camellia sinensis*). In summary, the use of infusion and decoction of strawberry tree leaf and fruit could provide considerable benefits for health.

KEY WORDS: *decoction; DPPH; infusion; total phenolic content*

Occurence of aflatoxins in food and feed sampled in Slovenia between 2010 and 2016

Trofenik P[1]**, Blaznik U[3], Rozman U[2], and Šostar Turk S[1,2]

Faculty of Agriculture and Life Sciences[1], Faculty of Health Sciences[2], University of Maribor, Maribor, National Institute of Public Health Environmental Health Centre, Ljubljana[3], Slovenia

Aflatoxins are the most common and most researched group of mycotoxins. They are produced by two species of *Aspergillus* that grow on plants before harvest or on foods during storage. Aflatoxins can occur in raw materials and foods, are genotoxic and carcinogenic, and pose a threat to human and animal health. The aim of our study was to examine the presence of aflatoxins B1, B2, G1, and G2 in foods and feed samples from the Slovenian market during 2010-2016. Data were collected within the frame of mycotoxin official control by the Food Safety, Veterinary and Plant Protection Administration (UVHVVR). Food and feed samples data were analysed by descriptive statistics and compared to limit values laid down in Commission Regulation (EC) No. 1881/2006. Altogether, 1293 food samples and 474 feed samples were analysed, where 1.5 % of food samples (most often peanuts) and 2.5 % of feed samples (most often corn feeder) exceeded the limit values. The majority of samples did not deviate from EU Regulation limit values. We can conclude that concern for consumer health regarding the exposure of aflatoxins by foodstuffs is minimal.

KEY WORDS: *contaminants in foodstuff; foodborne disease; food safety; mycotoxins; official control*

**juricakarlo@gmail.com*

***petra.trofenik@gmail.com*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):62-72

Do we pay enough attention reading declarations?

Antunović M*, Gregurić Beljak Ž, and Mikšić Smolec J

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Declarations of food products according to legal norms provide evidence of food content. The aim of this research was to determine the frequency of reading and understanding food labels. Descriptive analysis of data was obtained from anonymous questionnaires. The survey included 130 attendants of a food hygiene course (45 men and 85 women) aged 20-60 years. The analysis of obtained data showed that 44 % of respondents mostly read the declarations, while 32 % read them rarely. Only 23 % of respondents read product declarations on a regular basis. Almost half of the respondents understood the product declaration readings, and 36 % declared that it is important to study the numbers marked with E. Reading the declarations affected purchase choices in 37 % of respondents. A smaller number of respondents (32 %) paid attention to the origin of food when purchasing, and only 37 % preferred food produced in Croatia. Almost a third of the respondents believed that the declaration letters should be bigger. Reading food labels affected the choice of product at first purchase only within 3 % of respondents. Bearing in mind that the survey was attended by a group of course participants, the results showed insufficient awareness to read the declarations. The data presented showed the need for continuous education on food labelling in order to provide better information to people working in food business entities.

KEY WORDS: *education; food hygiene course; food labels; informativeness; questionnaire*

Level of awareness about Croatian quality labels among employees in the food business (FBOs)

Mikšić Smolec J**, Gregurić Beljak Ž, and Kecerin R

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Signs of Croatian quality "Croatian Quality" and "Original Croatian" ensure Croatian product recognisability. The right to use quality signs should prove to consumers the quality, safety, and reliability of their products.The aim of this study was to establish the information level of the participants of the Hygiene Minimum Course on Croatian Quality Product Labels. Data for the survey was collected using an anonymous questionnaire. The study included 129 people (85 women and 44 men) aged 20-60 years. Data analysis showed that more than half of the respondents paid attention to the quality mark when purchasing food products. In 83 % of respondents, the quality mark affected the decision to purchase a food product while for 22 % a discounted price was an exclusive prerequisite for the purchase of a food product. Only about one third of the respondents had enough information. In 65 %, products with Croatian quality labels met their expectations. A high percentage of consumers paid attention to Croatian quality labels, but a third of respondents did not have enough information about them. Given that this was a group of respondents who are every day in contact with products with marks of quality in their workplace, the data are not satisfactory. We should therefore continue to raise and promote awareness of consumers as to the identity and uniqueness of Croatian quality as a key factor when purchasing products.

KEY WORDS: *Croatian quality labels; information; purchasing food products; shopping; survey*

**melita.antunovic@stampar.hr*

***jasenka.miksicsmolec@stampar.hr*

Infectious disease knowledge – a significant parameter of education?

Gregurić-Beljak Ž*, Kosanović Ličina ML, and Mikšić Smolec J

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

Infectious disease transmission prevention is one of most important preconditions of good hygienic practice in the food handling business. The aim of the present study was to evaluate basic knowledge on infectious diseases of food handlers. Food safety knowledge among food handlers (N=100) was assessed using a structured, paper-based questionnaire among attendees of Food Safety Training (FST). The participation of food handlers in this study was conducted on a voluntary basis. One hundred respondents participated in this survey (60 % male). One third of respondents (38 %) was for the first time involved in FST. All previously educated respondents showed a satisfactory level of knowledge about symptoms of foodborne illnesses and participant self-reported food safety practices rules compared to first-time attendees. First-time attendees were found to be the least knowledgeable regarding sources of infection as a possible cause of food poisoning. The present study provides an insight to basic knowledge on food safety and food handling practices among attendees of FST. Nevertheless, as previously educated respondents showed gretaer knowledge on food borne illnesses, the overall results point the need of continuous education on food handling practices and attitudes.

KEY WORDS: *food handlers; food safety practices; Food Safety Training; foodborne illnesses; survey*

Characteristics of foodborne disease outbreaks in Belgrade, 2012-2017

Pavlovic N**, Beljin A, Randjelovic S, and Zlatar B

Institute of Public Health of Belgrade, Belgrade, Serbia

Foodborne diseases are a global public health concern. The aim of this descriptive study was to present the characteristics of the foodborne disease outbreaks (FBDOs) that had been registered in Belgrade from 2012 to 2017. Data on conducted epidemiological and microbiological investigations of FBDOs in relation to the place of exposure, causative agent and diagnosis, and results of indicators of hygiene process at facilities of food preparation, were obtained from the Institute of Public Health of Belgrade. For assessment indicators of hygiene process, we used the Guidelines for Assessing the Microbiological Safety of Ready-to-Eat Foods Placed on the Market, Public Health England and the Guidelines for the Application of Microbiological Criteria for Food, Republic of Serbia. During 2012-2017, 163 outbreaks were reported resulting in 2268 reported cases. Of the total number of outbreaks, about 2/3 occurred at individual households. The most frequent outbreaks were salmonellosis (74.1 %), followed by significantly less frequent outbreaks of bacterial foodborne intoxications (8.3 %) and trichinellosis (7.4 %). The average attack rates in the order of frequency of outbreaks were 68.7, 72.4, and 59.3 %. Most of the registered outbreaks had ≤5 cases (50-88.7 %). The rest of the FBDOs occured via exposure at different facilities for food preparation. The most common were viral gastroenteritis (43.6 %), salmonellosis (25.5 %) and bacterial foodborne intoxication (16.4 %). They were characterised by a higher number of exposed, higher incidence of outbreaks with ≥11 cases (57.1-88.8 %) and lower average attack rates: 21.9, 26.4, and 28.3 %. The highest percentage of positive results of the indicators of hygiene process in food and environmental samples at facilities of food preparation was determined by the outbreaks of bacterial foodborne intoxications. The results demonstrate the sensitivity of the epidemiological surveillance system, and give useful directions for improving preventive efforts targeting the most common causes of the diseases and factors that contribute to the emergence of FBDOs.

KEY WORDS: *environmental samples; epidemiological surveillance system; hygiene process indicators; microbiological safety*

**zeljka.beljak@stampar.hr*

***nevenka.pavlovic@zdravlje.org.rs*

Nitrosamines

Baltazar A*, Monteiro A, Soares A, Ávila M, Martins R, Santiago R, Matos C, and Joaquim J

Instituto Politécnico de Coimbra, ESTeSC, Coimbra, Portugal

Nitrosamines (H_2N_2O) are aliphatic or aromatic N-nitroso compounds with a nitrous functional group attached to a nitrogen atom. They are associated with acute toxicity, mutagenic, teratogenic, carcinogenic, and organ-specific action. Our aim was to enhance the nitrosamines' toxicity, as well as their presence in foods, and compare it with the legal limits established by the legislation in force. The keywords "nitrosamines", "nitrosamines toxicity", and "nitrosamines and cancer" were searched in Google Scholar, PubMed and Science Direct, and articles were selected between 1987 and 2018, as well as the digital manual "Diet, Nutrition and Cancer: A Critical Evaluation" (Chapter 9, Volume II). Exposure to nitrosamines occurs either endogenously or exogenously. These compounds are rapidly absorbed into the gastrointestinal tract or through the skin, however most are formed *in vivo* after the ingestion of their precursors. About 5 % of the ingested nitrate is reduced to nitrite in saliva. Nitrite reacts with amines and nitrosation occurs. This reaction is favored by an acidic pH of the stomach. Nitrosamines require metabolic activation to exert their carcinogenic action. It was estimated that the tolerable exposure level for humans is 5-10 μg kg^{-1} (ppb) bw. We concluded that further studies are required to evaluate its presence in food. In addition, it is also necessary to set a limit for its use in Portugal because there are no records of the amount of nitrosamines allowed in food. The values used as reference belong to other countries; however, there is no guarantee of safety due to the food diversity between countries.

KEY WORDS: *food; health effects; N-nitroso compounds; scientific databases; toxicity*

Nutrition habits, ventilatory funcion test, and survival in the elderly inland and coastal Croatian population

Pavlović M**

Croatian Academy of Medical Sciences, Zagreb, Croatia

In the coastal and inland region of Croatia, a longitudinal sample of elderly examinees (165 men and 220 women aged in 2006: 65-92 years) participated in check-ups on ventilatory function tests, electrocardiogram, blood lipids and urine analyses, smoking data, and nutrition in a longitudinal study of chronic diseases 1972-1982-2006-2012. The aim of the study was to determine relationships between forced vital capacity (FVC) and nutritional characteristics divided in clusters (fresh fruits, meat and smoked meat, bread, milk and cheese, beans, fish, subjective assessment of salt consumption, and alcohol intake) in the free-living elderly. The exclusion criteria were: death during 5 years from the last check-up in 2006 (N=64 in 2012), positive butyl alcohol sniff test, noted symptoms of dysosmia in the 2006 examination (N=11). The used statistical methods were log-linear modelling and factor analysis. A statistically significant difference was observed between coastal and inland regions in fish and salt consumption regarding FVC values, body mass index (BMI), and follow-up survival in male and female elderly examinees. Attention should be paid to the fish diet and the impact on free-living healthy ageing in inland and coastal region citizens, with emphasis on lung health, besides the nutrition quality and food control, the possible long-term influence on unidentified scombrotoxism on lung health, including monitoring the status of smell and gustatory organs.

KEY WORDS: *fish consumption; FVC; log linear modelling; longitudinal survival*

**ana.santos@estescoimbra.pt*

***mladen.pavlovic47@gmail.com*

Food-drug interactions – a silent and underestimated risk?

Joaquim J*, Vitória A, Rocha C, Alves F, Magalhães M, Miranda S, and Baltazar A

Instituto Politécnico de Coimbra, ESTeSC, Coimbra, Portugal

Nutrients can interact with drugs, modifying the pharmacological effects of the drug due to the changes in the risk-benefit ratio of the use of a particular drug, and these interactions are quite facilitated since the drugs are mostly administered orally. The aim was to study the importance of considering food-drug interactions in the nutritional and pharmacological approach and to understand the intervening processes and the clinical manifestations arising from these interactions. A search was performed on different databases such as PubMed, Google Scholar, Science Direct, and specialised literature. This search returned 20 articles using the keywords "food-drug interactions", "nutrition", and "medicines". Of these, only nine papers published between 2005 and 2015 were used for research. Changes can be avoided by the separation of the administration period of the medicines and co-administration with meals (such as NSAIDs). The improvement of total caloric intake (acidic influence, hyperlipidic, hyperproteic, and fibre-rich diets) or only one specific food/nutrient. Increasing the dose of the drug or modification of the type of drug/food administration itself, emphasising as a major agonist or antagonist interactions, the grapefruit with warfarin; phytates with iron absorption; calcium and vitamin D with tetracyclines; potassium/sodium/magnesium with diuretics; and proteins with levodopa. Orally administered medications can interact with different foods. Interactions that occur in the stomach and intestine are the most relevant. These interactions may be responsible for changes in plasma concentrations of the drug, which may decrease its efficacy or lead to toxicity, which can be life threatening in severe interactions.

KEY WORDS: *interactions in the stomach and intestines; medicines; nutrition; scientific databases*

Calcium interaction with tetracyclines – what is known?

Joaquim J*, Morgado A, Tavares A, Lé J, Faria L, and Baltazar A

Instituto Politécnico de Coimbra, ESTeSC, Coimbra, Portugal

Nowadays, a rising interest in the interaction between tetracyclines and calcium has been noticed. Tetracyclines belong to the group of antimicrobials, which have a wide range of action, acting under gram-positive and gram-negative bacteria, aerobic and anaerobic, as well as some protozoa and even fungi. They have interesting properties, such as a wide action spectrum, low toxicity, low cost and can be administered orally in most cases due to these properties. Calcium is the mineral with the highest concentration in the human body, and it is mostly localised in bones and teeth. However, it can also be founded in the blood, muscle, and the fluid between cells. This study intends to characterise, under a review, the interaction between calcium and tetracyclines. The review process was conducted using scientific databases such as PubMed, Google Scholar, Science Direct, SciELO, and specialised literature using keywords such as "tetracyclines", "calcium", "interaction", "food", and "absorption". We selected the 14 most relevant articles found between 2005 and 2015. Based on the literature consulted, an obvious propensity for interaction between tetracyclines and calcium was found. When we relate calcium with tetracycline and study the effects of their interaction, we realise that calcium in higher concentrations decreases the absorption of tetracycline, so we decided to focus on this interaction. Research indicates that calcium avoids the pharmacological effect of tetracyclines by chelation but more research is needed to strengthen the scientific background of calcium-enriched foods and this group of antibiotics.

KEY WORDS: *absorption; antimicrobials; food; mineral; scientific databases*

**jjj@estescoimbra.pt*

The occurrence and movement of salmonelloses in the city of Zagreb during the period from 2007 to 2017

Ponjan Vojaković D*, Gregurić Beljak Ž, and Vodopija R

Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia

The aim of this study was to estimate the number of salmonelloses in the city of Zagreb during 2007-2017, according to official reports of communicable diseases, as well as seasonality, risk groups, the length of carrier state, and the most common sources of infection. According to the official reports of communicable diseases that need to be reported pursuant to the Protection of Population from Infectious Diseases Act and epidemiological questionnaires, a retrospective study was conducted. In the observed period, the total number of sick persons from salmonelloses was 4,733. The most severe clinical manifestations (including death) of the illness have not been recorded. The greatest peak of salmonelloses with 996 official reports was registered in 2008, and the smallest in 2017 with 143 reports. *Salmonella enteritidis* was the most frequent isolate. The most representative were age groups 20-39 years, followed by senior age groups from 60 years and above. Mostly there were single, sporadic cases, while family outbreaks were registered in a smaller number of cases. The vehicles of infection were sweets, chicken, egg meals, barbecue meat, and dairy products. Salmonelloses represent the leading cause of alimentary toxic infections in the city of Zagreb. Despite the significant decline in salmonelloses in the observed period, further specific measures need to be implemented for suppressing salmonelloses. There is need for greater education of employees who work with food (preparation, production, and distribution) through a course of hygienic minimum.

KEY WORDS: *alimentary toxic infections; education;* Salmonella enteritidis*; seasonality; vehicle*

Contamination of leafy vegetables with protozoan cysts from local markets in the Osijek area during two seasons

Banjari I*, Marček T, and Ižaković M

Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology, Department of Food and Nutrition Research, Osijek, Croatia

While the consumption of nutrient-dense fresh, raw vegetables is one of the basic principles of a balanced diet, if contaminated whilst growing in fields, during harvesting, or handling, processing and distribution, raw vegetables may be the source of a food-borne disease. We conducted a screening of pathogens in raw, green-leafy vegetables, primarily consumed as salads, from two local markets located in the city of Osijek, Croatia. Samples of lettuce, cabbage, and kale were collected each month from both markets during March and June in 2017 and 2018. A total of 32 samples were analysed using the procedure described by Said (2012). Four samples were positive to protozoa cysts. Contamination was higher in 2017 (37.5 %) than in 2018 (4.2 %), which can be attributed to a large difference in climate (rain seasons). Lettuce samples were contaminated at a much higher rate (23.1 %) in comparison to kale (11.9 %) or cabbage samples with no parasite elements found. Seasonal variations in contaminations showed that the month of May was the most critical; half of all contaminations were detected during May. The results show that fresh vegetables from local markets need to be monitored closely for parasites to avoid food-borne diseases. Seasonal variations and climate should be considered when planning inspections.

KEY WORDS: *cabbage; food-borne diseases; kale; lettuce; parasite; source of contamination*

**danijela.ponjan@stampar.hr*

***ibanjari@ptfos.hr*

Use of food supplements by employed population of Croatia: a cross-sectional study

Molnar D[1]*, Sorić T[3], and Čoklo M[2]

Faculty of Food Technology and Biotechnology, University of Zagreb[1], Institute for Anthropological Research[2], Psychiatric Hospital Ugljan, Ugljan[3], Croatia

In the last few decades, the use of food supplements has increased greatly in Western countries. Defined as a concentrated source of nutrients or other substances with a nutritional or psychological effect, food supplements are intended to correct nutritional deficiencies, improve physical performance, and support specific physiological functions. The aim of this study was to determine the prevalence of food supplements use among the employed population of Croatia, as well as to determine whether there is a difference in supplement consumption depending on sex and educational level. A cross-sectional study was conducted among 132 healthy, employed subjects aged 18-65 years from different parts of Croatia. The intake of various food supplements over the past month period was assessed using the validated Food Frequency Questionnaire (FFQ). According to the results, 43.9 % of participants reported using at least one of the studied supplements. The most commonly used supplements were magnesium (34.1 %) and vitamin C (20.5 %), while only 2.3 % of the participants reported supplementation with vitamins A and E. The study showed that none of the female participants took vitamins A or E, but regarding the use of other supplements, there was no significant difference depending on sex. Moreover, no significant difference was determined according to level of education. The study showed a high prevalence of food supplement use in the employed population of Croatia. Further studies that would elucidate the reasons for using supplements are needed to assure their proper, justified, and safe use.

KEY WORDS: *employed population; minerals; prevalence; supplementation; vitamins*

Food supplement registration in the Republic of Srpska

Bojanić LJ[1,2]*, Đermanović M[1,2], Marjanović M[1], and Zrnić K[1]

Public Health Institute[1], Faculty of Medicine, University of Banja Luka[2], Banja Luka, Republic of Srpska, Bosnia and Herzegovina

The Food Act, published in the Official Gazette of the Republic of Srpska (No 19/17) lays down provisions on food supplements. The Regulation of Food Supplements was published after the aforementioned Food Act (OG, No 10/18). Pursuant to this Act and Regulation, food supplements imply foodstuffs intended to supplement the normal diet and which are concentrated sources of nutrients and other substances with a nutritional or physiological effect, alone or in combination. The aim of the study was to determine the category and nature of nutritional supplements that have entered the registration process so far. Expert reports on registration were analysed at the Public Health Institute of the Republic of Srpska, 33 in total. It was found that of the 33 samples, 23 samples were based on vitamins and minerals. Seven samples contained herbal drugs as active components and three samples were based on other substances according to the Ordinance on Additives (omega-3 fatty acids, coenzyme Q10). Multicomponent products were more frequent than those that had only one physiologically active substance in their composition (e. g. vitamin C). Regulations clearly regulate the efficiency, quality, and safety of this group of products which is very important because of its wide range in use. It is therefore necessary that the conditions specified by the Regulation are met.

KEY WORDS: *control; nutritional supplements; minerals; samples; vitamins*

**dunjamolnar151@gmail.com*

***farmacija@phi.rs.ba*

Arh Hig Rada Toksikol 2018;69(Suppl. 1):73-75

Pharmaceutical active ingredients as adulterants in dietary supplements

Ristić M*, Pantić-Palibrk V, Tadić M, Vuković G, and Koprivica D

Institute of Public Health, Belgrade, Serbia

Dietary supplements are a market with continuous increases in sales. These products are advertised with claims of effectiveness, as "natural" and "harmless", available without prescription. The demand for products improving erectile dysfunction as well as weight loss products is continuously growing. Adulteration of dietary supplements with active pharmaceutical ingredients, purposely added to a product and undeclared, has become a serious health problem, not to mention a legal one. In weight loss, the banned medicine sibutramine was the most often detected synthetic substance. Fluoxetine, an antidepressant is another ingredient to add to the list of APIs showing up in weight loss products. In the sexual enhancement area, the undeclared ingredients of concern are sildenafil and other erectile dysfunction drugs. Laboratory testing of active pharmaceutical ingredients (sibutramine, fluoxetine, orlistat, bisacodyl, sildenafil, tadalafil) in dietary supplements (LC-MS/MS) were performed at the Institute of Public Health, Belgrade at the request of the border inspection and importers from 2015 to 2018. In total, 367 samples were tested. Sildenafil was detected in four samples (48 to 50 mg per capsule/tablet/chocolate bar) and fluoxetine in one sample (10.9 mg per capsule). The wish for better sexual well-being and a perfect physical appearance can be very risky, sometimes life threatening. With the growing popularity of dietary supplements, there is increased need for more effective control of their production and distribution.

KEY WORDS: *fluoxetine; fraud; health; sildenafil; sibutramine*

In silico ADMET study of sildenafil and its analogues found in herbal dietary supplements – ecotoxicity approach

Jadrijević-Mladar Takač M[1], Žuntar I[1]**, Krivohlavek A[3], and Takač T[2]

Faculty of Pharmacy and Biochemistry[1], Faculty of Chemical Engineering and Technology[2], University of Zagreb, Andrija Štampar Teaching Institute of Public Health[3], Zagreb, Croatia

Erectile dysfunction (ED) medicines are obtained outside of the official health system and possibly legitimate sales channels. According to the literature, a high-risk segment of this market is occupied by adulterated food supplements. The aim of this *in silico* study was to evaluate phosphodiesterase 5 inhibitors (PDE5Is) including sildenafil and its analogues previously detected in food supplements by liquid chromatography-electrospray ionisation-tandem mass spectrometry (LC-ESI-MS/MS) and predict their toxic profile by ADMET Predictor™ (SimulationsPlus Inc., USA) in order to elucidate their impact on the environment and health. ADMET (absorption, distribution, metabolism, excretion, and toxicity)-related descriptors relevant to environmental toxicity were computed using four models: the fathead minnow acute toxicity model based on lethal effects on *Pimephales promelas* (TOX_FHM, Minnow LC_{50} in mg L^{-1}), the concentration needed to inhibit 50 % growth in protozoan species *Tetrahymena pyriformis* (TOX_ATTP, $pIGC_{50}$ in mmol L^{-1}), the lethal concentration that results in the death of 50 % of *Daphnia magna* (water fleas) (TOX_DM, *Daphnia* LC_{50} in mg L^{-1}) and bioconcentration factor (BCF). The results of this *in silico* study revealed that the investigated PDE5Is are non-biodegradable molecules and the predicted scores for bioconcentration factor (BCF) were computed from 0.011 to 10.614. Toxicities for TOX FHM expressed as Minnow LC_{50} were computed from 0.147 to 15.877 mg L^{-1}, TOX_ATTP expressed as $pIGC_{50}$ from 0.945 to 1.489 mmol L^{-1} and TOX_DM expressed as *Daphnia* LC_{50} from 0.184 to 776.975 mg L^{-1}. In general, based on computed data, sildenafil analogues have been revealed as more ecotoxic compared to sildenafil (computed scores: BCF 1.311; TOX FHM Minnow LC_{50} 2.269 mg L^{-1}; TOX_ATTP $pIGC_{50}$ 0.711 mmol L^{-1}, and TOX_DM *Daphnia* LC_{50} 0.343).

KEY WORDS: *ecotoxicity; food supplement; PDE5Is*

**maja.ristic@zdravlje.org.rs*

***izuntar@pharma.hr*

Important micronutrient – magnesium

Pollak L* and Adanić Pajić A

Croatian Institute for Public Health, Zagreb, Croatia

The consumption and use of vitamins and minerals in food supplements is increasing. Manufacturers were supposed to adapt all the ingredients based on the new legislative frameworks covering this area. The most demanding requirement was to adjust the bioavailable new chemical forms of vitamins and minerals and declare the product according to the requirements of regulations and markets. We differentiate several types of food supplements – pure vitamins, pure mineral, herbal supplements and/or combinations of all these. In the group of mineral food supplements, magnesium takes the lead in this, thanks to its harmlessness, ubiquity and accessibility. Magnesium is extremely important for the basic functions of the organism. Its positive impact on the body has also been confirmed by a whole series of approved health claims. Some of them are related to the normal functioning of the nervous and muscular system, psychological functions, fatigue, and exhaustion. In combination with B vitamins, the effect on the body is even more positive. During the lectures, we will get acquainted with important scientific facts about magnesium and vitamin B groups, and there will also be an interactive, short workshop/discussion with the audience to consider if magnesium is a trend or a necessary micronutrient.

KEY WORDS: *body effect; food supplements, health claims; minerals; vitamin B group*

**lea.pollak@hzjz.hr*

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PUBLISHER
Institute for Medical Research and Occupational Health, Zagreb, Republic of Croatia

Arh Hig Rada Toksikol (ISSN 0004-1254, e-ISSN 1848-6312) offers free access to full-text articles on the Portal of the Scientific Journals of Croatia – HRČAK (http://hrcak.srce.hr) and through e-publishing services by De Gruyter Open (http://www.degruyter.com/view/j/aiht).
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This journal is supported by the Ministry of Science and Education of the Republic of Croatia.

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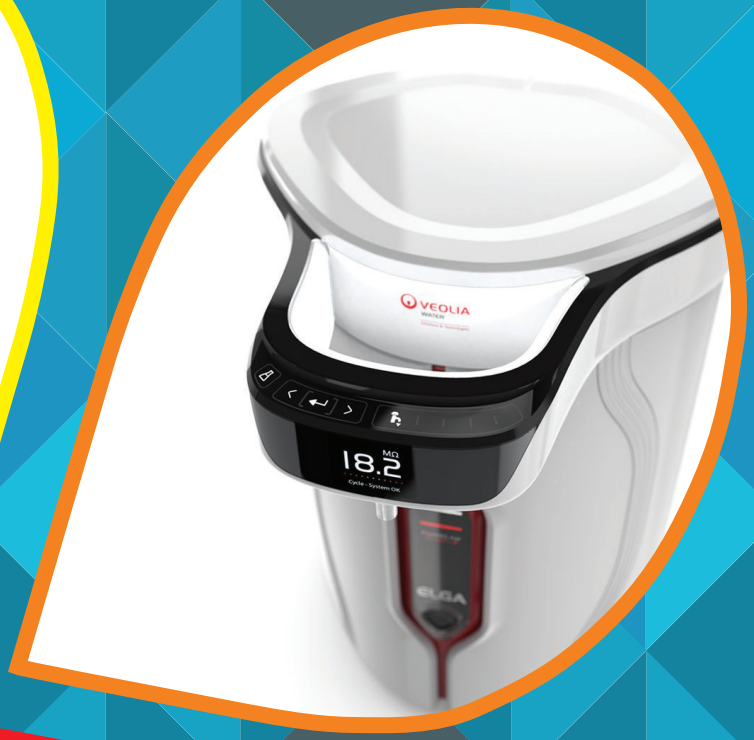

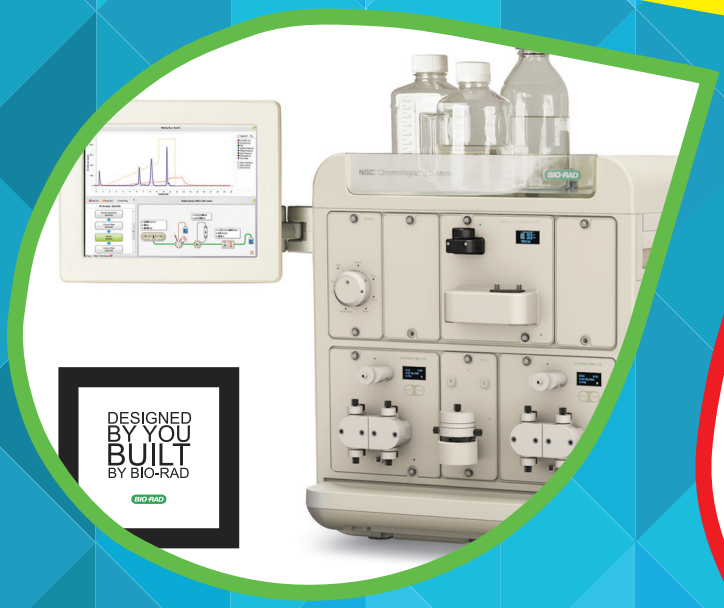

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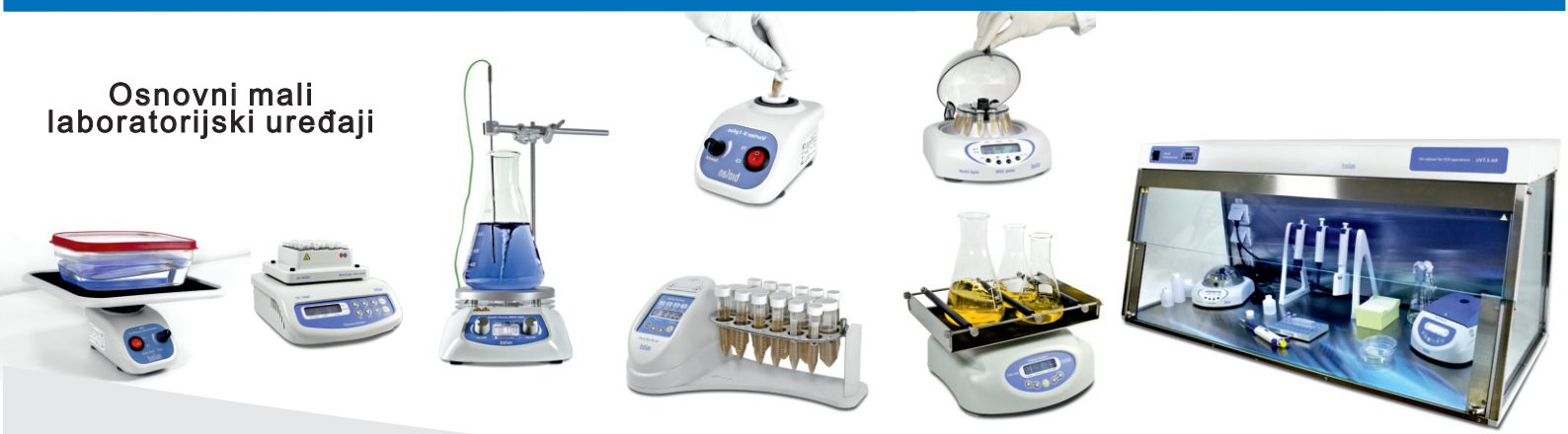

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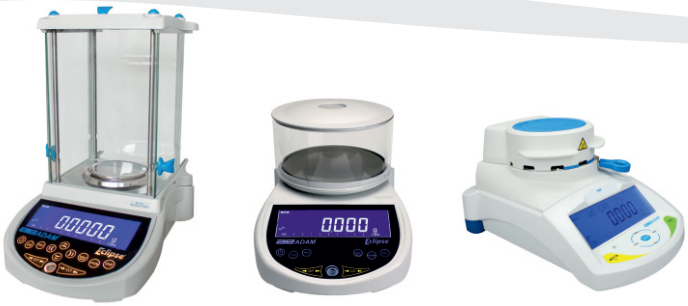

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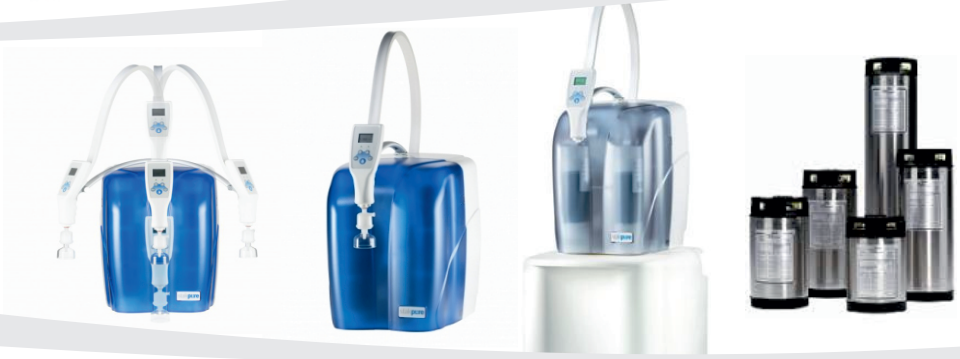

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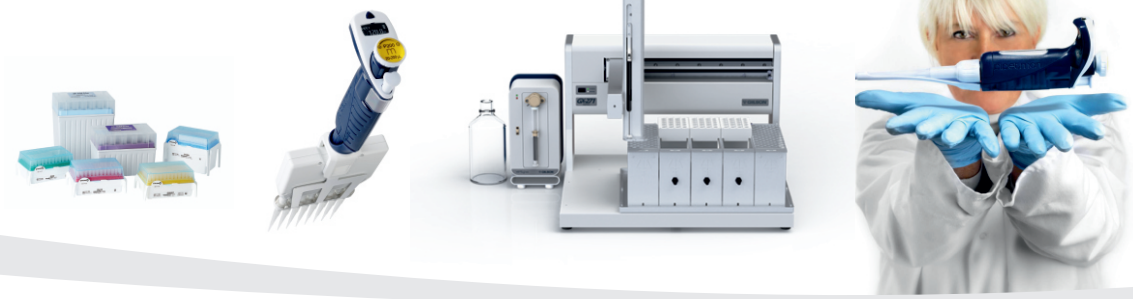

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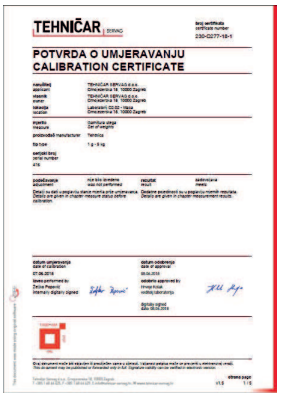
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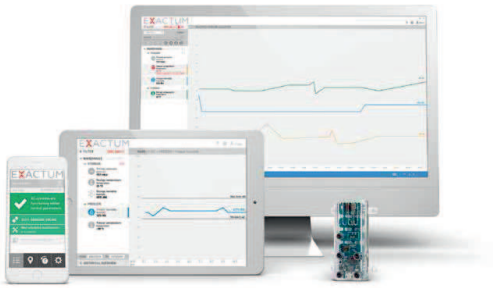

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