Hranom do zdravlja : knjiga sažetaka s 13. međunarodnog znanstveno-stručnog skupa

13 hranom do zdravlja / with food to health

Book of Abstracts of the 13th International Scientific and Professional Conference
WITH FOOD TO HEALTH

Knjiga sažetaka s 13. međunarodnog znanstveno-stručnog skupa
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13th International Scientific and Professional Conference

WITH FOOD TO HEALTH

September 16th and 17th 2021, Osijek, Croatia

13. međunarodni znanstveno-stručni skup

HRANOM DO ZDRAVLJA

16. i 17. rujna 2021., Osijek, Hrvatska

13 hranom do zdravlja with food to health

Osijek and / i Tuzla, 2021.

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SCIENTIFIC PROGRAMME / PROGRAM SKUPA

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Pauza za kavu, razgledavanje postera

***Oral presentations* / Usmena priopćenja**
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Ivana Flanjak, Đurđica Ačkar

***Oral presentations* / Usmena priopćenja**

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***Moderators* / Moderatori:**
Ines Banjari, Valentina Pavić

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Invited lecture, Oral presentations and Sponsor presentation /
Pozvano predavanje, usmena priopćenja i sponzorsko predavanje
***Moderators* / Moderatori:**
Ante Lončarić, Ljiljana Krstin

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***Sponsor presentation /* Sponzorsko predavanje**

CROATIAN VETERINARY INSTITUTE IN FOOD ANALYSIS
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Worksop / **Radionica**
Moderator **/ Moderator:**
Ines Banjari

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POSTER PRESENTATIONS /
POSTER PREZENTACIJE

POSTER PRESENTATIONS / POSTER PREZENTACIJE

Thursday, September 16th 2021 / Četvrtak, 16. rujna 2021.

NUTRITION / NUTRICIONIZAM

DIETETICS AND DIET THERAPY / DIJETETIKA I DIJETOTERAPIJA

FUNCTIONAL FOOD AND DIETARY SUPPLEMENTS / FUNKCIONALNA HRANA I DODACI PREHRANI

POSTER PRESENTATIONS / POSTER PREZENTACIJE

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WITH WATER TO HEALTH
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Nela Nedić Tiban, Martina Rukavina, Mirela Šimović

FOOD ANALYSIS / ANALIZA HRANE

PRODUCTION OF SAFE FOOD AND FOOD WITH ADDED NUTRITIONAL VALUE / PROIZVODNJA ZDRAVSTVENO SIGURNE I NUTRITIVNO VRIJEDNE HRANE

PLENARY LECTURES /
PLENARNA PREDAVANJA

PROBIOTICS: FROM MOTHER'S MILK MICROBIOTA TO NOVEL FOOD SUPPLEMENTS AND LIVE BIOTHERAPEUTICS

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plenary lecture

Mother's milk contains a diverse range of lactic acid bacteria (LAB) which have an emerging role in the establishment of the gut neonatal microbiota and have a huge potential as a next-generation of probiotics. Microbiomes analyses by QIIME2 bioinformatics platform, shown correlation between faeces microbiota composition of infant and their mother's milk. Unique autochthonous strains of LAB, isolated from the microbiota of mothers' milk, produce specific metabolites with potential therapeutic properties, such us surface S-layer proteins (Slps), bacteriocins and exopolysaccharides (EPS) which have an impact on their activity as probiotics in food supplements and as live biotherapeutics. According to our research results, Slps and EPS enhance survival of probiotics during biotechnological production by freeze-drying and gastrointestinal transit, prolong residence time in the colon of the host with potential immunomodulatory activity. Additionally, EPS are prebiotic substrates for the gut microbiota – producers of short-chain fatty acids and lactate, metabolites with antibacterial activity, immune system modulation, energy supply for the intestinal epithelial cells, and the modulation of cholesterol and lipid metabolism. Bacteriocins, as well as Slps and EPS, promote competitive exclusion of pathogens, whereas bacteriocins display antimicrobial activity. The huge potential of next-generation of probiotics as live biotherapeutics and food supplements is recognised for re-establishing of disturbed balance of intestinal microbiota, with potential therapeutic effect on obesity, mood, metabolic disorders, autoimmune diseases and female urogenital infections. Therefore, pharmaceutical and food companies founded large microbiome research centres for the development of next-generation of probiotics with predicted microbiota medicines market of over 500 million EUR by the year 2030.

Keywords: mother's milk microbiota, next-generation of probiotics, S-layer proteins, bacteriocins, exopolysaccharides

POLYPHENOLIC EXTRACTS: NATURAL PHYTOARMS AGAINST UNWANTED MICROORGANIMS

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plenary lecture

Infectious diseases remain one of the leading causes of death and an ongoing global public health challenge. Infections caused by multi-drug resistant pathogens derived from the abuse of antibiotics are of particular concern, not only for humans but also in farmed animals' production. Natural polyphenols, with well-known antimicrobial and antioxidant capacities, emerge as an alternative to synthetic compounds for the formulation of non-antibiotic antimicrobial products, having a well-founded scientific basis. Polyphenols form part of the chemical defensive arsenal of plants, essentially as a result of the inherent physicochemical properties of the phenol functional group.

Many plant materials are rich in polyphenols, particularly, but not exclusively, many fruits. Moreover, some by-products or co-products from the processing of these plant-based foods retain a high load of the original phytochemicals, making them a sustainable source of extracts rich in these bioactive compounds.

The polyphenolic content of such natural extracts depends on the phenotypic and agro-environmental conditions, and the extraction technique and solvents used. Existing data suggest that the antimicrobial activity of a multi-component extract containing most of the original polyphenols will be higher than that of a single-component extract.

In this talk, we will look at some of the most interesting polyphenols and polyphenolic extracts for their application as "defensive phytoarms", mentioning their diverse mechanisms of action. Finally, the challenges of obtaining these extracts on a scale that makes them realistically applicable will also be discussed.

Keywords: polyphenols, antimicrobial activity, antioxidant activity, antimicrobial resistance (AMR), phytochemicals.

Acknowledgment

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KAKO HRANA I DODACI PREHRANI MOGU UTJECATI NA UČINAK LIJEKOVA?

HOW FOOD AND DIET SUPPLEMENTS INFLUENCE EFFECT OF MEDICATIONS?

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plenarno predavanje */ plenary lecture*

Interakcije hrane ili drugih tvari s lijekom podrazumijevaju mogući slabiji ili jači učinak toga lijeka kod njihove istodobne primjene. Ove se interakcije mogu zbivati na razini apsorpcije lijeka u krv (npr. iz probavnog sustava, što je kod hrane i najčešće mjesto mogućih interakcija!), raspodjele lijeka u organizmu, biotransformacije u jetri, eliminacije lijeka ili može doći do promjena u učinku lijeka na ciljne organe. Pri tome je važno voditi računa o klinički značajnim interakcijama. Sama prisutnost hrane u želucu može smanjiti apsorpciju nekih lijekova u krv (npr. antibiotika azitromicina i penicilina V ili bisfosfonata za liječenje osteoporoze). Antipsihotik ziprasidon mora se uzimati s hranom kako bi se optimalno apsorbirao. Kationi iz mliječnih proizvoda mogu se vezati u želucu na antibiotike tetracikline i fluorokinolone i smanjiti njihovu apsorpciju u krv. Fumarokumarini u soku od grejpa mogu uzrokovati inhibiciju metabolizma mnogih važnih lijekova u jetri (npr. imunosupresiva i nekih antikoagulansa) i posljedično povećati njihovu koncentraciju u krvi do toksičnih vrijednosti. Ako osobe koje uzimaju lijekove iz skupine inhibitora monoaminoksidaze (MAO), kao što su antidepresivi (moklobemid), antiparkinsonici (selegilin) ili antibiotik linezolid konzumiraju namirnice bogate tiraminom, mogu razviti hipertenzivnu krizu jer ovaj vazoaktivni amin povećava krvni tlak, a metabolizira se putem enzima MAO.

Ključne riječi: hrana, lijekovi, interakcije, neželjeni učinci

Keywords: food, drugs, interactions, adverse effects

NUTRITION /
NUTRICIONIZAM

DID COVID-19 PANDEMIC CHANGE SUPPLEMENTATION PRACTICE – AN OBSERVATIONAL STUDY FROM CROATIA AND BOSNIA AND HERZEGOVINA

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poster presentation

COVID-19 pandemic was announced on March 20, 2020 and since then the whole world has changed. High virulence and mortality made people look into alternative ways to strengthen immunity, which eventually led to increased interest for supplements, mainly vitamin C, D, and zinc. Several studies have shown that the use of aforementioned supplements results in milder form of COVID-19.
This research intended to analyse supplementation practice among adults from Croatia and Bosnia and Herzegovina, depending on their COVID-19 status. An anonymous, online, study-specific questionnaire was completed by 957 adults aged 18 to 76 years. 37% of study participants recovered from COVID-19, the majority had mild symptoms (56%) and 9% had severe symptoms (including 2% who were hospitalized). There was no difference in symptoms of COVID-19 among our subjects with chronic diseases and without. Higher supplement use was reported by 37% of those recovered from COVID-19, but also among 63% of those free from COVID-19. The most common supplements used by people who recovered from COVID-19 were vitamin C, vitamin D, and zinc, consumed by 39%, 42%, and 47%, respectively. Additional supplements which were most commonly used were probiotics, multivitamins, propolis, vitamin B complex and beta glucan. Finally, people who recovered from COVID-19 were younger, they changed their diet and lifestyle during the pandemic, were taking zinc supplements. Supplementation was used for both prevention and as adjuvant therapy, and people thought that supplementation helped both with the prevention and recovery.
COVID-19 pandemic has increased supplementation practice with vitamin C, D, and zinc in Croatia and Bosnia and Herzegovina, regardless of their COVID-19 status. Importantly, people use supplements for prevention and as adjuvant therapy during the pandemic. Additional benefit noted was change in diet and lifestyle habits.

Keywords: COVID-19, pandemic, supplementation, vitamin C, vitamin D, zinc, diet

PREKOMJERNI UNOS ŠEĆERA I ZDRAVLJE

EXCESSIVE SUGAR INTAKE AND HEALTH

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usmeno priopćenje */oral presentation*

Početkom 2015. godine Svjetska zdravstvena organizacija (WHO) je pozvala roditelje i djecu svih zemalja da u prehrani smanje količine šećera, koji se unose uglavnom kroz razne industrijske prehrambene proizvode i smanje unos energije šećerom na 10 % od ukupnog unosa energije. Daljnja redukcija na 5 % ili preporučena dnevna doza od oko 25 grama dnevno bi također polučila velike zdravstvene benefite za dječju i opću populaciju. Preporuke se temelje na analizi najnovijih znanstvenih dokaza i pobijaju prethodne studije koje su odbacivale nepovoljno djelovanje šećera na zdravlje te odgovornost za bolesti prebacivale na masnoće. Znanstvene studije su dokazale da odrasli koji konzumiraju manje šećera imaju manju tjelesnu mase. Pored toga, istraživanja su pokazala da djeca koja konzumiraju velike količine pića sa šećerom, imaju veću vjerojatnost prekomjerne tjelesne mase ili pretilosti, od djece koja konzumiraju male količine pića zaslađenih šećerom ili koja uopće ne konzumiraju pića sa šećerom. Ispitivanjem tržišta RH tijekom prve polovine 2021. godine, analizirali smo udio šećera u grupama proizvoda gazirana, negazirana pića i voćni jogurti. U skupini gazirana pića (10 robnih marki) utvrdili smo prosječan udio šećera od 10,1 %; u skupini negazirani voćni sokovi i nektari (14 robnih marki) utvrdili smo prosječan udio šećera od 10,64 %; a u skupini jogurti (16 robnih marki) utvrdili smo prosječan udio šećera od 11,9 %. Višekratnim dnevnim unosom ovih vrsta proizvoda, zavisno od veličine porcije, vrlo brzo se dostiže preporučeni dnevni unos šećera.

Ključne riječi: šećer, dijabetes, pretilost, hrana

Keywords: sugar, diabetes, obesity, food

MATERNAL DIETARY HABITS AND FOOD RESTRICTIONS DURING BREASTFEEDING

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poster presentation

Appropriate dietary intake during post-partum is of particular importance since it strongly determines the health status of mother and infant. Many countries have developed national guidelines for diet while breastfeeding. However, cultural tradition has an important effect on lactation behavior. Popular myths about maternal diet during breastfeeding can become barriers to breastfeeding and lead to unnecessary dietary restrictions. So, the aim of this study was to examine dietary habits of women during breastfeeding, self-food restrictions as well as increased consumption of some food. This study enrolled 148 voluntary breastfeeding mothers from Bosnia and Herzegovina. The data were obtained through a specially designed anonymous online questionnaire. The weight of breastfeeding women at the time of completing the survey was higher for 3,48 (95% CI, 2.70 to 4.26) kg compared to their weight at the time of conception [$t(147)=8.806$ $p<0.001$]. According to the BMI category, 12.2% of women were in pre-obese and 4.7% in the obese category before conception, compared to the time after the childbirth (24.3% and 6.1% respectively). Results from the study showed that 35.8% of women were taking supplements during breastfeeding, and 5.4% of all participating women were on some dietetic regimen. Only 28.4% did not avoid specific food or food group, while others avoided one or more types of food during breastfeeding. Commonly restricted food were citrus, vegetables from the *Brassicaceae* family, legumes, garlic, onion and dairy products. Nursing mothers should be educated on proper diet practices while being warned about unscientific approaches to diet restriction, as well as dietetic regimens by non-professionals.

Keywords: lactating women, dietary habits, food restrictions

POLYPHENOLS FROM *Prunus spinosa* L. FLOWER EXTRACT IMPACT ON α-AMYLASE ACTIVITY IN ALLOXAN INDUCED HYPERGLYCEMIC C57BL/6 MICE

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The aim of this work was to determinate the influence of polyphenols from *Prunus spinosa* L. (PSE) extract on serum α-amylase activity after 10 days intake of 25 mg kg^{-1} bm of total polyphenols in hyperglycemic C57BL/6 mice. Hyperglycemia was induced with 150 mg kg^{-1} bm of alloxan. Mice were divided in 4 groups: (1) as control (C), (2) as *Prunus spinosa* L. flower extract (PSE), (3) as alloxan group (AL) and (4) as Alloxan group treated with PSE (AL+PSE).
The PSE intake resulted in significantly lower serum α-amylase activity ($p<0.0001$) in *Prunus spinosa* L. flower extract group compared to control group until 10^{th} experimental day. This means that 10 repeated doses of daily consumption of PSE had the potential to inhibit amylase activity. When the *Prunus spinosa* L. flower extract was administrated to the hyperglycemic mice (AL+PSE) there was a significant reduction of α-amylase activity ($p<0.0001$) compared to alloxan (AL) group 10^{th} experimental day.
These findings may be used in designing a nutraceutical polyphenol mixture as a supportive therapy in hyperglycemia treatment. The conclusion of this study is that 10 days intake of *Prunus spinosa* L. flower extract has a potential protective effect on inhibiting serum α-amylase activity.

Keywords: α-amylase, hyperglycemia, mice, polyphenols, *Prunus spinosa* L.

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PHYTOSTEROLS IN THE TREATMENT OF SYMPTOMS OF HYPERCHOLESTEROLEMIA

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poster presentation

Cholesterol is a molecule wich presents the basic building part of every cell. Cholesterol chomeostasis is crucial for proper cellular and systemic functions and it is very important to maintain it within reference values. Disturbed cholesterol balance causes cardiovascular diseases as well as other diseases such as neurodegenerative and cancer. Symptoms of high cholesterol include dizziness, increased sweathing, nausea and vomiting, fainting, confusion, blurred vision, tingling in the legs and arms. Reducing of high level of cholesterol can be done by using medical therapy but also and with diet rich in phytosterols. The main sources of phytosterols are vegetable oils (flaxseed, olive, soybean, sesame, wheat germ), nuts(walnut, almond, pistachio, Indian walnut), legumes (beans, peas), fruits (orange, apple, banana, pear, cherry, peach), vegetables (beets, broccoli, onion, carrot, cabbage, sweet potatoes) and herb (sycamore, ginseng). The most important property of phytosterols is their effect on the reduced absorption of endogenous and exogenous cholesterol in the body. According to the results obtained by numerous studies their sufficient intake can significantly reduce the asporption of cholesterol from food in the small intestine. Normal blood cholesterol levels can be maintained with adequate nutrition and intake of ingredients from foods that contain phytosterols in their composition.

Keywords: cholesterol, phytosterol, hypercholesterolemia

KURKUMA: ZAČIN ILI LIJEK ZA OSTEOARTRITIS?

TURMERIC: A SPICE OR A CURE FOR OSTEOARTHRITIS?

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postersko priopćenje / *poster presentation*

Osteoartritis (OA) je multifaktorijalna degenerativna bolest s upalnom komponentom, čije su incidencija i prevalencija posljednjih desetljeća u značajnom porastu, te trenutno globalno pogađa oko 240 milijuna ljudi. Uzrok nije u potpunosti razjašnjen, lijek za sada ne postoji, a terapijske intervencije usmjerene su poglavito kupiranju simptoma te usporenju progresije destrukcije zgloba. Od terapijskih opcija koje su na raspolaganju najviše se propisuju nesteroidni antireumatici. Danas se diferencira potreba za sigurnom a djelotvornom tvari, koja će biti korištena u adjuvantnom liječenju, ali i prevenciji bolesti. Jedna od takvih tvari je i kurkumin, hidrofobni polifenol koji čini aktivnu komponentu rizoma biljke *Curcuma longa*. Više studija pokazalo je njegovo jako antioksidativno i protuupalno djelovanje, uz netoksičnost i sigurnost primjene i pri visokim dnevnim dozama. Kurkumin osim što blokira apoptozu hondrocita, blokira i ekspresiju ciklooksigenaza, prostaglandina E-2 i proupalnih citokina u hondrocitima te tim mehanizmom potencijalno ublažava simptome upalne bolesti. Premda postoje velike varijacije kvalitete, metodologije i razultata do sada provedenih istraživanja, u ovom trenutku svoje mjesto u liječenju OA kurkumin prvenstveno nalazi kao kratkoročna i srednjeročna adjuvantna terapija u liječenju boli i smanjenju biokemijskih faktora upale. Navedeno u konačnici dovodi do bolje regulacije boli i poboljšanja funkcije zahvaćenog zgloba, što rezultira značajnom redukcijom standardno propisivanih doza lijekova koji sa sobom nose čitav niz nuspojava. Potrebna su daljnja istraživanja s ciljem utvrđivanja preventivne uloge kurkumina na razvoj OA, učinka dugoročne primjene kurkumina na prevenciju i/ili liječenje bolesti, te determiniranja optimalnih terapijskih doza.

Ključne riječi: kurkuma, kurkumin, ljekovite tvari, hrana kao lijek, osteoartritis

Keywords: curcuma, curcumin, medicinal substance, food as medicine, osteoarthritis

HERBS FOR EYE HEALTH - IS THERE SCIENTIFIC EVIDENCE?

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poster presentation

Since the beginning of human existence, herbs in traditional medicine, played an important role in the treatment of multiple human diseases in many parts of the world. The problem of harmful effects of modern drugs led to the increased application of plant-derived drugs. In the treatment of the eye diseases, traditional medicine is foremost used in the developing countries for primary health care, but the interest is growing in developed countries as well, mostly in the form of prevention or as supportive therapy to pharmacological treatment. Herbs such as eyebright and goldenseal are used for a long time in the form of eye drops and are also used for rinsing the eyes suffering from conjunctivitis and blepharitis. Green tea showed positive effects in alleviating the symptoms of dry eye. Ginkgo has neuroprotective effect against the retinal ganglion cells suffering from increased eye pressure, preventive and therapeutic effect against the eye diseases related to aging such as cataract, glaucoma, diabetic retinopathy and macular degeneration. *Cannabis sativa* and coleus help decrease eye pressure. Saffron and goji berries have neuroprotective effect against retinal ganglion cell death caused by increased eye pressure. Grape seeds showed to have preventive effect against occurrence of cataract but also against other eye diseases related to aging due to their antioxidative effects. Anthocyanins from blue berries protect the nerve cells of retina, strengthen blood vessels, improve circulation and block the creation of new blood vessels.

Keywords: traditional medicine, herbs, eye health, scientific evidence

CONSUMPTION OF PROCESSED FOOD AND ITS IMPACT ON DIET QUALITY IN CROATIAN SCHOOL-AGED CHILDREN

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poster presentation

In countries around the world, a dietary shift is observed in which the consumption of highly processed foods with high content of added sugar, sodium and fat increases over unprocessed or minimally processed foods. Such inadequate dietary behaviour in childhood can increase the risk of developing obesity and other non-communicable diseases. The objectives of this study were to observe the consumption of processed foods in the overall diet of school-aged children and to estimate differences in dietary intake between two dietary fractions. Dietary intake was observed from dietary records for three non-consecutive days of 168 children (50.6% boys) aged 8.3 ± 0.5 years (Zagreb City). All foods and beverages were classified into four groups according to the NOVA Food Classification system based on the type, extent and purpose of industrial food processing. The contribution of each NOVA food group to total energy was calculated and the mean nutrient intake of two dietary fractions (<50% and ≥50% of total energy intake from ultra-processed foods) was compared. Anthropometric measurements were performed according to standard protocols, while z-scores were obtained using AnthroPlus software. Results show that 'unprocessed or minimally processed foods' had the highest proportion of dietary intake (38.4% of energy intake), followed by 'ultra-processed foods' (37.7%), 'processed foods' (16.4%), and 'processed culinary ingredients' (7.5%). There was no difference in all four processed food categories intake by gender or BMI. Children who had ≥50% of their energy intake from 'ultra-processed foods' had lower intake of monounsaturated fatty acids (p=0.003), polyunsaturated fatty acids (p=0.004), vitamins and minerals compared with children with <50%. In conclusion, nearly one-third of energy intake in these Zagreb school-aged children came from ultra-processed foods, which may contribute to poor overall nutrition. Further research is needed on the factors contributing to the consumption of ultra-processed foods to reduce their intake.

Keywords: dietary patterns, dietary intake, food processing, NOVA, ultra-processed food

NUTRIENTS AND FETAL DEVELOPMENT

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oral presentation

Historical reasons have led to knowledge that would not have been possible to obtain through research without gross violations of ethical norms. Quantification of macro- and micro-nutrient intake is hampered by a number of barriers. It has been observed that changes in fetal nutrition and its endocrine status can result in developmental adjustments that permanently alter the structure, physiology, and metabolism of children, thus exposing individuals to the risk of metabolic, endocrine, and cardiovascular diseases in adulthood. In research on the process better known as "fetal programming", the influence of the *in utero* environment on the epigenetic mechanisms of the fetus has been observed. Decreased or increased amounts of food intake may interfere with placental function and interfere with fetal growth. Altered placental function can lead to endothelial dysfunction, leading to changes in fetal growth and development. More recently, there has been increasing research on the impact of dietary supplementation on pregnant women and perinatal outcome. Among the more frequently examined variables are micronutrients such as folic acid, antioxidants, iron, magnesium and zinc, but also polyunsaturated fatty acids. The Covid-19 pandemic further highlighted the need to create disease registries and systematically monitor data, especially given the differences in health care availability on the one hand and the incredible global differences in nutrient availability on the other, given that the hunger is still the leading cause of death in the world.

Keywords: nutrients, fetal development, intrauterine growth retardation, preinatal outcome

MALNUTRITION IN COVID-19

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oral presentation

A novel coronavirus SARS-CoV-2 virus is rapidly spreading worldwide, making coronavirus disease 2019 (COVID-19) a global emergency. Although it is initially identified as the causative agent for respiratory diseases, now it is known that the SARS-CoV-2 virus colonizes and affects the gastrointestinal tract, leading to impairment of patient's nutritional status and consequently malnutrition. Using the angiotensin-converting enzyme 2 receptor as an entry receptor in the cells of the gastrointestinal tract, the virus creates rapid viral replication and cell damage, which causes inflammation and increased cytokine secretion. On the other hand, it is known that malnutrition decreases immune response with consequent increased risk of infection and disease severity. The associations between malnutrition and COVID-19 can be explained by the complex interactions between infection and nutritional status, resulting in a vicious cycle. This vicious cycle begins with an inflammatory response that generates fever, increases catabolism, and alters the intestinal absorption, which induces or aggravates malnutrition. Malnutrition, in turn, reduces gut barrier function, modifies the intestinal microbiota, and compromises immune cell generation and activation. All things considered, malnutrition has been identified as a negative prognostic factor in COVID-19 disease, increasing hospital length of stay, death rate, and re-admission rate.

Keywords: SARS-CoV-2, COVID-19, nutritional status, malnutrition

ASSESSMENT OF DIETARY HABITS OF PREGNANT WOMAN TROUGH FOOD GROUP INTAKE IN THE MUNICIPALITY OF ILIDŽA

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oral presentation

Pregnancy is a very sensitive condition, in which balanced diet is one of the most important aspect. The aim of this study was to examine the frequency of consumption of vegetable food group in the diet of pregnant women from the Municipality of Ilidža, Sarajevo Canton, Bosnia and Herzegovina.
The research included 136 pregnant women. The data collection was conducted using single anonymous questionnaire that included data on the sociodemographic characteristics, general pregnancy data and data on eating habits trough consumption of foods from the groups of vegetables (green leafy vegetables, fresh tomatoes and cucumbers, red onion, garlic, mushrooms, zucchini, eggplant, canned vegetables, frozen vegetables, fresh cabbage, sauerkraut, boiled and baked potatoes, french fries). Data was processed using statistical techniques and methods (inferential and descriptive statistics) and appropriate software support. The obtained results show that pregnant women most often consume boiled potatoes, red onions and baked potatoes, while only once a week on average they consume green leafy vegetables, lettuce, fresh cucumber, cabbage, garlic, and frozen vegetables. The results indicated poor eating habits in the examined group, as well as insufficient awareness of the respondents about the importance of examined food group in their diet. In accordance with the stated outcomes of this research, there is a significant need for education through counseling within public institutions specializing in pregnant women.

Keywords: pregnancy, diet, vegetables, Sarajevo

PREHRAMBENE NAVIKE SREDNJOŠKOLACA PRIJE I ZA VRIJEME *LOCKDOWNA*

DIETARY HABITS OF SECONDARY SCHOOL STUDENTS BEFORE AND DURING LOCKDOWN

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postersko priopćenje / *poster presentation*

Podložnost različitim utjecajima društva i okoline najizraženija je u doba adolescencije. Kako je utjecaj vršnjaka u ovom razdoblju života značajan i za prehrambene navike, cilj istraživanja bio je ispitati da li je fizičkom izoliranošću od vršnjaka i prelaskom na online nastavu, za vrijeme prvog *lockdowna* došlo do promjena prehrambenih navika srednjoškolaca. U istraživanju je sudjelovalo 1005 ispitanika, 288 mladića i 717 djevojaka, s područja cijele Hrvatske. Prosječna dob ispitanika je 16,7 godina. Istraživanje je provedeno od travnja do lipnja 2020., ispunjavanjem online upitnika, objavljenog kao dio nastavnog materijala na službenim stranicama Agencije za strukovno obrazovanje i obrazovanje odraslih (ASOO). Rezultati su pokazali da 49 % ispitanika smatra da ima iste prehrambene navike kao i prije *lockdowna*. 30 % smatra da ima bolje prehrambene navike, nego prije. 55 % ispitanika navelo je da ima doručak uvijek, dok je prije *lockdowna* redoviti doručak imalo 43 % ispitanika. 73 % ispitanika procijenilo je da manje konzumira grickalice u odnosu na prije. Većina ispitanika navela je da manje konzumira hranu u večernjim satima. Najviše ispitanika (37 %) nije promijenilo učestalost tjelesne aktivnosti. Sveukupno gledano, prehrambene navike srednjoškolaca za vrijeme *lockdowna* nešto su bolje nego prije, naročito po pitanju učestalosti konzumacije doručka i grickalica, što se može povezati s više slobodnog vremena i slabijeg utjecaja vršnjaka za vrijeme izoliranosti.

Ključne riječi: prehrambene navike, srednjoškolci, *lockdown*

Keywords: dietary habits, high school students, lockdown

BELIEFS ABOUT WILD AND FARMED FISH AMONG CATERING CUSTOMERS

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poster presentation

The consumption of fish offers health benefits due to its nutritional value and it is highly recommended on different eating occasions. Although increased demand cannot be sustained by capture fisheries, farmed fish consumption is still burdened with prejudices. This work aims to better understand consumption habits and beliefs about wild and farmed fish among catering customers. The national representative sample of the Croatian population was split into two groups: frequent catering customers (FCC; n=264) and non-frequent catering customers (NFCC; n=654). Fish consumption habits and beliefs towards wild and farmed fish were tested with a tailor-made questionnaire. The obtained results showed that the highest share of FCC ate white fish (56%) and fatty fish (42%) in catering facilities on a monthly basis, while the majority of NFCC ate them once a year or less (37% and 35%, respectively). The NFCC group believed that farmed fish contains more antibiotics (p=0.003), more fat (p<0.001) and is more artificial (p<0.001) compared to the wild counterpart. However, they have more positive beliefs regarding its control (p=0.001), availability (p=0.004) and price (p<0.001). It can be concluded that one of the preconditions for increasing fish consumption in catering establishments is breaking down prejudices about farmed fish.

Keywords: beliefs, catering customers, farmed fish, wild fish

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NUTRIENTS AND WOMEN'S HEALTH

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oral presentation

There is a growing number of studies examining the relationship between certain nutrients and women's health. The research covers different dietary patterns trying to quantify the nutrient intake that is presumed to be associated with benign, premalignant, or malignant diseases in women. Quantification of nutrient intake is probably the biggest challenge of these studies. Likewise, it is not clear to what extent altered concentrations of certain nutrients may support disease onset, maintenance, and / or progression. Among the most frequently examined are certain types of fruits and vegetables, and micronutrients such as vitamins C, B9, B12 and E, alpha and beta carotene, retinol, lycopene and trace elements such as selenium, copper, zinc, magnesium and calcium. Polyunsaturated fatty acids have also been studied, especially in the younger population of women. They are inversely associated with depression, and risk of breast cancer, but are associated with an improvement in the clinical status in women with polycystic ovary syndrome. The putative mechanisms of action of individual micronutrients in premalignant and malignant diseases are a reduction in DNA damage and an increase in the repair capacity of damaged DNA. Among the more frequently examined diseases of women that are associated with changes in the amount of nutrients present in the body are cervical intraepithelial neoplasia, infertility, premalignant and malignant changes of the endometrium and associated changes in menopause. We present a review of studies with a quantified impact of certain nutrients on women's health.

Keywords: nutrients, women's health, preinvasive lesions, malignancies, infertility

PREHRAMBENE NAVIKE UČENIKA ČETVRTIH RAZREDA OSNOVNIH ŠKOLA IZ OSIJEKA

DIETARY HABITS OF FOURTH GRADE PRIMARY SCHOOL STUDENTS FROM OSIJEK

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postersko priopćenje / *poster presentation*

Pravilna prehrana od iznimne je važnosti tjekom intenzivnog rasta i razvoja djece. Edukacija djece o prehrani i prehrambenim navikama uz pravovremene nutricionističke intervencije mogu imati veliki utjecaj u prevenciji kroničnih bolesti i stanja, a time i bolje opće stanje i kvalitetu života u odrasloj dobi. Cilj ovog rada bio je ispitati stavove i znanje o prehrani te prehrabene navike i tjelesnu aktivnost učenika četvrtih razreda dvije osnovne škole iz Osijeka. U istraživanju je sudjelovalo 76 učenika (39 dječaka i 37 djevojčica) koji su ispunili anonimni upitnik prilagođen uzrastu. Rezultati su pokazali da 51,4 % djevojčica ima poželjnu tjelesnu masu u odnosu na dob, dok je 33,3 % dječaka u kategoriji povećane tjelesne mase, a njih 28,2 % u kategoriji pretilosti. Aktivno trenira 64,5 % djece, a svakodnevno kuhani obrok ima njih 43,4 % odnosno 41 % dječaka i 45,9 % djevojčica. Zabrinjavajuće je da 32,9 % djece (38,5 % dječaka i 27 % djevojčica) ne konzumira povrće svaki dan te da 34,2 % djece (35,9 % dječaka i 32,4 % djevojčica) nikada ne doručkuje prije odlaska u školu. Iako su učenici, prema rezultatima provedene ankete, pokazali dobro znanje o pravilnoj prehrani, ono se ne podudara sa njihovim prehrambenim navikama.

Ključne riječi: prehrambene navike, znanje o prehrani, učenici četvrtih razreda, osnovna škola

Keywords: dietary habits, nutrition knowledge, fourth grade students, elementary school

USE OF COFFEE AND CAFFEIN BEVERAGES IN STUDENTS UNIVERSITY OF TUZLA

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poster presentation

Caffeine is a natural stimulant most commonly found in tea, coffee and cocoa plants, a stimulant often used among the student population. It stimulates the brain and central nervous system, improves alertness and prevents fatigue. Caffeine is considered safe for most healthy adults when used in doses up to 400 mg per day. Higher doses can cause headache, anxiety, restlessness, and chest pain. The aims of the paper are to examine the habit of caffeine intake of the student population of the University of Tuzla, to examine the awareness of students about the harmful effects of caffeine on health and to examine the impact of caffeine on achieving student goals and tasks. The research included surveying, collecting, processing and analyzing data on the frequency of caffeinated beverage consumption of the student population, collected with the help of a questionnaire based on caffeine intake habits and perception of its effects. The research included 150 respondents, aged 18 and over.

The study showed that, although caffeine is a frequently used stimulant among the student population, overuse was not detected because 1-2 caffeinated beverages are consumed the most per day. Many students reported that they could go 48-72 hours without caffeine and that more than half of the respondents did not experience withdrawal symptoms when not consuming caffeine. Students reach for caffeine to achieve better results, are more productive and focused with the consumption of caffeinated beverages, the negative effects are not taken into account. Research has shown that excessive caffeine use among students is not as widespread as it seems. There is an awareness of potential harm, but education about it is insufficient or non-existent. More detailed studies are needed on the effect of caffeinated beverages, as well as on knowledge related to potential harmfulness, in a larger student population.

Keywords: caffeine habits, caffeinated beverages, perception of caffeine intake

SOCIAL MEDIA AS A MARKETING TOOL AND THEIR IMPACT ON FOOD CHOICE AND NUTRITION

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poster presentation

In recent years on social media (Livestiling, Facebook, Instagram, etc.) there is a growing interest in food, diet and nutritionism, and apart from this we have gastro blogs and influencers as channels used for marketing purposes. The subject of research of this paper is the theoretical development of a new methodology of the so-called Nutrition marketing based on five principles (5N). One of the main goals is to investigate how realistic the viral messages on social networks, in the form of tips, photos and other forms placed on their followers by popular influencers, especially gastro-bloggers and food influencers are, and how they are converted into dietary rules and knowledge of nutrition. In the second part of the research, a survey was conducted on the impact of social media on eating habits and nutrition in Republic North Macedonia as one of the concepts of Nutrition Marketing. The analysis uses several statistical models and methods of data mining. Research done in this paper shows that there is a need to deepen the knowledge about the perception of social media users and consumers in general, due to the wide range of different claims about food and nutrition, and sometimes it is difficult to draw appropriate conclusions about the correct use of marketing tools in that context.

Keywords: social media, nutrition, nutrition marketing, nutrition determinant, consumer behavior

NUTRITIONAL HABITS OF CROATIAN ADULT POPULATION AMIDST THE COVID-19 PANDEMIC

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poster presentation

In addition to a significant impact on health systems around the world, the COVID-19 pandemic also had a strong impact on the population lifestyle and their nutritional habits. The aim of this study was to investigate the nutritional habits of adult working population in central and northwestern Croatia amidst the COVID-19 pandemic. This cross-sectional questionnaire study was conducted during February to April 2021 period among 629 subjects mean age 41.8±9.4 years, 35.3% males and 64.7% females. The study revealed that 34.0 % of subjects consumed more food during the COVID-19 pandemic than before the pandemic.The study also showed that 38.0% of subjects consumed more snacks during the COVID-19 pandemic compared to the time before the pandemic. Finally the study revealed that 40.2 % of subjects cooked more in their households than during the time before the pandemic. Females more frequently consumed more food during the pandemic and also more frequently consumed more snacks in comparison to males (p=0.028 and p=0.006, respectively). It can be concluded that COVID-19 pandemic had significant negative influence on nutritional habits of Croatian adult population, which is important for planing appropriate future preventive programs in observed population.

Keywords: nutritional habits, COVID-19 pandemic, adults, prevention, Croatia

ULOGA PREHRAMBENE INTERVENCIJE U RAZVOJU VJEŠTINA SAMOSTALNOG ŽIVLJENJA U OSOBA S DUŠEVNIM SMETNJAMA – PREGLEDNI RAD

THE ROLE OF DIETARY INTERVENTION IN THE DEVELOPMENT OF INDEPENDENT LIVING SKILLS IN PEOPLE WITH MENTAL DISORDERS – A REVIEW

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postersko priopćenje / *poster presentation*

Smatra se da prehrambene intervencije, osim u poboljšanju prehrambenih navika, mogu imati pozitivne učinke i na brojne aspekte tjelesnog i mentalnog zdravlja, među kojima je i razvoj određenih vještina samostalnog življenja. Unatoč tome, do danas se malo zna o učincima prehrambenih intervencija na razvoj spomenutih vještina u osoba s duševnim smetnjama. Stoga je cilj ovog preglednog rada sažeti trenutna saznanja o učincima različitih vrsta prehrambenih intervencija na vještine samostalnog življenja u ove specifične populacijske skupine. Pregled literature putem bibliografske baze podataka PubMed uključio je izvorne znanstvene članke i pregledne radove. Prehrambene intervencije, različitog dizajna i duljine primjene, rezultirale su razvojem i unaprjeđenjem određenih vještina samostalnog življenja (veća samostalnost prilikom nabave namirnica i pripreme obroka, veća odgovornost kod raspolaganja prihodima, socijalna interakcija) u osoba s duševnim smetnjama. Daljnje studije na većem uzorku ispitanika su potrebne kako bi se potvrdili pozitivni učinci prehrambenih intervencija na vještine samostalnog življenja u ove populacijske skupine. Unatoč potrebi za daljnjim istraživanjima, rezultati publiciranih studija govore u prilog nužnosti uključivanja prehrambenih programa u cjelokupni tretman osoba s duševnim smetnjama. Pritom je od izrazite važnosti da u provedbu prehrambenih intervencija, uz nutricioniste, budu uključeni i radni terapeuti kako bi se postigao optimalan učinak na aspekte samostalnog življenja.

Ključne riječi: prehrambena intervencija, vještine samostalnog življenja, osobe s duševnim smetnjama, radni terapeut, nutricionist

Keywords: dietary intervention, independent living skills, people with mental disorders, occupational therapist, nutritionist

MACRONUTRIENT CONTRIBUTION TO TOTAL ENERGY INTAKE IN INFANTS, TODDLERS AND CHILDREN UNDER 9 YEARS

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poster presentation

The research was conducted as a pilot study for Food Consumption Survey on Infants and Children in Croatia 2017-21. This survey is based on EU Menu methodology and financially supported by European Food Safety Authority (EFSA). The fieldwork was done, in February 2019, on 43 randomly selected participants from cities of Osijek and Zagreb. One face-to-face in-home interview and two computer-assisted telephone interview (CATI) were conducted with each participant. A face-to-face interview included gathering information on anthropometry, completing a general questionnaire, food propensity questionnaire and instructions on how to complete a food diary. The food diary was kept for two non-consecutive days. The data was collected and analyzed in NutriCro® software developed especially for purposes of this survey. Average daily energy intake was analyzed. Average energy intake for infants was 768 kcal/day, for toddlers 1045 kcal/day and for children 1506 kcal/day, with carbohydrates as predominant energy source. The majority of the results were in agreement with the recommendations for the targeted population.

Keywords: food consumption, energy intake, infants, toddlers, children

ASSESSMENT OF NUTRITIONAL STATUS AND DIFFERENCES IN SELF-REPORTED AND MEASURED HEIGHT AND WEIGHT IN THE STUDENT POPULATION

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poster presentation

Nutritional status is an important indicator of the health status and physical ability of an individual. Commonly used tools to evaluate nutritional status include anthropometric measurements and body mass index. The aim of this study was to compare values and classification obtained by various tools. Results showed differences between the self-reported and measured values for height and body mass. The majority of the student population overestimates their body height, female participants underestimate body weight while male overestimate it. A statistically significant difference between self-reported and measured values was shown for body height but not for body weight. Over or underestimation impacts body mass index values and results in lower values which might result in misclassification. Results also indicate that female students tend to see themselves as overweight, 14% have increased body weight, but 39% of female participants perceive themselves as such. Unlike women, men assess their own figure better. BMI and body composition (fat content) are confirmed as a good choice to evaluate nutritional status in studies conducted on student population while self-reported values due to shift in values should be used only in studies where other options are not available.

Keywords: nutritional status, self-report, body mass index, student population

DIFFERENCES IN THE FOOD CHOICE DETERMINANTS BEFORE AND DURING THE COVID-19 PANDEMIC IN THE ADULT POPULATION OF CROATIA AND BELGIUM (CFC CRO-BE): A STUDY CONCEPT

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poster presentation

Adequate dietary habits are believed to have a substantial positive influence on both the prevention and treatment of COVID-19 infection. The aim of the present study will be to examine the differences in food choice determinants before and during COVID-19 pandemic in the adult population of Croatia and Belgium. It is planned for the research to involve ≥ 1,000 participants of both genders aged 18 years and older from Croatia, and the same target of participants from Belgium. A self-administered online questionnaire, distributed via e-mail and social media networks, will be used to assess all the necessary data from the study participants. The questionnaire consists of three parts (15 questions about participants' general characteristics, 36 questions about food choice determinants before COVID-19 pandemic, and 36 questions about food choice determinants during COVID-19 pandemic). All participants will have to provide an informed consent before completing the questionnaire. The results are expected to show significant changes in food choice determinants during COVID-19 pandemic, when compared to the period before the pandemic, indicating the amelioration in the overall dietary habits of both the Croatian and Belgian adults during these challenging times.

Keywords: food choice determinants, COVID-19 pandemic, adults, Food Choice Questionnaire

NUTRITIONAL COUNSELING AT THE TEACHING INSTITUTE OF PUBLIC HEALTH FOR THE OSIJEK-BARANYA COUNTY AS AN INVESTMENT FOR FUTURE

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oral presentation

Chronic non-communicable diseases, in which one of the risk factors is inadequate diet, often goes hand in hand with impaired mental health. The increase in the number of individuals dealing with the symptoms of chronic non-communicable diseases is constant and their treatment represents a major health and economic cost. In order to disburden the health care system and make the individual problem aware it is necessary to continuously strengthen the effectiveness of the primary prevention of chronic non-communicable diseases. One of the priorities of the Teaching Institute of Public Health for the Osijek-Baranja County is improved health care quality for the population hence the establishment of nutrition counseling is a justified decision. The nutrition counseling is guided by experts in the field of nutrition and food science who focus their knowledge and skills to achieving goals of the individual. The counseling is equipped with innovative nutrition software to design meal plans accompanied by graphic representations and with body composition analyzer. Following the obtained information, personalized tasks are being created with recipes based on scientifically based knowledge and individual approach. The nutrition profile of the individual is formed with data presented in this study and helps to take responsibility for it's health care. On the other hand nutritional profile can be used as a useful tool for networking and counseling with other public health institutions and thus disburdening the health care system from nutrition related issues.

Keywords: diet, primary prevention, nutrition counseling, health

CHANGES IN DIETARY HABITS DURING THE COVID-19 OUTBREAK CONFINEMENT IN THE REPUBLIC OF KOSOVO

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poster presentation

The purpose of this study was to investigate self-reported nutritional behavior and weight gain/physical activity performance during the COVID-19 lockdown among a representative adult population from Kosovo and to evaluate socio-demographic variance in nutrition and eating behaviors. Dietary habits, PA (physical activity), body weight, and sociodemographic variables were measured through validated online survey started one week after lockdown decision and lasted for next two month (May and June 2020). Six hundred eighty-nine participants (women 79% and men 21%) aged between 20 and 65 years from the Kosovo territory participated in the research. Multivariate models showed that participants in family home residence, participants from Gjilan, participants female and participants with professional educations reported a higher likelihood of turning into a higher adherence to the Mediterranean diet (MedDiet) (OR: 6.09, 5.25, 5.17, 4.19, respectively). The weight gained during the lockdown was positively associated with a higher cooking frequency (OR; 2.90, $p<0.01$), lower meat and fish consumption (OR; 1.15, $p=0.02$; OR; 1.04, $p=0.04$, respectively), higher fast-food consumption (OR; 0.49, p=0.02) and no physical activity performance (OR; 0.43, $p=0.02$) during the COVID-19 lockdown. Overall, our results highlighted that most participants decreased unhealthy nutritional behaviors and physical activity level during the lockdown.

Keywords: mediterranean diet, body weight, lockdown, COVID-19, physical activity

EPIDEMIOLOGIJA KARDIOVASKULARNIH BOLESTI U DUBROVAČKO-NERETVANSKOJ ŽUPANIJI U RAZDOBLJU OD 2017. DO 2019. GODINE

EPIDEMIOLOGY OF CARDIOVASCULAR DISEASES IN THE DUBROVNIK-NERETVA COUNTY IN THE PERIOD FROM 2017 TO 2019

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postersko priopćenje / *poster presentation*

Kardiovaskularne bolesti su bolesti srca i krvožilnog sustava. Vodeći su uzrok smrti i invaliditeta u cijelom svijetu, te jedan od najvažnijih čimbenika koji utječe na smanjenu kvalitetu života. Više od 17,5 milijuna ljudi u svijetu godišnje umre od kardiovaskularnih bolesti, a predviđa se da će se ta brojka do 2030.godine povisiti na gotovo 23 milijuna. Srčani bolesnici jedna su od najugroženijih skupina u pandemiji COVID-19, budući je svaka treća zaražena osoba imala neku od kardiovaskularnih bolesti. Uspoređujući 2019. godinu s 2017. kardiovaskularne bolesti su vodeći uzrok smrti u Dubrovačko- neretvanskoj županiji s 46,50 % udjelom (591 umrla osoba) od ukupnog mortaliteta (1271 umrla osoba), ali s manjim udjelom u odnosu na 2017. godinu kada je ukupni mortalitet iznosio 1375 osoba, od kojih je od kardiovaskularnih bolesti umrlo 675 osoba (49,67 %). Analiza spolne raspodjele pokazuje kako su kardiovaskularne bolesti češće u žena nego muškaraca. Iako ukupno umire više muškaraca (2019. godine ukupno 652 muške osobe u odnosu na 619 žena), od kardiovaskularnih bolesti umire više žena (2019. godine 349 umrlih ženskih osoba u odnosu na 242 umrle muške osobe). Vodeći uzrok smrti za oba spola u razdoblju 2017. – 2019. godine je ishemijska bolest srca, a iza nje su cerebrovaskularne bolesti.

Ključne riječi: epidemiologija kardiovaskularnih bolesti, kardiovaskularne bolesti, epidemiologija, mortalitet

Keywords: epidemiology of cardiovascular diseases, cardiovascular diseases, epidemiology, mortality

CORRELATION OF PHYSICAL ACTIVITY LEVELS WITH GUT MICROBIOTA COMPOSITION

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The gut microbiota is the largest part of the human-microorganisms macrocosm, populated by trillions of microorganisms that influence our health and well-being. The microbiota can influence various physiological processes in the human body, and conversely, it is influenced by almost every actions we take – from diet to lifestyle and exercise. Recently, changes in the microbiota have been observed depending on an individual's level of physical activity. Until now several bacterial taxa have been correlated with increased stamina and endurance, such as *Prevotella,* which was positively correlated with a number of amino acid metabolism pathways, and *Veillonella,* which metabolises the conversion of exercise-induced lactate to propionate, thereby enhancing athletic performance. We wanted to test whether we can detect differences in microbiota composition based on varying levels of physical activity in a cohort of 40 volunteeres from MicroEquilibrium project. Subjects were of different Body Mass Indexes and had different dietary habits and lifestyles. The level of physical activity was measured using Global Physical Activity Querstionnaire, which allows us to express it numerically and correlate it with the composition of the subject's gut microbiota.

Keywords: gut microbiota, physical activity, global physical activity questionnaire

DIETETICS AND DIET THERAPY /
DIJETETIKA I DIJETOTERAPIJA

PREVENCIJA I KONTROLA KARDIOVASKULARNIH BOLESTI

PREVENTION AND CONTROL OF CARDIOVASCULAR DISEASES

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Kardiovaskularne bolesti su bolesti srca i krvnih žila. One uključuju hipertenziju, koronarnu bolest srca, cerebrovaskularnu bolest mozga, periferne vaskularne bolesti, srčanu insuficijenciju i miokardiopatiju. One danas predstavljaju najteži zdravstveni problem u svijetu. U podlozi svih ovih bolesti najčešće je ateroskleroza, odnosno oštećenja stijenke arterija obilježeno suženjem lumena žile zbog lokalnog zadebljanja unutrašnjeg sloja stijenke žile koje se zove aterom. Aterom se sastoji od jezgre građene od masti, posebno kolesterola i raspadnutih stanica, koju prekriva vezivo i kalcij, te je stijenka žile na tom mjestu tvrđa i neelastična. Aterosklerotično nakupljanje sužava promjer arterije pa tkivo koje ona opskrbljuje dobiva manje krvi, a samim tim kisika i hranjivih komponenti. Zbog smanjenja elastičnosti može doći i do puknuća žile, što se manifestira krvarenjem najčešće u mozak i začepljenjem koronarnih krvnih žila. Od faktora rizika za kardiovaskularne bolesti, na koje se može utjecati, najrašireniji su pušenje, hipertenzija, hiperlipidemija, a prevalencija pretilosti i dijabetesa posljednjih godina bilježi izraziti porast. Odgovarajuća prevencija kod koronarnog bolesnika sprječava preranu smrt i neželjene kardiovaskularne događaje, a postiže se kombinacijom nefarmakoloških mjera i farmakološkog liječenja. Promjenom stila života pacijenta i redovita kontrola uveliko će doprinijeti smanjenju učestalosti kardiovaskularnih oboljenja. Modifikacija faktora rizika može smanjiti kardiovaskularni morbiditet i mortalitet.

Ključne riječi: kardiovaskularne bolesti, prevencija, kontrola, faktori rizika

Keywords: cardiovascular diseases, prevention, control, risk factors

THE MAIN RISK FACTORS FOR THE DEVELOPMENT OF ANATOMICAL CHANGES BLOOD VESSELS IN THE RETINA IN DIABETES MELLITUS

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Diabetes mellitus is an inherited metabolic disease that leads to anatomical changes in the tiny blood vessels of the retina and other organs if the disease lasts for more than 10 years. If we have other risk factors in addition to diabetes mellitus, there is faster damage to the capillaries of the retina and other parenchymal organs. In a study conducted in patients with diabetes mellitus, we wanted to find out the severity and extent of anatomical changes in the blood vessels of the retina of patients of both sexes given the existence of a risk factor such as: hypertension, hyperlipidemia, hypertriglyceridemia, smoking, alcohol and increased obesity, given the duration of type II diabetes mellitus and the length of risk factors. Every patient has been determined visual acuity, tonometry, biomicroscopy, refractometry, direct ophthalmoscopy for each patient were performed. Criteria for inclusion in the study were: duration of diabetes mellitus; manner of glycemic regulation, quality of glycemic regulation, high blood pressure, hyperlipidemia, time elapsed since previous ophthalmological examination, alcohol and cigarette consumption. The research was done with the consent of the Ethics Committee of the Medical Chamber. In statistical data processing we used Student's T test and Hi Square test.

Keywords: diabetic retinopathy, anatomical changes at the fundus, risk factors

KARAKTERISTIKE PREHRANE OBOLJELIH OD KARCINOMA DOJKE S PODRUČJA PRIMORSKO-GORANSKE ŽUPANIJE

DIETARY CHARACTERISTICS OF BREAST CANCER PATIENTS FROM PRIMORJE-GORSKI KOTAR COUNTY

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Karcinom dojke je najčešći karcinom kako u svijetu tako i u Hrvatskoj. Održavanje optimalne tjelesne mase je iznimno važno, kako u prevenciji tako i za preživljenje. Ipak, osim iznimno negativnog utjecaja fizičke neaktivnosti i konzumacije alkohola, uloga prehrane je i dalje nejasna. Čini se da izbjegavanje crvenog mesa i prerađevina te jednostavnih ugljikohidrata uz konzumaciju biljne hrane imaju zaštitnu ulogu. Cilj ovog istraživanja bio je utvrditi karakteristike prehrane oboljelih od karcinoma dojke s područja Primorsko-goranske županije. Provedeno je opažajno istraživanje na ženama s dijagnosticiranim karcinomom dojke bez metastaza koje su regrutirane u udruzi žena operiranih dojki Nada, Rijeka. Upitnik je kreiran s obzirom na literaturno dostupne podatke o utjecaju prehrane i životnog stila na rizik i preživljenje oboljelih. Dob žena koje su sudjelovale u istraživanju se kreće od 41. do 71. godine te žive s karcinomom dojke između jedne i 23 godine. Njih 44,4 % ima pozitivnu obiteljsku anamnezu a kod 66,7 % žena radi se o hormonalno ovisnom karcinomu. Indeks tjelesne mase žena se kreće od 22,9 do 33,1 kg/m^2 odnosno njih čak 72,2 % ima povećanu tjelesnu masu ili je pretilo. Polovica žena je izjavilo kako su povećale svoju tjelesnu masu u odnosu na prije bolesti, a važno je napomenuti kako je 55,6 % ovih žena izjavilo kako nikada prije nisu imale problema s viškom kilograma. Svega 22,2 % žena je izjavilo kako nije ništa promijenilo u svojoj prehrani dok su ostale žene navele kako su izbacile crveno meso i prerađevine, kravlje mlijeko i slatkiše. Ipak, 44,4 % preferira jače slatku hranu dok 22,2 % žena navodi kako ne može bez slatkoga. 38,9 % žena je nakon bolesti manje fizički aktivno nego prije a njih 44,4 % je fizički aktivnije. Stanje uhranjenosti najvećeg broja žena ne ide u prilog povoljnijem ishodu, kao ni prehrana koja nije usklađena tipu karcinoma. Potrebno je intenzivnije educirati žene s karcinomom dojke te ih uputiti na relevantne izvore informacija.

Ključne riječi: rak dojke, prehrana, status uhranjenosti, fizička aktivnost

Keywords: breast cancer, nutrition, Body Mass Index, physical activity

UNOS MAGNEZIJA PUTEM VODE ZA PIĆE U PODRUČJU BUGOJNA

INTAKE OF MAGNESIUM FROM DRINKING WATER IN THE AREA OF BUGOJNO

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Magnezij je esencijalni mineral za ljudski organizam koji je prirodno prisutan u mnogim namirnicama biljnog i životinjskog porijekla, a voda također može biti značajan izvor magnezija. Magnezij iz vode je biološki dostupniji od magnezija u hrani i iz toga razloga bi mogao imati veću nutritivnu važnost. Magnezij je kofaktor u više od 300 enzimskih sustava koji reguliraju različite biokemijske reakcije, uključujući sintezu proteina, funkciju mišića i živaca, kontrolu glukoze u krvi i regulaciju krvnog tlaka. Cilj ovog rada je utvrditi dnevni unos magnezija putem vode za piće sa izvorišta Husića vrelo Bugojno te procijeniti udio u odnosu na preporučeni referentni unos magnezija. Retrospektivnom analizom rezultata ispitivanja fizikalno-kemijskih parametara uzetih uzoraka vode u 2017. i 2018. godini utvrđene su koncentracije magnezija, koje su se kretale u rasponu od 19,44 mg/L do 51,51 mg/L. Na temelju prosječnog dnevnog unosa vode u organizam od 2 L kod odraslih osoba, procijenjeni prosječni dnevni unos magnezija putem vode za piće je iznosio 64,18 mg (38,88-103,02 mg). Unos magnezija iz vode za piće je imao udio od 18,33 % (11,11 %-29,43 %) za muškarce i 21,39 % (12,96 %-34,34 %) za žene u odnosu na preporučeni referentni unos. S obzirom da je preporučeni dnevni unos magnezija 350 mg za muškarce i 300 mg za žene, unos 2 L vode ne može biti dovoljan za zadovoljenje minimalnih potreba za magnezijem. Budući da prehrambene navike uveliko utječu na nedovoljan unos magnezija, gdje oko 45 % potrebnog unosa magnezija dolazi iz hrane, unos magnezija putem vode za piće bi mogao biti od važnosti, posebno ako se uzme u obzir da se unosom 2 L vode dnevno može osigurati unos magnezija oko 20 % od preporučenog unosa.

Ključne riječi: magnezij, voda za piće, preporučeni unos

Keywords: magnesium, drinking water, recommended intake

LIFESTYLE AND PREGNANCY PLANNING IN GENERAL POPULATION OF REPRODUCTIVE AGE WOMEN AND WOMEN UNDERGOING IVF PROCEDURE

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oral presentation

A healthy pregnancy is best achieved by optimising health prior to falling pregnant, yet only about one third of pregnancies are planned. Lifestyle modifications and prenatal supplements achieve their full potential only if applied in prepregnancy period.
We compared general population of reproductive age women (N=574) and women undergoing in vitro fertilization (IVF) procedure (N=220) to assess difference in pregnancy planning. Women undergoing IVF were found to be older (p=0.005), they tended to never smoke (p<0.001), and plan pregnancies more often (p<0.001) in comparison to general population of women. All women undergoing IVF were taking supplements in comparison to 17% general population of women. Among general population of women using supplements, 26% was planning a pregnancy. Finally, women who plan pregnancy are 45.6% more likely to never smoked (p=0.002) and 2.9 times more likely to take supplements.
Women who undergo IVF procedures are more likely to prepare through written materials and counseling and as a result are more informed about pregnancy risks. They are taking suplements as a form of ensurance for upcoming pregnancy and are generally leading a less risky lifestyle in order to protect a hard-earned pregnancy.

Keywords: pregnancy planning, supplementation, smoking

VAŽNOST PREHRANE ZA KOGNITIVNI RAZVOJ DJECE S DOWN SINDROMOM

THE IMPORTANCE OF NUTRITION FOR COGNITIVE DEVELOPMENT OF CHILDREN WITH DOWN SYNDROME

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postersko priopćenje / *poster presentation*

Down sindrom kao najčešći genetski poremećaj uzrokovan viškom kromosoma na 21. paru uzrokuje niz fenotipskih, psihomotoričkih i kognitivnih specifičnosti koje se povezuju s viškom genetskog materijala. Ovisno o jačini ekspresije gena prisutne su anomalije mozga različitog intenziteta poput razlike u veličini i izgledu mozga, poremećaj proteina ključnih za neuromorfogenezu i optimalno funkcioniranje stanica mozga što u konačnici izaziva niz stanja poput neurodegenarativnih bolesti, oksidativnog stresa, poremećaja grananja dendrita te intelektualne poteškoće. Višak genetskog materijala kod djece s Down sindromom ne definira posebne zahtjeve glede prehrambenih navika, međutim njegova prekomjerna ekspresija vrlo često uzrokuje stanja koja zahtjevaju posebnu prehrambenu intervenciju. Od najranije dobi učestali su problemi s hranjenjem koji nastaju usljed hipotonije, te je izražena i senzorska osjetljivost na određenu konzistenciju i teksturu hrane što dovodi do deficitarnog unosa nutrijenata putem prehrane potrebnih za kognitivni razvoj. Brojna su istraživanja usmjerena na važnost unosa određenih nutrijenata prehranom radi unaprijeđenja kognitivnog razvoja djece s Down sindromom. Od izuzetnog značaja za razvoj mozga je unos ω-3 masnih kiselina, željeza, cinka, selena, joda, B12 vitamina i folne kiseline. Cilj ovoga rada je dati pregled najnovijih istraživanjima o važnosti unosa nutrijenata ključnih za razvoj kognitivnih sposobnosti prehranom kod djece s Down sindromom.

Ključne riječi: Down sindrom, trisomija 21, prehrana, kognitivni razvoj

Keywords: Down syndrome, trisomy 21, nutrition, cognitive development

THE COVID-19 PANDEMIC AND THE SILENT EPIDEMIC OF SARCOPENIA

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oral presentation

The term sarcopenia is defined as age-related loss of muscle mass and function. The SARS-CoV-2 virus causes direct changes in muscle tissue. Restrictive measures were introduced, leading to increased stress and changes in diet, and normal lifestyle.
The first goal of this paper is to estimate the incidence of secondary sarcopenia during the COVID-19 pandemic. The second goal is to summarize possible measures to prevent the occurrence of sarcopenia.
Available studies on the COVID-19 pandemic that prove negative effects on muscle strength and mass were analyzed. Recommended measures have been registered, which refer to the possibility of daily physical activity, dietary characteristics, stress control and the possibility of using vitamin and mineral supplements that significantly affect the health of an individual.
20 studies related to the link between the COVID-19 pandemic and the occurrence of sarcopenia were reviewed. All relevant studies indicate an increased incidence of sarcopenia during the COVID-19 pandemic, which can also be considered a silent epidemic. The proposed measures can benefit nutritionists and other multidisciplinary teams dealing with the prevention and treatment of COVID-19 and the negative consequences.
Due to the epidemic phenomenon of sarcopenia, preventive nutritional interventions are of special importance.

Keywords: sarcopenia, COVID-19, isolation, stress, nutritional interventions

PREHRANA U DJEČJOJ DOBI I ORALNO ZDRAVLJE

CHILDHOOD NUTRITION AND ORAL HEALTH

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postersko priopćenje / *poster presentation*

Pravilna prehrana najvažnija je za dobro zdravlje i pravilan razvoj zubi i usne šupljine. Karijes je najčešća oralna bolest u dječjoj dobi i znatno može narušiti kvalitetu života u dječjoj dobi, ali i uzrokovati lošije stanje usne šupljine tijekom daljnjeg rasta i razvoja. Sve ranije uvođenje prehrane bogate jednostavnim ugljikohidratima i šećerima u dječjoj dobi može znatno utjecati na lošije oralno zdravlje cjelokupne populacije. Također, prekomjerna konzumacija šećerima bogate hrane povezana je s povećanim rizikom za nastanak pretilosti, razvoj dijabetesa i kardiovaskularnih bolesti u kasnijoj životnoj dobi.
Cilj našeg rada je pregled recentne literature i znanstvenih radova koji povezuju sastav prehrane i zdravlje usne šupljine u različitim fazama dječje dobi. Prepoznavanjem rizičnih čimbenika za nastanak bolesti usne šupljine, te razvojem adekvatnih preventivnih programa na značajan se način može unaprijediti zdravlje usne šupljine u svim fazama dječje dobi, kao i kod djece s poteškoćama u razvoju.

Ključne riječi: prehrana bogata šećerima, karijes, oralno zdravlje, dječja dob

Keywords: diet rich in sugar, caries, oral health, childhood

PREDTRETMAN ČEŠNJAKOVIM ULJEM SMANJUJE OŠTEĆENJE NASTALO DJELOVANJEM NaT-a U AGS MODELU ULKUSNE BOLESTI

PRETREATMENT OF GARLIC OIL REDUCES DAMAGE CAUSED BY NaT IN AGS MODEL OF ULCER DISEASE

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Češnjak (*Allium sativum*) ima malo kalorija, bogat je vitaminom C, vitaminom B6 i manganom, te sadrži količine različitih hranjivih sastojaka u tragovima. Brojne studije su pokazale kako smanjuje veličinu čira na želucu, ukupnu kiselost te količinu želučanog soka. Cilj našeg istraživanja bio je smanjiti oksidativno oštećenje nastalo primjenom žučne soli (NaT-a) u ljudskoj želučanoj staničnoj liniji (AGS) uz primjenu inhibitora protonske pumpe lansoprazola (LPZ) te antioksidativnim djelovanjem češnjakova ulja. Stanice su prethodno tretirane LPZ-om i rastućim koncentracijama češnjaka, te potom izložene 4mM NaT-u. Sposobnost češnjakova ulja u zaštiti AGS stanica od oštećenja izazvanog NaT-om procijenjena je određivanjem koncentracije glutationa (GSH) i ukupnom količinom prostaglandina (PGE2) koristeći ELISA kit, preživljenje AGS stanica brojanjem stanica Neubauerova hemocitometrom te genska ekspresija superoksid dismutaze (SOD) i Nuclear Factor Kappa B Subunit 2 (NFKB2) RT PCR-om. Stanice prethodno tretirane LPZ-om i češnjakovim uljem pokazale su značajno preživljenje u usporedbi s odgovarajućom kontrolom. Predtretman uljem češnjaka povećava proizvodnju PGE2 i suzbija iscrpljivanje GSH. Tretman stanica Nat-om smanjuje ekspresiju SOD-a te NFKB2-a, dok je kod predtretmana uljem češnjaka i LPZ-om dokazana pozitivna korelacija. Predtretman češnjkovim uljem pokazao je gastroprotektivni učinak, premda su potrebni daljnji eksperimenti kako bi se u potpunosti rasvijetlila njegova zaštitna uloga u ulkusnoj bolesti.

Ključne riječi: ekstrakti češnjaka, herbalna medicina, ulkusna bolest, natrijev turokolat, želučana stanična linija

Keywords: garlic extracts, herbal medicine, ulcer disease, sodium taurocholate, AGS cell line

SPOJ NUTRITIVNE TERAPIJE I TEHNOLOGIJE U REGULACIJI GLIKEMIJE U TRUDNOĆI U VRIJEME PANDEMIJE COVID-19

A COMBINATION OF NUTRITIONAL THERAPY AND TECHNOLOGY IN GLYCEMIC CONTROL IN PREGNANCY DURING THE COVID-19 PANDEMIC

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postersko priopćenje / *poster presentation*

Tip 1 šećerne bolesti autoimuna je bolest s posljedičnom inzulinskom deficijencijom. Dobra regulacija glikemije u trudnica s dijabetesom smanjuje pojavu komplikacija, malformacija i smrti fetusa. Ciljne vrijednosti glikemije su 3,5 do 7,8 mmol/L.

U ovom radu prikazana je analiza slučaja 30-godišnje trudnice koja od 11. godine boluje od šećerne bolesti tip 1. Prekoncepcijski dugodjelujući inzulin degludec zamijenjen je inzulinom detemir i provedena je dodatna edukacija o redovitoj uravnoteženoj prehrani i prilagođavanju doze inzulina. HbA1c bio je 7,4 %, a u vrijeme utvrđivanja trudnoće 7,2 %. Glikemija je kontrolirana uređajem za kontinuirano mjerenje glukoze u međustaničnoj tekućini; podaci su slani telemedicinski. Ispitanica je u početku imala mučnine i želju za slatkom i kiselom hranom; zbog postprandijalnog porasta glikemije smanjila je količinu ugljikohidrata u obroku. Uz 15 g ugljikohidrata primjenjivala je 6 jedinica brzodjelujućeg aspart inzulina uz doručak i 3 jedinice uz ručak i večeru, te je inzulin apliciran 15 minuta prije obroka. U 32. tjednu trudnoće HbA1c bio je 5,4 %. Vrijeme provedeno u ciljnom rasponu bilo je 95 %, iznad ciljnih vrijednosti 5 %, ukupno je bilo 4 hipoglikemije u trajanju od 75 s, a varijabilnost glikemije bila je 24,1 %. Pomoću kontinuiranog očitavanja glikemije učinjene su korekcije u prehrani i inzulinskoj terapiji i postignute su ciljne vrijednosti glikemije.

Ključne riječi: tip 1 šećerne bolesti, trudnoća, redovita uravnotežena prehrana, telemedicina, kontinuirano mjerenje glukoze

Keywords: diabetes mellitus type 1, pregnancy, healthy diet, telemedicine, blood glucose self-monitoring

LJUTA PAPRIKA "STARA PRIJATELJICA S NOVOM ULOGOM"

CHILI PEPPER "OLD FRIEND WITH A NEW ROLE"

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Stoljećima ljuta crvena paprika predstavlja jedan od glavnih začina u tradicionalnoj hrvatskoj kuhinji. Osim kao začin tijekom pripremanja jela, crvena paprika pripada nezaobilaznim sastojcima u pripremi suhomesnatih proizvoda. Iako dugo prisutna u prehrani čovjeka, tek unazad desetak godina dobiva status namirnice s izrazito povoljnim učinkom na zdravlje čovjeka. Upravo ljuta paprika odnosno kapsaicin, alkaloid odgovoran za njezinu ljutinu, prepoznat je kao glavni čimbenik odgovoran za ljekovita svojstva paprike. Naime, pokazano je da redovito konzumiranje ljute paprike smanjuje rizik za razvoj srčanog i moždanog udara, a time smanjuje i ukupnu kardiovaskularnu smrtnost. Nadalje, poznat je povoljan učinak kapsaicina na značajne kardiovaskularne rizične faktore kao što su hipertenzija te metabolički sindrom. *In vivo* studije pokazale su povoljan učinak kapsaicina na metabolizam glukoze s posljedičnim smanjenjem inzulinske rezistencije. Također, na životinjskom modelu pokazano je da kapsaicin smanjuje koncentraciju triglicerida u plazmi te dovodi do smanjenja masnog tkiva što rezultira redukcijom tjelesne težine. Uzevši u obzir iznešene dokaze ljuta paprika definitivno zaslužuje centralno mjesto na svakoj polici sa začinima, ako ne zbog zdravstvenih blagodati onda bar zbog vitke linije.

Ključne riječi: ljuta paprika, kapsaicin, kardiovaskularne bolesti, šećerna bolest

Keywords: chili pepper, capsaicin, cardiovascular disease, diabetes mellitus

CHRONIC COURSE OF COVID-19 DISEASE AND LATE COMPLICATIONS

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oral presentation

At first, COVID-19 was thought to be an acute respiratory disease. After one year follow-up, the conclusion was that COVID-19 is a multisystem disease that also progresses to chronic conditions. The aim of this study was to monitor the occurrence of COVID-19 in two family medicine clinics, and then to monitor the occurrence of all symptoms during regular systematic examinations. 300 patients who had an acute phase of the disease were analysed. In all patients, clinical symptoms, laboratory tests and the appearance of new diseases and complications during regular monthly systematic examinations were registered in the health records.
After the completion of the acute phase of the disease, 173 patients had symptoms of gastroenterohepathological diseases, 89 patients with respiratory symptoms and 63 patients had changes in the nervous system and symptoms of cardiovascular disease occurred in 46 patients. General symptoms of the disease and fatigue were observed in 90% of the respondents, which indicated the existence of a chronic course of the disease (postcovid stress syndrome, PCSS). COVID-19 leaves permanent consequences on almost all organ systems and there are assumptions of an unpredictable chronic course of the disease.

Keywords: COVID-19, PCSS, chronic course, late complications

VAŽNOST DIJETE U LIJEČENJU HIPERKOLESTEROLEMIJE

IMPORTANCE OF DIET IN THE TREATMENT OF HYPERCHOLESTEROLEMIA

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usmeno priopćenje / *oral presentation*

Ateroskleroza je jedan od vodećih uzroka pobola i smrtnosti u svjetskoj populaciji, a poremećaji u metabolizmu lipoproteina, uključujući hiperkolesterolemiju, imaju značajnu ulogu u nastanku ateroskleroze. Hiperkolesterolemija je posljedica poremećaja koji utječu na razgradnju lipoproteina posredovanu LDL receptorom. Rijetko su prepoznate nasljedne hiperlipoproteinemije od kojih je posebno važna familijarna hiperkolesterolemija. Snižavanje vrijednosti LDL-kolesterola pokazalo se važnim za smanjenje kardiovaskularnog rizika, time i za smrtnost od kardiovaskularnih bolesti. Aktualne smjernice za liječenje hiperkolesterolemije preporučuju: za pacijente s vrlo visokim kardiovaskularnim rizikom vrijednost LDL-kolesterola <1,4 mmol/L, a za pacijente s visokim kardiovaskularnim rizikom vrijednost <1,8 mmol/L uz smanjenje ≥50 % u odnosu na početnu vrijednost. U pacijenata s umjerenim i niskim kardiovaskularnim rizikom preporučuju se vrijednosti <2,6 mmol/L i <3,0 mmol/L. Aktualne smjernice naglašavaju važnost prehrane, posebice zasićenih masnih kiselina koje su dijetetski faktor s najvećim utjecajem na razine LDL-kolesterola te bi trebale činiti <7 % energetskog unosa. Poželjni dominantni izvor masti su jednostruko zasićene masne kiseline, ugljikohidrati imaju neutralni efekt na LDL-kolesterol dok prehrambena vlakna uzrokuju sniženje LDL-kolesterola. Učinkovitim su se pokazali monakolin iz crvene riže i fitosteroli u količini od 2 g dnevno, a danas dostupna farmakoterapija izuzetno je potentna u snižavanju vrijednosti LDL-kolesterola.

Ključne riječi: hiperkolesterolemija, dijeta

Keywords: hypercholesterolemia, diet

PROMJENA PREHRAMBENIH NAVIKA – SAVEZNIK U BORBI PROTIV HIPERTRIGLICERIDEMIJE?

MANAGING HYPERTRIGLYCERIDEMIA WITH DIET MODIFICATIONS?

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Današnje smjernice naglasak stavljaju na sniženje LDL kolesterola kao primarni cilj u sprječavanju nastanka kardiovaskularnih bolesti i incidenata. Unatoč sve češćoj primjeni terapije za hiperkolesterolemiju čak i nakon postizanja ciljnih vrijednosti LDL-kolesterola pojavnost kardiovaskularnih incidenata ostaje visoka. Smatra se kako je preostali rizik povezan uz povišene vrijednosti triglicerida i snižene vrijednosti HDL-kolesterola. Aktualne smjernice preporučuju određivanje vrijednosti triglicerida, a vrijednosti se koriste i za izračunavanje kardiovaskularnog rizika pomoću SCORE alata. Za smanjenje razine triglicerida u plazmi preporučena je prije svega redovita tjelesna aktivnost koja povećava inzulinsku osjetljivost i smanjuje koncentaciju triglicerida. Važnim se smatra i smanjenje ukupnog dnevnog unosa ugljikohidrata, posebice monosaharida i disaharida, a najveću značajnost pokazalo je smanjenje unosa alkohola. Važnu ulogu ima smanjenje tjelesne mase u osoba s prekomjernom tjelesnom masom i pretilih osoba te zamjena zasićenih masnih kiselina s nezasićenim masnim kiselinama u prehrani. Omega-3 masne kiseline u dozi od 2 do 3 grama dnevno smanjuju koncentraciju triglicerida za oko 30% te djeluju sinergistički sa statinskom terapijom. Statinska terapija preporučena je u pacijenata s visokim kardiovaskularnim rizikom s vrijednostima triglicerida >2,3 mmol/L, a u kojih do smanjenja nije došlo promjenom životnog stila. Dostupne farmakoterapijske mjere uključuju statinsku terapiju, fibrate, PCSK9 inhibitore i omega-3 masne kiseline.

Ključne riječi: trigliceridi, statini, fibrati, omega-3 masne kiseline

Keywords: triglycerides, statins, fibrates, omega-3 fatty acids

KETOGENA DIJETA KAO KOMPLEMENTARNI OBLIK LIJEČENJA MALIGNIH BOLESTI

KETOGENIC DIET AS A COMPLEMENTARY THERAPY IN THE TREATMENT OF CANCER

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Ketogena dijeta podrazumjeva prehranu bogatu mastima, a siromašnu ugljikohidratima i proteinima. Iako je ovaj koncept prehrane osmišljen još u 1920-ima i danas je popularan jer se pokazuje korisnim u smanjenju tjelesne težine te pomaže u kontroli šećerne bolesti tipa 2, epilepsije i mnogih drugih kroničnih bolesti. Važno je napomenuti da kontraindikacija za ketogenu dijetu praktički nema, ali svakako je potrebno pažljivo planiranje obroka uz stručnu pomoć. Prije otprilike 100 godina otkriveno je i kako maligne stanice imaju drugačiji metabolizam od zdravih stanica. Naime, maligne stanice koriste velike količine glukoze i dobivaju energiju procesom glikolize uz stvaranje laktata. Fenomen ovakve aerobne glikolize naziva se Warburgovim efektom i specifičan je za tumorske stanice, a rezultat je prilagodbe malignih stanica na stanje hipoksije kojem su često izložene uslijed brzog rasta tumorskog tkiva. Warburgov efekt ujedno je i podloga za ispitivanje učinka ketogene dijete u liječenju malignih bolesti. U kliničkim ispitivanjima istražuje se učinak ketogene dijete kao komplementarne terapije standardiziranom liječenju pojedinih maligniteta. Svakako treba imati na umu da se u pretkliničkim studijama pokazalo da ketogena dijeta može imati i pro-proliferativni učinak na neke tipove tumora, stoga je osobito važno preporuke o prehrani temeljiti na dokazima za određeni tip tumora od kojeg bolesnik boluje.

Ključne riječi: ketogena dijeta, onkologija, karcinom, ugljikohidrati, Warburgov efekt

Keywords: ketogenic diet, oncology, cancer, carbohydrates, Warburg effect

FUNCTIONAL FOOD AND DIETARY SUPPLEMENTS / FUNKCIONALNA HRANA I DODACI PREHRANI

EVALUATION OF THE ADRIATIC SEA MACROALGAE AS A FOOD SUPPLEMENT: FROM FROM ANTIOXIDANT ACTIVITY TO SAFETY

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poster presentation

Extensive work has been done in the field of determining bioactivity of marine organisms with a tendency towards its application in various industries, such as food, pharmaceutical, and cosmaceutical industries. Polysaccharides with marine origin have already proved to have numerous properties beneficial for human health. These properties depend on the species, but also various biotic and abiotic characteristics of the ecosystem. The extreme variety regarding abiotic conditions of the Adriatic sea has forced marine organisms to develop unique biochemical and physiological properties, thus representing a valuable source of novel bioactive compounds. This study was designed to evaluate the antioxidant activity of polysaccharide fractions from five brown macroalgae *Cystoseira barbata*, *Cystoseira compressa*, *Fucus virsoides*, *Halopteris scoparia*, and *Padina pavonica*. The highest protective effect against H_2O_2-induced oxidative stress in zebrafish embryos was observed during exposure to Cystoseira and Halopteris species (fluorescence intensity decreased from 38.97% (for *C. barbata*) up to 60.27% (for *H. scoparia*), comparing to the group on H_2O_2), which corresponds well with the high amount of polysaccharide groups. Tested polysaccharide fractions showed no embryotoxic, cardiotoxic and/or neurotoxic potential. Collectively, the results obtained suggest that polysaccharides isolated from the Adriatic Sea macroalgae might be a potent source of natural antioxidants.

Keywords: brown macroalgae, zebrafish *Danio rerio*, model organism, *in vivo*

THE IMPACT OF BREASTFEEDING ON THE COMPOSITION OF THE INFANT FAECAL MICROBIOME

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poster presentation

Breast milk not only provides a perfect balance of nutrients to meet all the needs of the infant in the first months of life, but also contains a variety of bacteria that play a key role in tailoring the neonatal gut microbiome. To investigate the impact of breast milk on the composition of the infant faecal microbiome, DNA was extracted from samples of breast milk (n=15) and infant faeces (n=15) collected from 5 mother-infant pairs at 3 different time points. The V1-V3 region of the 16S rRNA gene was amplified, and amplicon sequencing was performed using the Illumina MiSeq platform. Analysis of the raw sequencing data using the QIIME 2 platform revealed the unique composition of each breast milk and infant feaces microbiome and confirmed the correlation of their composition in each mother-infant pair. *Firmicutes* (64.28%) and *Proteobacteria* were the most predominant phyla in breast milk microbiome, whereas *Firmicutes* (32.92%) and *Actinobacteria* (31.86%) dominated the faecal microbiome. The analysis confirmed that the composition of the breast milk microbiome changes during lactation, as does the faecal microbiome during infant growth and development. α-diversity analysis revealed that the breast milk microbiota is more diverse, i.e. species-rich, than the infant faecal microbiota.

Keywords: breast milk, microbiome sequencing, α-diversity, β-diversity

CHANGES IN PHYSICOCHEMICAL AND SENSORY PROPERTIES OF STRAWBERRIES DURING PROCESSING INTO JUICE

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poster presentation

In this work, the physicochemical and sensory properties of fresh strawberries (*Fragaria x ananassa* Duch., cv. Albion) harvested at different stages of ripeness (75% of maturity *vs.* full ripeness) and their changes during processing into juice were studied. The results regarding physicochemical parameters of the fresh fruits showed that fully ripe fruits had higher total soluble solids content and pH, while exhibiting lower hardness compared to fruits with lower ripeness. Juice yield was not dependent on ripeness stage. When considering color characteristics, the results showed that the total color difference (ΔE) was significantly lower during processing strawberries of lower maturity into juice than in the processing of fully ripe fruits (4.2 *vs.* 10.9). Regarding the influence of ripening stages on sensory profile, the results confirmed that both fully ripe strawberries and their juices resulted in higher sensory scores for all favorable sensory attributes. Since incompletely ripe strawberries are not harvested for consumption, this study confirms their good prospects for processing into juice. Strawberries with a lower degree of ripeness are less sensitive to quality changes during transport and, based on the results obtained, represent a good raw material for processing into juice without significant quality deterioration compared to fresh fruit.

Keywords: strawberry ripeness stage, strawberry juice, physicochemical parameters, color, sensory analysis

COMPARATIVE EVALUATION OF ANTIOXIDANT ACTIVITY AND ANTIMICROBIAL PROPERTIES OF SOME COMERCIALLY AVAILABLE EDIBLE AND MEDICINAL MUSHROOMS

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poster presentation

Four commercially available edible and medicinal mushrooms from Croatia including shiitake (*Lentinus edodes*), black poplar (*Agrocybe aegerita*), oyster (*Pleurotus ostreatus*) and golden oyster (*Pleurotus citrinopileatus*) were assayed *in vitro* for their antioxidant and antimicrobial activities using water, ethanol and ethyl acetate as extractive solvents. Extracts obtained from dried mushrooms were evaluated for antioxidant activity by the conjugated diene method, reducing power, DPPH free radical scavenging activity and ferrous ion chelating ability. Water extracts exhibited higher antioxidant activities than ethanol and ethyl acetate extracts. Concerning EC_{50} values of scavenging abilities, the effectiveness was in descending order: ethyl acetate > ethanol > water. Scavenging activity of all the extracts has been significant compared to controls. Positive correlations were found between total phenolic content in the mushrooms extracts and their antioxidant activities. *A. aegerita* found to have the highest phenolic and flavonoid content. The four studied mushrooms showed narrow antibacterial activities against Gram-positive and Gram-negative bacteria, and strongly inhibited the growth of yeast *Candida albicans*. Results of this study showed that water extract has maximum antioxidant and antimicrobial properties, which are potentially useful for overall health and nutritional purposes.

Keywords: *Lentinus edodes*, *Agrocybe aegerita*, *Pleurotus ostreatus*, *Pleurotus citrinopileatus*, antioxidant capacity, antimicrobial activity

INFLUENCE OF DIFFERENT COATINGS ON THE ENCAPSULATION EFFICIENCY OF TOTAL PHENOLIC COMPOUNDS FROM CABERNET SAUVIGNON GRAPE POMACE EXTRACT

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poster presentation

Encapsulation is the process of preserving an active substance using a coating. The choice of coating material depends on the desired encapsulation effect (odor and taste masking, protection against degrading, controlled release, etc.). Grape pomace is a production residue in the grape processing, which is a rich source of biologically active phenolic compounds characterized by multiple pharmacological effects.
The aim of this study was to investigate the influence of the use of different coatings on the encapsulation efficiency (EE) of total phenolic compounds (TPC) from red grape pomace extract of the variety Cabernet Sauvignon. Encapsulation was performed by ionic gelation method and several coatings were used: sodium alginate (SA), chitosan (CS), gum Arabica (GA), maltodextrin (MD), and gum Tragacanth (GT). EE was calculated from the content of encapsulated and free phenolic compounds.
The average content of total phenolic compounds from grape pomace extract was 186.96 mg_{GAE}/g_{ext}. The EE was higher than 50% for all the coatings used. SA (3%) in combination with the addition of different concentrations of CS (0.5%, 1%, 1.5%) was the best choice for encapsulation grape pomace extracts under experimental conditions, and the highest EE (75.47%) was obtained when 3% SA and 0.5% CS was used.

Keywords: grape pomace, polyphenols, ionic gelation, encapsulation efficiency

VALORIZATION OF BILBERRY POMACE FOR POTENTIAL USE IN FUNCTIONAL FOOD PRODUCTION

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poster presentation

The by-products of bilberries that remain after processing consist of the pericarp and seeds, which are excellent raw materials for further use, especially for the isolation of biologically active compounds (BACs) and incorporation into functional foods. Recently, green extraction methods based on the concept of environmental sustainability have been developed to extract BACs from various fruit by-products. Accordingly, the aim of this work was to evaluate the use of green extraction methods such as pressurized liquid extraction (PLE) in the valorisation of bilberry pomace obtained from *Vaccinium myrtillus* L. after pressing into juice. PLE was performed using water as extraction solvent with variation of static extraction time (5,10,15 min), temperature (40, 80, 120 °C) and number of cycles (1, 2, 3). A total of three flavonoids (catechin, quercetin-3-rutinoside and quercetin-3-galactoside) and four hydroxycinnamic acids (chlorogenic, caffeic, p-coumaric and ferulic acids) were identified and quantified by HPLC-DAD analysis. The obtained results showed that quercetin derivatives were the predominant polyphenolic compounds found in the bilberry pomace extracts. Multivariate statistical analysis was performed to optimize the PLE parameters with the highest BACs yields. In conclusion, increased the temperature, static time and number of extraction cycles significantly reduced the yield of all phenolic compounds.

Keywords: bilberry pomace, *Vaccinium myrtillus* L., phenolic compounds, green extraction, functional food

INKAPSULACIJA FENOLNIH SPOJEVA EKSTRAKTA LISTA KOPRIVE PRIMJENOM SUŠENJA RASPRŠIVANJEM

ENCAPSULATION OF PHENOLIC COMPOUNDS OF NETTLE LEAF EXTRACT USING SPRAY DRYING

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U posljednje vrijeme na tržištu se pojavljuju atraktivni biljni proizvodi bogati bioaktivnim sastojcima koji pozitivno utječu na ljudsko zdravlje. Pri tome se sve češće naglasak stavlja na očuvanje kvalitete, kontrolirano otpuštanje bioaktivnih komponenata te povećanje stabilnosti takvih proizvoda pa se u tu svrhu tekući biljni ekstrakti inkapsuliraju. Jedan od najraširenijih postupaka inkapsulacije je sušenje raspršivanjem gdje se ekstrakt uz dodatak odgovarajućeg nosača suši u struji vrućeg zraka u oblik praha visoke stabilnosti i kvalitete u kojem su zadržani okus, aroma i bioaktivne tvari. Jedna od biljnih vrsta poznata po svojim pozitivnim učincima na ljudsko zdravlje je kopriva (*Urtica dioica* L). Danas se najviše koristi u prehrambenoj, kozmetičkoj i farmaceutskoj industriji zbog bogatog sastava bioaktivnih spojeva s visokim antioksidacijskim kapacitetom. Stoga je cilj ovog istraživanja bio inkapsulirati ekstrakt lista koprive te utvrditi utjecaj temperature sušenja (120-200 °C), vrste nosača (maltodekstrin, maltodekstrin:arapska guma 50:50) i omjera uzorak:nosač (1:1, 1:2, 1:3) na koncentraciju ukupnih i površinskih fenola te na inkapsulacijski kapacitet. Najveća koncentracija ukupnih fenola i najmanja koncentracija površinskih fenola postignuta je pri temperaturi od 120 °C korištenjem mješavine maltodekstrina i arapske gume kao nosača pri omjeru uzorak: nosač 1:2 što ukazuje kako se najveći inkapsulacijski kapacitet postiže pri navedenim uvjetima.

Ključne riječi: sušenje raspršivanjem, list koprive, fenolni spojevi, biljni ekstrakt

Keywords: spray drying, nettle leaf, phenolic compounds, herbal extract

EVALUATION OF DIVERSE ANTIOXIDANT ACTIVITIES *IN VITRO* OF POLYSACCHARIDES DERIVED FROM BROWN ALGAE

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poster presentation

Among a large number of marine extracts and different isolated bioactive compounds, polysaccharides are recognized as one of the most promising sources of different biological activity, including anti-inflammatory, antioxidant, antimicrobial, antiviral, anti-coagulant, and antitumor activities thus paving the way for a new trend in the discovery of compounds from a sustainable source. This study aimed to conduct comprehensive research and determine antioxidant activities *in vitro* of water-soluble polysaccharide extracts from 5 brown algae (*Fucus virsoides, Padina pavonica, Cystoseira barbata, Cystoseira compressa*, and *Halopteris scoparia*), along with embryotoxicity potential to determine their safety for non-target organisms and humans. The highest extraction yields in acidic conditions after pretreatment with organic solvents for the removal of polyphenols and pigments were obtained for *F. virsoides* (18.21%) and *C. compressa* (14.81%). All samples had medium to high antioxidant activity, but the highest antioxidant activity was obtained for *C. barbata* and *C. compressa* extracts using DPPH, ABTS, and FRAP assays. The obtained results of embryotoxic testing have proven the safety of all isolated polysaccharide extracts, thus indicating the importance of marine-derived compounds in different areas of research and applications, from food supplements to higher pharmaceutical development.

Keywords: brown macroalgae, antioxidant activity, *in vitro*

NAPREDNI POSTUPCI EKSTRAKCIJE POLISAHARIDA IZ ALGI *Fucus virsoides* I *Cystoseira barbata*

ADVANCED EXTRACTION OF POLYSACCHARIDES FROM ALGAE *Fucus virsoides* AND *Cystoseira barbata*

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Fukoidan, sulfatirani polisaharid smeđih algi pokazuje široki raspon bioloških aktivnosti koje ovise o njegovoj kemijskoj strukturi koja je usko povezana s primijenjenom tehnikom i parametrima ekstrakcije kao što su temperatura ili vrijeme. Konvencionalna metoda ekstrakcije polisaharida je dugotrajna te zahtjeva upotrebu visoke temperature zbog čega primjena naprednih metoda ekstrakcije predstavlja obećavajuću alternativu. Cilj ovog istraživanja bio je ekstrahirati polisaharide iz smeđih algi *Fucus virsoides* i *Cystoseira barbata* primjenom 5 različitih tehnika ekstrakcije (konvencionalna ekstrakcija (CE), ekstrakcija potpomognuta mikrovalovima (MAE), ubrzana ekstrakcija otapalima pri povišenom tlaku (PLE), ekstrakcija potpomognuta ultrazvukom (UAE), primjena hladne atmosferske plazme (NTP) pri prethodno definiranim optimalnim uvjetima. Istražen je utjecaj navedenih tehnika na prinos polisaharida i parametre strukture polisaharida (udio fukoze, sulfatnih grupa i uronskih kiselina). Najviši prinos polisaharida za obje alge postignut je primjenom PLE, a najniži primjenom NTP te UAE. PLE rezultirala je najvećom koncentracije fukoze, UAE najvišom koncentracijom sulfatnih grupa i najnižom koncentracijom uronskih kiselina, a CE najvišom koncentracijom uronskih kiselina. Uz veće prinose u odnosu na konvencionalnu tehniku, primjenom PLE i MAE vrijeme ekstrakcije je skraćeno s 3 sata na 30 min.

Ključne riječi: polisaharidi, alge, ekstrakcija, fukoidan

Keywords: polysaccharides, algae, extraction, fucoidan

UBRZANA EKSTRAKCIJA FENOLNIH SPOJEVA IZ LISTA LOVORA (*Laurus nobilis* L.) PRI POVIŠENOM TLAKU

ACCELERATED SOLVENT EXTRACTION OF PHENOLIC COMPOUNDS FROM BAY LAUREL (*Laurus nobilis* L.) LEAVES

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Posljednjih godina, uslijed povećanja svjesnosti potrošača o brizi za zdravlje, potražnja na tržištu funkcionalnih proizvoda prirodnog podrijetla koji nose ekološke i „bio" oznake sve je veća. Ljekovito i aromatično bilje predstavlja važan izvor bioaktivnih molekula, koje, osim povoljnih učinaka na ljudski organizam, također mogu djelovati kao prirodni antioksidansi, konzervansi i mikrobiocidi te omogućiti formulaciju proizvoda koji će udovoljavati zahtjevima potrošača. Među mnogobrojnim biljnim vrstama ističe se lovor (*Laurus nobilis* L.), mediteranska biljka tradicionalno upotrebljavana u narodnoj medicini čiji se brojni biološki učinci u značajnoj mjeri pripisuju različitim grupama fenolnih spojeva. Ubrzana ekstrakcija pri povišenom tlaku (ASE) pokazala se vrlo učinkovitom u ekstrakciji fenolnih spojeva iz različitih biljnih vrsta te je stoga cilj ovog istraživanja bio optimirati ASE ekstrakciju fenolnih spojeva iz lista lovora s ciljem postizanja većih prinosa. Monitoring fenolnih spojeva u ekstraktima lista lovora proveden je spektrometrijskom Folin-Ciocalteu metodom. Varirani parametri bili su koncentracija etanola koji je korišten kao otapalo (50-70% w/v), temperatura ekstrakcije (90-150 °C), broj ciklusa (1-3) i statičko vrijeme (5 i 10 minuta). Definirani su optimalni uvjeti ekstrakcije (50 % etanol, 150 °C, 3 ciklusa, 10 minuta) pri kojima je postignuta najveća koncentracija fenolnih spojeva koja je iznosila 49,30 mg GAE g^{-1}.

Ključne riječi: funkcionalna hrana, bioaktivne molekule, lovor (*Laurus nobilis* L.), ubrzana ekstrakcija pri povišenom tlaku (ASE)

Keywords: functional food, bioactive molecules, bay laurel (*Laurus nobilis* L.), accelerated solvent extraction (ASE)

THE RESISTANCE OF CROATIAN TRADITIONAL APPLE CULTIVARS TO *Penicillium expansum* AND SUBSEQUENT PRODUCTION OF PATULIN

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poster presentation

The 25-50% of the total world annually fruit loss is caused by some mycotoxigenic foodborne fungi, mainly by *Penicillium expansum*. Apart from the fact that the contamination with *P. expansum* affects economic losses, it also causes the accumulation of patulin in apple fruit. Regarding this problem and any possible solutions, attention is drawn to traditional apple cultivars, which contain higher amount of polyphenolic compounds. Traditional apple cultivars showed great potential for *P. expansum* infection resistance due to higher levels of polyphenols, procyanidins, dihydrochalones, flavan-3-ols, flavonols and phenolic acids. The resistance of Croatian traditional apple cultivars 'Kleker', 'Masanka' and 'Paradija' to infection by *P. expansum* experiment was performed after harvesting and after three months storage period. Each traditional apple cultivar samples were analysed by HPLC in purpose of polyphenol profile determination. Furthermore, sterilised 1 cm thick apple slices were inoculated by 168 hours old *P. expansum* (CBS 325.48) disc grown on potato dextrose agar in Petri's dish at 29 °C. Inoculated apple samples were incubated at 29 °C until the *P. expansum* colony reaches the edge of apple slice. After that time, samples were stored at -80 °C. Patulin content was determined in stored samples by UPLC-MS/MS method. Extracts were prepared by MycoSeop® 228 AflaPat Multifunctional Columns. Results showed that patulin was detected only in 'Mašanka' after three months of storage (49.90 ± 3.39 μg/kg). Furthermore, a total of 17 phenolic compound were detected. 'Kleker' had the highest content of procyanidins, dihydrochalcones and flavonols, 'Paradija' had the highest content of phenolic acids and 'Mašanka' had the highest content of flavanols.

Keywords: Croatian traditional apple cultivars, polyphenols, *P. expansum*, patulin, HPLC, UPLC-MS/MS

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OPIUM POPPY'S ALKALOIDS IN FOOD

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invited lecture

Poppy seeds obtained from the plant *Papaver somniferum* L., the opium poppy, are used throughout the world for food as decoration, for filling cakes (as in the traditional Croatian cakes "makovnjača" and "međimurska gibanica") and for making edible oil. Nutrients useful for human health contained in poppy seeds include many minerals such as manganese, calcium, copper, zinc, iron, healthy fatty acids such as linoleic, palmitic and oleic acids, many vitamins and fibers. The opium poppy plant produces significant amounts of opioid alkaloids such as morphine, codeine, and thebaine, which can be used in the pharmaceutical industry to make drugs and, unfortunately, for drug abuse. Although ripe poppy seeds themselves contain only small amounts of opioid alkaloids, they can be contaminated from the other parts of the poppy plant. Consuming foods containing contaminated seeds can cause adverse health effects, especially in infants, young children, and people with medical conditions. It can also lead to false-positive drug tests, which can have serious consequences. Monitoring of opium poppy alkaloids in food could be of great importance for the protection of public health in order to determine the actual exposure of consumers to these toxins and to allow preparation for upcoming legislation.

Keywords: opium alkaloids, morphine, codeine, poppy seeds, food safety

DETERMINATION OF ANTIOXIDANT ACTIVITY AND PHENOLIC CONTENT IN AQUEOUS AND ETHANOL-AQUEOUS EXTRACTS OF YARROW (*Achillea millefolium*)

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Achillea millefolium is a medicinal plant that has wide application in the treatment of various diseases. It is also called yarrow and milfoil grass, and it is a source of various nutrients and biologically active substances. This plant has been used in traditional medicine as an antibacterial, against infections, in wound healing, as a sedative and diuretic. The essential oil of flowers and leaves contains achilles and azulene which have anti-inflammatory properties. In this work, the antioxidant activity of yarrow extracts, using the DPPH and FRAP method was determined. The results clearly showed that yarrow extract (*Achillea millefolium*) is a rich source of polyphenols and has high antioxidant properties.

Keywords: antioxidant activity, extract, yarrow, polyphenols

VAŽNOST BOTANIČKE ILUSTRACIJE U ISTRAŽIVANJU LJEKOVITIH PREDSTAVNIKA PORODICE USNAČA (Lamiaceae)

THE IMPORTANCE OF BOTANICAL ILLUSTRATION IN STUDIES OF THE REPRESENTATIVE MEDICINAL PLANTS OF THE FAMILY Lamiaceae

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postersko priopćenje / *poster presentation*

Predstavnici porodice Lamiaceae razlikuju se prema morfološkim osobinama i ljekovitim svojstvima, a njihovi ilustrirani prikazi nužni su za točno raspoznavanje vrsta. Ljekovitost ovih biljaka potječe uglavnom iz sastava njihovih eteričnih ulja koja sadrže terpene, fenole, glikozide i karboksilne kiseline. Ovi spojevi u različitim koncentracijama imaju antioksidacijsko, antimikrobno ili protuupalno djelovanje. Aktivni sastojci eteričnih ulja usnača djeluju blagotvorno na zdravlje ljudi te se primjenjuju u liječenju različitih poremećaja dišnog, probavnog, pokrovnog i živčanog sustava. Botanička ilustracija, disciplina koja povezuje vještine preciznog realističnog crtanja i poznavanje biologije, morfologije i anatomije biljaka, jasno ističe karakteristike biljnih dijelova koje su važne pri determinaciji pojedinih ljekovitih vrsta ili su specifične za temu istraživanja. Razvoj digitalnog crteža i medija, s brojnim prednostima u odnosu na tradicionalnu botaničku ilustraciju, omogućava primjenu ovih metoda u modernim botaničkim, farmakološkim i medicinskim istraživanjima biljaka porodice usnača, a ujedno potiče i sigurniju primjenu u prehrani i tradicionalnom liječenju.

Ključne riječi: digitalna botanička ilustracija, Lamiaceae, ljekovite biljke, eterična ulja

Keywords: digital botanical illustration, Lamiaceae, medicinal plants, essential oils

POLYPHENOL CONTENT AND ANTIOXIDANT ACTIVITY OF PHYTOESTROGEN CONTAINING FOOD AND DIETARY SUPPLEMENTS: EVALUATION OF DPPH FREE RADICAL SCAVENGING ACTIVITY BY HPLC

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poster presentation

Soybeans, red clover, chastetree, hop and flax have all been found to contain a wide range of phytoestrogenic compounds, and a large number of dietary supplements contain their extracts as principal ingredients. Since polyphenolic compounds are responsible for the potential antioxidant activity and radical scavenging capacity of plant food, this study aimed to evaluate total polyphenol content (TPC) and antioxidant activity (AA) of phytoestrogen-containing food and dietary supplement (DS) formulated products prepared. The HPLC-DPPH method was applied for the analysis of various phytoestrogen-containing samples.

Polyphenol content and antioxidant activity in formulated DS (TPC: 17.65±10.28 mg/g; AA: 103.01±58.42 mM TROLOX/g) was higher than in functional food samples (TPC: 6.18±1.37 mg/g dry matter; AA: 40.01±15.80 mM TROLOX/g dry matter). Also, the results indicate that multi-botanical products (TPC: 23.70±9.09 mg/g; AA: 143.49±45.63 mM TROLOX/g) have higher polyphenol content and antioxidant activity than monopreparation (TPC: 15.63±10.11 mg/g; AA: 89.52±57.07 mM TROLOX/g).

Furthermore, the correlation between polyphenol content and the antioxidant activity was strongly statistically significant, so it can be concluded that antioxidant activity is proportional to the content of secondary metabolites. The most eye-catching batch-to-batch deviations were represented by two chasteberry-based products (RSD 12.6% and 41.3%) and one red clover (RSD 57.9%) derived product.

Keywords: phytoestrogens, polyphenol content, antioxidant activity, functional food, dietary supplements

CARNOSINE – FUNCTIONAL INGREDIENT IN CHICKEN MEAT

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Carnosine is a natural metabolite in chicken cells with antioxidant activity. It derives from the amino acids β-alanine and L-histidine with carnosine synthase enzyme action. Larger quantities of this metabolite are present in skeletal and brain tissue. Anserine is formed by carnosine methylation. Recent researches have shown that carnosine can prolong cell lifetime, rejuvenate old cells, inhibit protein glycosylation and preserve cellular homeostasis. It is important in neurotransmission maintenance. Carnosine inhibits lipid oxidation and improves stability during meat storage. There is a difference in the carnosine content in some parts of chickens' carcass. Breast muscles (white meat) contain more carnosine than muscles of drumsticks and thighs (dark meat). Genetic basis of broilers and sex also affect carnosine and anserine content in muscles. Higher carnosine values were determined in the thighs meat of female chickens (339.28 μg/g tissue) compared to male chickens (319.29 μg/g tissue) $p>0.05$). White meat of female chickens contains 1200.05, and of male ones 684.82 μg/g tissue in standard breeding. Carnosine concentrations in both animal and human muscle tissue can be increased by daily ration supplemented with amino acids (β-alanine and L-histidine). Carnosine deposition in the breast and thigh muscles depends on the added concentrations of some amino acids in the broilers feed.

Keywords: β-alanine, L-histidine, chicken meat, enrichment, carnosine

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NUTRICINES CONTENT IN TABLE EGGS OF CROATIAN PRODUCERS

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poster presentation

Considering their nutritional composition eggs represent an excellent source of nutricines. Because of their availability on the market and good price, they are often consumed both in the world and in our country. In this research, eggs of weight class L (63-73 g) produced at the farms of two domestic producers (A, B) were used. Eggs of both producers are available at shopping centres where they are stored at 4 °C. For nutricine analysis total of 20 eggs (10 from each producer) were used. The nutricines: lutein, vitamin E, selenium and omega-3 fatty acids were analyzed in eggs. Significant higher (p<0.001) lutein content was found out in egg yolks of producer A (1.06 mg/100 g) compared to producer B (0.682 mg/100 g). There was no difference in the content of vitamin A and selenium in egg yolks between producer A and B (8.57: 8.09 mg/100 g, p=0.129; 0.501 and 0.485 μg/g, p=0.635, respectively). The total content of SFA, MUFA, n-6 and n-3 PUFA and the n-6 PUFA/n-3 PUFA ratio in 100 g of the edible part of the egg was a little higher in eggs of producer A compared to producer B (p>0.05). It is confirmed that the feeding of laying hens with mixtures that have increased content of nutricines may have an impact on a higher amount of nutricines in eggs. Such eggs may have a significant role in human nutrition aiming to fulfil the daily requirement of nutricines.

Keywords: eggs, lutein, vitamin E, selenium, omega-3

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WHAT IS HIDDEN IN FOOD SUPPLEMENTS?

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invited lecture

Food supplements are concentrated sources of nutrients or other substances with a nutritional or physiological effect. On market they are in "dose" form like pills, tablets, capsules or liquids in measured doses. In the EU, food supplements are regulated as foods.
Food supplements are intended to correct nutritional deficiencies, maintain an adequate intake of certain nutrients, or to support specific physiological functions. They are not medicinal products and as such cannot exert a pharmacological, immunological or metabolic action and cannot be attributed medicinal properties.
Changing lifestyles, rising health awareness, growing geriatric population and adoption of a healthy diet are one of the major factors driving the demand for food supplements. In 2020., the global food supplements market size is estimated to be valued at USD 136.2 billion and projected to reach USD 204.7 billion by 2026, recording a compound annual growth rate (CAGR) of 7.0% during the forecast period.
In recent years, the number of RASFF notifications in the category of dietetic foods, food supplements and fortified foods has increased significantly. These include permitted food additives in excess of their limits, contaminants, unauthorised novel food ingredients, unauthorised nutritionally-related compounds, excess vitamins and controlled drugs. Selling online in uncontrolled conditions only further increases that number.

Keywords: food supplements, unauthorized composition, lifestyles, a healthy diet

PRIMJENA LJEKOVITIH BILJAKA NA PODRUČJU BARANJE

APPLICATION OF MEDICINAL PLANTS IN THE AREA OF BARANJA

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postersko priopćenje / *poster presentation*

Istraživanje primjene ljekovitog bilja na području Baranje u mjestima Darda, Beli Manastir, Mece, Petlovac i Bilje provedeno je tijekom 2019. godine. U anketnom istraživanju sudjelovalo je 33 ispitanika od 30 do 87 godina, od kojih su najbrojniji između 41 i 50 godina starosti. Ispitanici su većinom bile osobe ženskog spola i srednjoškolskog obrazovanja. Od ukupno 32 svojte koje ispitanici upotrebljavaju, njih 13 ispitanici uzgajaju, a 19 ih je samoniklo. Utvrđene biljne svojte su iz 17 porodica, a najčešće biljke koje ispitanici koriste pripadaju porodicama Lamiaceae i Asteraceae. Ispitanici najviše koriste crnu bazgu (*Sambucus nigra* L.), običnu koprivu (*Urtica dioica* L.), pravu kamilicu (*Chamomilla recutita* (L.) Rauschert), maslačak (*Taraxacum officinale* Weber), veliki trputac (*Plantago major* L.) i ljekovitu kadulju (*Salvia officinalis* L.). Od prikupljenih i uzgojenih biljaka ispitanici pripremaju čajeve, sokove i sirupe te ih najčešće koriste za ublažavanje i liječenje dermatoloških, gastrointestinalnih i respiratornih zdravstvenih problema. Za izradu ljekovitih pripravaka najviše upotrebljavaju listove i cvjetove, a najmanje plod i zelen. Kako bi se upotpunila saznanja o prikupljanju, uzgoju i primjeni ljekovitog bilja na području Baranje potrebno je u istraživanje uključiti i druga baranjska mjesta.

Ključne riječi: samoniklo bilje, etnobotanika, uzgoj biljaka

Keywords: wild plants, ethnobotany, plant breeding

ELUCIDATING THE BIOACTIVE POTENTIAL OF MOUNTAIN GERMANDER (*Teucrium montanum*) BY APPLYING FRACTIONATION OF PHENOLIC COMPOUNDS

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poster presentation

The inclusion of herb plants in folk medicine has been present through the decades in frame of its health benefits. Emerging from the presence of biologically active compounds, Mountain Germander represents insufficiently explored plant with widespread interest in the pharmacological investigations and possible findings applications in food industry. In order to closely deliver an insight into the polyphenolic content of Mountain Germander, free- soluble (FP), esterified (EP) glycosylated (GP) and insoluble- bound (IP) phenolic fractions were prepared and analysed using spectrophotometric and HPLC- PDA methodology. FP, EP and IP fractions exhibited similar total phenolic content and antioxidant capacity. Initial extract showed to be the noteworthy source of echinacoside (7.05±0.03 mg/g dw) and verbascoside (4.94±0.09 mg/g dw). Caffeic esters were the most dominant in EP fraction (3.09±0.52 mg/g dw) as the consequence of the retained echinacoside and verbascoside in the aqueous phase, which is in accordance to the absence of echinacoside and lower content of verbascoside (1.87±0.30 mg/g dw) in FP fraction. Notable content of *p*-coumaric acid was determined in EP (1.38±0.22 mg/g dw) and IP (1.59±0.00 mg/g dw) fractions. This findings could lead toward expanded comprehension of overall bioactive composition of *T. montanum,* as promising source of functional agents.

Keywords: Mountain Germander (*T. montanum*), fractionation, esterified phenolics, HPLC analysis

Acknowledgment
This research was acquired as part of the project named: "Formulating encapsulated systems of bioactive ingredients from traditional plants: Mountain Germander and Ground Ivy for the development of innovative functional food products" (IP-2019-04-5879 / FUNCBIOCAP), funded by the Croatian Science Foundation.

PROBIOTICI I ZDRAVLJE: STAVOVI I POTROŠNJA

PROBIOTICS AND HEALTH: ATTITUDES AND CONSUMPTION

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U radu su predstavljeni rezultati istraživanja poznavanja i potrošnje probiotika. Provedeno je Online istraživanje na prigodnom uzorku od 380 ispitanika. Upitnik je pripremljen na temelju nalaza iz literature i sadržavao je tri dijela: 1) pitanja o ispitaniku, 2) izjave o probioticima i zdravlju, 2) pitanja o navikama konzumiranja probiotika. Za analizu podataka korišteni su postupci deskriptivne statistike. Trećina ispitanika konstantno konzumira probiotike, a polovina samo povremeno. Najčešće konzumiraju jogurt ili čokoladice s probioticima, kao doručak ili kao međuobrok. Kao razloge konzumacije navode se prevencija zdravlja i zdravstveni problemi. Ispitanici se uglavnom slažu da probiotici imaju klinički pozitivne učinke, njihova konzumacija ne predstavlja rizik te da se probiotici nedovoljno konzumiraju zbog nedostatka informacija o dostupnim vrstama probiotika. Pozitivne učinke probiotika najčešće vežu uz jačanje imunološkog sustava i rješavanje problema s crijevima i dijarejom. Rezultati pokazuju da ispitanici poznaju probiotike, no ne u dovoljnom opsegu blagodati i vrsta. Nedovoljna informiranost o probioticima i dalje koči njihovu intenzivnu konzumaciju kao sastavni dio svakog obroka.

Ključne riječi: potrošači, probiotici, stavovi, zdravstveni učinci

Keywords: attitudes, consumers, health effects, probiotics

ANTIOXIDANT PROPERTIES OF RADISH MICROGREENS GROWN AT DIFFERENT LED LIGHTING

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poster presentation

Microgreens have recently become very popular food product. They are considered as "functional food" containing high content of bioactive components and antioxidants that can benefit human health. Although they are easy to grow, the artificial lighting could significantly influence the antioxidant capacity and the content of phytochemical components. The aim was to determine the effect of two different artificial light sources on antioxidant properties of radish microgreens.The study was performed on three cultivars of radish (*Raphanus sativus* L.): China rose (CHR), Sango and Daikon. Radishes were grown in a growth chamber with artificial purple and white LED lighting (45 µmol m^2s^{-1}, 24 °C, photoperiod 16 h/8 h). Physiological status of 7-day old microgreens were determined by measuring total antioxidant capacity (DPPH and FRAP), amount of total soluble phenols (PHE), sugar and proteins, as well as the concentrations of ascorbic acid (AA), carotenoids, total chlorophyls and anthocyanins. Our results showed that white light provoked higher PHE ant ANTH in Sango. However, purple light induced higher antioxidant capacity, PHE and AA in CHR and Daikon, as well as higher AA and PROT in all three cultivars. Therefore, purple LED lighting had more beneficial influence on antioxidant properties of radish microgreens compared to white LED lighting.

Keywords: *Raphanus sativus* L., antioxidant capacity, polyphenols, ascorbic acid, anthocyanins

DEEP EUTECTIC SOLVENTS IN THE EXTRACTION OF BIOACTIVE COMPOUNDS FROM TWO BROWN MACROALGAE *Padina pavonica* AND *Cystoseira compressa*

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poster presentation

Marine algae are known for their numerous benefits and pharmacological effect due to the presence of various bioactive compounds such as terpenoids, meroterpenoids, lipids, phlorotannins and phenolic compounds. Phlorotannins usually serve as a plant defense system against different adverse conditions and are often associated with different biological activities of macroalgae extracts, such as antifungal against *Candida* sp., antibacterial, anti-inflammatory, antioxidant, antitumor and neuroprotective. Phlorotannins possess numerous -OH groups in their structure, making them a highly hydrophilic molecules which can be extracted using polar deep eutectic solvents (DES).
Fifteen different choline chloride based DESs were used for extraction of phlorotannins from *Padina pavonica and Cytoseira compressa*. Phlorotanin content and antioxidant activity (DPPH method) were determined spectrophotometrically in obtained extracts.
Phlorotannines content is much higher in most of the *C. compressa* extracts compared to *P. pavonica.* For *C. compressa*, choline chloride:lactic acid (1:2) showed the best results, considering both phlorotannin yield and DPPH scavenging activity. In the case of *P. pavonica* extracts, choline chloride:urea (1:2) was the most efficient for the extraction of phlorotannins and the best DPPH scavenging activity was obtained with choline chloride:thiourea (1:2).

Keywords: brown algae, extraction, deep eutectic solvents, stephlorotannins, DPPH

Acknowledgment
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SUBCRITICAL WATER EXTRACTION FOR THE VALORIZATION OF BLACK ELDERBERRY BYPRODUCT

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poster presentation

Current practice in the agro-industrial waste management does not fully exploit waste potential since biowaste often contains valuable compounds that can be extracted from it and further used in different industries. Black elderberry pomace is a byproduct from the production of black elderberry juice. It is mostly composed of hemicellulose and cellulose, but it also represents an important source of polyphenolic compounds to be used in food, pharmaceutical, and cosmetic industries, with many applications related to the health benefits. Subcritical water extractions from dry elderberry pomace were performed in order to obtain phenols rich extracts. Elderberry pomace was extracted at temperatures from 120 to 200°C and pressure of 20 bar for 20 min, maintaining sample to solvent ratio 1:10. Total phenolic and total flavonoid contents were calculated by spectrophotometric method. The elderberry pomace extracts obtained at 120 °C showed the highest content of total phenols (139.24 mg GAE/g dry weight) and total flavonoids (32.06 mg CE/g dry weight) highlighting the great potential of elderberry pomace for valuable applications. The lowest contents for total phenolics and flavonoids (125.81 mg GAE/g dry weight and 27.75 mg CE/g dry weight, respectively) were observed in the extracts obtained at 160 °C.

Keywords: black elderberry pomace, subcritical water extraction, phenols, flavonoids

SYNERGISTIC EFFECT OF *Myrtus communis* L. AND *Laurus nobilis* L. ESSENTIAL OILS

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poster presentation

The aim of the study was to determine antimicrobial effectiveness of *Myrtus communis* L. and *Laurus nobilis* L. essential oils, both alone and in combination. The broth microdilution MIC method is used to measure the *in vitro* activity of an antimicrobial agent against a bacterial isolate. After overnight incubation, the minimum inhibitory concentration (MIC) is determined by observing the lowest concentration of an antimicrobial agent which will inhibit visible growth of the bacterium. The bacterial strains used in the study were *Listeria monocytogenes, Bacillus subtilis, Staphylococcus aureus, Salmonella enterica, Enterococcus faecalis* and *Escherichia coli*. Ampicilin, ciprofloxacin, chloramphenicol and enrofloxacin were used as standard drugs in antimicrobial assays. The results obtained highlighted the occurrence of good antibacterial effect of myrtle and laurel oils when administered alone. Using checkerboard method, the combinations of subinhibitory concentrations of myrtle and laurel essential oils were examined. The results proved synergism among *M. communis* L. and *Laurus nobilis* L. essential oils, with a **fractional inhibitory concentration (FIC) index** under 0.50. The essential oil from myrtle and laurel is a potential source of novel antimicrobial agents for the treatment of infections.

Keywords: synergistic effect, myrtle, laurel, MIC method, FIC index

Acknowledgment
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THE INFLUENCE OF EXTRUDED SUGAR BEET PULP ON COOKIES´ COLOUR

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poster presentation

In this work, wheat flour is replaced with extruded sugar beet pulp (SBPEs) in the amount of 5, 10 and 15% during the production of cookies. The influence of the percentage of sugar beet pulp in the SBPEs (ratios of corn grits to sugar beet pulp in extrudates were 85:15, 70:30, and 55:45), the size of the SBPE particles (<250 μm, 250-1000 μm and 1000-2000 μm) and the percentage of wheat flour substituted with SBPEs on the cookies´ colour was examined using a MINOLTA Chroma Meter CR-400, 24 h after baking. The CIE L*, a*, b* colour coordinates (L* - lightness, a* - redness to greenness, and b* - yellowness to blueness) were determined. As the particle size of the extrudate increased, the colour of cookie surface became darker, however, with the increase in the proportion of extrudate in cookies, the L* value decreased. Although the addition of sugar beet pulp in bakery products can lead to a decrease in parameters a* and b*, as was the case with the addition of sugar beet pulp to cookies, pasta, and bread (which had a slightly greyish colour), the cookie samples with SBPEs had positive a* values and b* values similar to the control cookie sample.

Keywords: cookies, sugar beet pulp, extrusion, by-product, colour

Acknowledgment
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PHENOLIC CONTENT AND ANTIOXIDANT PROPERTIES OF FUNCTIONAL COOKIES WITH GRAPE POMACE

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poster presentation

The aim of this work was to investigate the possibility of producing functional cookies with grape pomace (GP). The content of total phenolic compounds (TPC), total flavonoids (TF), and antioxidant activity (AA) of cookies enriched with GP were determined.
In the first experimental set, the wheat flour in the cookies formulation AACC 10-50.05 was replaced by milled GP in proportions of 10, 20 or 30 %. In the other two experimental sets, evaporated or encapsulated extracts were added to the standard cookies formulation in amounts that contained the same phenolic content as the GP substitutes in the first experiment. The liquid GP extracts were obtained with 50 % ethanol and then vacuum evaporated or encapsulated by ionic gelation with sodium alginate (3 %) and calcium chloride (0.25 M).
The TPC of the functional cookies ranged from 0.90 to 10.96 mg/g_{db}, while the TF ranged from 0.27 to 5.70 mg/$g_{db.}$ The AA determined by ABTS assay (3.44–44.59 μg_{TE}/g_{db}) and FRAP assay (0.68–21.16 μg_{TE}/g_{db}) were well correlated ($R > 0.997$).
The highest effect to increase TPC, TF and AA (FRAP assay) was obtained by adding 30 % GP to cookies compared to control as follows: 14.2-fold, 17.3-fold and 34.4-fold, respectively.

Keywords: functional cookies, grape pomace, phenolic compounds, antioxidant activity

Acknowledgment
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ZDRAVSTVENE POGODNOSTI JAPANSKE JABUKE

HEALTH BENEFITS OF JAPANESE APPLES

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usmeno priopćenje / *oral presentation*

Japanska jabuka (*Diospyros kaki L.*) je bogat izvor biološki aktivnih spojeva koji su povezani s antikancerogenim i antimutagenim djelovanjem. Plod obilno raste na području Hercegovine, gdje se uzgaja bez upotrebe dodatnih sredstava za rast i razvoj, što plodove japanskih jabuka čini slobodnim od štetnih ostataka. S obzirom da su plodovi meke konzistencije u zreloj fazi, dolazi do brzog truljenja svježeg voća, iako se u njima nalazi izvor aktivnih spojeva s korisnim učincima na zdravlje. Japanske jabuke su prirodno bogate ugljikohidratima, a sadrže jako malo do gotovo nikako masti. Neke od značajnih komponenti utvrđenih kroz znanstvena istraživanja su: askorbinska kiselina, tanini, dijetalna vlakna, mineralne tvari, β-karoten, β-kriptoksantin, lutein, zeaksantin i likopen. Potencijal u promicanju zdravlja uključuje učinkovitost japanske jabuke protiv proizvodnje slobodnih radikala, hiperkolesterolemije, dijabetesa, raka, kožnih oboljenja, hipertenzija i dr. Zbog takve fitokemije japanske jabuke, otvorila se mogućnost izoliranja korisnih sastojaka iz ploda za kozmetičku i farmaceutsku industriju, te kao dodatak s ciljem obogaćivanja drugih proizvoda. Široka je paleta produkata koji se mogu proizvesti iz ovog ploda, no potrebna je provedba daljnjih ispitivanja s ciljem otkrivanja načina razvoja novih proizvoda, ali i terapijskih mehanizama bioaktivnih komponenti japanske jabuke. U ovom radu su obuhvaćeni rezultati znanstvenih istraživanja o zdravstvenim pogodnostima japanske jabuke.

Ključne riječi: japanska jabuka, bioaktivni sastojci, zdravlje

Keywords: japanese apples, bioactive compunds, health

HETEROTROPHIC CULTIVATION OF *Euglena gracilis* IN STIRRED TANK BIOREACTOR: A PROMISING BIOPROCESS FOR SUSTAINABLE PARAMYLON PRODUCTION

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poster presentation

Microalgae *Euglena gracilis* generate and accumulate valuable intracellular components like vitamins, pigments and carbohydrates. One of this carbohydrates is paramylon. Investigations revealed exceptional immune system buster effect of paramylon. Therefore, paramylon has high commercial value and can be found in many food-supplements and drugs. In this study, complex medium with corn steep solid (CSS) and various bioreactor processes (batch, fed batch, semi-continuous and continuous) were performed in order to maximize paramylon production in microalgae *Euglena gracilis*. Compared to the batch, fed batch and repetitive batch bioprocess, during the continuous bioprocess in stirred tank bioreactor (STR) with complex medium, containing 20 g/L of glucose and 25 g/L of CSS, *E. gracilis* accumulated the competitive paramylon content (67.0%) and the highest paramylon productivity of 0.189 g/Lh was observed. This demonstrates that application of the continuous bioprocess with corn steep solid as an industrial by-product can be a successful strategy for efficient and economic paramylon production.

Keywords: *Euglena gracilis*, paramylon, stirred tank bioreactor, heterotrophic cultivation, corn steep solid

BIOACTIVE AND SENSORY EVALUATION OF CHOCOLATE PRALINES ENRICHED WITH POLYPHENOLIC COMPOUNDS EXTRACTED FROM GROUND IVY AND MOUNTAIN GERMANDER

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poster presentation

Due to abundant number of different chocolate products on market, the need has arisen for development of attractive chocolate products with functional properties. Therefore, in the present study, a total of five innovative formulations of chocolate pralines were developed containing coffee, chicory, carob, cocoa powder and peanut protein powder as the main ingredients of their fillings, additionally enriched with phenolic extracts from medicinal plants – ground ivy (*Glechoma hederacea* L.) and mountain germander (*Teucrium montanum* L.). Formulated pralines were subjected to sensory analysis and bioactive characterization. Total phenolic content (TPC) and antioxidant capacity were conducted using spectrophotometric methods, while content of individual phenolic compounds and methylxanthines using HPLC-DAD methodology. TPC of plain chocolate pralines was 4.66 mg GAE/g, while for filled ones it was higher, even two-fold for coffee pralines made with ground ivy (10.42 mg GAE/g), and even more for the same made with mountain germander (16.93 mg GAE/g). Results revealed that dominant phenolic compounds of both ground ivy- rutin, chlorogenic, cryptochlorogenic, caffeic and rosmarinic acid, and mountain germander- echinacoside and verbascoside, were successfully incorporated into chocolate pralines. The pralines enriched with ground ivy were sensory evaluated with higher grades in terms of overall acceptability that those with mountain germander for which the greatest flaw was recognized by an extremely bitter taste.

Keywords: chocolate pralines, ground ivy, mountain germander, polyphenols

Acknowledgment
This research was acquired as part of the project named: "Formulating encapsulated systems of bioactive ingredients from traditional plants: Mountain Germander and Ground Ivy for the development of innovative functional food products" (IP-2019-04-5879 / FUNCBIOCAP), funded by the Croatian Science Foundation.

COMPARISON OF MICROWAVE-ASSISTED, SUBCRITICAL WATER, AND HIGH VOLTAGE ELECTRIC DISCHARGE EXTRACTION FOR RECOVERY OF POLYPHENOLS FROM QUINCE LEAVES

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poster presentation

Quince (*Cydonia oblonga*) is a plant spread throughout the world with a very diverse application. While it has been shown that the fruit in addition to the fragrance and taste has dominant role in quince pharmacological activity, other parts of plant such as leafs also show significant health beneficial properties. Traditionally, the leaves were used as astringent and antiseptic, while modern medicine states that quince leaf extracts have antioxidant, antibacterial, cardiovascular, and antidiabetic activity.

Considering the wide application of quince leaf extract, there is a constant need to improve the efficiency of the processes for obtaining those extracts. Therefore, three green extraction technologies microwave-assisted extraction (MAE), subcritical water extraction (SWE), and high voltage electric discharge (HVED) extraction were used for obtaining quince extracts. Furthermore, obtained extracts were chemically characterized with the goal to determine the most adequate extraction technology. The content of total phenols in MAE extracts was in the range 354.68-456.27 mg GAE/g DE, whereas phenols content in SWE extracts was from 213.97 to 349.12 mg GAE/g DE. Finally, HVED proved to be the most efficient extraction method, with the highest content of total phenols ranging from 269.55 to 985.17 mg GAE/g DE.

Keywords: quince, *Cydonia oblonga*, microwave-assisted, subcritical water, high voltage electric discharge

UPOTREBA DODATAKA PREHRANI TIJEKOM PANDEMIJE COVID-19 U BOSNI I HERCEGOVINI

USE OF NUTRITIONAL SUPPLEMENTS DURING THE COVID-19 PANDEMIC IN BOSNIA AND HERZEGOVINA

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postersko priopćenje / *poster presentation*

Adekvatan unos koncentriranih izvora hranljivih sastojaka u doziranom obliku ima ulogu u očuvanju zdravlja, jačanju imunološkog sustava i obogaćenju uobičajene prehrane. Značaj protektivne uloge dodataka prehrani od velikog je interesa u doba pandemije.
Cilj rada bio je ispitati učestalost upotrebe odabranih dodataka prehrani prije i tijekom pandemije COVID-19.
Presječna studija je provedena među općom populacijom u centralnoj Bosni i Hercegovini tijekom svibnja 2021. U istraživanju je korišten samopopunjavajući, anonimni upitnik u elektronskoj formi s pitanjima o socio-demografskim karakteristikama, frekvenci korištenja odabranih dodataka prehrani u dva ispitivana perioda, te razlozima i motivaciji ispitanika za njihovo korištenje. Za statisičku obradu je korišten Micosoft office Excell 2016.
Istraživanjem je obuhvaćen 371 ispitanik, prosječne starosti 42 godine (raspon 19 – 76), od čega je 306 (82,48 %) ženskog spola. Suplemente koristi 307 (82,75 %) ispitanika, dominantno ispitanice 257 (83,71 %), osobe s normalnom tjelesnom masom 141 (45,93 %) i 112 (36,48 %) ispitanika s kroničnim oboljenjima. Utvrđeno je povećanje konzumacije selena (14,28 %), vitamina D (15,31 %) i cinka (24,04 %) tijekom pandemije COVID-19. Najčešći motiv za konzumaciju dodataka prehrani je poboljšanje zdravlja s ciljem jačanja imunološkog sustava (85,80 %).
Dobiveni trendovi ukazuju na povećanje unosa mikronutrijenata, što upućuje na nužnost edukacije stanovništva o optimalnom unosu i prevenciji neželjenih utjecaja.

Ključne riječi: dodaci prehrani, COVID-19, vitamin D, cink, selen

Keywords: dietary supplements, COVID-19, vitamin D, zinc, selen

DURUM WHEAT PASTA ENRICHED WITH ENCAPSULATED CARROT WASTE EXTRACT

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poster presentation

The scientific focus on pasta products has progressively moved toward the addition of natural bioactive compounds, which resulted in improved nutritional and functional properties. Carrot waste has attracted considerable attention in recent years, because of the potential health benefits of its lipophilic bioactives, mainly carotenoids and tocopherols. Hence, durum wheat semolina was used to prepare control pasta, and pasta enriched with 10% encapsulated carrot waste extract obtained by freeze drying (FDE) or spray drying techniques (SDE). Obtained encapsulates added significant α-carotene, β-carotene and *cis* β-carotene quantities to the enriched pasta, which were more stable than semolina carotenoids (lutein and zeaxanthin) during processing. The pasta enriched with 10% FDE/SDE had about 23% higher carotenoid contents than the control sample, while pasta with 10% FDE or SDE had 32.4% and 38.4% more tocopherols, respectively. Cooking reduced carotenoids content in all cases except for the pasta with 10% SDE. In terms of tocopherols, cooking led to minimal losses, particularly in the 10% encapsulate enriched pasta. Considering a single pasta portion (85 g cooked pasta), the 10% FDE and 10% SDE provided, respectively, 23% and 25% of the RDA for carotenoids as well as 9.6% and 10.9% of RDA for vitamin E (α-tocopherol).

Keywords: carrot waste, functional pasta, carotenoids, tocopherols, cooking trials

BIOACTIVE PEPTIDES OBTAINED FROM OYSTER PROTEINS

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oral presentation

Bioactive peptides (BP) are organic compounds; specific protein fragments, made up of amino acids joined by a peptide bond, the consumption of which has a physiologically measurable positive impact on health, without negative consequences such as toxicity, allergenicity and mutagenicity. Some BPs are present in free form, but most are obtained by enzymatic degradation of proteins, fermentation, or prepared by synthesis in the laboratory. Recently, there has been an increased interest from the scientific community, the food and pharmaceutical industries to explore the possibilities of obtaining and exploiting BP for various purposes. Various foods of animal (milk, cheese, eggs, gelatin, fish, meat) and plant origin (corn, wheat, soy, mushrooms, seeds) are a source of BP, but proteins present in marine organisms are a particularly interesting area for BP research, and thus those obtained from shellfish, oysters. The quality of oyster protein (*Crassostrea sp*., *Ostrea sp*.) shows a high biological and nutritional value with respect to amino acid composition, and the biological activity of oyster peptide is intensively examined. To date, anti-fungal, anti-cancer, anti-tumor, antioxidant activity, ACE (angiotensin converting enzyme) inhibitory activity and immunomodulatory activity have been reported. Oysters therefore represent a unique source of protein that has the potential to become a raw material for obtaining a new generation of different BPs.

Keywords: oysters, peptides, bioactive peptides, nutraceutical

DODACI PREHRANI U LIJEČENJU BLAGE DEPRESIJE I DEPRESIVNO-ANKSIOZNOG POREMEĆAJA

DIETARY SUPPLEMENTS FOR TREATMENT OF MILD DEPRESSION AND MIXED DEPRESSION AND ANXIETY

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pozvano predavanje / *invited lecture*

Depresivni poremećaji (depresija major i distimija) te depresivno-anksiozni poremećaj ozbiljan su javno-zdravstveni problem koji zahvaća, barem jednom u životu, 8-12 % svjetske populacije. Terapijske opcije obuhvaćaju psihoterapiju, elektrokonvulzivnu terapiju i farmakoterapiju. Iako je na tržištu prisutan velik broj antidepresiva, a novije generacije lijekova karakterizira bolja učinkovitost i smanjena pojavnost nuspojava, kod oko 30 % pacijenata ne dolazi do nastupa remisije bolesti, suradljivost pacijenata i adherencija su loši, a smrtnost relativno velika. Stoga su za velik broj pacijenata s blažim oblikom bolesti dodaci prehrani (u kombinaciji s drugim alternativnim metodama liječenja) preferirani terapijski odabir. Provođenje ljekarničke skrbi u tom kontekstu zahtijeva posjedovanje konkretnih znanja o učinkovitosti temeljenoj na dokazima, terapijskim režimima, sigurnosti i ograničenjima primjene te kvaliteti dodataka prehrani koji se mogu koristiti u terapiji blage do umjerene depresije i anksioznosti.

Ključne riječi: dodaci prehrani, blaga depresija, miješani anksiozno-depresivni poremećaj, ljekarnička skrb

Keywords: dietary supplements, mild depression, mixed depression and anxiety, pharmaceutical care

DEVELOPMENT OF MEDICINAL PLANT POWDER FOR PULMONARY DELIVERY

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invited lecture

The main goal of the study was to determine the possibility of applying polyphenols through pulmonary administration which would enable efficient manifestation of biological activity while avoiding fast metabolism of polyphenols in the organism. Aromatic medicinal plants *Thymus serpyllum* and *Salvia officinalis* were used as sources of polyphenols. Moreover, herbal powders of these plants were obtained using the spray drying method. Parameters of quality of obtained powders were investigated and their physico-chemical, structural, and aerodynamic *in vitro* properties were determined. The efficiency of the spray drying process which was higher than 50% resulted in the attainment of stable powders with a moisture content lower than 5% and hygroscopicity which was lower than 16% after seven days. The chemical profile of the extracts was determined by applying the UPLC-MS analysis and rosmarinic acid was confirmed as the most dominant compound. Furthermore, the amorphous structure of powders was established by structural analysis using X-ray powder diffraction, while particle size, particle size distribution, and pulmonary deposition results indicated that powders are adequate for pulmonary application. In addition, to determine the safety of powder application, the activity of powders was investigated on normal MRC-5 lung cells.

Keywords: pulmonary delivery, medicinal plants, spray drying

Acknowledgment
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IMPACT OF ENZYME AND MICROWAVE PRETREATMENTS ON THE SUPERCRITICAL CARBON DIOXIDE EXTRACTION OF *Origanum vulgare*

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poster presentation

Aromatic medicinal plant oregano (*Origanum vulgare*) represents a highly important natural resource widely used in the production of food, flavour, cosmetic, and pharmaceutical products. Given the importance of oregano lipophilic bioactive components and their high applicability and demand, there is a constant need for improving technologies for their recovery.
A technology that has been established as a green approach for obtaining lipophilic compounds from natural resources is supercritical carbon dioxide ($ScCO_2$) extraction. To achieve rational exploitation of material and increase extraction efficiency, enzymatic and microwave pretreatments of the *O. vulgare* herbal material were applied.
The $ScCO_2$ extraction was performed at 40 °C and 200 bar. For the enzymatic pretreatment, the cellulolytic enzyme mixture was used, whereas the microwave pretreatment was conducted using 360 W for 2 min. Presence of 20 components was detected in the aromatic profiles of extracts, among which the most dominant component was carvacrol in the 68-80% range. The application of the pretreatments resulted in the disruption of the cellular structure of the plant material and a greater release of lipophilic components, compared to the control (extraction without pretreatment). Moreover, the enzymatic pretreatment increased the extraction yield by 48.51%, while the microwave pretreatment achieved a 53.2% higher yield.

Keywords: oregano, aroma, supercritical carbon dioxide, enzymatic pretretament; microwave

Acknowledgment
This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 101003396".

IN VITRO GASTROINTESTINAL STABILITY AND BIOACCESSIBILITY OF GLUCOSINOLATES FROM SELECTED PLANTS OF THE ORDER BRASSICALES

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poster presentation

Glucosinolates, compounds present in Brassica vegetables, provide several benefits to human health, such as anticancer, antimicrobial, antihyperglycemic, anti-inflammatory, and etc. Therefore, it is extremely important to evaluate the rate of stability and bioaccessibility of glucosinolates after digestive process. Static *in vitro* digestion methods are the simplest methods for simulation of *in vivo* digestion model. The concept of a compound bioaccessibility has been defined as the fraction released from the food matrix in the gastrointestinal tract that becomes available for absorption. Therefore, the aims of this research were to determine glucosinolates in the plant seeds of different mustards and in *Tropaeolum majus* L. that belong to the order *Brassicales*, and their stability and bioaccessibility after two simulated digestion methods - *in vitro* method based on the use of commercial enzymes from the stomach and small intestine, and *in vitro* method with human digestive juices from the stomach and small intestine. Identification of glucosinolates, their *in vitro* gastrointestinal stability and bioaccessibility were determined using high pressure liquid chromatography - tandem mass spectrometry (HPLC-MS/MS). Glucosinolates showed higher stability after gastric digestion phase in comparison with intestinal phase.

Keywords: order Brassicales, glucosinolates, *in vitro* digestion method, gastrointestinal stability and bioaccessibility, HPLC-MS/MS

PROBIOTICS IN CLINICAL PRACTICE – A NEW CONCEPT IN COMBATING MALNUTRITION IN CHILDREN AND ADOLESCENTS

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invited lecture

Probiotics are increasingly applied to prevent and treat many infectious, immune related and gastrointestinal diseases. Although the mechanisms behind the putative effects are poorly understood, it has become clear that the intestinal microbiota plays an important role in maintaining health and thus is an attractive target for clinical interventions. There is a growing interest of scientists and clinicians in assessing the ability of probiotics to enhance the nutritional status of malnourished and children with non-communicable disease-associated malnutrition, since they are among the greatest global health problems of our time. We performed first randomised, double-blind, placebo-controlled study with *Lactobacillus reuteri* DSM17938 in children and adolescents with anorexia nervosa and constipation. *L. reuteri* DSM17938 was more effective than placebo in improving bowel movements and normalization of body weight in patients with AN, and showed positive trend considering the bone density recovery and vitaminD3 levels. We're still in the relatively early stages of research into the microbiome. Over the next decades, we're going to learn more about each individual microbial species and how they work with the food to impact health. This will allow us to smartly engineer interventions that correct the dysbiosis. Future possibilities implies the idea of personalising probiotic therapy, which contain tailored bacterial combinations that ensure optimal gut health what may affect the prevention and/or treatment of numerous diseases.

Keywords: probiotics, malnutrition, children, adolescents

EVALUATION OF GUT MICROBIAL ENZYME ACTIVITY AFTER CONSUMMATION OF LAUREL AND MYRTLE EXTRACT IN RAT

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poster presentation

Polyphenols exhibit structural diversity, which impacts on bioavailability, metabolism, and bioactivity. The gut microbiota play a key role in modulating the production, bioavailbility and, thus the biological activities of phenolic metabolites, particularly after intake of food containing high-molecular-weight polyphenols. The main aim of this study was to investigate whether polyphenols alter intestinal microbiota and their enzymatic activity after intake of Laurel and Myrtle water extract and whether changes in intestinal enzyme activity affect the health of rats. We investigated growth of lactic acid bacteria (LAB), *β*-glucuronidase, *β*-glucosidase, *β*-galactosidase activity, pH value, body weight change and food effecacy ration after intragastric treatment of rats with Laurel and Myrtle extract at doses of 50 and 100 mg/kg during two weeks. The endogenous populations of colonic probiotic bacteria (Lactobacilli and Bifidobacteria) were counted on selective media. According to our data Laurel in the applied dose of 50 and 100 and Myrtle (100 mg/kg) positively affect the health of rats by increasing the number of colonies of Lactobacilli and Bifidobactera compared to the control group, causes minor changes in enzyme activity, and in high doses Laurel increases food efficiency ratio, while Myrtle in a reduced dose.

Keywords: laurel and myrtle extract, gut microbial enzymes, probiotic bacteria

Acknowledgment
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***FOOD SAFETY* /**
ZDRAVSTVENA SIGURNOST HRANE

MICROBIOLOGICAL STABILITY OF CHOCOLATES WITH ADDED COCOA SHELL

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poster presentation

The cocoa shell is byproduct that is rich in dietary fibres and bioactive components. Also, because of its contact with environmental pollution, it can be contaminated with different microorganisms. In this study, we produced milk and dark chocolate with 5% and 15% of cocoa shell, respectively. Also, control chocolates (milk and dark) were produced without added cocoa shell. These chocolates were stored for one year and analyses were conducted after production, 1, 2, 3, 6, 9, and 12 months of storage at room temperature. During that period water activity, total viable count, *Salmonella* spp., *Enterobacteriaceae*, yeasts and moulds were determined for every chocolate. Results showed that water activity was higher in milk chocolates and that with time, water activity increased in milk chocolate with cocoa shell and decreased in dark chocolate with cocoa shell. In all chocolates measurements did not show the presence of *Salmonella* spp., *Enterobacteriaceae*, yeasts and moulds. Chocolates with added cocoa shell had a higher total viable count (colony forming units (CFU)) and results showed that they increased within a period of one year. Dark chocolate with cocoa shell did not comply with regulations for total viable count, while milk chocolates with cocoa shell complied with regulations after production. After first month milk chocolates with cocoa shell also did not comply with regulations. In future research, it is necessary to find an adequate solution for decontamination of cocoa shell prior using as an ingredient in the production of chocolate.

Keywords: chocolate, cocoa shell, microbiological stability, water activity

Acknowledgment
The research was supported in part by Croatian Science Foundation under the project UIP 2017-05-8709.

OCCCURRENCE, CHARACTERIZATION AND DISTRIBUTION OF MICROPLASTICS AND BISPHENOL A IN THE SEAFOOD: THE COMMERCIALLY RELEVANT MYTILLUS GALLOPROVINCIALIS CASE STUDY FROM THE ADRIATIC SEA

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oral presentation

Microplastics (MPs) is recognized as multifaceted stressor based on the physical effects due to particle size, shape, and concentration and chemical effects related to hazardous chemicals (additives and polymeric raw materials, chemicals absorbed from the environment). The plastic litter has been recognized as a serious problem to the environment and at European level has become one of eleven descriptors defining a Good Environmental Status (GES) of the aquatic environment in the EU Marine Stategy Framework directive (MSFD, 2008/56/EC). Levels of marine litter in the Mediterranean sea have become critical. Over the last decade, bisphenol A (BPA) has become a chemical of concern in the marine environment since it can persist longer in sea water than in freshwater. The seafood is especially affected by MPs and BPA owing to the amount of plastic waste received in the marine environment. In terms of risk assessment the exposure to MPs in food should be quantified and after that evaluate aiming to investigate the possible detrimental effects. Therefore since the occurrence of plastic litter and BPA has been recorded in the Adriatic Sea the present lecture aims at verifying the potential entrance of MPs and BPA in the food web by the commercially relevant Mytillus galloprovincialis, sessile filter-feeding organism. An overview of the current knowledge of the occurrence, characterization and distribution of MPs and BPA in the seafood will be presented by the lecture in order to elucidate the gaps in knowledge about the analytical methods and exposure to MPs.

Keywords: microplastic, seafood, environmental contamination, bisphenol A

VODOM DO ZDRAVLJA

WITH WATER TO HEALTH

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postersko priopćenje / *poster presentation*

Voda je jedina namirnica koju svakodnevno koriste svi stanovnici Zemlje, neovisno o vjeri, rasi i socioekonomskom statusu. Pravo na dostupnost zdravstveno ispravne vode za piće temeljno je ljudsko pravo dano svakom ljudskom biću rezolucijom Opće skupštine UN-a naslovljenom „Ljudsko pravo na vodu i sanitarne uvjete" od 28. srpnja 2010. Globalizacija i nezaustavljivi industrijski razvoj, urbanizacija te prekomjerno korištenje prirodnih resursa značajno je narušilo ravnotežu svih segmenata ekosustava te ubrzalo i osnažilo učinke klimatskih promjena koje se naročito očituje u sve češćoj pojavi problema dostupnosti vode kao i pogoršanju kvalitete vodnih resursa. Stoga je prerada i isporuka zdravstveno ispravne vode danas zahtjevna i jedna od najodgovornijih zadaća naše civilizacije.
Redoviti unos vode u organizam osnovni je uvjet za život, a udio vode u organizmu ovisi o starosnoj dobi pojedinca te drugim stanjima organizma. No, redovitim unosom vode, čovjek svakodnevno u organizam unosi i niz kemijskih tvari koje prirodno ili kao rezultat ljudskih aktivnosti kruže u okolišu. S obzirom na potrebe ljudskog organizma, pojedine kemijske tvari prisutne u vodi su nužne za metaboličke procese i zdravlje ljudskog organizma, no često se u vodi mogu naći i one kemijske tvari koje pri dugotrajnom unosu u organizam mogu uzrokovati pojavu niz nepoželjnih i štetnih učinaka na organizam. U ovom radu prikazani su u svijetu najčešće zabilježeni štetni učinci mikrobiološki ili kemijski onečišćene vode za ljudsku potrošnju na zdravlje ljudi.

Ključne riječi: voda, zdravlje, mikrobiološki sastav, kemijski sastav

Keywords: water, health, microbiological composition, chemical composition

DETERMINATION OF ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES OF APPLE PEEL EXTRACT AS POSSIBLE ADDITIVE FOR CHITOSANE BASED EDIBLE COATING

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poster presentation

We are nowadays searching for an alternative to plastic packaging in the so called an edible coating for foods, which are biodegradable. Chitosan, a derivative of chitin, is one of the polysaccharides that can be used as edible coating. Various additives are added to the chitosan coating to improve its antioxidant and antimicrobial efficacy.
One such promising additive tested in our research was an apple extract, made from organically-grown apples with the highest possible content of chlorogenic acid (a model compound coming from naturally present apple antioxidant). The antimicrobial activity of apple extract, reference chlorogenic acid solution and chitosan solution were checked against ten microorganisms.
The solution of chitosan and higher concentrations of apple extract had the best antimicrobial properties against the investigated microorganisms, while the standard solution of chlorogenic acid did not have an inhibitory effect on any of the analyzed microorganisms. Apple extract had an average 40% inhibitory effect. Chitosan, on the other hand, has shown inhibitory potential against four microorganism *S. sciuri, E. coli* and *M. luteus* and against the yeast *H. Gilliermondii*. Besides, it has shown significantly lower activity against *Penicillium* (t test; $p<0.05$; 0.038), when the peel of the fruit (apple) was treated with chitosan (1% w/w, 2% acetic acid).

Keywords: edible coating, chitosan, apple extract, antioxidative properties, antimicrobial properties

DIFFERENTIAL ACCUMULATION OF DOMOIC ACID IN EUROPEAN OYSTERS, QUEEN SCALLOPS AND ASCIDIANS *Microcosmus spp*.

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poster presentation

Being filter feeders, shellfish and ascidians can accumulate contaminants present in the environment becoming their vectors to a higher food chain. Consumption of bivalves contaminated with potent neurotoxin - domoic acid can cause Amnesic shellfish poisoning syndrome. The aim of this study was to determine differences in occurrence and accumulation of this hydrophilic marine biotoxin in European oysters (*Ostrea edulis* Linnaeus, 1758) (n = 46), Queen scallops (*Aequipecten opercularis* Linnaeus, 1758) (n = 53) and edible ascidians of the *Microcosmus spp*. (n = 107) originating from the same harvesting area in the northern part of the Adriatic Sea. Determination was performed using ultra-performance liquid chromatography-tandem mass spectrometry (LC-MS/MS) preceded by derivatization with dansyl chloride in order to achieve a lower limit of detection. Domoic acid was found in very low concentrations throughout the year, with the maximum value of 0.8 mg/kg. This study reveals differences in the occurrence and accumulation of domoic acid among investigated species. Though domoic acid was detected in all of them, Queen scallops have a greater preference for this phycotoxin accumulation as compared to the other two, making them suitable sentinel species for monitoring the level of domoic acid in seafood.

Keywords: domoic acid, LC-MS/MS, shellfish, ascidians

DETERMINATION OF STERIGMATOCYSTIN IN TRADITIONAL DRY-FERMENTED SAUSAGES USING LC-MS/MS METHOD

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poster presentation

Given the toxicity of sterigmatocystin (STC) and insufficient data on its occurrence in food, there is a need for STC detection in different food matrices and the development of sensitive analytical methods. Dry-fermented meat products can be contaminated indirectly through contaminated animal feed and spices or directly through production by the moulds of the *Aspergillus* genus that overgrow their surface during ripening. In this study, the method for STC determination in dry-fermented meat products based on the extraction and clean-up using immunoaffinity columns followed by liquid chromatography with tandem mass spectrometry (LC–MS/MS) was developed. Method validation resulted in the limit of detection (LOD) and the limit of quantification (LOQ) of 0.02 µg/kg and 0.06 µg/kg, respectively. Linearity of the method was tested in the range of 0.1 µg/kg to 10 µg/kg, with the recovery of 114%. The method was applied in the analyses of 47 samples of 5 different types of traditional household-produced dry-fermented sausages. STC was not detected in any of the analysed samples. One of the reasons behind it can be the fact that moulds of the *Aspergillus* genus are more frequently isolated in meat products that ripen longer and in warmer regions so that these types of products should be further investigated.

Keywords: analytical method, validation, contamination, meat products, mycotoxins

MICROBIOLOGICAL AND PARASITOLOGICAL QUALITY OF DIFFERENT FRESH-CUT SALADS

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poster presentation

Fresh-cut salads are "ready-to eat" food products intended for immediate consumption after minimal processing including washing, (cutting) and packaging. Although raw salads washing procedure reduces microbial load up to 90%, working surfaces contamination spreads through chopped salad while injured cell juices provide a favourable substrate for microbial growth. If present, higher loads or pathogenic microorganisms and parasites pose a serious health threat for consumers since these products are eaten fresh, without thermal treatment. The aim of this work was to examine the microbiological and parasitical quality of ready-to-eat salads from retail locations. In total 80 samples were collected from retail locations during February, May, June and July 2020. The presence of microorganisms in analysed samples was determined by standard microbiological methods while, parasites presence was checked using sedimentation, differential staining and microscopy. Yeasts, moulds and *Enterobacteriaceae* as well *Staphylococcus aureus* were detected in higher counts in expired salads, making them unsafe for consumption. *Salmonella,* coliforms, sulphite-reducing bacteria and parasites or their life forms (cysts/oocysts) were not detected. The presence of fungi *Alternaria spp.*, possible mycotoxin producers, was higher in whole leaf salads, compared to chopped salads. Fresh-cut salads are perishable minimally processed products and it's microbiological and parasitical contamination should be closely monitored.

Keywords: fresh-cut salads, minimally processed, vegetables, microorganisms, parasites, safety

ANALIZA RIJETKIH MEDOVA NA OSTATKE VETERINARSKIH LIJEKOVA – NITROIMIDAZOLA

ANALYSIS OF RESIDUES OF VETERINARY DRUGS - NITROIMIDAZOLES IN RARE HONEY

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postersko priopćenje / *poster presentation*

Nitroimidazoli pripadaju skupini anitibiotika koji se koriste u liječenju infekcija izazvanih anaerobnim bakterijama i parazitima. Sukladno važećoj legislativi ostaci nitroimidazola nisu dopušteni u medu. Med kao prirodni proizvod botaničkog i animalnog podrijetla vrlo je cijenjena namirnica kada govorimo o zdravom načinu prehrane, ne samo kao zamjena za šećer, već i zbog niza drugih svojstava blagotvornih za ljudsko zdravlje. Cilj ovog istraživanja bio je utvrditi prisustvo i koncentraciju ostataka veterinarskih lijekova iz skupine nitroimidazola metodom tekućinske kromatografije visokog učinka s masenom detekcijom, na jedanaest uzoraka meda rijetko zastupljenog botaničkog podrijetla s područja Hrvatske. U svim uzorcima koncentracija nitroimidazola bila je ispod vrijednosti ccα dobiveninih validacijom metode, te isti udovoljavaju važećim propisima RH u pogledu ostataka ovih veterinarskih lijekova.

Ključne riječi: nitroimidazoli, med, zdravstvena ispravnost

Keywords: nitroimidazoles, honey, health safety

MICROBIOLOGICAL QUALITY ASSESMENT OF ROSE HIP NECTARS TREATED WITH HIGH VOLTAGE ELECTRICAL DISCHARGE DURING REFRIGERATED STORAGE

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poster presentation

Conventional thermal processing technology for pasteurization of nectars ensuring microbiological safety and enzyme inactivation, but causes several physical and chemical changes and decreases the bioavailability of some nutrients. Therefore, an increasing effort has been made in applying novel technologies to preserve the sensory, nutritional and functional properties while providing safe products. High voltage electrical discharge (HVED) is one of such novel non-thermal processing technologies. This study aimed to investigate the microbiological quality of rose hip nectars treated with HVED (100 Hz, 20 minutes) during storage. Microbiological quality assessment of untreated, HVED treated nectars (prepared with/out purée blanching, low-calorie nectar), as well as pasteurised nectar, was performed on 0, 6 and day 12 of storage at 4 °C. Microbiological analysis was applied to determine the conformity of the samples according to the valid microbiological criteria. Aerobic mesophilic bacteria, *Enterobacteriaceae* and *Escherichia coli* count in all samples during 12 days were below the permitted levels for fresh fruits and vegetable juices. *Salmonella spp.* and *Listeria monocytogenes* were not detected in any of the samples. The total yeasts and moulds population level in the samples was above the regulatory limits, except for the pasteurised and nectar produced from blanched purée.

Keywords: rose hip, nectar, HVED, microbiological quality

TEŠKI METALI U HRANI I NJIHOV UTJECAJ NA ZDRAVLJE LJUDI

HEAVY METALS IN FOOD AND THEIR IMPACT ON HUMAN HEALTH

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postersko priopćenje / *poster presentation*

Zdravstvena sigurnost hrane je prioritetno pitanje za zdravlje ljudi. Metali, kao što su arsen, kadmij, olovo, nikal, živa, krom i uran, su jedni od onečišćivača hrane koji utječu na zdravlje ljudi, uzrokujući promjenu metabolizma, utječući na morbiditet i na mortalilitet, a neki od njih su klasificirani i kao kancerogenici.
Teški metali predstavljaju prirodne sastojke okoliša, ali izvor kontaminacije potječe i od antropogenih izvora (sagorijevanje fosilnih goriva, industrijska postrojenja, ekstrakcija rude, motorna vozila, deponije industrijskog i komunalnog otpada, gnojiva i atmosferski talozi). Kontaminacija hranidbenog lanca s ovim elementima potječe iz zraka, vode i tla. Antropogeni izvori zagađenja posebno dolaze do izražaja u regijama koje imaju velike industrijske zagađivače. Nepostojanje sustavnog monitoringa kontaminacije hranidbenog lanca, ili neadekvatnog sustavnog monitoringa, uzrokuje da konzumiramo hranu upitne kvalitete, koja s vremenom može postati uzrok bolesti kod ljudi.
Teški metali predstavljaju jednu od najhitnijih briga u raspravi o sigurnosti i kvaliteti hrane kao i eventualne mjere sanacije kontaminiranih područja. Unatoč važnosti za pojačanim praćenjem i poduzimanjem mjera za sanaciju kontaminiranih regija, jako mali broj istraživanja je usmjeren k tom javnozdravstvenom problemu.

Ključne riječi: teški metali, hrana, zdravlje ljudi

Keywords: heavy metals, food, human health

POJAVNOST BAKTERIJA *Salmonella spp.* U PILEĆEM MESU S PODRUČJA ISTOČNE HRVATSKE

OCCURRENCE OF BACTERIA *Salmonella spp.* IN CHICKEN MEAT IN EASTERN CROATIA

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postersko priopćenje / *poster presentation*

Bakterije roda *Salmonella*, uz *Campylobacter*, uzrokuju najčešće bakterijske infekcije koje se prenose hranom, a meso peradi je prepoznato kao njihov najčešći izvor zaraze kod ljudi. Budući je pileće meso jedno od najzastupljenijih vrsta mesa u svakodnevnoj ljudskoj prehrani, cilj ovog rada je bio utvrditi pojavnost bakterija roda *Salmonella* u navedoj vrsti mesa. Uzorkovanje je provedeno u razdoblju od 2016. do 2020. godine u okviru monitoringa hrane životinjskog podrijetla u mesnicama i klaonicama na području istočne Hrvatske. Ukupno je analizirano 837 uzoraka svježeg pilećeg mesa, a u 124 (14,81 %) uzorka je ustanovljena prisutnost bakterija *Salmonella*. Serološkom tipizacijom u svim pozitivnim uzorcima je identificirana *Salmonella* ser. Infantis, koja je najviše bila izolirana u pilećem krilu, a najmanje u prsima.

Ključne riječi: *Salmonella spp., S. infantis,* pileće meso, istočna Hrvatska

Keywords: *Salmonella spp.*, *S.infantis*, chicken meat, eastern Croatia

POSTHARVEST MILD HEAT TREATMENT INHIBIT *Penicillium expansum* GROWTH ON PEACH FRUIT (*Prunus persica*)

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oral presentation

Nowadays, fruit and vegetable producers try to replace phytopharmaceuticals with physical treatments that are considered safe. Hot water dipping (HWD) gained the reputation as successfully preventing physiological and microbiological diseases and inhibiting ripening. The aim of the present investigation was to determine the impact on HWD of peach fruit ripening and growth of *Penicillium expansum*. Peach fruit cv. 'Redhaven' were first disinfected in NaOCl (2% for 2 minutes) then treated with hot water (60 °C for 2 minutes) and stored at 20°C for five days. Analyses of red and yellow fruit peel were carried out and included: antioxidative potential (AOP), total phenols, activity of phenylalanine ammonia lyase (PAL), fruit surface colour, *P. expansum* growth and fruit surface contact angle.
Higher AOP was found for red and yellow coloured skin of HWD peaches as compared to the non-treated control. HWD reduced growth of *P. expansum* on peach fruit with a greater effect on red colored peel as compared to yellow colored peel. Growth inhibition of *P. expansum* correlated negatively with AOP and total phenols content. Red colored peel had a lower contact angle as compared to yellow coloured, while HWD increased the contact angle of both red and yellow part of the fruit surface.

Keywords: peach, *Penicillium expansum*, hot water dipping

FOOD ANALYSIS /
ANALIZA HRANE

HIGH VOLTAGE ELECTRIC DISCHARGE EXTRACTION OF CHLOROGENIC ACID FROM TOBACCO INDUSTRIAL WASTE

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poster presentation

The chlorogenic acid (3-O-Caffeoylquinic acid) is a member of a group of caffeoylquinic acids, commercially delivered from *Lonicera japonica* Thunb and *Eucommia ulmoides* Oliver plants. It can be naturally found in green coffee beans, tea leaves and tobacco. Recently, the chlorogenic acid and its isomers have received increasing attention due to its multiple pharmacological effects and biological activities such as antioxidant, antibacterial, antiobesity, anti-inflammatory, antitumor, antihypertensive, and gastrointestinal tract-protective effects. This study aimed to evaluate the potential of high voltage electrical discharge in the extraction of chlorogenic acid from tobacco industrial waste, as an alternative source of this important compound. Extraction was conducted using high voltage electric discharge procedure under various process conditions: solvent/solid ratio (from 300 to 700 mL/g), treatment time (from 15 to 45 min) and frequency (from 40 to 100 Hz), to study the effect of these conditions on the concentration of chlorogenic acid. The optimal extraction conditions are defined as follow, solvent/solid ratio: 695.24 mL/g, frequency: 47.16 Hz and extraction time: 15.06 min. The present study clarified that tobacco waste is a rich source of chlorogenic acid that could be recovered and used for many purposes as a food additive or nutraceutical.

Keywords: chlorogenic acid, high voltage electric discharge, extraction, tobacco waste

Acknowledgment
This work has been supported by Croatian Science Foundation under the project "Application of innovative techniques of the extraction of bioactive components from by-products of plant origin" (UIP-2017-05-9909).

THE FATTY ACID PROFILES OF SELECTED MACROALGAL SPECIES FROM THE ADRIATIC SEA

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poster presentation

Lately, there is an increasing demand for alternative natural sources of polyunsaturated fatty acids (PUFAs) due to their health benefits of reducing the risk of heart diseases. Macroalgae were shown as potential sources of ω3 and ω6 fatty acids and to assess their suitability, species collected from the Adriatic Sea were investigated for their fatty acid profiles by the gas chromatography with flame ionization detector (GC-FID). Macroalgae included in this study were as follow; *Amphiroa rigida* and *Asparagopsis taxiformis* (red species), *Cystoseira compressa* and *Cystoseira amentacea* (brown species), *Codium adhaerens* and *Ulva lactuca* (green species). The obtained results indicated the significant differences in fatty acid profiles between and within algal groups. Red and brown macroalgae were generally richer in ω3 and ω6 fatty acids with eicosapentaenoic (C20:5, EPA) and arachidonic acids (C20:4) as the most represented, while green macroalgae indicated higher levels of saturated fatty acids such as palmitic acid (C16:0). *Amphiroa rigida* was identified as the most promising source of ω3 fatty acid EPA, amongst all species investigated, and there is a possibility of using this alga as a good source of this essential fatty acid.

Keywords: macroalgae, saturated fatty acids, ω3 and ω6 fatty acids

Acknowledgment
We would like to thank Croatian Government and the European Union through the European Regional Development Fund - the Competitiveness and Cohesion Operational Programme (KK.01.1.1.01) for funding The Scientific Centre of Excellence for Marine Bioprospecting - BioProCro.

EKSTRAKCIJA BOBICA MIRTE (*Myrtus communis* L.) SUPERKRITIČNIM CO_2

EXTRACTION OF MYRTLE (*Myrtus communis* L.) BERRIES WITH SUPERCRITICAL CO_2

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postersko priopćenje / *poster presentation*

Mirta (*Myrtus communis* L.) je višegodišnji samonikli grm koji raste na području Mediterana te je od davnina poznat po svojim blagotvornim terapeutskim učincima na organizam, posebice u liječenju probavnih (dijareja), dišnih (astma) i dermatoloških tegoba (psorijaza). Isto tako, bobice mirte koriste se u proizvodnji likera, a samljeveni listovi i u kulinarske svrhe tj. kao začin. Najznačajniji spojevi koji se nalaze u listovima mirte su fenolni spojevi, flavonoidi, tanini i monoterpenoidi dok su bobice dobar izvor antocijana i masnih kiselina. Ekstrakcija takvih spojeva se u novije vrijeme provodi alternativnim tehnikama koje reduciraju upotrebu otapala ili ih uopće ne koriste, ekološki su prihvatljive te su ekonomski dugoročno isplative. Jedna od njih je ekstrakcija superkritičnim CO_2 pomoću koje je provedena izolacija bioaktivnih molekula iz bobica mirte. U ovom istraživanju, prema Box-Behnken dizajnu eksperimenta sa 17 pokusa i 5 ponavljanja u centralnoj točki, provedena je optimizacija procesa ekstrakcije. GC-MS analizom identificirano je 18 hlapljivih spojeva od kojih su dominantni bili mirtenil-acetat, 1,8-cineol i α-pinen. Analiza varijance pokazala je značajan utjecaj temperature, tlaka i protoka CO_2 na iskorištenje ekstrakcije i udjele pojedinih sastavnica. Definirani su uvjeti u kojima se postiže maksimalno iskorištenje ekstrakcije i najviši udjeli dominantnih hlapljivih spojeva – temperatura od 60 °C, tlak od 200 bara i protok CO_2 od 40 g/min.

Ključne riječi: Myrtus communis L., superkritični CO_2, GC-MS, hlapljivi spojevi, optimizacija

Keywords: Myrtus communis L., supercritical CO_2, GC-MS, volatile compounds, optimization

KEMIJSKI SASTAV I ANTIOKSIDATIVNA AKTIVNOST VODENO-ETANOLNIH EKSTRAKATA MASLAČKA (*Taraxacum officinale*)

CHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY OF WATER-ETHANOL EXTRACTS OF DANDELION (*Taraxacum officinale*)

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postersko priopćenje */ poster presentation*

Maslačak ili *Taraxacum officinale* poznata je ljekovita biljka koja je izvor različitih hranjivih i biološki aktivnih sastojaka, a upravo se polifenolni spojevi smatraju odgovornima za visoku biološku aktivnost maslačka te njegovo antioksidacijsko, protuupalno i antitumorsko djelovanje. Vodeno-etanolni ekstrakti dobiveni su primjenom različitih tehnika ekstrakcije, maceracija na sobnoj temperaturi i temperaturi ključanja, ultrazvučna i Soxhlet ekstrakcija. U ovom istraživanju analizirani su svi dijelovi biljke, korijenje, lišće, stabljike, cvijeće u svježem stanju. Utvrđen je sadržaj mineralnih elemenata biljke pomoću AAS, antioksidativna aktivnost DPPH (2,2-difenil-1-pikril hidrazil) i FRAP (engl. Ferric Reducing/Antioxidant Power) metodom, a flavonoidi (metoda s $AlCl_3$), vitamin C, karoten i klorofil određeni su spektrofotometrijski. Sadržaj ukupnih fenola određen je metodom po Folin-Ciocalteau. Sadržaj fenolnih spojeva veći je u vanjskim dijelovima biljke, u cvjetovima i listovima nego u korijenu. Najveću antioksidativnu aktivnost imao je vodeno-etanolni ekstrakt dobiven primjenom Soxlet ekstrakcije.

Ključne riječi: antioksidativna aktivnost, DPPH, ekstrakcija, FRAP, *Taraxacum officinale*

Keywords: antioxidant activity, DPPH, extraction, FRAP, *Taraxacum officinale*

PHYTOCHEMICAL ANALYSIS OF MISTLETOE (*Viscum album* L.) BY FTIR SPECTROSCOPY

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poster presentation

The use of *Viscum album* as a remedy has ancient tradition in treating various diseases. The cytotoxic and immunomodulatory properties of different *Viscum album* preparations have been intensively studied in the last years. Besides antitumoral and quality of life–promoting activities *Viscum album* applications reduce side effects of conventional anticancer therapies. Chemical properties of *Viscum album* could be influenced by factors like type of host, geographical locations, mistletoe harvesting season, freshenes of plant (fresh mistletoe/comercial tea pruducts/ dried fresh mistletoe, etc.). Information regarding the functional group presence in different mistletoe comercial products like teas and fresh leaves from the continental and coastal part of Croatia is lacking. We hypotheise that data obtained by FTIR spectroscopy will show a high correlation with the elemental composition of mistletoe samples. The FTIR spectra of the eight samples showed distinct features that enabled their discrimination through Principal Componenent Analysis (PCA) models with high accuracy. Regardless of the type of the sample, PCA showed that the location of a sample has substantial influence on the obtained FTIR results, so it is possible to distinguish the FTIR spectra of continental from coastal samples, as well as samples from eastern part of Croatia from those from central Croatia.

Keywords: *Viscum album*, FTIR, PCA, Croatia

PROGRAM PRAĆENJA GENETSKI MODIFICIRANIH ORGANIZAMA NA TRŽIŠTU REPUBLIKE HRVATSKE: PRIMJER SOJE

MONITORING PROGRAM FOR GENETICALLY MODIFIED ORGANISMS ON THE CROATIAN MARKET: AN EXAMPLE OF SOYBEAN

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usmeno priopćenje / *oral presentation*

Na svjetskoj razini približno je 190 milijuna hektara zasijano različitim GM kulturama od kojih gotovo polovicu čini uzgoj GM soje. Ovo čini soju poljoprivrednom kulturom najvišeg rizika, te su u skladu sa nacionalnim politikama službene kontrole i monitoring najvećim dijelom usmjereni na kontrolu i praćenje prisutnosti genetskih modifikacija u soji sa naglaskom na sjemensku proizvodnju.
Analize sjemena za potrebe službenih kontrola provode se u ovlaštenom nacionalnom referentnom laboratoriju za kontrolu i praćenje genetski modificiranih organizama u sjemenu hrani i hrani za životinje, Hrvatske agencije za poljoprivredu i hranu. Uzorci se analiziraju RealTime PCR metodom koja podrazumijeva amplifikaciju specifičnog odsječka DNA upotrebom termostabilnog enzima polimeraze omogućavajući eksponencijalno umnažanje produkta, dok fluorescirajuća proba omogućava mjerenje produkta u stvarnom vremenu mjereći fluorescirajući signal. RealTime PCR metoda je metoda velike osjetljivosti i specifičnosti, omogućava detekciju odsječka DNA od interesa na samom mjestu umetanja i uspješno se primjenjuje na svim tipovima uzoraka.
U periodu od 2015. do 2020. godine u sustavima službenih kontrola ukupno je analizirano 3699 uzoraka sjemena i zelene mase na kojima je provedeno približno 15000 PCR analiza. Ovakav sveobuhvatan pristup omogućuje sagledavanje stvarnog stanja hrvatskog tržišta i proizvodnje sjemena za koju se očekuje da je u potpunosti bez prisustva genetski modificiranih organizama.

Ključne riječi: monitoring, RealTime PCR, GMO, NRL

Keywords: monitoring, RealTime PCR, GMO, NRL

DETERMINATION OF POLYPHENOLS BIOACCESSBILITY BY *IN VITRO* GASTROINTESTINAL DIGESTION OF APPLE PEEL

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poster presentation

Bioaccessible polyphenols represent polyphenols that are released from the food matrix during digestion and become available for absorption. This work aimed to determine the bioaccessible polyphenols from the peel of commercial apple variety 'Idared' throughout oral, gastric, and intestinal simulated digestion. Polyphenols were extracted by the means of chemical and enzymatic extraction. *In vitro* gastrointestinal digestion of the peel of apples was conducted. Polyphenols present in the extracts and oral, gastric, and intestinal digest were identified and quantified with the use of high-performance liquid chromatography. The amount of polyphenols released during the simulated digestion was lower than the one present in the extracts. Polyphenols bioaccessibility, expressed as a percentage of initial polyphenol concentrations, was 29%, 43%, and 23% for oral, gastric, and intestinal phases, respectively. Flavonols showed to be the most stable group with the intestinal recovery of 38%, followed by phenolic acids (11%) and dihydrochalcones (8%). Flavan-3-ols and anthocyanins were not found in the intestinal phase. These results suggest that polyphenols are released from the peel of apples during digestion and that the amount decreases in the intestines.

Keywords: polyphenols, bioaccessiblity, simulated digestion, apples

PHENOLIC PROFILE AND ANTIOXIDANT ACTIVITY OF REVERSE OSMOSIS CONCENTRATES OF CONVENTIONAL AND ECOLOGICAL CABERNET SAUVIGNON RED WINE

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poster presentation

Red wine polyphenols are responsible for its colour, astringency and bitterness. They are known as strong antioxidants that protect human body from harmful effects of free radicals and prevent various diseases. Wine phenolics are influenced by viticulture methods and vinification techniques and therefore, conventionally and ecologically produced wines of same variety do not have the same phenolic profile. Ecological viticulture avoids the use of chemical adjuvants in vineyards in order to minimize their negative influence on environment, wine and human health. Phenolic profile and antioxidant activity of wine can also be influenced by additional treatments, such as concentration by reverse osmosis. The aim of this study was to investigate the influence of four different pressures (2.5, 3.5, 4.5 and 5.5 MPa) and two temperature regimes (with and without cooling) on phenolic profile and antioxidant activity of conventional and ecological Cabernet Sauvignon red wine during concentration by reverse osmosis. The results showed that individual phenolic compounds retention depended on applied processing parameters, chemical composition of initial wine and chemical properties of a compound. Higher pressure and retentate cooling favoured the retention of total polyphenols, flavonoids and monomeric anthocyanins, comparing to the opposite conditions. Same trend was observed for antioxidant activity.

Keywords: phenolic compounds, antioxidant activity, conventional and ecological red wine, reverse osmosis, retention

DEVELOPMENT OF NEW MICROFLUIDIC METHODS FOR AMINO ACIDS AND PEPTIDES DETECTION IN DIETARY SUPPLEMENTS

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oral presentation

In modern nutrition research amino acids and peptides have a broad potential therapeutic applications, and are used as supplements or as functional food ingredients. β-alanine, L-histidine and carnosine are commonly used in the form of dietary supplements. Carnosine is dipeptide produced by condensation of β-alanine and L-histidine which is the reason these two amino acids are often used simultaneously. Standard methods for analysis of amino acid and peptides have a number of disadvantages. They are expensive, complex and time consuming. Microchip electrophoresis evolved from capillary electrophoresis with purpose of reducing the time and cost of analysis, the amount of reagents, samples and waste. During the study various parameters was investigated to provide high resolution and to optimize the separation. A key point was to optimize the separation buffer in order to avoid overlapping of the amino acids with the other constituents in the analysed sample. Linear response region for all three analytes was determined using linear regression. Detection limits were below 1 mg/mL. Proposed microfluidic methods are environmentally friendly and offer great promises for routine multi-analyte pharmaceuticals analyses.

Keywords: amino acids, dietary supplements, microchip electrophoresis, microfluidics, peptides

INFLUENCE OF HIGH VOLTAGE ELECTRICAL DISCHARGE AND PULSED ELECTRIC FIELD ON THE ACETYLATION OF ANNEALED POTATO STARCH

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poster presentation

The aim of this study was to investigate the effect of the application of high voltage electric discharge and pulsed electric field for the acetylation of annealed potato starch. Acetylation of starch was carried out with the addition of acetic anhydride (4, 6 and 8 % w/w starch), and modification without and in combination with high electric discharge or pulsed electric field was examined. In the obtained modified starches percent of acetylation and degree of substitution, swelling power and solubility index, the texture of starch gels and thermophysical properties were determined.

The obtained results showed that in all modified annealed potato starches, percent of acetylation and degree of substitution increased proportionally to the concentration of acetic anhydride. With acetylation, the gelatinization temperature decreased, while swelling capacity and solubility index increased. The hardness, fracturability and adhesiveness of annealed starch gels were reduced by acetylation, and the effect was more pronounced when acetylation was combined with high voltage electric discharge or pulsed electric field compared to the classical acetylation procedure.

Keywords: annealed potato starch, acetylation, high voltage electric discharge, pulsed electric field, physical properties

ELECTROCHEMICAL CHARACTERIZATION OF GALLIC ACID

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poster presentation

Gallic acid (3,4,5 trihydroxybenzoic acid) is a polyphenol, known for its strong anticancer, antioxidant, anti-inflammatory and antimutagenic properties. Additional advantage of selective cytotoxicity for cancerous cells, makes gallic acid important additive in food to prevent cancer risks. It can be abudantly found, in different plants and foodstuff, especially in honey, gallnuts, mango, oak bark and pomegranate. The main goal of this study was to detect gallic acid in model systems and real samples (tea, liquer and wine) with differential pulse voltammetry.
Electrochemical research was performed in a three electrode voltammetric cell with working gold electrode, reference Ag/AgCl electrode and platinum wire counter electrode. Before each measurement the surface of working electrode was polished with *a*-Al_2O_3 powder (particle size 0.05 mm) and the system was purged with high purity argon Ar5 (f_{Ar} = 99.999 %).
Differential pulse voltammogram has shown two oxidation peaks which correspond to oxidation of gallic acid. It was also determined that the anodic peak current of gallic acid increases with the increase of its concentration (linear response was obtained in the concentration range from 1 mM to 67 mM). Gallic acid was detected in real samples where its quantity varied from 0.4 mM to 36 mM.

Keywords: gallic acid, differential pulse voltammetry, detection, real samples

PROXIMATE ANALYSIS OF SELECTED AGRO-FOOD INDUSTRIAL WASTES: EGGSHELLS, SPENT COFFEE GROUNDS AND BROWN ONION SKINS

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poster presentation

The agro-food industry generates a vast amount of residues (wastes) every year due to its own constant growth as a number of population is in increasing. Food loss and industry food waste has become an issue of great public concern. Among many types of food wastes eggshells, spent coffee grounds and brown onion skins stand out by their low reusability. Most of these wastes end up in the environment, which is a devastating fact since, according to literature-available data on chemical composition represent high-value material that can be used as secondary feedstock. The eggshells is rich in calcium, while spent coffee grounds and brown onion skins have high content of cellulose, hemicellulose, and valuable bioactive components. The aim of this work was to evaluate the chemical composition of these agro-industrial wastes and point out their possible utilization in vary industries for production of different value added products and eventually as a potential candidates for biorafinery concept.

Keywords: eggshells, spent coffee grounds, brown onion skins, chemical composition, value added products

Acknowledgment
This work has been fully supported by Croatian Science Fundation under the project IP-2020-02-6878.

DIFFERENCES IN GLUTEN PROTEINS CONTENT BETWEEN SOME HISTORICAL AND MODERN WHEAT CULTIVARS (*Triticum aestivum* L.)

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poster presentation

It is well established that bread-making quality of wheat is mostly related to the gluten proteins composition and quantity and at the same time, some of these proteins are responsible for human health problems. The wheat gluten proteins are classified according to electrophoretic mobility into monomeric gliadins (GLI) (α-, γ- and ω-) and polymeric glutenins (GLU) (low molecular weight (LMW-GS) and high molecular weight glutenin subunits (HMW-GS)). Six common wheat cultivars grown at the Agricultural Institute Osijek were subdivided into two groups (historical and modern ones release before and after the late 60s) and evaluated during two consecutive years. On average, the very similar protein and wet gluten content were found between historical and modern cultivars (14.3% vs. 14.2% and 27.0 % and 26.5%, respectively), while the more significant differences have found for gluten index (84 vs. 92) and sedimentation values (27 cm^3 vs. 36 cm^3) as good indicators of gluten strength. Considering gluten proteins a significant decrease in expression of α-GLI (27.1% vs. 28.8%) and γ-GLI (15.7% vs. 18.7%) as major trigger of coeliac disease was observed in modern cultivars, while ω-GLI with highly immunogenic potential (6.7% vs. 5.6%) was increased. The obtained better technological properties of modern cultivars were correlated with an increase of glutenins sub-fractions HMW-GS (10.6% vs 9.4%) and LMW-GS (22.9% vs. 19.1%) and consequently reducing the GLI/GLU ratio (1.48 vs 1.90).

Keywords: wheat, cultivars, gluten proteins, RP-HPLC

SEA BUCKTHORN BERRIES AS A VALUABLE SOURCE OF LIPOPHILIC AND HYDROPHILIC BIOACTIVE COMPOUNDS

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oral presentation

Sea buckthorn or sea berry (*Hippophae rhamnoides* L.; *Elaeagnus rhamnoides* L.) (SB) berries contain a wide spectrum of lipophilic and hydrophilic bioactive molecules which possess nutritional and health-promoting properties. Therefore, the aim of this study was to evaluate the content of carotenoids, fatty acids, phenolics, α-tocopherol and L-ascorbic acid in SB berries grown in Croatia. Lipophilic and hydrophilic extracts were obtained by ultrasound-assisted extraction with n-hexane (lipophilic) or 70% ethanol (v/v) (hydrophilic), and analyzed using liquid and gas chromatography. Results showed that analyzed SB extracts were characterized with high content of ascorbic acid (123.89 mg/100 g dw), carotenoids (53.93 mg/100 g dw), flavonoids (50.87 mg/100 g dw) and α-tocopherol (29.85 mg/100 g dw). Moreover, high amounts of unsaturated fatty acids, such as omega-7 palmitoleic fatty acid (34.54%) and omega-6 γ-linolenic acid (10.78%) were also determined. Carotenoids were mainly represented by lutein and zeaxanthin fatty acid esters (35.02 and 15.13 mg/100 g dw), respectively. Among the flavonoids, the most abundant were flavanol glycosides (25.06 mg/100 g dw) such as isorhamnetin-3-hexoside, rutin and isorhamnetin-3-rutinoside. SB berries certainly showed to be a rich source of various antioxidants and they could be used in the production of functional and value added products.

Keywords: sea buckthorn berry, lipophilic and hydrophilic bioactive molecules

VALIDATION OF HPLC-PDA METHOD FOR DETERMINATION OF POLYPHENOL PROFILE OF CROATIAN TRADITIONAL APPLE CULTIVARS

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poster presentation

Polyphenols are molecules with strong antioxidant activity that plants synthesize in response to stress conditions. Apple cultivars containing higher levels of polyphenols, procyanidins, dihydrochalcones, flavan-3-ols, flavonols, and phenolic acids, are more resistant to blue mould caused by *P. expansum.* Furthermore, apple polyphenols are involved in the response to patulin contamination, as they neutralize the free radicals induced by patulin. For this reason, a HPLC method was established, optimized, and validated for the separation and quantitation of 19 polyphenols extracted from the Croatian traditional apple cultivars. A reversed-phase C18 column was used as stationary phase, and an acidified water and methanol were used as mobile phase. The polyphenols were detected using a photo-diode array detector (PDA) at 280, 320, 360 and 520 nm. For the evaluation of fitness for purpose, linearity, trueness and precision were determined and all validation parameters were acceptable for all determined polyphenols. Identification of the separated components was performed based on the retention time and comparison of the absorption spectra of the components in the apple extract with the spectra of the standards, while the quantification of the components was performed based on the external calibration method. The method was successfully applied for simultaneous analysis of procyanidins, dihydrochalcones, flavan-3-ols, flavonols, and phenolic acids from Croatian traditional apple cultivars.

Keywords: polyphenols, HPLC, validation, Croatian traditional apple cultivars

Acknowledgment
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HLAPLJIVI SPOJEVI PIVA

VOLATILE COMPOUNDS OF BEER

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postersko priopćenje / *poster presentation*

U ovom radu analiziran je kemijski sastav hlapljivih spojeva komercijalnih piva, pivskih stilova: *pale lager*, *dunkel*, *pale ale* i *hefeweizen*. Hlapljivi spojevi izolirani su metodom mikroekstrakcije vršnih para na krutoj fazi (SPME) korištenjem dva različita vlakna te su analizirani vezanim sustavom plinska kromatografija–spektrometrija masa (GC-MS). Identificirani spojevi mogu se svrstati u sljedeće kemijske skupine: alkoholi, esteri, terpeni i karbonilni spojevi.

Ključne riječi: pivo, hlapljivi spojevi, SPME, GC-MS

Keywords: beer, volatile compounds, SPME, GC-MS

SENSORY ANALYSIS AND AFFECTIVE TESTS IN ASSESSMENT OF HONEY

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poster presentation

Different types of honey; honeydew, acacia, linden, floral and sage, were sensory evaluated by consumers (N = 70) and expert sensory analysts (N = 5). Samples of all of the honey types were collected directly from the local producers and also in retail chains. Preference of consumers (N = 70) for different types of honey samples, assessed by affective acceptance and preference tests, was compared with the results of sensory analyses conducted by expert sensory analysts. Sage honey and honeydew honey from the retail chains, which achieved the highest levels of liking according to the results of consumer preference assessment (N = 70) are more preferred over the same types of samples purchased directly from the beekeepers. Floral honey purchased directly from the producer has achieved the lowest levels of likes by consumers and is less preferred compared to floral honey purchased in retail chains. Unlike consumers, expert sensory analysts (N = 5) give the highest scores for most sensory properties to honey samples purchased directly from the beekeepers, especially in the case of honeydew honey and linden honey. Among the honey samples purchased in retail chains, expert sensory analysts give high scores only to acacia honey.

Keywords: acceptance test, affective tests, honey, preference test, sensory analysis

FATTY ACIDS AND MINERAL COMPOSITION OF DIFFERENT TYPES OF NUTS

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poster presentation

Nuts have been valued since historical times due to their high oil content. They are an important source of nutrients and energy because they contain a large proportion of protein, vitamins, fiber and minerals. Also, they contain a significant proportion of unsaturated fatty acids, therefore they have a positive effect on health. It is used daily as a food supplement or as a snack product. In order to be used as such in the diet, before use, they must meet several quality criteria, and for this purpose, research is being conducted to determine the properties and composition of nuts. The chemical composition of nuts varies greatly from species to species depending on botanical affiliation, genetic characteristics, harvest season, origin, degree of ripeness, method and area of cultivation of which the most important characteristics are climate and soil composition. The aim of this study is to determine the total lipid content, fatty acid and mineral composition of the most commonly consumed nuts and examine dietary habits of a certain population regarding the consumption of nuts.

Keywords: nuts, health, fatty acids, mineral composition

ASSESSMENT OF VIRGIN OLIVE OIL THERMAL OXIDATION BY DIFFERENTIAL SCANNING CALORIMETRY AND ELECTRON SPIN RESONANCE

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poster presentation

Extra virgin olive oil (EVOO), a pillar of the Mediterranean diet, is resistant to oxidative deterioration due to its triacylglycerol composition and high antioxidant content. On the other hand, the free fatty acids and photosensitizers present may act as prooxidants and reduce its stability. Both effects influence the shelf life of EVVO, i.e., the time during which EVOO remains free of off-flavors or defects and its quality parameters remain within limits. Since a real-time determination of shelf life is not possible and existing accelerated testing methods are limited by expensive and highly specialized equipment, innovative techniques to develop accurate shelf-life prediction models are being investigated. Therefore, the objective of this study was to evaluate the feasibility of using differential scanning calorimetry (DSC) and electron spin resonance (ESR) in assessing the deterioration of EVOO during accelerated oxidation in the oven. A portion of EVOO oil was heated at 98 °C for 24 hours during which samples (0, 2, 4, 8, 16 and 24 hours) were collected. Heating of EVOO caused the shift of crystallization peak to lower temperatures and a decrease in radical scavenging activity towards 1,1-diphenyl-2-picrylhydrazyl (DPPH), which were correlated with the increase in peroxide levels and ultraviolet spectrophotometric parameters.

Keywords: extra virgin olive oil, oxidation, DSC, ESR

DETERMINATION OF TOTAL PHENOLIC CONTENT, ANTIMICROBIAL AND ANTIOXIDANT ACTIVITY OF GRAPE SKIN EXTRACTS FROM TEN ARMENIAN GRAPE VARIETIES FROM ARARAT VALLEY AND SYUNIQ REGION

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poster presentation

The grapevine (*Vitis vinifera* L.) is a phenol-rich plant, and the phenolics are mainly distributed in the skin and seed of grape which show a great ability of antioxidant, antibacterial and antifungal activities. Armenia is characterized by a distinctive habitat and a very long tradition of grape growing and high-quality winemaking. Therefore, the aim of this study was to evaluate the total phenolic content, antibacterial and antioxidant properties of ten autochthonous Armenian varieties, with different genetic background and geographic origin. Obtained results have revealed a notable difference among the varieties. A positive correlation was found between total phenol content and antioxidant activity which confirms that phenolic groups are highly responsible for the antioxidant activity of selected grape skins extracts. The highest total phenol content (45.84 mg GAE/g skin) and the highest antioxidant activity (93.37%) were recorded in the red variety Karmrashat. The red variety Armenia showed the highest antibacterial activity against human pathogenic bacteria, especially against gram-positive *B. subtilis* and gram-negative *E. coli.*

Keywords: Armenian grape varieties, total phenolic content, antioxidant activity, antibacterial activity

PHENOLIC COMPOSITION AND ANTIOXIDANT ACTIVITY OF MINT (*Mentha spp.*) HONEY

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poster presentation

The composition of honey is influenced by the botanical source and geographical area of the nectar from which it is derived. Unifloral honeys reach higher market values than multifloral ones due to their specific and reproducible aromas, which result from volatile and phenolic compounds. The aim of our study was to characterize the phenolic composition of a rare unfloral variety of honey- *Mentha spp*. honey. To date, only the volatile fraction of *Mentha spp.* honey has been analysed, and the detailed phenolic composition of these honeys remains unknown. Our results indicate that *Mentha spp*. honeyhas high phenolic content, ranging from 76.66 ± 0.56 to 121.14 ± 3.81 mg GAE eq phenols/100 g and 6.70 ± 0.62 to 17.10 ± 0.68 mg QUE eq flavonoids/100 g. These honeys also exhibit strong antioxidant activity ranging from 33.58 ± 2.80 to 57.86 ± 1.24 mg Trolox eq/100 g and 14.37 ± 0.85 to 57.83 ± 0.18 mg Trolox eq/100 g when analysed using DPPH and ABTS assays, respectively. Quantitative LC-MS/MS analysis revealed that the most abundant phenols in all samples were chrysin, apigenin and *p*-coumaric acid. Qualitative LC-MS/MS analysis identified the presence of kaempferide, diosmetin, acacetin and several caffeic acid derivatives. Our study indicates that *Mentha spp*. honeys contain unique phenolic profiles, which likely contribute to their distinctive aroma and strong antioxidant activity.

Keywords: *Mentha spp.* honey, antioxidant activity, LC-MS/MS, phenols, phenolic profiling

SURFACE MOULDS AFFECTING THE SENSORY PROPERTIES OF TRADITIONAL CROATIAN DRY-CURED HAMS

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poster presentation

Moulds play an important role in the production of dry-cured hams by affecting the sensory properties of the final product due to their enzymatic and antioxidant activity. The aim of this study was to identify surface moulds overgrowing the surface of 35 samples of Croatian protected homemade dry-cured hams "Istarski pršut" and "Dalmatinski pršut", produced in a traditional manner in 2018/2019, and to determine mould influence on sensory properties of the products. Surface moulds were isolated and identified using mycological and molecular methods. A total of 6 *Penicillium* and 6 *Aspergillus* species, mostly *A. proliferans, P. citrinum* and *A. chevalieri*, were recovered. On "Dalmatinski pršut" surfaces, *Aspergillus* species were found in higher percentages and showed greater variability. Due to the differences between the production areas and technologies, the sensory analysis uncovered significant variations in 9 out of 19 sensory parameters analysed. A more pronounced tenderness and juiciness of, and higher tyrosine crystals' content in "Dalmatinski pršut" samples, can be linked to the higher proteolytic activities of mould species populating their surface. Principal component analysis (PCA) showed that moulds represent a significant source of information needed for better dry-cured hams' characterization.

Keywords: meat products, "pršut", sensory evaluation, *Aspergillus*, *Penicillium*

FATTY ACIDS COMPOSITION OF MONOFLORAL BEE POLLEN

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poster presentation

The composition and amount of fatty acids in diet are important for both, the bees community and humans. Considering that the chemical composition of bee pollen is strongly related to botanical origin, and that the vegetation is specific to a particular geographical area, the aim of this study was to collect samples of unifloral bee pollen from different locations in Croatia and examine specifics of fatty acids composition, and the influence botanical origin on bee pollen fatty acid composition. Bee pollen samples were collected in the period from April 1 to June 15, 2019. After sorting pollen load by colour and qualitative melissopalynological analysis, seven monofloral samples were selected. A total of 25 fatty acids (from C12 to C24) were identified with a significant difference in their proportions in the samples. n-3 fatty acids are most prevalent in *Aesculus hipposcantum* bee pollen (49.11%) and least present in *Quercus pubescens* (13.12%). The proportion of n-6 fatty acids in the samples ranged between 14.40% in *A. hipposcantum* bee pollen to 38.28% in *Salix* spp. bee pollen. Palmitic acid was the dominant saturated fatty acid in most analysed samples, ranged from 14.78% in *Salix* spp. pollen to 32.70% in *Q. pubescens* pollen. Exception is *Taraxacum officinale* pollen where pentadecanoic acid (19.75%) was dominant while its content in other bee pollen samples was below 5%. Odd-chain fatty acids, pentadecanoic (C15:0) and heptadecanoic acid (C17:0), are present in small amounts in dairy fat, some fish and plants and have been associated with lower risks of cardiovascular disease, adiposity, type 2 diabetes and many other diseases. Therefore, their finding in some species of bee pollen is a strong motivation for further research.

Keywords: monofloral bee pollen, composition, fatty acids

ESSENTIAL OILS IN WILD ISTRIAN FENNEL (*Foeniculum vulgare* Mill.): VARIABILITY IN THE CONTENT AND COMPOSITION

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poster presentation

Fennel (*Foeniculum vulgare* Mill.) is a ubiquitous member of the Apiaceae family whose fruits (seeds) are used extensively as flavoring agents in food, cosmetic and pharmaceutical products. Fennel seeds are rich in essential oils (EO), the content and composition of which may vary according to geographical origin. Therefore, this study aimed to evaluate EO variation in wild fennel seeds collected from five natural habitats located in Istria region (Croatia): Poreč, Pula, Plomin, Raša and Vodnjan. For this purpose, dry mature fennel seeds were subjected to hydrodistillation and the obtained EO were evaluated by GC-MS analysis. All obtained results were statistically analyzed. The samples differed significantly according to the EO yield, which ranged from 4.90 (Plomin) to 6.30% (Pula). A total of 20 volatiles were identified and quantified: α-pinene, camphene, sabinene, β-pinene, myrcene, α-phellandrene, α-terpinene, *p*-cymene, D-limonene, eucalyptol, γ-terpinene, *cis*-sabinene hydrate, L-fenchone, linalool, camphor, α-terpineol, estragole, carvone, *p*-anisaldehyde and *trans*-anethole. Despite significant differences among samples, phenylpropanoids dominated in all samples (71.33-77.31%), followed by oxygenated monoterpenes (14.40-18.32%) and monoterpene hydrocarbons (7.48-12.02%). *Trans*-anethole (15.57-70.94%), estragole (6.18-55.89%) and L-fenchone (11.60-16.85%) were the major constituents, while α-pinene, myrcene and D-limonene were present in lower but noticeable amounts (1.85-3.78, 1.66-2.63 and 1.04-1.57%, respectively).

Keywords: fennel, essential oils, GC-MS, phenylpropanoids, terpenes

CHEMICAL COMPOSITION OF BERRY FRUITS

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poster presentation

Berries are fruits that are very well known and recognized for its sweet taste and colour that variates from red to blue or black. They have different chemical composition and numerous healthy properties. Because its possible positive health impact insufficiently researched berries for consumption are increasingly being explored. The purpose of this work was to compare basic fruit chemical composition of three berries grown as wild plants, two of which are poorly researched. Used were 35 samples of bilberries (*Vaccinium myrtillus* L.) from different locations in Gorski kotar; 21 samples of common juniper (*Juniperus communis* L.) from 7 different regions (Istra, Lika, Gorski kotar, Velebit, Northern Adriatic, Slavonia and Žumberak); and 63 samples of rowanberry (*Sorbus aucuparia* L.) from different locations in both Gorski kotar and Velebit, Republic of Croatia. Basic chemical composition of fruit including moisture, total ash, fibre total fat, crude protein, total sugar was determined. On average, bilberries showed the highest moisture content (87.01%) and the lowest content of ash (0.24%), fat (0.45%) and the crude protein (0.95%); while rowanberry showed the highest crude protein (2.93%) and the lowest total sugar (4.70%) content. Juniper berries showed the lowest moisture content (30.46%) and the highest content of ash (2.45%), total fat (8.22%) and total sugar (23.49%).

Keywords: berries, chemical composition, *Sorbus aucuparia* L., *Juniperus communis* L., *Vaccinium myrtillus* L.

UTJECAJ RAZLIČITIH OMJERA I VRSTA (*Coffea arabica* I *Coffea robusta*) NA SENZORNU OCJENU I PRIHVATLJIVOST NAPITKA OD KAVE

EFFECTS OF DIFFERENT TYPE AND RATIO (*Coffea arabica* AND *Coffea robusta*) TO SENSORY ASSESSMENT AND ACCEPTANCE OF COFFEE BEVERAGE

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postersko priopćenje / *poster presentation*

Kava spada u najpopularnije napitke širom svijeta. Na našim prostorima postoji duga tradicija konzumiranja napitka crne kave. Kava, kao i svaka namirnica, vrijednuje se osnovnim senzornim svojstvima (boja, miris, okus, konzistencija). Precizan opis arome, okusa i boje napitka crne kave, kao najvažnijih senzorskih svojstava, moguće je dati primjenom deskriptivne senzorske analize.
Cilj ovog rada bio je ispitati senzorsku kvalitetu i prihvatljivost mješavina napitaka crne kave pripremljenih na tradicionalan način. Za pripremanje napitka crne kave koristile su se dvije vrste kave, Arabika (sorte Rio Minas i Santos) i Robusta (sorte Sheery i Camerun) u različitom odnosu. Sudionici u senzorskom ocjenjivanju uzoraka kave bili su upućeni ocjenjivači i potrošači. Rezultati senzorskih svojstva ispitivanih uzoraka napitaka kave uglavnom su bila pod utjecajem vrste i omjera korištene kave. Miješanje kave Arabike i Robuste značajno je poboljšalo senzorska svojstva proizvoda, naročito mirisa i okusa. Rezultati instrumentalnih mjerenja boje pokazuju da su ispitivani uzorci kave tamno i srednje prženi. Test prihvatljivosti je pokazao dobru prihvatljivost uzoraka različitih napitaka crne kave od strane potencijalnih potrošača.

Ključne riječi: kava, Arabika, Robusta, senzorska analiza, boja

Keywords: coffee, *Arabica, Robusta,* sensory analysis, color

CHROMATOGRAFIC DETERMINATION OF BISPHENOL A IN BOTTLED WATER

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poster presentation

Bottled water may contain numerous toxins, like bisphenol A. These toxins can pass from the container into water. Bisphenol A is frequently used in the synthesis of epoxide resins. Its unreacted particle migrates into water and when consuming, those may cause numerous diseases and abnormalities in human bodies. Due to BPA-related negative impacts on human health, numerous plastics producing companies have decided to eliminate bisphenol A from the synthesis, but it is in general still used. For this reason, we developed useful methods of extraction of bisphenol A by solid phase extraction on Strata X and its quantitative analysis by liquid chromatography with UV detection. 15 samples of bottled water were analysed. 10 of them were purchased on Serbian and Bosnian market while 5 samples were from Slovene origin. Reverse phase isocratic elution was performed, and bisphenol A was detected at a wavelength of 210 nm. It was shown that the analysis of bisphenol A is very suitable for samples where the concentrations are above 1 mg/L. Bisphenol A is present in the package in extremely low concentrations and the results achieved were below the detection limits of the UV detector.

Keywords: bisphenol A, bottled water, plastic, liquid chromatography, ultraviolet light

IN VITRO AND *IN VIVO* ANTIOXIDANT POTENTIAL OF SWEET BASIL (*Ocimum basilicum* L.) EXTRACT

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poster presentation

Sweet basil (*Ocimum basilicum* L., *Lamiaceae*) exhibits strong antioxidant activity due to high content of phenolic and flavonoid compounds. The aim of this research was to examine the effects of pre-treatment with basil extract on acetaminophen-induced acute liver injury in rats. *In vitro* analysis of total phenolic, flavonoid content and antioxidant activity was perfored by spectrophotometric methods. Effects of basil extract on oxidative stress parameters in an *in vivo* model of acetaminophen-induced liver injury in Wistar rats. Basil extracts contain chlorogenic, p-hydroxybenzoic, caffeic, ferulic, vanilic, rosmarinic and cinnamic acid, rutin, quercetin, naringenin and epicatechin. Total phenolic content ranged from 0.53 to 118.19 mg GAE/g SE, and flavonoid content from 0.42 to 2.84 mg KE/g. IC_{50} values varied from 11.72-210.39 μg/mL for DPPH radical, 11.44-57.86 μg/mL for OH radical, 0.41-52.45 μg/mL for H_2O_2 and 1.41-46.99 μg/mL for lipid peroxidation. The extract lowered the intensity of lipid peroxidation and potentiated the activity of antioxidant enzymes, with statistically significant increase in catalase ($p<0.01$), glutathione reductase ($p<0.05$), glutathione transferase activities ($p<0.05$), except for glutathione peroxidase activity. The use of basil extract alleviates the acetaminophen induced changes in markers of oxidative stress and liver injury.

Keywords: sweet basil, free radicals, oxidative stress, antioxidant enzymes, acute liver injury

INFLUENCE OF GALLIC ACID ON CALCIUM OXALATE PRECIPITATION

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poster presentation

Gallic acid (GA) or 3,4,5-trihydroxybenzoic acid is a phenolic acid widely distributed in the plant kingdom. It consists of three hydroxyl groups and a carboxylic acid group attached to a benzene ring. The bonding of the hydroxyl groups in an ortho position results in a coplanar and bent configuration, which is favorable for antioxidative activities. GA is commonly used to prevent the oxidative damage that takes place in biomolecules. The main goal of this study was to observe the effect of gallic acid on calcium oxalate precipitation.

Calcium oxalates are calcium salts of oxalic acid and are the most common constituents of kidney stones. Calcium oxalates crystallize in three forms: calcium oxalate monohydrate (COM), calcium oxalate dihydrate (COD) and calcium oxalate trihydrate (COT).

The precipitation methods were based on the mixing of calcium and oxalate solutions which pH values have been previously adjusted to pH=6.50. The experiments took place inside a thermostated reactor with a capacity of 400 cm^3. The experiments were performed at two temperatures 25 °C and 48 °C. In this study, the influence of the phenolic acid addition was monitored, and the changes in the morphology, hydrate phase and reaction kinetics were observed.

Infrared spectroscopy (FT-IR), powder X-ray diffraction (PXRD) and thermogravimetric analysis (TGA) were used to characterize the presence of individual hydrate phase in the precipitated systems. The morphological characteristics were determined by a light microscope and scanning electron microscopy (SEM). The higher concentration of additive favors the formation of the COD, while the increase in the applied system temperature causes the formation of COT.

Keywords: gallic acid, calcium oxalate monohydrate, calcium oxalate dihydrate

DEVELOPMENT OF ELECTROCHEMICAL SENSORS FOR DETERMINATION OF VITAMIN C AND EVALUATION OF ANTIOXIDANT ACTIVITY

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poster presentation

It is known that carbon materials due to low ohmic resistance can significantly improve the electroanalytical properties of the sensing layers. Carbon materials also provide a variety of modification options that often have been used to develop highly sensitive sensors to investigate electrochemical properties and detect organic and inorganic compounds. The first goal of this work was to develop a simple electrochemical method for the determination of Vitamin C (VitC). The cyclic voltammetry was used to characterize microelectrodes and square wave voltammetry to quantify VitC. A procedure for quantifying VitC in the real sample is established. The second goal was to determine the effect of the addition of a different type of "green" biowaste on plant growth, VitC content, and antioxidant activity in arugula (*Eruca sativa L*) by using carbon microelectrode. The obtained results were compared with the standardized methods. After three weeks of cultivation, small differences in growth and large differences in certain nutritional characteristics were observed. The addition of peanut shell contributes to soil aeration and the fastest development of healthy and green *Eruca sativa* has been observed. The addition of black coffee makes the soil slightly alkaline and results in a significant increase in the VitC content and antioxidant activity.

Keywords: carbon microelectrodes, "green" biowaste, vitamin C, antioxidant activity

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PRODUCTION OF SAFE FOOD AND FOOD WITH ADDED NUTRITIONAL VALUE /

PROIZVODNJA ZDRAVSTVENO SIGURNE I NUTRITIVNO VRIJEDNE HRANE

UPOTREBA JESTIVIH FILMOVA I PREMAZA OD HIDROKOLOIDNIH POLIMERNIH MATERIJALA U PROIZVODNJI SIRA: PREGLEDNI RAD

THE USE OF EDIBLE FILMS AND COATINGS OF HYDROCOLLOID POLYMERIC MATERIALS IN CHEESE PRODUCTION: A REVIEW

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postersko priopćenje / *poster presentation*

Sir je namirnica specifičnih karakteristika i složenog sastava koja zavisi o mnogo faktora, uključujući korištene sirovine, tehnološki proces proizvodnje te uvjete i način skladištenja koji podrazumijeva održavanje hladnog lanca. Kvaliteta sira se lako može narušiti neadekvatnom ili oštećenom ambalažom te nepravilnom manipulacijom namirnice, što dovodi do razvoja novih materijala za pakiranje i oblaganje sira. Jedan od načina zaštite sira od štetnih fizičkih, kemijskih i bioloških utjecaja je upotreba hidrokoloidnih polimernih materijala. Materijali poput pektina, celuloze, škroba, kitozana, brašna sjemenki rogača, karagenana, alginata, agara i sl. se koriste za proizvodnju jestivih filmova i premaza na površini i između komponenti hrane. Tanki sloj materijala oblaže sir koji kontrolira migraciju vlage, plinova i lipida te sprječava prodor neželjenih mikroorganizama što neposredno utječe na produljenje roka trajanja sira, a istovremeno je siguran za konzumaciju. Osim toga, jestivi filmovi i premazi mogu postužiti i kao medij za inkorporaciju bioaktivnih spojeva koji osim svoje funkcionalne prirode, imaju i ulogu u povećanju nutritivnih svojstava sira koji mogu imati pozitivan utjecaj na zdravlje potrošača. U ovom radu su opisana dostignuća u pakiranju sireva upotrebom hidrokoloidnih polimernih materijala.

Ključne riječi: sir, jestivi filmovi, premazi, hidrokoloidni materijali

Keywords: cheese, edible films, coatings, hydrocolloid materials

THE TECHNOLOGY OF ICE CREAM BASED ON WHEY WITH FUNCTIONAL ADDITIVES

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poster presentation

One of the trends in the modern ice cream market is the production of low-calorie ice cream with functional additives. The existing shortage of milk resources leads to the use of by-products of the raw milk processing, in particular whey. The combination of plant and animal raw materials in ice cream recipes has been substantiated by numerous researchers. Plant supplements improve the organoleptic properties of ice cream, enrich its chemical composition with vitamins, carotenoids, bioflavonoids, improve the structure of ice cream and reduce its calorie content.
The technology of ice cream based on milk whey with plant additives has been developed. To develop a recipe-component solution for ice cream, two compositions with different functional additives were investigated. Pumpkin puree and apricot puree were used as functional additives.
The substantiation of the components content was carried out taking into account the organoleptic, physicochemical and rheological characteristics. The optimal dosage of the applied puree was recommended. At a dosage of 15% puree, the most favorable indicators of color, taste and aroma of ice cream are provided, as well as a whole range of physicochemical, physical and antioxidant properties of the product.

Keywords: ice cream, milk whey, functional additives, pumpkin, apricot

NON-DAIRY KEFIR BEVERAGES BASED ON APPLE JUICE WITH ADDITION OF FRESH APPLE PIECES

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poster presentation

Water kefir is a slightly acidic fermented beverage produced by the work of unique composition of water kefir microorganisms, known as water kefir grains. Unlike dairy kefir, the production of water kefir is based on sucrose solution as fermentation substrate. Fresh or dried fruits, juices and aromatic plants can be used in order to enrich the nutritional value of non-dairy beverages. Therefore, the aim of this study was to compare the suitability of diluted freshly made apple juice and apple juice bought in a local market for production of water kefirs in terms of physico-chemical and sensory properties. The influence of addition of chopped apple pieces in previously prepared fermentation medium, was also investigated.
In the case of water kefirs based on apple juices, the fermentation process at 24 °C took 24 h, but the recognizable aroma and refreshing carbonated taste were not achieved even after 72 h, in the case of water kefir sample with fresh apple pieces. Considering all physico-chemical and sensory properties of prepared water kefirs, it was concluded that water kefir based on apple juice bought in a local market had the most desirable fruity taste and optimal overall quality, compared to the other investigated samples.

Keywords: water kefir, fermentation process

ANTIGENOTOKSIČNI UČINAK EKSTRAKTA *Echinacea purpurea* IZAZVAN (PROUZROČEN) AFLATOKSINOM B_1 I OHRATOKSINOM A

ANTIGENOTOXIC EFFECT OF *Echinacea purpurea* EXTRACT INDUCED (CAUSED) BY AFLATOXIN B_1 AND OCHRATOXIN A

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postersko priopćenje / *poster presentation*

Biljni bioaktivni polifenoli su relativno dobro poznati po svojim antioksidativnim, antimutagenim, antikancerogenim, protuupalnim, antiangiogenim, antiulkusnim i antimikrobnim (baktericidnim, fungicidnim te antivirusnim) osobinama. Temeljem preliminarnih istraživanja antigenotoksičnosti ekstrakata različitih biljnih vrsta, uočeno je da one vrste koje su bogate polifenolima imaju značajan antigenotoksični učinak spriječavanjem oksidativnih oštećenja izazvanih citostaticima u kulturi ljudskih limfocita.
Ispitano je djelovanje vodenih i alkoholnih ekstrakata vrste *Echinacea purpurea* L. antigenotoksično u uvjetima *in vitro*. Rezultati pokazuju konkretan utjecaj vodenih i alkoholnih ekstrakata, kao i najdominantnijih sastavnica *E. purpurea*, te polifenola (tanina), nakon tretmana stanica mikotoksinima ohratoksinom A i aflatoksinom B_1.
Nadalje, ispitan je sadržaj polifenola u ekstratima vrsta *Echinacea purpurea* L. *Moench* te određen antioksidativni učinak ekstrakata primjenom elektronske spinske rezonancije i kolorimetrijske metode gašenja slobodnog radikala DPPH. Antioksidativna aktivnost ekstrakata bi mogla biti jedan od pokazatelja antigenotoksičnog učinka s obzirom na mogućnost nastanka oštećenja DNA djelovanjem slobodnih radikala. Antigenotoksični potencijal ekstrakata utvrđen je primjenom alkalnog kometnog testa na ljudskim leukocitima *ex situ*.

Ključne riječi: antioksidativna aktivnost, kometni test, *Echinacea purpurea*, genotoksičnost, polifenoli

Keywords: antioxidant activity, Comet assay, *Echinacea purpurea*, genotoxicity, polyphenols

PLANT BY-PRODUCTS REGULATIONS

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poster presentation

The food industry produces large quantities of by-products that may contain high-value compounds. Special attention is on by-products of plant origin due to their potential as a source of bioactive compounds, dietary fibers, fatty acids, proteins, etc. Pepper by-products are potentially interesting in this matter, due to the pepper great variety and numerous species grown in different regions worldwide, and consequently the products thereof.
Utilization of pepper by-products generated during industrial processing has potential for new product development.
However, processing of by-products into new ingredient or product and/or their application in a new products improving their functional or culinary value, addressing certain challenges on one side, but also pose an opportunity to promote a circular economy and sustainability to the consumers on the other side.
It is important to have a good understanding of the plant by-products regulations alongside the whole food chain, both in terms of food safety, as well as in clear communication on product labels and informing consumers about the nature and benefits of this type of food.
The aim of this paper is to provide an overview of the legislation and conditions that need to be met before placing on the market of an innovative pepper by-products ingredients and products thereof.

Keywords: by-products, food regulation, pepper, circular economy, sustainability

VOLATILE PROFILE OF CITRUS FIBER/BLACKBERRY JUICE FREEZE-DRIED COMPLEXES

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poster presentation

Flavor has a strong impact on food quality and therefore its preservation and controlled release are of great importance. In this study, citrus fibers were selected as carriers of blackberry juice flavor compounds and a freeze-drying method was applied to obtain dry complexes. Due to its proven health benefits (reduction of hypertension, obesity, etc), dietary fibers are an active field of research. Different amounts of fibers (1%, 2% and 4%) were used for preparation of complexes and their stability after eight months of storage was examined. Using gas chromatography-mass spectrometry analysis, in the pre-storage complexes, 32 flavor compounds were identified and quantified while 10 of them were lost during storage, in addition to the identification of 3 new ones. Most of flavor compounds were aldehydes and ketones (around 60%). Green and fatty notes were dominant, followed by citrus, floral and fruity notes. Concentration of total flavor compounds on complexes before storage was the highest on complex with 1% of fiber while during storage, changes occurred and complex with 4% of fiber had the highest total concentration of flavor compounds. These dry complexes could find their application in the food industry as flavoring agents for purpose of development novel, innovative foods.

Keywords: flavor, blackberry juice, citrus fibers, freeze-drying

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ENRICHMENT OF PECTIN-BASED BLACKBERRY HYDROGELS WITH APPLE FIBER

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poster presentation

Modern consumers search for food with health-promoting properties as the awareness of the link between diet and health is on the rise. Great deal of attention is being paid to polyphenols and their various sources in plant-based foods due to their antioxidant properties and other beneficial effects. The addition of apple fiber in the manufacturing of novel food products increases their dietary value and at the same time does not cause changes in general costs. Since bioactive compounds such as phenolics are unstable, hydrogels may be used as their delivery systems whose release may then be controlled. Consequently, we investigated pectin-based (low-methoxyl pectin and high-methoxyl pectin) hydrogels prepared from blackberry juice and enrichment with apple fiber (10%). It was observed that the addition of apple fiber had an effect on antioxidant activity (FRAP, CUPRAC, DPPH and ABTS assays), total phenolics, proanthocyanidins and color parameters (L*, a*, b*, °h, C*) of prepared hydrogels. Results obtained in this research showed that pectin-based hydrogels could be used for the efficient delivery of blackberry phenolics and apple fiber could serve as an ingredient with the potential to enhance the nutritive value of novel food products.

Keywords: hydrogels, apple fiber, blackberry, novel food

Acknowledgment
This work was supported by the Croatian Science Foundation under the project (IP-2019-04-5749) "Design, fabrication and testing of biopolymer gels as delivery systems for bioactive and volatile compounds in innovative functional foods (bioACTIVEgels)", and Young Researchers' Career Development Project-Training New Doctoral Students (DOK-2020-01-4205).

MICROENCAPSULATION OF GLUCOSYL-HESPERIDIN IN ALGINATE/CHITOSAN HYDROGEL BEADS

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poster presentation

Glucosyl-hesperidin is a water-soluble derivate of hesperidin. Both these derivates have many health-promoting properties such as antioxidant, anti-inflammatory and antimicrobial activities. However, the low water solubility of hesperidin disables its wide utilization in the food and pharmaceutical industry so glucosyl-hesperidin has an advantage concerning new product development. This study aimed to produce hydrogel beads filled with glucosyl-hesperidin using encapsulator (B-390, BUCHI). Beads were fabricated under the same operating conditions of the encapsulator (1000 µm nozzle, 500 mbar, 200 Hz, 1000 V) and obtained by dropping a mixture of glucosyl-hesperidin and alginate into different cross-linking solutions (calcium chloride or calcium chloride-chitosan) with different times of complexation (30 min or 90 min). The best retention ability of glucosyl-hesperidin had chitosan-alginate beads which were complexed for 30 min (590.93 mg/kg), while the lowest retention ability was observed for alginate beads with a complexation time of 30 min (409.94 mg/kg). Beads were stored for 7 days and the highest amount of glucosyl-hesperidin was detected in chitosan-alginate beads as after preparation. Formulated beads can be used for controlled release of glucosyl-hesperidin, but also for enhancement of antioxidant potential of food and pharmaceutical products.

Keywords: microencapsulation, glucosyl-hesperidin, beads, alginate, chitosan

Acknowledgment
This work was supported by the Croatian Science Foundation under the project (IP-2019-04-5749) "Design, fabrication and testing of biopolymer gels as delivery systems for bioactive and volatile compounds in innovative functional foods (bioACTIVEgels)", and Young Researchers' Career Development Project-Training New Doctoral Students (DOK-2020-01-4205).

ENCAPSULATION OF FLAVOR COMPOUNDS ON PLANT PROTEIN MATRICES

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poster presentation

Flavor compounds possess antifungal, antibacterial, antioxidant and anti-inflammatory activity. Being unstable, different matrices are utilized for their protection. In this study different amounts (5%, 10% and 20%) of pumpkin and almond protein matrices (approximately 50% of proteins) and constant amount of eugenol, cinnamaldehyde or α-ionone were used to produce complexes. Gas chromatography-mass spectrometry technique was applied to evaluate the concentration of flavor compounds on complexes after preparation and 3 months storage at room temperature. Type of protein and their amount had impact on the concentration of flavor compounds. Increased protein amount resulted in decreased concentration of volatile compounds after preparation and storage. It was observed that the concentration of α-ionone on both almond and pumpkin protein complexes was the highest, followed by eugenol and cinnamaldehyde. Pumpkin protein complexes had higher concentration of cinnamaldehyde (8.28 mg/kg) and eugenol (20.28 mg/kg) compared to almond protein complexes (7.07 mg/kg and 16.57 mg/kg, respectively). Concentration of α-ionone was higher on almond protein complexes (69.05 mg/kg) compared to pumpkin protein complexes (55.10 mg/kg). Proper formulation is important to achieve efficient delivery of flavors using plant proteins.

Keywords: flavor compounds, plant protein matrices, GC-MS

Acknowledgment
The work was part of PZS-2019-02-1595 project and it has been fully supported by the "Research Cooperability" Program of the Croatian Science Foundation funded by the European Union from the European Social Fund under the Operational Programme Efficient Human Resources 2014-2020.

FRESH-CUT POTATOES TREATED WITH FENNEL ESSENTIAL OIL: SHELF-LIFE DURING REFRIGERATED STORAGE

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poster presentation

The aim of this study was to investigate the effect of fennel essential oil (FEO) treatment on the shelf-life of fresh-cut potatoes (FCP). Peeled and sliced potatoes were immersed in the aqueous solution of various FEO levels (25, 125 and 250 mg/L) and water (control) for 15 minutes, subsequentely drained, packaged in vacuum and stored at 8 °C for 12 days. The CIELAB color parameters and aerobic mesophilic bacteria count (AMBC) of the raw FCP and sensory properties of the raw, boiled and fried samples were determined. AMBC decreased with increasing FEO level and generally this trend remained during storage. Slight negative changes in color were observed with increase of FEO content and with storage duration. The attributes of fennel taste and odor in raw and boiled potatoes increased with the increase of FEO, while FEO aroma was not pronounced after frying. Despite the antibacterial activity of FEO, spoilage of FCP was not prevented during storage. In general, after 6 days, the best results were obtained in terms of the absence of browning and off-odor of raw and off-taste and sour taste of boiled and fried FCP with 25 mg/L FEO treatment.

Keywords: fresh-cut potato, fennel essential oil, aerobic mesophilic bacteria, sensory, boiled and fried potato

THE EFFECT OF PUMPKIN SEEDS ADDITION ON THE CHARACTERISTICS OF CREAM CHEESE

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poster presentation

Pumpkin seeds contain various bioactive components that promote human health. Cream cheese is a very popular dairy product often enriched with various additives. The aim of this study was to determine the effects of different proportions (5 and 10 g/100 g), roasting level (light to dark) and grinding degree (fine to coarse) of added pumpkin seeds on the cheese spread quality. The basic chemical composition of the samples was tested using NIR spectroscopy, colour by spectrocolorimetric (*L*a*b** colorimetric system), spreadability using a texture analyser, acceptability of the product using a hedonic scale, and the intensity of the individual property by the JAR test. Roasting of pumpkin seeds increased the spreadability of the product and had a positive effect on the flavour of the product. The highest rated samples were those with added roasted pumpkin seeds with a higher degree of milling. Based on the results, the optimal proportion of additive and the optimum degree of roasting and grinding of the pumpkin seeds were determined.

Keywords: cream cheese spread, pumpkin seeds, chemical composition, texture, sensory properties

PROIZVODNJA HLADNO PREŠANOG ULJA CRNOG KIMA

THE PRODUCTION OF COLD-PRESSED BLACK CUMIN OIL

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Sjemenke crnog kima (*Nigella sativa* L.) korištene su godinama kao začin, lijek i sirovina za dobivanje visokokvalitetnog i ljekovitog ulja. Iz sjemenki crnog kima postupkom hladnog prešanja dobije se jestivo ulje visoke nutritivne vrijednosti. U ulju crnog kima dominira esencijalna linolna masna kiselina (omega-6) i oleinska (omega-9), a od zasićenih palmitinska masna kiselina. Cilj ovog rada bio je ispitati utjecaj procesnih parametara prešanja sjemenke crnog kima na iskorištenje ulja tijekom prešanja s kontinuiranom pužnom prešom. Od procesnih parametara prešanja ispitivani su: veličina nastavka za izlaz pogače, frekvencija elektromotora, temperatura grijača glave preše. Primjenom standardnih metoda u proizvedenom ulju određeni su osnovni parametri kvalitete (peroksidni broj, slobodne masne kiseline, udio vode i netopljivih nečistoća). Rezultati ispitivanja pokazuju da procesni parametri prešanja utječu na iskorištenje hladno prešanog ulja crnog kima. Porastom temperature glave preše, smanjenjem nastavka za izlaz pogače i frekvencije elektromotora ostvarena je veća proizvodnja ulja crnog kima.

Ključne riječi: ulje crnog kima, prešanje, procesni parametri, kvaliteta ulja

Keywords: black cumin oil, pressing, process parameters, oil quality

PRAĆENJE PROIZVODNJE ČOKOLADE PREMA MIKROBIOLOŠKIM KRITERIJIMA

MONITORING OF CHOCOLATE PRODUCTION ACCORDING TO MICROBIOLOGICAL CRITERIA

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postersko priopćenje / *poster presentation*

Prema Zakonu o hrani (NN 81/13, 14/14, 15/18), subjekti u poslovanju s hranom obavezni su stavljati na tržište hranu koja je sigurna za potrošača. Hranom štetnom za zdravlje ljudi smatra se i hrana koja je zdravstveno neispravna jer ne udovoljava mikrobiološkim kriterijima sigurnosti hrane prema posebnim propisima o mikrobiološkim kriterijima za hranu, te sadrži ostale patogene mikroorganizme, mikroorganizme koji nisu patogeni i parazite za koje je procjenom rizika utvrđen rizik za zdravlje ljudi. Subjekt u poslovanju s hranom obavezan je izraditi plan samokontrole. U plan samokontrole mora uvesti sve obvezne mikrobiološke kriterije i ostale zahtjeve specifične za poslovanje s hranom.

Cilj ovoga istraživanja bio je pratiti proizvodnju čokolade prema mikrobiološkim kriterijima. U svrhu istraživanja napravljen je plan samokontrole s navedenim mikroorganizmima koji se ispituju, plan uzorkovanja, granične vrijednosti, ispitna metoda, faza u kojoj se kriterij primjenjuje, te korektivne mjere u slučaju nezadovoljavajućih rezultata.

Izrađeni plan samokontrole pokazao se učinkovitim u prepoznavanju kritičnih točaka koje mogu utjecati na mikroobiološku ispravnost proizvoda, te su se rezultati pokazali kao indikativni na prisutnost bakterije iz porodice *Enterobacteriaceae* u fazama proizvodnje gdje su zaposlenici direktno uključeni.

Ključne riječi: čokolada, zdravstvena ispravnost, mikrobiološki kriteriji

Keywords: chocolate, health safety, microbiological criteria

TOXICITY EVALUATION OF FLUORINATED PYRAZOLE DERIVATIVES AS POTENTIAL ACTIVE COMPONENTS IN PLANT PROTECTION

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poster presentation

Prior to comercialization of plant protection products, active components must be evaluated regarding their impact on the enviroment, animal and human health. Toxicity research data must be obtained in a laboratory environment by animal testing for long-term and short-term health effects. The REACH (*Registration, Evaluation, and Authorization of Chemicals*) guidelines implemented by the European Parliament restrict the overusage of animals in testing, and suggest the application of computational softwares in preliminary toxicity predictions. The aim of this research is to estimate the toxicity of the 10 newly synthetized flourinated pyrazole derivatives as potential compounds in plant protection treatments, as they show great prominence as phosphodiesterase inhibitors, making them possibly applicable as future pesticides. The software used to predict the compound toxicity is the T.E.S.T. (*Toxicity Estimation Software Tool*) software. Toxicity parameters that were evaluated are:

- the lethal doses for rats (oral rat LD_{50});
- aquatic toxicity (doses for growth inhibition of *Tetrahymena pyriformis* and lethal doses that kills half of fathead minnow (*Pimephales promelas*);
- mutagenicity of compound that induces revertant colony growth of *Salmonella typhimurium*;
- bioaccumulation factor (the ratio of the concentration of a chemical in the tissue of an aquatic organism (fish) to its concentration in water.

Keywords: plant protection, toxicity, active compounds, computational chemistry

THE IMPACT OF BEAN AND CHESTNUT FLOUR ON NUTRITIONAL VALUES AND SENSORY QUALITIES OF BISCUITS

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poster presentation

Biscuits are known as food products with good taste and attractive to consumers, they have high content of fats, sugar and calories, but are poor in dietary fiber, minerals and other nutrients. Our study is exactly based on the possible improvement of nutritional values and maintaining the sensory qualities by using different flours. This paper aims to determine the potentially acceptable level of bean flour and chestnut flour that can be added to biscuit production, improving nutritional values while maintaining the sensory qualities of the product.The results showed that the addition of 20% bean and chestnut flour in the making of biscuits increased the nutritional value of both protein (9.98 ± 0.17 with only 20% bean flour), cellulose (4.28 ± 0.39 with only 20% bean flour) and minerals (3.67 ± 0.28 with 10% bean flour and 10% chestnut flour), but did not increase the energy value, while the sensory qualities did not change significantly. However, with the increase of the flour mixture to 30%, even though the nutritional values increase even more, the sensory qualities of the biscuits become unacceptable for the consumers.

Keywords: bean flour, minerals, nutritional value, biscuit

NUTRITIONAL VALUE OF PUFF PASTRY ENRICHED WITH CHIA SEEDS AND DIETARY FIBERS

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poster presentation

In order to increase the content of insoluble dietary fibers, dough for puff pastry production was made from mixture of white and whole wheat flour (70:30). Chia seeds (CS, 3-6%) and sugar beet fibers (SBF, 5-10%) were added into the formulation in the aim to increase the content of both soluble and insoluble dietary fibers and minerals. The composition of puff pastry enriched with CS and SBF was optimized: OE1 (6% CS), OE2 (5% SBF) and OD (3.6% CS and 2.25% SBF). Sample without CS and SBF was used as a control. The addition of 6% CS resulted in increased TDF content and in almost ideal (3:1) IDF to SDF ratio. The effect of 5% SBF was reflected in the lowest energy value and increased TDF content by 1.6 times and 11% compared to control and OE1, respectively. Minimal fat and maximal TDF content (6.17 g/100 g) was achieved by the combination of CS and SF. For this sample, the nutritive statement "high-fiber" could be applied. All samples had high content of Mn, originating mainly from whole wheat flour. OE1 and OD were also rich in Fe and Zn, which was the contribution of CS incorporated in puff pastry formulation.

Keywords: puff pastry, whole wheat flour, chia seeds, sugar beet fibers, nutritional value

OLIVE LEAF EXTRACT (OLE) AS BIOACTIVE CONSTITUENT IN CHEESE MANUFACTURING

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poster presentation

Plants have been traditionally used for centuries in cheese manufacturing, either for their aromatic properties or as technological auxiliaries. Some of these plants are known to have antimicrobial and/or antioxidant properties and could also act as natural preservatives for raw milk and derived dairy products. The olive leaf has been widely used in folk medicine for several thousand years in European Mediterranean islands and countries. Although considered waste, the olive leaf has proven to be an excellent source of biologically active molecules (phenolics and flavonoids). Oleuropein, hydroxytyrosol, and verbascoside are recognized as the most abundant polyphenols identified in olive leaf extract (OLE) and possess antioxidative, antimicrobial, antiviral, even against the HIV virus, anti-atherogenic, cardioprotective, antihypertensive, and anti-inflammatory properties. Enriching dairy products with OLE would contribute to the creation of a new type of functional dairy products, but also expand the possibilities of reducing waste generated in the food industry. OLE can also be counted as a bioactive compound for food packaging applications and as a biopreservative.
The objectives of the work were to gather the data on the potential use of OLE as a natural preservative in dairy processing and then focus on its application in cheese manufacturing.

Keywords: plant extract, olive leaf extract, oleuropein, natural preservatives

GERMINATED SEEDS IN BREAD AS SOURCE OF BIOACTIVE COMPOUNDS AND DIETARY FIBRE

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oral presentation

Germinated seeds are recognised as a valuable source of bioactive compounds. In this study, we investigated the addition of germinated spelt, oat, and buckwheat seeds on the total phenolic content, antioxidant activity, dietary fibre content, textural and sensory properties of the prepared bread. Enriched breads were prepared from white wheat flour with different proportions (30% and 60%) of germinated seeds to obtain 8 different functional bread, including two multigrain formulations, along with a control bread. A significant increase in total phenolic content and antioxidant activity was observed in all samples of the enriched bread, with the highest increase determined in the bread prepared with germinated buckwheat seeds. The enriched bread samples showed a significant increase in the content of dietary fibre, ranging from 15 to 40%, with the highest values detected in 60% buckwheat bread. Texture analysis (TPA test) showed that a positive effect on staling properties was observed during three days of bread storage, especially when 60% enrichment was used. Sensory evaluation was carried out and all samples of the enriched bread were evaluated as highly preferred in terms of flavour, technological properties and overall acceptability. Overall, the incorporation of germinated seeds is an effective way to improve the nutritional value of bread and other products.

Keywords: germinated seeds, enriched bread, buckwheat, oat, spelt

WORKSHOP /
RADIONICA

KOLOREKTALNI KARCINOM U HRVATSKOJ

COLORECTAL CANCER IN CROATIA

Ines Banjari*

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radionica / *workshop*

Kolorektalni karcinom je najčešće sijelo raka u Hrvatskoj, s ukupno 3 600 novooboljelih godišnje, što znači da svaki dan imamo 10 novo dijagnosticiranih. Treće je najčešće sijelo maligne bolesti u muškaraca (16 % svih karcinoma) i drugi po učestalosti u žena (14 %) u Hrvatskoj. Hrvatska se nalazi i u samom svjetskom vrhu zemalja s visokom učestalošću i smrtnošću od kolorektalnog karcinoma. Ono po čemu se kolorektalni karcinom razlikuje od svih ostalih je njegova jaka povezanost s prehranom. Visoka konzumacija crvenog (npr. govedina) i procesiranog mesa (npr. kobasice, kulen) povećava rizik za obolijevanje i progresiju kolorektalnog karcinoma. S druge strane, hrana bogata vitaminom D i kalcijem poput mlijeka i mliječnih proizvoda, čini se ima zaštitni učinak, a moguće je da zaštitnu ulogu ima i vitamin B12 koji je u značajnoj količini zastupljen upravo u ovim namirnicama. Iz navedenog je jasno kako se može očekivati da će se regionalne razlike u prehrani između regija Hrvatske očitovati i u obroju novooboljelih. U sklopu radionice predstavit ćemo Nacionalni programa ranog otkrivanja kolorektalnog karcinoma, koje se mjere poduzimaju kako bi odziv na program ranog otkrivanja bio veći, uključujući i ulogu obiteljskog liječnika, koje su novosti u dijagnostici i liječenju te analizirati ulogu prehrane kao najvažnijeg modulatora rizika kod sporadičnih oblika bolesti ali i važnim aspektom u rekurenciji bolesti.

Ključne riječi: kolorektalni karcinom, nacionalni programa ranog otkrivanja, prehrana

Keywords: colorectal cancer, national program of early detection, nutrition

Voditelj: **izv. prof. dr. sc. Ines Banjari** (Sveučilište u Osijeku, Prehrambeno-tehnološki fakultet Osijek, Hrvatska)
Panelisti radionice: **prof. dr. sc. Neven Ljubičić, dr. med.** (Sveučilište u Zagrebu, Medicinski fakultet, Pročelnik Klinike za unutarnje bolesti, KBC Sestre milosrdnice, Zagreb, Hrvatska); **prim. dr.sc. Ljubica Vazdar, dr. med.** (KBC Sestre milosrdnice, Zagreb, Hrvatska); **doc. dr. sc. Sanja Mandić, mag. med. biochem.** (Medicinski fakultet Osijek, KBC Osijek, Hrvatska); **Jadranka Karuza, dr. med.** (Sveučilište u Rijeci, Medicinski fakultet, Rijeka, Hrvatska)

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ETHOS XL - MAXIMIZE THE EXTRACTION OF FRAGRANCES AND FLAVORS

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sponsor presentation

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Keywords: microwave extraction, essential oils, aromas

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Hanna Instruments je vodeći proizvođač i distributer znanstvenih instrumenata, proizvoda za analizu vode, hrane i pića, te analizu tla. Tvrtka je osnovana 1978. i može se pohvaliti različitim proizvodnim objektima, istraživačkim centrima, uredima tehničke podrške, te prodajnim uredima na svim kontinentima. Filozofija tvrtke je ponuditi kupcima jednostavne i intuitivne instrumente s izuzetno konkurentnim cijenama.

Hanna Instruments d.o.o., dio Hanna Instruments grupe, otvorena je 2009. godine u Republici Hrvatskoj, u Zagrebu za pružanje ponude i podrške za cijelu Hrvatsku.

Naš asortiman obuhvaća više od 3000 proizvoda koji se primjenjuju u ovim sektorima: laboratorij, vinarstvo, proizvodnja hrane i očuvanje okoliša, obrada voda, zaštita okoliša, bazeni, pitka voda, akvakultura, poljoprivreda, procesna oprema.

Mi nismo samo dizajneri instrumenata, već i vertikalno integrirani proizvođač. Od originalne ideje za proizvod do gotovog proizvoda kontroliramo cijeli proces. Sve se proizvodi u našim tvornicama. To osigurava visoku kvalitetu proizvoda, a smanjuje troškove outsourcinga na treće strane.

Svake godine, novim proizvodima obogaćujemo širok raspon Hanna instrumentacije, od instrumenata džepne veličine do laboratorijskih stolnih instrumenata s grafičkim prikazom.

Hanna Instruments pruža kvalificiranu tehničku pomoć i nužnu potporu za sve vrste instrumenata, te instalaciju instrumenata za analizu i kontrolu.

Ključne riječi: Hanna Instruments, laboratorij, hrana, analiza

Keywords: Hanna Instruments, laboratory, food, analysis

HRVATSKI VETERINARSKI INSTITUT U ANALITICI HRANE

CROATIAN VETERINARY INSTITUTE IN FOOD ANALYSIS

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sponzorsko predavanje */ sponsor presentation*

Hrvatski veterinarski institut nalazi se u Zagrebu, ali ima četiri podružnice (veterinarski zavodi) koji djeluju u Splitu, Rijeci, Križevcima i Vinkovcima. Institut, provodi analitiku hrane životinjskog podrijetla i hrane za životinje. Područje analitike hrane u Institutu obuhvaća mikrobiološke pretrage, kemijsku analitiku i određivanje rezidua. Institut ima 241 akreditiranu metodu s fleksibilnim područjem u određivanju rezidua.

Portfelj mikrobioloških ispitivanja uključuje bakterijske zoonotske patogene i mikroorganizme koji ukazuju na lošu higijenu ili na kontaminaciju. Razvijene su metode brze analitike (PCR, ELFA, EIA).

U području određivanja rezidua provodi se kontrola ostataka zabranjenih tvari, veterinarskih lijekova i kontaminanata odnosno kemijskih elemenata (metala) i pesticida u hrani životinjskog podrijetla, medu i hrani za životinje. Primjenjuju se orijentacijske i potvrdne metode induktivno spregnute plazme s optičkom emisijom i masenom spektrometrijom, tekućinske i plinske kromatografije s masenom detekcijom, te visokoučinkovite tekućinske kromatografije–tandemske spektrometrije masa.

Kemijska analitika obuhvaća oko stotinu tvari koje predstavljaju kvalitetu i sigurnost hrane. Primjenjuju se klasične i suvremene metode plinske i tekućinske kromatografije u kombinaciji s masenom spektrometrijom i ostalim tehnikama detekcije. Najzastupljenije su analize nutritivnog sastava i deklariranja proizvoda te ispitivanja brojnih aditiva, mikotoksina, alergena i hormona.

Rezultatima postignutim najsuvremenijim analitičkim metodama nastojimo ispitanu hranu učiniti sigurnijom i zaštititi zdravlje ljudi. Institut je od Ministarstva poljoprivrede ovlašten kao nacionalni referalni laboratorij za navedenu analitiku.

Ključne riječi: Hrvatski veterinarski institut, mikrobiologija hrane, kemijska analitika, određivanje rezidua

Keywords: Croatian Veterinary Institute, food microbiology, chemical analysis, residue determination

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''Projekt je sufinancirala Europska unija iz Europskog fonda za regionalni razvoj''
''The project was co-financed by the European Union from the European Regional Development Fund''

Razvoj inovativnih proizvoda od nusproizvoda tijekom prerade povrća KK.01.2.1.02.0069

The development of innovative products of by-products during the processing of vegetables

https://www.podravka.hr/kompanija/r-d/eu-istrazivacki-projekti/

Ukupna vrijednost projekta: **6.899.956,33 HRK**

Iznos koji sufinancira EU: **3.055.545,56 HRK**

Korisnik bespovratnih sredstava: **Podravka d.d.**

Vrijeme provedbe: **1.9.2020.- 1.9.2022.**

Opis projekta: istražiti inovativni tehnološko učinkoviti proces odvajanja nutritivno vrijednog biootpada te mogućnost njegovog recikliranja u svrhu razvoja novih i inovativnih prehrambenih proizvoda više dodane vrijednosti; istražiti potencijal proizvodnje bioplina iz svih otpadnih tokova proizvodnje Tvornice Kalnik, Varaždin, Hrvatska.

Total project value: ***6.899.956.33 Croatian kuna***

Amount co-financed by the EU: ***3.055.545.56 Croatian kuna***

Grant beneficiary: ***Podravka Ltd., Croatia***

Implementation time: ***1.9.2020.- 1.9.2022.***

Project description: *investigate the innovative technologically efficient process of separation of nutritionally valuable by-products and the possibility of its recycling for the purpose of developing new and innovative food products of higher added value; investigate the potential of biogas production from all waste production streams of the Kalnik Factory, Varaždin, Croatia.*

Sadržaj materijala isključiva je odgovornost Podravke d.d.

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Tvrtka **V.I.A.-lab d.o.o.** sa sjedištem za R. Hrvatsku u Varaždinu, bavi se zastupanjem, uvozom i distribucijom različitim dijagnostičkim proizvodima poznatih proizvođača za kontrolu namirnica i kontrolu higijene životne sredine. To su testovi za brzu i klasičnu mikrobiološku kontrolu namirnica i ulaznih sirovina, ELISA testovi, testovi za PCR, kolonama za pročišćavanje uzoraka za HPLC i C18 te testovima za kontrolu higijene po HACCP sustavu. Opskrbljujemo laboratorije prehrambene industrije, laboratorije nacionalnih instituta i laboratorije zavoda za zaštitu zdravlja, bolnice, samouslužne restorane i restorane brze hrane na području R. Hrvatske. Svjesni smo da samo tvrtka sa vizijom uspješno raste i razvija se, zato ćemo i ubuduće tome posvetiti puno pažnje i sredstava.

R-Biopharm – Vodeći svetski proizvođač testova za kontrolu hrane, stočne hrane i higijene.	**Celsis – Proizvode aparature na bazi bioluminiscencije za brzu mikrobiološku kontrolu gotovih proizvoda.**	**HiMedia – globalni proizvođač mikrobioloških medija i podloga, podloge u granuli.**
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Pouzdan partner u kontroli namirnica, stočne hrane i higiene.

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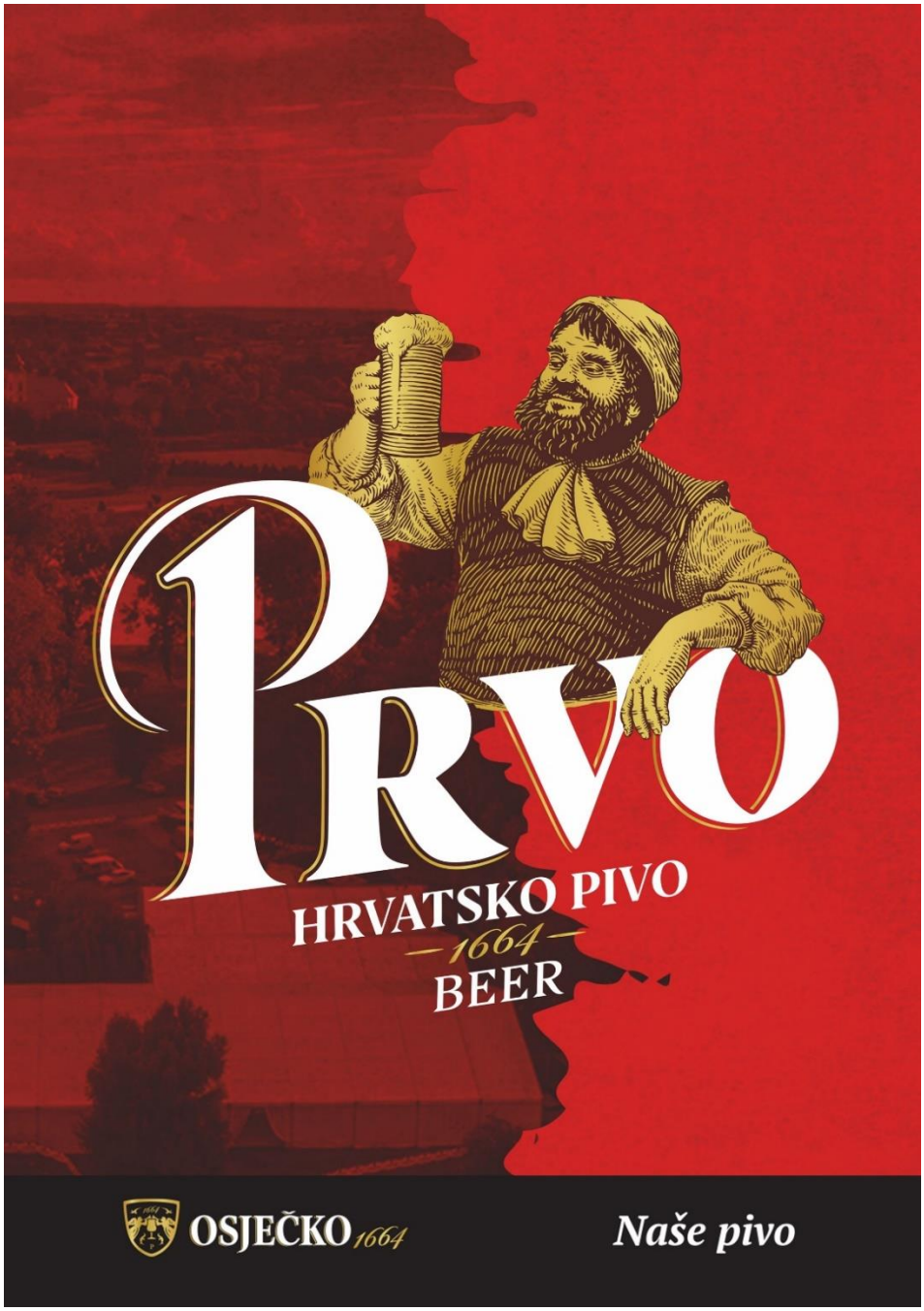

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