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Plenary lectures / Plenarna predavanja

NOVEL TECHNOLOGIES IN FRUIT AND VEGETABLE PROCESSING

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Fruit and vegetables are a valuable source of nutritionally important compounds. The aim of novel technologies is to preserve the bioactive compounds with minimal impact on sensory quality, and to improve quality control and safety along the food chain. Besides that, the production of shelf-stable semi-fresh products, the reduction of food losses through increased shelf life, the reduction of energy and water use, and the generation of food ingredients from by-products are also very important objectives. To achieve the above mentioned goals, new technologies, like sensor technology, sustainable packaging, non thermal pasteurisation and sterilisation, nano and micro technology, utilisation of rest and by-products, the application of low energy and low water technologies, as well as better knowledge transfer, should be applied. Sensor technologies that include uni-molecular sensors, bio-arrays, solid state sensors, optical and spectrographic sensors, radio frequencies, and sensor networks have recently been widely tested with encouraging outcomes. In this way, quality and safety can be controlled more precisely during storage of a particular product. Combining sensor technologies and produce physiology (so called dynamic control system) offers more accurate requirements for storage conditions (content of O₂ and CO₂) to better preserve quality, the content of bioactive compounds, and thus inhibit some physiological disorders without the usage of phytopharmaceuticals. Non thermal technologies (pulsed electric field, cold plasma, high hydrostatic pressure) all enable the inactivation of microorganisms and enzymes with a minimal impact on sensory properties.

Keywords: novel technologies, bioactive compounds, safety, sensory properties

SOIL AND SOIL-RELATED AGROECOSYSTEM EFFECTS IN THE FOOD CHAIN (REGARDING THE INTERNATIONAL DECADE OF SOIL 2015-2024)

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As incredibly complex array of elements and compounds flows in balanced fashion, into our bodies along the nutrient chain. We are what we eat. In a sense, we are unique, moist packages of animated soil.

F. D. Hole (1988)

The primary production of organic matter, of which food is only a small part, takes place through the process of photosynthesis thanks to, among other things, soil-related effects realised by the unique characteristic – the fertility of the soil. Soil supplies the growing crops with water and nutrients, from which, according of the above words, our body is built. We are therefore merely a "soul-enriched moist soil package". As much as 95 % of food is produced by the soil-related productive effects of agroecosystems - the central, spatially limited unit in the agrosphere and the creation of the *Homo sapiens*. We dare to say (in spite of the accusations that are coming) that the perfection of Nature/Creator and the genius of Man are mirrored in the agroecosystem. Consequently, soil fertility and the available agricultural land area determine the production capacities and the food security and food safety on the level of farms/states/globally. The population that passed through the "Blue Planet" - Earth from the pre-history to date (from Adam to the Anthropocene) is estimated at 106 billion (106×10^9), using 15×10^9 hectares of agricultural land. Today, the world population of 7.5×10^9 people uses 5×10^9 hectares, 1.5×10^9 hectares of arable land and 3.5×10^9 hectares of pastures; in turn it is very unevenly distributed across continents. To cope with current food requirements (with about 8×10^8 hungry people), by the middle of the century food production needs to be increased for about 70-100 %, but under the conditions of chaotic climatic changes and the increasing degradation of all resources used in agriculture. For all the professionals participating in this meeting, especially agronomists - very challenging, not an easy task!

In "the shadow" of food security – the "quantity problem", there is already another problem, no easier or simpler, increasing food safety – "quality problem", leaving "the shadow" only in the case of incidents with more severe consequences. Food-safety is the result of the ecological-regulatory soil-related effects of the agroecosystem. Namely, the root of the growing crop takes the biogenic elements and the elements hazardous for humans – pollutants, from the soil and includes them in the food chain. The list of those pollutants is long and open: Heavy metals (metals metalloids) like Cd, Pb, Hg, Cr, As, etc, residues of biocidal substances - pesticides, polycyclic

aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), polychlorinated and polybrominated furans and dioxins, radionuclides, mineral hydrocarbons - petrochemicals, mineral fibres (asbestos), pathogens (prions, anthrax), etc. They are all very diverse, some are of natural origin (volcanoes), but most of the pollutants are emitted in the soil from the anthroposphere (industry, traffic), and some are intentionally spread (plant protection, fertilization). Each of these substances has different sources, each is coming into the soil in its own way, retention and accumulation in the soil is achieved by special mechanisms, the root of the growing crop receives them and introduces them into the food chain, they accumulate in the plant, fortunately not only (or not always) in the edible organs of the crop. Some are inactivated or removed in food processing... Their toxicity (and phytotoxicity) and carcinogenic, mutagenic, or teratogenic effects on humans are the consequence of the consumption of food that contains more than the permissible level of these substances. Along with the described reasons, there are other, powerful reasons to establish permanent monitoring of the soil in the countries of South Eastern Europe during the International Decade of Soil 2015-2024. For this purpose, we propose the approach we developed in the framework of a special EU project, which can be accessed in Croatian and English on the web page: <http://www.azo.hr/Publikacije26> in Croatian, but <http://www.azo.hr/TheSoilMonitoring>, in English.

We keep this question beyond and above all the daily interests and as an obligation to our grandchildren and the generations following after them.

Keywords: food, soil-related effects of agroecosystems, soil

PERSONALIZED BARIATRIC SURGERY, MULTIDIMENSIONAL APPROACH - WHY IT IS ESSENTIAL TO HAVE A NUTRITIONIST IN A TEAM

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The human population is constantly putting on weight. There is a pandemic on the scene, on the planet Earth. The number of the obese has surpassed the number of the undernourished. All those with a body mass index (BMI) of 30 and more are affected by obesity, and this phenomenon is constantly increasing. During the last thirty years, BMI in twenty-year-olds and above is escalating and is increasing at the rate of 0.4 kg/m² during a decade.

Given these trends in the years ahead of us, bariatric surgery convinced me to admit it, or I would not be subjected to a large number of patients. In the future, besides being well educated, a bariatric surgeon will also know how to make projections along with his multidisciplinary team. In other words, they will know how to design the most optimal models of treatment, taking into account the numerous factors that could affect outcomes of the treatment.

As humans we are different, our expectations are different, as well as our interests, the socio-economic conditions, and climate. All these have to be respected when optimizing surgery. The absolute imperative in a surgical obesity treatment is a multidisciplinary quality. What may be considered as protocol is a complete pre-operational treatment by an endocrinologist, a gastroenterologist, a psychiatrist and a clinical psychologist. Acknowledging the fact that the long term outcome in surgery is the most important, there is no doubt that a nutritionist has to be included in the pre- and post-operational observation. A comment on the patient's eating habits, behaviour, and nutritional goals, and ways of accomplishing them, must be given by licensed nutritionists. We think that by working with groups of obese patients, a nutritionist could absolutely have a positive effect on the surgical outcome of the treatment. This paper provides an article about the main problems connected with the post-operational deficit of minerals and vitamins, as well as problems with hipoproteinemia and anemia, which appear after combined bariatric restrictive malabsorptive surgeries. We consider this to be a huge space in which a nutritionist can act and may raise the outcome of the surgery on a higher level with adequate engagement.

Keywords: bariatric surgery, nutritionist

HORMONI U HRANI ŽIVOTINJSKOG PODRIJETLA - PRIRODNA POJAVNOST ILI ZLOUPORABA?

HORMONES IN FOOD OF ANIMAL ORIGIN - NATURAL OCCURRENCE OR ABUSE?

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Hormoni su organsko-kemijske tvari čijom se uporabom u stočarskoj proizvodnji mogu postići značajniji prinosi, a time i veći profit. U farmских životinja hormoni imaju anabolički učinak, odnosno djeluju na način da povećavaju sintezu proteina i razgradnju masti, čime se ujedno dobivaju i senzorski prihvatljiviji proizvodi. Međutim, primjenom na životinjama ove tvari se „carry over“ efektom prenose u jestiva tkiva i tjelesne tekućine, te u konačnici i u gotove proizvode (mlijeko, iznutrice, meso, jaja), a termičkom obradom uglavnom ih nije moguće inaktivirati ili ukloniti. Na taj način potrošači konzumacijom namirnica životinjskog podrijetla mogu biti izloženi hormonskom djelovanju. S obzirom da su dokazane brojne intoksikacije i hormonski učinci u ljudi, njihova primjena kao promotora rasta u životinja je u Europskoj uniji zabranjena. Zloupotreba ovih tvari predstavlja potencijalni rizik za potrošače, a kako bi se spriječio mogući štetan utjecaj na zdravlje važno je sustavno pridržavanje zakonskih odrednica definiranih za njihovu primjenu i kontrolu. Budući da su spolni hormoni prisutni u tkivima i tjelesnim tekućinama farmских životinja u fiziološkim razinama, a pojavnost može biti i posljedica liječenja odnosno terapijske primjene, kako bi se dokazala njihova ilegalna uporaba od velikog je značaja utemeljena interpretacija utvrđenih razina. U posljednjem desetljeću se u ovom području provode brojna istraživanja budući da za veliki broj tvari s hormonskim djelovanjem još uvijek nisu istraženi toksični učinci, a stalan je i razvoj novih sintetskih hormona i njihovih mješavina. Stoga je u cilju proizvodnje zdravstveno ispravne hrane i zaštite zdravlja potrošača potreban kontinuirani nadzor pojavnosti hormona u svim kritičnim točkama proizvodnje hrane od farme do potrošača, kao i razvoj novih suvremenih analitičkih metoda u identifikaciji njihove zloupotrebe.

Ključne riječi: hormoni, anabolički učinak, ostaci u hrani životinjskog podrijetla, intoksikacija, sigurnost hrane

Keywords: hormones, anabolic effect, residues in food of animal origin, intoxication, food safety

PROBIOTICS IN FOOD SUPPLEMENTS, CURRENT STATUS AND THEIR FUTURE

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Introduction: The human gastrointestinal system contains a large number of useful bacteria that play an important role in maintaining the health of the digestive system, as well as the health of the entire organism. These bacteria participate in food digestion, prevent the colonization of pathogenic microorganisms, participate in the synthesis of vitamins K and B, produce intestine mucus, and stimulate the entire immune system.

Results: Probiotics are live microorganisms that, if taken at an appropriate dose, have a positive effect on host health (FAO / WHO). For the consumers, they are available as functional foods, nutritional supplements, or medicines. Numerous studies have shown that stress, inadequate nutrition, modern lifestyle in an almost sterile environment, frequent use of antibiotics, and some illnesses can significantly undermine the balance of the intestine microflora. At the beginning of the 20th century, a therapy was proposed to treat the imbalance of the intestinal microflora, and it included the introduction of beneficial, probiotic bacteria. In order to be used for prevention, i.e., the treatment of certain conditions, probiotic bacteria must meet a number of criteria. Their efficacy and safety must be clinically proven.

Clinical studies have shown that probiotics, depending on the type of strain and dose, play a role in the treatment and prevention of many disease states of the digestive system, including diarrhoea and constipation, allergies, vaginal infections, and urinary tract infections. Their use is important in breastfeeding, adolescence, pregnancy, and for strengthening immunity. A significant aspect of probiotic issues is made by legislative or health claims, which is the responsibility of the IPA (International Probiotic Association) and the EFSA.

Conclusion: The use of probiotics, as well as functional microbial cultures has been steadily increasing in recent years, as they show efficacy in prevention, treatment, and support for the treatment of various diseases.

Keywords: probiotics, application, health claims

UČINCI NAČINA PREHRANE NA EPIGENETIČKE OBRASCE I ZDRAVLJE ČOVJEKA

THE EFFECTS OF NUTRITION ON EPIGENETIC PROFILES AND HUMAN HEALTH

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Epigenetski procesi opisuju promjene u genomu koje mogu promijeniti ekspresiju gena bez promjene slijeda u DNA. Poznato je da se prve epigenetske modifikacije DNA, kao što je metiliranje citozinskih baza na CpG dinukleotidnim mjestima, događaju već tijekom ranog fetalnog razvoja, no postoje i znanstveni dokazi da su određene epigenetske promjene nasljedne što ukazuje i na moguće transgeneracijske učinke. Tijekom života na promjene u epigenomu utječu brojni unutrašnji i vanjski čimbenici kao što su izloženost toksikantima iz okoliša i stresu, dob i prehrane navike što može utjecati na očuvanje zdravlja, ali i povećati sklonost razvoju određenih bolesti. Prehrana i prehrane navike izuzetno su važne jer nutrijenti (epi-nutrijenti) mogu direktno ili indirektno stupiti u interakcije s genima te na taj način stabilizirati genom, ali i mijenjati gensku ekspresiju i metabolički odgovor. Brojne znanstvene studije pokazale su da djelovanjem epi-nutrijenata dolazi do epigenetskih promjena kao što su preoblikovanje kromatina, modifikacije u metilaciji DNA i histonima, a uočene su i promjene u mikroRNA koje reguliraju za određene bolesti specifične gene. Budući da su epigenetske promjene vrlo dinamične i potencijalno reverzibilne, moguće je promjenom molekularnog sastava hrane pozitivno utjecati na epigenetsku stabilnost, te time i na očuvanje zdravlja.

Ključne riječi: epigenetika, epi-nutrijenti, zdravlje

Keywords: epigenetics, epinutrients, health

***Nutrition* / Nutricionizam**

ALGORITHM OF COMMUNICATION WITH CLIENTS IN NUTRITIONAL COUNSELLING

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Introduction: Counselling about diets requires the knowledge and skills of communication with patients and clients. The success of counselling in nutrition therapy directly depends on the client's acceptance of the advice that the therapist is offering.

Goal of the assignment: The goal of the assignment is to present the most important techniques and procedures for communicating with clients who are interested in advice about a healthy lifestyle and a diet according to modern standards, recommendations, and guides.

Results: As a first step, the client needs to explain the reason for coming to the nutritionist or dietician. At the beginning of the conversation, it is mandatory to use an appropriate and acceptable tone of communication with a client.

After that, the client undergoes the process of providing their anamnesis and, at the same time, the terms of their eating status and their medical condition will be graded. After that, the therapist determines the nutritional level using the methods of anthropometric measuring, and the nutritional status is evaluated and analyzed using the standardized questionnaires. While doing all of this, the nutritionist should be focused on grading the nutritional risks and risks regarding lifestyle, like stress, absence of sleep, physical inactivity, presence of vices, etc. Based on the overall grade of the client's condition and after determining the risks, nutritional and diet therapy is administered in the planned period and the date for re-counselling is recommended.

Conclusion: The algorithm for counselling patients contains a clearly defined procedure for the admission of a client, taking anamnesis, grading their eating status and medical condition, and offering diet advice for the period of nutrition and diet treatment.

Keywords: nutrition counselling, algorithm of communication with clients

ATTITUDES TOWARDS NUTRITION CARE AMONG GENERAL PRACTITIONERS IN CROATIA

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Poor nutrition behaviour is a risk factor for chronic diseases. Patients with a chronic disease expect to receive nutrition care from general practitioners (GPs). Attitudes towards nutrition care strongly influence the implementation of nutrition care in GPs offices. The aim of this study was to determine the attitudes of Croatian GPs towards nutrition and nutrition care. A cross-sectional study was conducted among 17.0 % of randomly selected GPs in Croatia, from May to July of 2013, via a specially designed anonymous questionnaire. There was no statistically significant difference in the median number of positive attitudes between males and females ($p=0.336$); between GPs with 14 or less and GPs with 15 or more years of experience ($p=0.380$); between younger GPs (45 years old or less) and older GPs (46 years old or more) ($p=0.163$), and between specialists of family medicine and GPs without specialization ($p=0.577$). The study revealed that the GPs with additional education in nutrition and the GPs who had been suffering from a chronic disease had more positive attitudes towards nutrition and nutrition care ($p<0.001$ and $p=0.022$, respectively). In order to provide nutrition care in GPs offices in Croatia, strategies for changing GPs attitudes towards nutrition and nutrition care are needed.

Keywords: nutrition, attitudes, general practitioners, primary health care, Croatia

UČESTALOST I KOLIČINA KONZUMACIJE POVRĆA U PREHRANI

FREQUENCY AND QUANTITY OF DIETARY VEGETABLE CONSUMPTION

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Povrće obiluje bogatim sadržajem vitamina, mineralnih tvari, fitonutrijenata, antioksidansima i vlaknima.

Cilj rada je ispitati koji faktori utječu na učestalost i količinu konzumacije povrća.

Anonimno anketno istraživanje provedeno je putem internetske mreže na uzorku 47 ispitanika muškog i 202 ispitanika ženskog spola u dobi od 15 do 79 godina u svrhu obrade seminarske teme iz kolegija Dijetetika.

Anketa koja je kreirana za ovo istraživanje sadrži 20 pitanja, od kojih su na dva ispitanici upisivali odgovor (dob, omiljeno povrće), a za ostalih 18 pitanja ispitanici su dobili mogućnost odabira jednog od višestruko ponuđenih odgovora prezentiranih udjelom ispitanika u istome. Podaci su obrađeni pomoću programskog alata MS Excel.

Dobiveni rezultati govore o konzumaciji povrća na dnevnoj bazi kod 112 ispitanika, tri puta tjedno kod 131 ispitanika, a 6 uopće ne konzumira povrće i vezano je za sezonu. Način uzgoja povrća važan je 51 ispitaniku. Također, podaci nam daju uvid u način pripreme povrća, gdje 195 ispitanika pere povrće pod mlazom vode, a 35 ostavlja povrće u vodi. Sirovo i termički obrađeno povrće konzumira 164 ispitanika.

158 ispitanika smatra da cijena ima velik utjecaj na dobiveni rezultat o konzumaciji povrća. Samo 48 ispitanika ima vlastiti vrt, dok 248 kombiniraju povrće iz vlastitog uzgoja i kupnje.

Ključne riječi: povrće, pravilna prehrana, priprema povrća

Keywords: vegetables, proper nutrition, vegetable preparation

NUTRITIONAL AND HEALTH BENEFITS OF INULIN

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Inulin is a complex carbohydrate that belongs to a class of compounds known as fructans. Its greatest concentration is in chicory, Jerusalem artichoke, garlic, leek, and onion, and this compound has been consumed for centuries by mankind from plant sources. It is believed that inulin shares many of the properties of soluble dietary fibres, such as the ability to lower blood lipids and stabilize blood glucose. Additionally, inulin has been shown to enhance the growth of bifidobacteria and lactobacilli, and enhance the gut environment. There is some scientific evidence that inulin decreases the risk of coronary heart disease and has immunomodulation effects; thus, it is a food ingredient with potential health-promoting effects. Because of their properties, inulin-type fructans are gaining attention in recent years. This review focuses on the nutritional properties of inulin and the health benefits from its inclusion in the daily diet.

Keywords: inulin, fructans, dietary fibres, nutrition, health

NITRATI I NITRITI, METABOLIZAM I TOKSIČNOST

NITRATES AND NITRITES, METABOLISM AND TOXICITY

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Nitrati i nitriti se prirodno nalaze u okolišu kao dio ciklusa kruženja dušika i dušikovih spojeva u prirodi. Mogu se pronaći u zraku, tlu, vodi i hrani (osobito u povrću) i prirodno se sintetiziraju u ljudskom tijelu. Često se koriste kao gnojiva, rodenticidi, ali i kao aditivi u hrani. Igraju vrlo važnu ulogu u ishrani i metabolizmu biljaka. Nitrati nastaju u reakcijama oksidacije organskog otpada djelovanjem bakterija koje vežu dušik. Veće količine nitrata najčešće se nalaze u listovima biljaka, dok se u manjim količinama nalaze u sjemenkama ili gomoljima. Ljudi su izloženi nitratima najčešće putem konzumacije povrća i mesnih prerađevina, a u manjoj mjeri putem vode ili druge hrane. Konzumacija vode za piće s povećanom koncentracijom nitrata može na ljudski organizam djelovati dvojako: (i) akutno, što se najčešće manifestira u obliku methemoglobinemije pri čemu se u probavnom sustavu nitrati reduciraju u nitrite koji potom oksidiraju željezo u hemoglobinu crvenih krvnih stanica tvoreći methemoglobin, koji nema sposobnost prenošenja kisika do stanica u tijelu pri čemu krvne žile i koža poplave; te (ii) kronično, što se najčešće manifestira pojavom karcinoma kao posljedice izloženosti organizma nitrozaminima koji nastaju tijekom reakcije nitrata s aminima u tijelu.

Ključne riječi: nitrati, nitriti, voda za piće, hrana, toksičnost

Keywords: nitrates, nitrites, drinking water, food, toxicity

POVEZANOST SOCIODEMOGRAFSKIH OBILJEŽJA MAJKE I PERINATALNOG TIJEKA SA STOPOM I DULJINOM DOJENJA PRVOROTKINJA

THE CONNECTION BETWEEN THE SOCIODEMOGRAPHIC TRAITS OF THE MOTHER AND THE PERINATAL PERIOD, AND THE RATE AND DURATION OF BREASTFEEDING FOR NEW MOTHERS

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Cilj: Majčino mlijeko predstavlja jedini način prehrane koji osigurava dojenčetu optimalne uvjete za rast, razvoj i nastavak bliske povezanosti majke i djeteta. Zahvaljujući brojnim organizacijama koje potiču i educiraju majke o dojenju, u Hrvatskoj je zabilježen rast stope i duljine dojenja. Cilj ovog rada je utvrditi povezanost utjecaja sociodemografskih obilježja, razine samopoštovanja majke i perinatalnih osobitosti na odluku i duljinu dojenja prvog djeteta.

Materijali i metode: Za potrebe ovog rada konstruiran je on-line upitnik od 48 pitanja koji je ispunila 571 majka iz svih dijelova Republike Hrvatske.

Rezultati: Prvo dijete je dojilo 526/571 (92,12 %) ispitanica. Rezultati istraživanja govore u prilog činjenici kako na stopu i duljinu dojenja ne utječe značajnije mjesto stanovanja majke ($p=0,054$). Zabilježena je pozitivna korelacija mjesečnih primanja ($p=0,004$) i stupnja obrazovanja ($p=0,016$) majke, prema stopi i duljini dojenja. Na odluku o dojenju negativno su utjecale komplikacije u trudnoći ($p=0,034$), ali nisu značajnije utjecale na duljinu dojenja ($p=0,808$). Kraće su svoje prvo dijete dojile i one majke koje pridaju veću važnost vanjskom izgledu u odnosu na one suprotnih stavova ($p=0,012$). Nije zabilježena statistički značajna povezanost samopoštovanja majki i stope i duljine dojenja ($p=0,737$).

Zaključci: Stupanj obrazovanja i mjesečna primanja imaju važan utjecaj kako na donošenje odluke o dojenju tako i na duljinu dojenja prvog djeteta. Edukatvine programe stoga bi trebalo intenzivirati u populaciji mlađih majki i onih s nižim stupnjem obrazovanja. Pored toga, rezultati ovog istraživanja naglašavaju negativan utjecaj suvremenih društvenih normi o vanjskom izgledu žene na odluku o dojenju, što predstavlja opće prihvaćen obrazac suvremenog društva.

Ključne riječi: dojenje, prvorotkinje, sociodemografski čimbenici, samopoštovanje, vanjski izgled

Keywords: breastfeeding, new mothers, sociodemographic factors, self-respect, external appearance

PROCJENA KAKVOĆE PREHRANE MALE DJECE POMOĆU SKORA PREHRAMBENE KAKVOĆE

TODDLER DIET QUALITY ASSESSMENT USING A DIET QUALITY SCORE

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Procjena kakvoće prehrane putem indeksa za procjenu kakvoće prehrane daje bolji pregled ukupnog obrasca prehrane, raznolikosti prehrane i usklađenosti s prehrambenim smjernicama nego procjena adekvatnosti unosa pojedinih hranjivih tvari. Premda indeksi za procjenu kakvoće prehrane imaju široku primjenu u odrasloj populaciji, kod djece je takav pristup manje zastupljen. Cilj ovog istraživanja bio je procijeniti kakvoću prehrane male djece pomoću indeksa razvijenog za tu specifičnu populacijsku skupinu – skora prehrambene kakvoće (engl. Diet Quality Score-DQS). U istraživanje je bilo uključeno 66 djevojčica i 65 dječaka u dobi od 1 do 3 godine. Dva neovisna dnevnika prehrane korištena su za izračun skora prehrambene kakvoće. Prosječan rezultat indeksa iznosio je $4,30 \pm 1,17$ bodova, dok je maksimalna vrijednost koju je bilo moguće ostvariti iznosila 10 bodova (najbolja kakvoća prehrane). Iako nije utvrđena statistički značajna razlika između skora prehrambene kakvoće i dobi, s porastom dobi došlo je do opadanja rezultata indeksa. Utvrđena je statistički značajna povezanost između skora prehrambene kakvoće i unosa ugljikohidrata ($p=0,002$) te prehrambenih vlakana ($p=0,004$), kao i unosa tiamina ($p=0,04$) i riboflavina ($p=0,02$), te bakra ($p=0,001$) na razini cijelog uzorka ili pojedinačnih dobni skupina. S obzirom na specifičnost skora prehrambene kakvoće za primjenu u populaciji male djece u budućim istraživanjima na većem broju ispitanika bilo bi zanimljivo povezati ostvarene rezultate sa zdravstvenim statusom djece.

Ključne riječi: mala djeca, kakvoća prehrane, skor prehrambene kakvoće

Keywords: toddlers, diet quality, Diet Quality Score

MAKRONUTRIJENTI U KOLEKTIVNOJ PREHRANI PREDŠKOLSKE DJECE

MACRONUTRIENTS IN THE COLLECTIVE DIET OF PRESCHOOL CHILDREN

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Za pravilan fizički rast, intelektualni razvoj i sazrijevanje, u dječjem uzrastu značajno je da hrana sadrži optimalno izbalansiran odnos makro i mikronutrijenata. Istraživanje je obuhvatilo ispitivanje specifičnosti i osnovnih karakteristika prehrane djece predškolskog uzrasta (5-6 godina) i to procjenu adekvatnosti sadržaja makronutrijenata u kolektivnoj prehrani predškolske djece. Procjena adekvatnosti unosa hranjivih tvari izvršena je na uzorcima dnevnih obroka prikupljenim tijekom 20 radnih dana u predškolskoj ustanovi u sjeverozapadnom dijelu Republike Srpske, uzimanjem porcije obroka ispred korisnika metodom „slučajnog izbora“. Prosječna masa dnevnog obroka ispitivane populacije bila je 662 grama. Rezultati kemijskih analiza pokazali su da dnevni obroci u predškolskim ustanovama prosječno sadrže 19,08 g proteina, 17,47 g masti, 101,51 g ugljikohidrata. Rezultati ovog istraživanja ukazuju na ozbiljne probleme u prehrani djece predškolskog uzrasta. Dobiveni rezultati ukazuju i na alarmantnu situaciju u prehrani djece u predškolskim ustanovama i ukazuju na potrebu za redovnim monitoringom. Dnevni obroci u predškolskoj ustanovi nisu u skladu sa preporučenim dnevnim unosima za makronutrijente.

Ključne riječi: djeca predškolskog uzrasta, kolektivna prehrana, makronutrijenti, kemijska metoda

Keywords: preschool children, collective diet, macronutrients, chemical method

PREHRAMBENE NAVIKE OSNOVNOŠKOLACA

NUTRITION HABITS OF PRIMARY SCHOOL CHILDREN

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Uvod: Za pravilan rast i razvoj djece temelj je pravilna prehrana. Smjernice pravilne prehrane su redoviti, uravnoteženi obroci uz unos dovoljnih količina vode. Cilj rada je ispitati prehrambene navike 713 učenika u Tuzlanskom kantonu (Bosna i Hercegovina) i procijeniti njihovo znanje i stavove o pravilnoj prehrani.

Metode: Ova prospektivna presječna studija Upitnikom kreiranim za ovu svrhu provedena je među učenicima šestih razreda osnovnih škola urbanih i ruralnih sredina u svibnju 2017. godine. Izbor ispitanika je baziran na dobrovoljnom anketiranju uz poštivanje anonimnosti. Pri izboru ispitanika korištena je metoda „claster uzorka“-razred, slučajni odabir 50 učenika iz šestog razreda iz svake škole. Ukupan uzorak ispitanika bio je 713 učenika i to 368 ženskog spola (52 %) i 345 muškog spola (48 %).

Rezultati: Ispitivanje je pokazalo da 56 % ispitanika kad pohađaju nastavu jede jednom dnevno, dok vikendom polovina ispitanika ima tri obroka. 25 % učenika ne doručkuje prije odlaska u školu, dok 90 % učenika ne preskače taj obrok vikendom. Povrće i voće, ali i slatkiše jedna trećina učenika (33 %) jede svakodnevno. Za piće 70 % učenika koristi vodu, a 40 % svaki dan piju mlijeko. U školi najčešće za prehranu koriste sendvič koji kupe, i to 70 % učenika.

Zaključak: Rezultati istraživanja potiču savjetovanja i promociju zdrave prehrane u populaciji djece koja će nužno prerasti u intervenciju i dostupnost zdrave hrane u svim obrazovnim ustanovama.

Ključne riječi: učenici osnovnih škola, prehrambene navike, zdravlje

Keywords: primary school children, nutrition habits, health

**PERCEPTION AND SATISFACTION WITH BODY IMAGE
ACCORDING TO THE NUTRITIONAL STATUS AMONG
ADOLESCENT BOYS FROM URBAN AND RURAL AREAS OF THE
SARAJEVO CANTON**

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Adolescence is a very sensitive period of life, characterized by intense growth and development, increased energy needs, and experimentation with independence. It is also the period in which body perception is developed, as well as the period when dissatisfaction appears, leading to risky behaviour. It is considered that mostly girls pay attention to their appearance, and in this research boys are chosen as respondents. The aim of the study was the evaluation of the boys' satisfaction with their appearance, based on the actual nutritional status and the tendency to risky behaviour that leads to eating disorders. Boys were divided into groups according to their place of residence (rural vs. urban).

Statistical significance is shown in both groups, in relation to the attempt of reducing body weight ($p < 0.0005$) and in relation to being on a weight reduction diet (rural: $p = 0.002$; urban: $p < 0.0005$). Nutritional status also affects urban boys' satisfaction with their appearance ($p < 0.0005$).

Detailed results suggest that most of the boys in all weight categories are not satisfied with their appearance, most of the normal weight and underweight boys tried to reduce their weight and were on a weight reduction diet, which means that adolescent boys do not have the proper perception of body image according to the actual nutritional status.

Keywords: adolescents, body perception, nutritional status, weight reduction diet

ZNANJA O PREHRANI ADOLESCENATA U OPĆINI BAČKA TOPOLA

NUTRITION-RELATED KNOWLEDGE AMONG THE ADOLESCENTS IN THE MUNICIPALITY BAČKA TOPOLA

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Adolescencija predstavlja razdoblje brzog rasta zbog čega su prehrambene potrebe značajno povišene. Da bi osigurali dovoljnu količinu energije i nutrijenata za rast, razvoj i dodatnu aktivnost, adolescenti trebaju dobro izbalansiranu prehranu koja će sadržavati dovoljnu količinu makronutrijenata kao i mikronutrijenata. Cilj ovog rada bila je procjena znanja o prehrani u populaciji adolescenata u općini Bačka Topola. Istraživanjem je obuhvaćeno 95 adolescenata iz dvije različite škole, a koji se koriste srpskim, odnosno mađarskim jezikom i pismom. Prikupljanje podataka provedeno je primjenom anonimnog jednokratnog upitnika koji je obuhvatio skupinu pitanja usmjerenu na procjenu znanja iz područja prehrane. Rezultati su ukazali da nešto više od polovine ispitanika (53 ispitanika) prepoznaje piramidu pravilne prehrane, te znaju da ona prikazuje prehrambene smjernice. Najveći broj ispitanika (61,64 %) zna da prehrambene smjernice pomažu ljudima da se kvalitetnije hrane. Na pitanje vezano za broj skupina hrane, najveći broj ispitanika izjasnio se da ne zna koliko skupina hrane postoji, od čega je veća zastupljenost odgovora „ne znam“ kod djevojaka (49 %) u odnosu na mladiće (35 %), te u strukovnoj školi (55 %) u odnosu na gimnaziju (36 %). Nepoznavanje prehrambene piramide, prehrambenih smjernica i skupina namirnica temeljni su problem uočen u znanju o prehrani u ispitivanoj populaciji.

Ključne riječi: adolescenti, znanje o prehrani

Keywords: adolescents, nutrition related knowledge

UČESTALOST KONZUMIRANJA MLIJEKA I MLIJEČNIH PROIZVODA KOD SREDNJOŠKOLACA NA PODRUČJU OPĆINE TRAVNIK U ODNOSU NA SPOL

THE FREQUENCY OF MILK AND DAIRY PRODUCT CONSUMPTION OF HIGH SCHOOL STUDENTS IN THE MUNICIPALITY TRAVNIK, IN RELATION TO GENDER

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Uvod: Pravilna prehrana može pomoći u optimiranju zdravlja i zaštiti od različitih bolesti koje se javljaju u zreloj dobi (kardiovaskularne bolesti, maligna oboljenja, osteoporoza...).

Cilj rada: Ispitati učestalost konzumiranja mlijeka i mliječnih proizvoda kod srednjoškolaca na području općine Travnik u odnosu na spol, percepciju vlastitog tijela, konzumiranje gaziranih pića, status uhranjenosti, mjesto prebivališta, dob...

Materijali i metode: Ispitivanjem je obuhvaćeno 205 srednjoškolaca s područja općine Travnik, od toga 108 djevojaka i 97 mladića. Učenici su birani metodom slučajnog uzorka, od 1. do 4. razreda. Prikupljanje podataka provedeno je primjenom anonimnog jednokratnog upitnika koji je obuhvatio opće informacije o ispitaniku (spol, dob, mjesto prebivališta, tjelesnu masu i tjelesnu visinu), kao i pitanja vezana uz prehranbene i životne navike.

Rezultati: Od ukupnog broja ispitanika 88 mladića i 84 djevojke svakodnevno konzumiraju mlijeko i mliječne proizvode, dok 9 mladića i 24 djevojke nikada ne konzumiraju iste. U odnosu na percepciju vlastitog tijela mlijeko i mliječne proizvode svakodnevno konzumiraju djevojke (70) i mladići (67) koji za sebe smatraju da su odgovarajuće tjelesne mase, dok je nekonzumiranje istih izraženije kod djevojaka (19) i mladića (9) koji sebe smatraju debelima.

Zaključak: Nekonzumiranje mlijeka i mliječnih proizvoda je izraženije kod djevojaka u odnosu na mladiće, što se može povezati sa strahom od povećanog unosa masti kroz takve proizvode i utjecaja na tjelesni izgled. Mlijeko i mliječni proizvodi trebaju biti zastupljeni u svakodnevnoj prehrani mladih kako bi se smanjili rizici od oboljenja uzrokovanih nedostatkom kalcija.

Ključne riječi: mlijeko, mliječni proizvodi, srednjoškolci, kalcij

Keywords: milk, dairy products, high school students, calcium

BREAD AS THE MAIN INDICATOR OF AGE-CHANGING DIETARY HABITS AMONG YOUNG PEOPLE

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Bread was recognized as a staple food consumed in large quantities in the Balkans region, hence, it is suitable for the investigation of dietary habits.

This survey was conducted as an insight into the dietary habits of the young population (age 14-26) related to the intake and knowledge about various bread types. The total number of surveyed respondents was 173 (37 % males and 63 % females), who were randomly selected among elementary school students (30), high school students (45) and university students (98) in the Novi Sad Municipality. Analysis of Variance was used for the statistical interpretation of the survey results.

The correlation between the respondents' age and the practice of "healthy food" intake was noticed, since whole wheat bread consumption increased from 15 % for elementary school to 26 % among high school and university students. Considering their gender, whole wheat bread intake among the female respondents was 9 % higher in comparison to male respondents. Still, white bread was most commonly consumed among all respondents, with 56-69 %, as a result of a habit adopted in the family. However, the obtained results indicate a strong correlation between the age-changing dietary habits ("healthy" food awareness) and the impact of the environment, rather than family. Namely, the greater impact of family and tradition is noticed among elementary school students (54 %), while among high school and university students the corresponding impact was significantly less pronounced (34 %).

Keywords: healthy diet, dietary habits, young population, bread intake, whole wheat bread

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UNOS KOFEINSKIH NAPITAKA STUDENTSKE POPULACIJE SVEUČILIŠTA U MOSTARU

THE INTAKE OF CAFFEINE DRINKS AMONG THE STUDENT POPULATION OF THE UNIVERSITY OF MOSTAR

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Kofein je čest sastojak suvremene prehrane. Osnovni je djelotvorni sastojak napitaka poput kave, čaja, energetskih napitaka, te u manjoj mjeri kakaa. Iako je kofein najviše proučavana supstanca stimulativnog učinka, mnoga zdravstvena pitanja o kofeinu još uvijek nemaju relativnu potvrdu. Cilj ovog rada bio je utvrditi učestalost konzumacije kofeinskih napitaka među studentima Sveučilišta u Mostaru. Istraživanje je provedeno prema načelima presječnog. Obuhvaćeno je 146 studenata uz jednaku zastupljenost oba spola. Podaci su prikupljeni primjenom jednokratnog, anonimnog, prigodnog upitnika. Upitnik je pored općih podataka o ispitaniku i prehrambenim navikama obuhvatio i podatke o učestalosti konzumacije kofeinskih napitaka. Prikupljeni podaci izraženi su na cjelokupnu ispitivanu populaciju, a i podskupine s obzirom na spol i status uhranjenosti, te obrađeni primjenom tabličnog alata Excela. Svakodnevno kavu konzumira 57 % ispitanika, 16 % konzumira ju povremeno, a 27 % uopće ne konzumira. Najveći broj konzumenata izjasnio se da dnevno konzumira jednu do dvije kave (38 % ispitanika s istom zastupljenošću u oba spola). Svakodnevnu konzumaciju čaja prijavilo je ukupno 27 % ispitanika dok njih više od 70 % ne konzumira čaj svakodnevno (61 %) ili uopće (12 %). Analiza je također pokazala komplementarnost konzumacije ova dva napitka. S obzirom na utvrđene relativno visoke unose kave u ispitivanoj populaciji potrebna su daljnja istraživanja kako bi se utvrdilo o kojim je konkretnim proizvodima riječ, te koliki su unosi čistog kofeina.

Ključne riječi: kofein, studentska populacija, kava, čaj, stimulans

Keywords: caffeine, student population, coffee, tea, stimulus

UTJECAJ POREMEĆAJA OSJETILA MIRISA I OKUSA NA PREHRANU OSOBA STARIJE DOBI

THE EFFECTS OF OLFACTORY AND GUSTATORY IMPAIRMENTS ON THE DIETARY HABITS OF THE ELDERLY

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Pravilna prehrana može značajno doprinijeti usporavanju funkcionalnog propadanja i pojava kroničnih bolesti koje se javljaju starenjem. Ipak je prehrana osoba starije dobi često jednolika što može dovesti do neuhranjenosti. Jedan od primarnih razloga je i loša prihvatljivost hrane, tj. njen neodgovarajući organoleptički profil. Razumijevanje povezanosti utjecaja odabira hrane na nutritivni status ove populacije je od izuzetne važnosti. Senzorski signali hrane važni su, između ostalog, jer potiču rad žlijezda slinovnica, lučenje želučane kiseline, lučenje gušterače čime se pospješuje probava i nutritivna apsorpcija. Okus i miris su posebice značajni jer su anatomske povezani neurološkim vezama i izravno uključeni u proces probave. U dijelu populacije starijih osoba događa se prirodni postepeni gubitak osjeta mirisa i okusa. Neki od poremećaja osjeta mirisa su: *hiposmija* – smanjeni gubitak i *anosmija* – potpuni gubitak mirisa. Poremećaji osjeta okusa obuhvaćaju *hipogeuziju* – smanjeni osjet i *ageuziju* – potpuni gubitak osjeta. Promjene u senzorskoj percepciji utječu na apetit, preferenciju i užitek u hrani, motivacija za konzumiranjem slabi što utječe na nizak energetske unos i nedostatak nutrijenata, a krajnja posljedica je povećani rizik od mortaliteta i morbiditeta. Razumijevanje promjena u senzorskim osjetilima omogućava odabir pravilne medicinske i nutritivne skrbi. Hrana prilagođena starijim osobama osim adekvatnog energetskeg i nutritivnog sadržaja mora imati i odgovarajući organoleptički profil koji će potaknuti prihvatljivost i užitek u hrani.

Ključne riječi: starije osobe, neuhranjenost, miris, okus

Keywords: elderly, malnutrition, olfaction, gustation

VITAMIN D INTAKE AND STATUS IN OVERWEIGHT PEOPLE

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Vitamin D deficiency may contribute to the development of osteoporosis and other chronic diseases, such as diabetes and cardiovascular disease. Inadequate vitamin D status is highly prevalent worldwide and is associated with low dietary intake, insufficient sun exposure, aging, and excess weight. The aim of this study was to determine the vitamin D intake and status among overweight people.

The participants were adults of both genders with the mean age of 43.5 (n=36). A food frequency questionnaire (FFQ) and 24-hour recall were used to assess the vitamin D intake. Body composition was determined by using the bioelectrical impedance method. Vitamin D status was assessed by determining the concentration of the circulating 25-hydroxyvitamin D [25(OH)D].

The average daily vitamin D intake was 2.51 µg/day, according to the FFQ, and fish was the main source of vitamin D in the diet. The vitamin D intake of the majority of the participants (77.8 %) was lower than 20 % of the dietary reference intake. The average serum 25(OH)D concentration was 48.4 nmol/L. 88.9 % of the participants had an inadequate vitamin D status (<75 nmol/L). A significant inverse association was determined between vitamin D intake and body fat mass.

The study has shown a high prevalence of inadequate vitamin D intake and status among overweight people.

Keywords: vitamin D intake, vitamin D status, overweight, body fat

**PROCJENA DNEVNOG UNOSA KALCIJA U MAKEDONSKIH
ŽENA U POSTMENOPAUI I NAJZNAČAJNIJE NAMIRNICE KAO
IZVOR KALCIJA U NJIHOVOJ PREHRANI**

**THE ESTIMATION OF THE DAILY CALCIUM INTAKE OF
MACEDONIAN POSTMENOPAUSAL WOMEN AND THE MOST
IMPORTANT FOODS AS SOURCES OF CALCIUM IN THEIR DIET**

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oral presentation / usmeno priopćenje

Unos kalcija ima vrlo važnu ulogu u razvoju kvalitete koštane mase, ali ima blagi utjecaj na održavanje koštane mase u odrasloj dobi i smanjenje gubitka koštane mase u starijih osoba i žena u postmenopauzi. Cilj ovog rada bio je utvrditi dnevni unos kalcija putem prehrane u žena u postmenopauzi u Republici Makedoniji, te odrediti grupe namirnica koje najviše doprinose dnevnom unosu. Dnevni unos kalcija je procijenjen pomoću kvantitativnog upitnika o učestalosti unosa hrane i pića (FFQ) u 104 žene prosječne dobi 64,73 godine. Prosječni je unos kalcija u ispitanice dnevno iznosio 854 mg/dan. Prema dobivenim rezultatima ispitanice unose hranom i pićem 71,2 % preporuke (Dietary Reference Intakes, DRI) za kalcij. Ispitanice su unosile najviše kalcija putem mlijeka i mliječnih proizvoda, a važan izvor kalcija u njihovoj prehrani bila je i voda koja pridonosi povećanju kalcija zbog značajne potrošnje. Dodatno, namirnice iz grupe povrća, koje su izvor kalcija i bile su zastupljene u njihovoj redovitoj prehrani, većinom su špinat i kuhani grah, dok su od voća najveći doprinos imale naranče. Ispitanice nisu dobro informirane o utjecaju kalcija na kvalitetu kosti, te nisu upoznate ni sa značajnim izvorima kalcija među prehrambenim namirnicama.

Ključne riječi: kalcij, postmenopauza, prehrana

Keywords: calcium, postmenopause, nutrition

**ZNAČAJ PREHRANE ZA UNAPREĐENJE ZDRAVLJA OSOBA
STARIJE ŽIVOTNE DOBI U ORGANIZIRANIM INSTITUCIJAMA
ZA SKRB I ZAŠTITU U KANTONU SARAJEVO**

**THE IMPORTANCE OF NUTRITION FOR IMPROVING THE
HEALTH OF ELDERLY PERSONS IN ORGANIZED CARE AND
PROTECTION INSTITUTIONS OF THE SARAJEVO CANTON**

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Pravilna prehrana jedan je od ključnih čimbenika za unapređenje kvalitete života osoba treće životne dobi. Utjecaj prehrane na zdravlje očituje se tijekom cijelog životnog ciklusa. Kod stanovništva u dobnoj skupini 65 i više godina na području Kantona Sarajevo vodeće bolesti su kronične nezarazne bolesti i to hipertenzivne bolesti i diabetes mellitus sa indeksom strukture 30,46 % u odnosu na ukupni morbiditet. Cilj rada je ukazati na značaj prehrane za unapređenje zdravlja i kvalitete života korisnika Gerontološkog centra u Sarajevu. Korisnici Centra nemaju procijenjeni nutritivni status kao preduvjet za preporučenu zdravu prehranu, premda se vodi briga o dijetetskim zahtjevima za određene kronične nezarazne bolesti. Hrana se priprema u vlastitoj kuhinji, sukladno, u većoj mjeri, željama korisnika i važećem normativu namirnica. Neophodno je uz redovitu procjenu nutritivnog statusa raditi na kontinuiranoj edukaciji te primjeni preporučenih nutritivnih standarda za prevenciju kroničnih nezaraznih bolesti kod korisnika Gerontološkog centra u Sarajevu.

Ključne riječi: pravilna prehrana, osobe starije životne dobi, zdravlje, institucije za skrb i zaštitu

Keywords: proper nutrition, elderly people, health, care and protection institutions

NUTRICIONIZAM I PRETILOST

NUTRITION AND OBESITY

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Nutricionizam je primjenjena prirodna znanost o hrani i njezinom djelovanju na ljudski organizam. Istraživanja s područja nutricionizma, osobito zadnjih godina, imaju vodeću ulogu u shvaćanju mnogih procesa vezanih uz prehranu i pojavu bolesti i poremećaja, ali i u shvaćanju uloge prehrane u moduliranju genetskog potencijala pojedinca. Kroz cijelu ljudsku povijest provlači se spoznaja o povezanosti hrane, načina prehrane i bolesti. Bez obzira na razvoj biokemije i fiziologije, problem prehrane veoma je prisutan u svijetu. Pretilost ili debljina je stanje prekomjernog nakupljanja masnog tkiva u organizmu s posljedičnim štetnim učinkom na zdravlje ljudskog organizma. Tijekom povijesti debljina je bila znak ljepote i zdravlja, te se povezivala s plodnošću i snagom. Danas znamo da debljina nije samo estetski problem, nego i zdravstveni poremećaj koji pridonosi razvoju kroničnih bolesti, osobito bolesti srca i krvnih žila, te šećerne bolesti tipa 2, hiperlipidemije, hipertenzije, cerebrovaskularne bolesti, osteoartritisa, masne infiltracije jetre, većoj učestalosti karcinoma, policističnim jajnicima i sl. Pretilih ima sve više, kako u bogatim tako i u siromašnim zemljama, a problema s viškom kilograma imaju skoro dvije trećine stanovnika Bosne i Hercegovine (62,9 %). Po broju pretilih osoba BiH je na šestom mjestu u svijetu, a na drugom u Europi. Zabrinjavajući su i podaci o sve većem broju ekstremno pretilih djece (20,22 %). Osobe čiji je indeks tjelesne mase (ITM) od 20 do 25 imaju normalnu tjelesnu masu, od 25 do 30 imaju prekomjernu tjelesnu masu, od 30 do 35 smatraju se pretilim, a osobe čiji je ITM preko 40 smatraju se ekstremno pretilim. Preporuke za pravilnu prehranu su jesti puno voća i povrća, proizvoda od žitarica, hranu s malo masnoće i bez šećera, nemasno meso i ribu, a primjenjivati zdravije načine pripremanja hrane, piti najmanje 6-8 čaša vode na dan. Izbjegavati grickalice, slatkiše, brzu hranu (fast-food), gazirana i alkoholna pića. Obavezno doručkovati, izbjegavati preskakanje obroka i prejedanje, jesti najmanje tri puta na dan u manjim obrocima. Za skidanje tjelesne mase obavezno treba konzultirati nutricionista i kineziologa. Vježbanje je važno za cjelokupno zdravlje, ne samo za redukciju kilograma. A za dijetu su najbitniji kardio treninzi, u koje spadaju sve aerobne vježbe bez opterećenja poput trčanja u prirodi ili na traci, vožnje biciklom, preskakanja vijače, brzog hodanja, hodanja stubama i sl.

Ključne riječi: nutricionizam, prehrana, genetski potencijal, pretilost, indeks tjelesne mase, dijeta, tjelesno vježbanje, kardio treninzi

Keywords: nutrition, diet, genetic potential, obesity, body mass index, diets, physical exercise, cardio training

PREHRANA S BALANSIRANIM UNOSOM SLOBODNE I VEZANE VODE

DIET WITH A BALANCED INTAKE OF FREE AND BOUND WATER

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Uvod: Voda je glavni konstituent ljudskog tijela pa su dnevne potrebe za unosom vode najveće. Voda se u organizam unosi pijenjem, ali i kao slobodna ili vezana sa hranom. Unos slobodne i vezane vode sa hranom u omjeru kolike su dnevne potrebe u individualiziranoj prehrani može dati određene benefite.

Opći cilj rada: Cilj rada bio je ocijeniti utjecaj posebno pripremljenih jelovnika u pogledu unosa slobodne i vezane vode prilagođen individualnom unosu, uz poštivanje načela pravilne prehrane.

Metode rada: Jelovnik je individualiziran za svaku osobu tako da unos vode sa hranom sadrži uvijek u suvišku. Iz jelovnika su eliminirane dehidrirane namirnice tipa trajnih kobasica, suhomesnatih proizvoda i sl. Istraživanje je vršeno na 46 ispitanika u periodu od 90 dana. Za svakog pacijenta popunjen je upitnik na početku i na kraju ispitivanja o prehrambenim navikama, antropometrijskim podacima (mjereni su tjelesna masa i visina). Za ispitivani period formirani su jelovnici pravilne prehrane kod kojih je posebno vođeno računa o dnevnom unosu slobodne i vezane vode kao i omjeru unosa ukupne suhe tvari i vode. Ispitivanje za svaku osobu vršeno je u periodu od 3 mjeseca. Ispitanicima su davane preporuke o prehrani, fizičkoj aktivnosti i metodama izbjegavanja stresnih stanja.

Rezultati: Primjenom jelovnika sa balansiranim sastojcima hrane i planiranim unosom vezane i slobodne vode došlo se do rezultata koji pokazuju poboljšanja u smanjenju tjelesne mase kod 91 % ispitanika. Kod svih pacijenata došlo je do smanjenja krvnog tlaka, poboljšanja glikemijskog i lipidnog statusa.

Zaključak: Utjecaj prehrane sa balansiranim unosom slobodne i vezane vode je evidentan kroz praćenje tjelesne mase, zdravstvenog stanja i antropometrijskih parametra.

Ključne riječi: unos slobodne i vezane vode s hranom, smanjenje tjelesne mase

Keywords: intake of free and bound water with food, reduction of body mass

ASSOCIATION OF FRUIT AND VEGETABLE INTAKE AND BONE MINERAL DENSITY IN ELDERLY WOMEN

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Different diseases and conditions are associated with inadequate diet, also including the decline in bone mineral density (BMD). A healthy and balanced diet includes the adequate consumption of fruit and vegetables, so the aim of this study was to determine if fruit and vegetable intakes are associated with bone mineral density in elderly women.

The subjects were 60 women of 65 to 90 years of age. The 24-hour recall estimates the average daily fruit and vegetable intake and the intake of micronutrients important for bone health. Anthropometric parameters (body weight, body height, % of body fat) and biochemical parameters (serum folate, folate in erythrocytes, and serum vitamin D) were determined. BMD was measured at the femoral neck, femur, and lumbar spine by dual energy X-ray absorptiometry (DXA).

There was no significant correlation between fruit and vegetable intake and BMD in elderly women. A significant positive correlation was determined between vitamin D intake and BMD of the lumbar spine.

These results did not show that adequate fruit and vegetable intake contributes to the maintenance of BMD.

Keywords: bone mineral density, fruit, vegetables, elderly women

BRZA HRANA U SVAKODNEVNOJ PREHRANI

FAST FOOD IN DAILY NUTRITION

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Današnji život se generalno opisuje riječima dinamičan i brz, što od pojedinca zahtijeva kontinuiranu i konstantnu posvećenost poslovnim obvezama. Pod pritiskom obveza ljudi sve manje vremena posvećuju pravilnoj prehrani te je posljednjih dvadesetak godina konzumacija brze hrane iznimno porasla. U radu su prezentirani rezultati istraživanja ponašanja i stavova ispitanika u kontekstu brze hrane. Istraživanje je provedeno početkom lipnja 2017. godine u Karlovcu, a korišten je prigodno pripremljeni anketni upitnik. Slučajnim uzorkom obuhvaćeno je 100 ispitanika. Deskriptivna statistička analiza provedena je u Microsoft Office Excel-u 2007. Skoro 90 % ispitanika konzumira brzu hranu, uglavnom kao međuobrok (38 %) i ručak (35 %); najčešće pizzu (55 %), hamburgere (47 %), pomfrit (46 %) i čevape (46 %). Brzu hranu najčešće kupuju u specijaliziranim restoranima brze hrane, a uz nju najčešće piju gazirana pića (51 %) i vodu (47 %). Skoro polovina ispitanika brzu hranu smatra ukusnom što im je, uz cijenu, vrlo važan kriterij pri odabiru. Većina ispitanika razumije rizike koje za zdravlje mogu imati loše prehrabene navike, a skoro polovina ne razmišlja o promjeni načina prehrane. Brza hrana je znatno zastupljena u svakodnevnoj prehrani te u budućnosti treba ulagati velike napore kako bi se promijenile navike ljudi s ciljem postizanja pozitivnog utjecaja na zdravlje i kvalitetu življenja.

Ključne riječi: brza hrana, konzumacija, prehrabene navike, stavovi

Keywords: fast food, consumption, eating habits, attitudes

Dietetics and diet therapy / Dijetetika i dijetoterapija

THE ROLE OF NUTRITIONISTS IN THE CROATIAN HOSPITAL SYSTEM

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In Croatia, according to the qualification of scientific and artistic areas, fields and branches, nutrition is defined as a field within the scientific field of biotechnical sciences, with the scientific branches of nutrition science, dietetics, and chemistry and biochemistry of food. Nutrition is a relatively young science. A small number of hospital administrations in Croatia have recognized the importance of including a nutritionist in the patient treatment and education, even though a rulebook came into force in May of 2017, by which nutrition screenings and check-ups can be billed by the Croatian Health Insurance Fund. Clinical Hospital Centre (KBC) Osijek is one of the first hospitals in Croatia where patients undergo nutrition education and a review. The nutritionist cooperates with almost all the departments at the KBC Osijek, by the beginning of this Congress we will open an Ambulance for Obesity and present our results there. The aim of this paper is to present nutritionists with an overview of their knowledge and skills, and their implementation in the services provided by the hospital system. The emphasis will be put on the complementarity with other members of the interdisciplinary hospital team working towards the aim of increasing the quality of services towards the end user and ultimately improving the health of the population. The ultimate goal is to encourage other hospitals in Croatia to include nutritionists in other departments, in addition to the Nutrition Department.

Keywords: nutrition, health, hospital, treatment, interdisciplinary approach

ŠTO DONOSI NOVI ZAKONODAVNI OKVIR ZA HRANU ZA POSEBNE SKUPINE

WHAT DOES THE NEW LEGISLATIVE FRAMEWORK ON FOOD FOR SPECIFIC GROUPS BRING

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oral presentation / usmeno priopćenje

U srpnju 2017. godine stupio je na snagu Zakon o provedbi Uredbe (EU) br. 609/2013 Europskog parlamenta i Vijeća od 12. lipnja 2013. o hrani za dojenčad i malu djecu, hrani za posebne medicinske potrebe i zamjeni za cjelodnevnu prehranu pri redukcijskoj dijeti (NN 69/17) kojim se osigurava primjena novog EU zakonodavnog okvira za hranu za specifične grupe. Ciljevi novog pravnog okvira su viša razina zaštite određenih ranjivih skupina potrošača reguliranjem sastava, informiranjem potrošača i marketingom hrane namijenjene i prezentirane specifičnim skupinama. Postalo je jasno da razlika između „dijetetske hrane“ i „normalne hrane“ za specifične grupe stanovništva više nije jasna niti potrošačima, niti proizvođačima, a ni nadležnim tijelima. Stoga postojanje koncepta „dijetetske hrane“ paralelno s propisima o tvrdnjama, obogaćivanju hrane i informiranju potrošača više nije opravdano. Izmjenama se također nastoji povećati pravna sigurnost u poslovanju i olakšati ispravna primjena propisa eliminacijom pravila koja su nepotrebna i kontradiktorna, posebice vezano za hranu bez glutena i zamjenski obrok za kontrolu tjelesne mase. Osim navedenog novim propisima se uspostavlja jedinstveni popis Unije o tvarima koje se mogu dodavati u ovu kategoriju hrane i ovlašćuje se Komisiju da usvaja Odluke kojima tumači pripada li određena hrana u djelokrug predmetne Uredbe s ciljem da se osigura ujednačena primjena propisa u svim državama članicama.

Ključne riječi: zakonodavni okvir, dijetetska hrana, hrana za specifične grupe

Keywords: legislative framework, dietary food, food for specific groups

THE VALIDITY OF PEPSIN DETERMINATION IN SPITTLE (PEP TEST) FOR LARYNGO-PHARYNGEAL REFLUX DISEASE CONTROL (LPRD) IN FAMILY MEDICINE

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Introduction: Laryngo-pharyngeal Reflux Disease (LPRD) is an inflammatory reaction of the mucous membrane of the pharynx, larynx, and other respiratory organs, as a result of the reflux of gastric contents outside the oesophagus (LPR). LPRD is a relatively new clinical entity, which has a specific etiopathogenesis with a pronounced role of pepsin in the destruction of laryngeal mucosa. Due to the variety of clinical manifestations, patients with LPRD are treated in practice by various clinical disciplines, without clearly defined diagnostic and therapeutic procedures. The disease is very common, even in epidemic proportions, and patients with the symptoms of LPRD are primarily reported to a family doctor. The knowledge of specific manifestations of LPRD, specific etiopathogenetic factors, and modern diagnostic procedures can be avoided by present wandering in adequate access, treatment, and prevention of this disease. Early diagnosis with non-invasive procedures and specific dietary measures in nutrition can play an important part in adequately controlling LPR in the daily practice of a family doctor.

The aim of the paper: The aim of the paper is to emphasize the importance of new non-invasive diagnostic procedures, such as the PEP test, which can be used to avoid invasive and costly interventions (laryngoscopy, esophagogastric scintigraphy, and pH monitoring). A positive PEP test evaluation with the evaluation of questionnaires for the occurrence of LPR symptoms allows a family doctor to immediately apply adequate treatment. The contemporary treatment refers primarily to the regimen of alkaline water and food regimens, and high doses of proton pump inhibitors (PPIs), which permanently inhibit the activation of pepsin in the respiratory organs.

Materials and methods: During one year, the symptoms of 710 patients who first appeared in the family medicine clinic were analyzed. The patients with the signs of LPR completed the Reflux Symptom Index-the Belafsky questionnaire. A PEP test was also performed on 50 patients with positive results for the LPR syndrome and with endoscopically confirmed changes in the larynx. The patients with positive results were treated using basic methods of modifying lifestyles, alkaline water and food, alginates, and high doses of proton pump inhibitors.

Results: Of the 710 patients who first appeared at the family medicine doctor, 132 patients had the symptoms of LPR. A PEP test was performed on 50 patients from this group (who also had endoscopically verified changes in the larynx). 46 patients, or

92 %, had positive results of the PEP test. This group of patients was treated according to the proposed protocol. 90 % of the patients had an adequate improvement of the disease condition while treated using the basic procedures of family medicine practitioners.

Conclusion: Almost every fifth patient in family medicine has symptoms of LPR. The basic procedures for prevention, diagnosis, and therapy of LPR may be established according to the proposed algorithm at the level of primary health care - family medicine. The PEP test, as a non-invasive and simple procedure, plays a very important role in this process and in the overall control of this disease. Only a small number of patients seek targeted procedures in other clinical disciplines.

Keywords: laryngopharyngeal reflux (LPR), PEP test, alkaline water and food, family medicine

THE ROLE OF THE MESENTERY AS A NEW ORGAN IN THE DIGESTION PROCESS

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Introduction: Until 2012, mesentery was considered as an integral part of other digestive organs in the form of fragmented structures, without specific anatomical and functional characteristics. In 2012, Dr. Calvin Coffey published studies in which he defined the mesentery as special organ with clearly defined anatomical, tissue, and functional characteristics, that connects the whole digestive tube and makes it the key factor and an independent organ in the gastrointestinal system. The new concept of anatomical structure and a newly discovered function of the mesentery have far-reaching effects on digestion research and they provide new insights into the etiopathogenesis of nutrition-related illnesses and treatments, as well as some abdominal interventions.

The aim of the paper: The aim of the paper is to evaluate and summarize new knowledge about the function of the mesentery as a special organ in the process of digestion. It is especially important to underline the findings of endocrine, immunologic, and anti-inflammatory functions of fatty tissues of the mesentery that directly control the entire digestion process with adequate immune responses. Its disturbed function can lead to the development of a large number of autoimmune diseases and insulin resistances associated with pathological obesity and chronic cardiovascular disease.

Results: Current research shows that there are three basic functions of the mesentery. The first is specific to the anatomical structure because it mechanically enables the proper positioning and intestinal motility, and the anatomical and functional connection with other organic systems. This function is a key moment for the process of digestion. The second function is immune control and systemic local response to antigen components of food and microorganisms, in the form of prevention of growth and the invasion of pathogenic bacteria. The modulation of the immune system of the small intestine with the control of the mucous membrane and the prevention of increased bowel permeability for harmful food ingredients is an important component of this function.

The mesentery fatty tissue has a neuroendocrine function with mediators called adipocytokines, of which adiponectin, leptin, resistin, and ghrelin are the most important. They play a role in all aspects of the metabolism and are an important component of overall neuroendocrine control of the entire body's function and digestion. The dysfunction of this component leads to pathological conditions not only

in the digestive organs but also in distant organs, and of course the brain. In connection with disturbed digestion, pathological thickness and diseases associated with liver steatosis and resistance to insulin, such as metabolic syndrome, can develop.

Current science has shown that food, nutrition, and digestive functions have a strong and decisive influence on life, quality of life, and on the appearance of various diseases. The interaction of the ingredients in food in first contact with human-specific microscopic and molecular builds and specific genomes have far-reaching consequences that people are not yet aware of. Choosing food with a healthy lifestyle gives the opportunity to prevent most diseases, as well as the extension of life and the quality of life.

Conclusion: The classification of the mesentery as a new organ and the new knowledge of the specific functions of the different tissues of this organ have led to the creation of a new mesenteric science and a new field of research. The significant role of the mesentery in the digestion process is also important for nutritionists, in order to provide adequate nutrition and prevent the disorder of the complex functions that leads to the disease.

Keywords: mesentery, function, digestion

HERBAL PRODUCTS AS POTENTIAL THERAPY FOR FUNCTIONAL DYSPEPSIA

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Functional dyspepsia (FD) is defined as the presence of postprandial fullness, early satiation, epigastric burning, or pain in the absence of other systemic, metabolic, or organic disease. *FD* is divided into the *postprandial distress syndrome (PDS)* and the *epigastric pain syndrome (EPS)*, with significant overlap with *gastroesophageal reflux disease (GERD)* and *irritable bowel syndrome (IBS)* symptoms. Current recommended therapy is antisecretory drugs (PPIs or H2RAs), but the recurrence of symptoms often occurs after an intermission in therapy. Prokinetic drugs, such as *metoclopramide* and *domperidone*, are especially effective for *PDS*, but like with antisecretory drugs, long term therapy is not recommended. *Acotiamide* could be as effective as prokinetics. Antidepressants (SSRI) have shown some results, as well as *bismuth salts* and *simethicone*, but adequate trials are needed. Various numbers of Chinese, Korean, and Iranian herbs are excluded from this research. Alginates provide effects for *GERD*, but *FD* effects are doubtful. Data shows that the *SWT5* is as effective as prokinetics, especially with *IBS* overlap. Peppermint and caraway oil, star anise, ginger, and artichoke leaf extract have better efficacy than placebo in the treatment of functional dyspepsia. Olive oil, red pepper, curcuma, dandelion, and Melissa could be useful, but well developed prospective clinical trials are needed.

Keywords: functional dyspepsia, herbal products, potential therapy

**DIJETA SA SMANJENIM UDJELOM FODMAP NAMIRNICA U
TERAPIJI SINDROMA NADRAŽAJNOG CRIJEVA U BOLESNICE S
CELIJAKIJOM – PRIKAZ SLUČAJA**

**LOW FODMAP DIET AS A DIETOTHERAPY APPROACH TO
IRRITABLE BOWEL SYNDROME IN PATIENTS WITH COELIAC
DISEASE-CASE REPORT**

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Celijakija je kronična, doživotna, autoimuna bolest gastroenterološkog sustava koja, ukoliko se ne liječi bezglutenskom prehranom, može oštetiti brojne organske sustave oboljelog. Sindrom nadražajnog crijeva je motorni (funkcionalni) poremećaj gastrointestinalnog sustava koji uzrokuje bol u trbuhu, proljeve, opstipaciju ili kombinaciju navedenih. Nenormalna stezanja gastrointestinalnog sustava mogu uzrokovati stres, prehrana, lijekovi, hormoni ili manji podražaji. Sindrom nadražajnog crijeva je često zabilježen kod osoba oboljelih od celijakije.

U 32-godišnje pacijentice, s od ranije poznatom celijakijom i striktnim pridržavanjem bezglutenske prehrane, gastroenterološkom obradom postavljena je dijagnoza sindroma nadražajnog crijeva. Korištena je uobičajena medikamentozna terapija peroralnim antikolinergicima bez značajnije redukcije simptomatologije. S obzirom na to da je FODMAP dijeta (dijeta koja isključuje fermentirajuće oligosaharide, disaharide, monosaharide i poliole) zlatni standard u dijetoterapijskom pristupu bolesnika sa sindromom nadražajnog crijeva, u bolesnice je korištena ista. Tijekom dvomjesečnog praćenja bolesnice dolazi do značajnog smanjenja simptoma nadutosti i proljeva, isključivo dijetoterapijskom modifikacijom, bez korištenja medikamentozne terapije.

Ključne riječi: celijakija, sindrom nadražajnog crijeva, FODMAP dijeta

Keywords: coeliac disease, irritable bowel syndrome, FODMAP diet

THE IMPORTANCE OF NUTRITION EDUCATION FOR DIABETICS –TYPE 1 VERSUS TYPE 2 DIABETICS

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Nutrition education is an integral part of the diabetic therapy that aims at achieving good glycaemic control to prevent complications. This is very important for type 1 diabetics (DMT1), where nutrition and insulin therapy must be matched. The aims of the study were: the evaluation of differences in nutrition education between DMT1 and type 2 diabetics (DMT2), the influence of education on glycaemic control and diet quality, and the self-assessment of health-related quality of life. An observational study was conducted on patients with DMT1 (n=101) and DMT2 (n=90) from Croatia, by using a study-specific questionnaire. Diet quality did not differ significantly between DMT1 and DMT2 patients. However, 18.0 % of DMT1 and 20.0 % of DMT2 patients lack proper education on the diabetic diet, thus they do not adhere to one. Poor glycaemic control was recorded for 48.5 % of DMT1 and 73.5 % of DMT2 patients ($p < 0.001$). Psychophysical health is better among the DMT2 patients ($p < 0.001$), while the DMT1 patients have a better social life ($p = 0.015$) and the overall quality of life ($p < 0.001$). The results show that diabetics have poor nutrition knowledge, clearly showing the need for professional, continuous nutrition education. Education would help diabetics in improving their life quality and glycaemia control, which decreases disease complications.

Keywords: diabetes type 1, diabetes type 2, diet quality, glycaemia control, quality of life

THE DIETARY-THERAPEUTIC APPROACH OF NON-INSULIN AND INSULIN THERAPY FOR DIABETES MELLITUS TYPE 2

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Introduction: The basic principles for the treatment of diabetes are dietary therapy, adapted physical activity on a daily basis, and continuous education about treatments. When the effects of this approach are not satisfactory, pharmacological treatment is introduced.

Goal: The aim of the activities is to emphasize the necessity of an individual dietary-therapeutic approach to pharmacological therapy for diabetes mellitus type 2.

Work methodology: The individualized dietary-therapeutic approach is based on monitoring and the evaluation of biochemical, metabolic, and anthropometric parameters of diabetes mellitus patients within the Diabetes and Nutrition Counselling Department. Anthropometric research is done on an InBody analyzer, using the method of direct segmental analysis of multi frequent bioelectrical impedance (DSM-BIA Method) - tetra polar system with 8 touching points.

Results and discussion: The selection of dietary therapy is based on the characteristics of medication, the presence of other metabolic disorders, and the overall health of the patient, with the goal of achieving good glycaemic control. The non-pharmacological form of treatment should be individualized depending on whether it is oral mono-therapy, oral dual therapy, triple therapy, combined, or insulin therapy. The dietary-therapeutic approach for insulin dependent patients requires the knowledge of calculating carbohydrate units in relation to the prescribed dose and the type of insulin.

Research indicates that the optimisation of metabolic control prevents chronic complications. A 1 % decrease of HbA1C lowers the risk of myocardial infarction by 14 %, of micro-vascular complications for 37 %, and of mortality from diabetes for 21 %.

The aim of the joint integrated approach to treatment is to lower the risk from macro and micro vascular events, while reaching the satisfactory values of glycosylated hemoglobin (HbA1c), with fasting glycemia of <7.2mmol/l and postprandial glycemia of <8.0 mmol/l. The latest recommendation for the optimal value of HbA1c is a value under 7 % with an individual approach to a patient.

Case overview: A 52 year old patient was referred by an Internal Medicine Specialist to the Diabetes and Nutrition Counselling Department for glycemia regulation. The values of HbA1c on last analysis was 10.3 % (86 mmol/mol), with measured fasting glycaemia of 12.2 mmol/l. The patient was educated about diabetic nutrition using an individualized dietary-therapeutic approach. The control findings have indicated that the introduction of an appropriate diet therapy and education led to the regulation of

glycemia based of the following measured values: HbA1c 7.10 % (53 mmol/l), fasting glycemia 9.5 mmol/l, with the regulation of other biochemical parameters.

Conclusion: The individualized dietary-therapeutic approach to pharmacological therapy of diabetes mellitus type 2 improves the effects of medication, insulin, and non-insulin therapy.

Keywords: dietary-therapeutic approach, diabetes mellitus type 2

KAKO PROMIJENITI STANJE DIJABETES TIP 2 POSTOM

HOW TO REVERSE DIABETES TYPE 2 BY FASTING

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Dijabetes tipa 2 pripada obitelji kroničnih progresivnih nezaraznih bolesti koje se očituju povećanom razinom glukoze u krvi. Pojedini metabolički poremećaji poput nakupljanja masnog tkiva i inzulinske rezistencije doprinose razvoju bolesti. Prevencijom razvoja i liječenjem, alternativnim metodama, postom i restrikcijom kalorijskog unosa navedenih skupina metaboličkog sindroma čini se da možemo utjecati na pojavu dijabetesa tipa 2 i njegovo liječenje. Istraživanja provedena na osobama s dijabetesom i onima koje pripadaju u rizičnu skupinu za razvoj iste, pokazala su kako dolazi do smanjenja koncentracije glukoze, inzulina i leptina tijekom faze posta. Takav stres za organizam dovodi do povećane koncentracije adiponektina i rezistina tijekom faze posta. To dovodi do snažne aktivacije i odgovora hipotalamusa, koji povećava razinu leptinskih receptora čija je zadaća razgradnja masnih stanica, te korištenje energije iz tog sustava kao odgovor obrambenog mehanizma tijela. Tijekom faze posta zabilježene su i značajno smanjene razine lipoproteina (LDL i HDL), sistoličkog i dijastoličkog krvnog pritiska. Psihološke procjene tijekom faze posta ukazuju na povećanje raspoloženja, smanjenje anksioznosti, umora i depresije kod ispitanika. Sve navedeno možda ukazuje na to da dijabetes tipa 2 ipak nije u potpunosti progresivna i neizlječiva bolest. U ovome radu prezentirali smo određena saznanja i ponudili neke odgovore na problem.

Ključne riječi: dijabetes, inzulinska rezistencija, post

Keywords: diabetes, insulin resistance, fasting

NUTRITIONAL CHARACTERISTICS OF PATIENTS WITH CHRONIC PAIN

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Chronic pain is defined as a distinct health issue and it often alters all aspects of the patient's life, inducing severe physical, psychological, and social impairments, while significantly affecting the individual's quality of life. Until today, there is no efficient single medical treatment to deal with chronic pain.

The nutritional evaluation results of the patients with chronic pain who attended the multidisciplinary four-week programme for treating chronic pain, which has been carried out at the University Hospital Osijek, are presented here. The four-week programme was specially designed for individuals who have been living with chronic pain for more than ten years and have tried more than five different pain treatments, after which their problem was left unresolved. Forty people of the average age of 60.4 ± 9.1 (15 % men, 85 % women) have filled out a nutritional survey before and after attending this programme. The nutritional status assessment showed that 72.5 % of the examinees were either overweight or obese, which is particularly worrisome considering the fact that 80 % of the patients suffer from some sort of back pain. Nutritional habits were graded (scores/points) as positive or negative, according to the available literature data regarding the influence of certain foods and/or nutrients on chronic pain pathophysiology (e.g. fast food consumption, vitamin B and omega-3 fatty acids consumption, etc.). The results have revealed considerable improvement of the patients nutritional intake after attending the programme, which is evident from the less negative nutritional characteristics (3.55 ± 2.41 points before and 2.80 ± 1.85 points after the programme; $p < 0.001$).

Keywords: chronic pain, nutrition, multidisciplinary team of experts, education

THE NUTRITIONAL STATUS OF HAEMODIALYSIS PATIENTS

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Haemodialysis patients are a vulnerable population group and they, among others, should take special care about food and fluid intake, with the emphasis on energy, potassium, phosphorus, sodium, and protein intake, as well as weight gain.

The assessment of the nutritional status was determined in 14 patients using body weight, body height, upper arm circumference, lower leg circumference, and hand dynamometry; same as the biochemical parameters: urate concentration, calcium and phosphate levels, total protein, creatinine, albumin, and globulin ratio, and C-reactive protein; and the dietetic method: 3-day dietary record (3DD).

This study showed that 57 % of the included participants are overweight, and 35.7 % are adequately nourished. According to the 3DD, most of the subjects are supposed to align their micro- and macro- nutrients intake with the recommendations, with the emphasis on potassium, phosphorus, sodium, protein, and energy intake.

Further studies with larger sample sizes and regional difference are required for better and accurate knowledge about the nutritional status of patients undergoing dialysis in Croatia.

Keywords: haemodialysis, nutritional status, food intake, 3-day dietary record

THE BENEFITS OF EARLY VERSUS DELAYED ORAL FOOD INTAKE IN PATIENTS WITH GYNAECOLOGICAL AND OBSTETRICS OPERATIONS

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poster

Traditionally, postoperative oral intake is withheld until the return of the bowel function. There has been concern that early oral intake would result in vomiting and severe paralytic ileus, with subsequent aspiration pneumonia, wound dehiscence, and anastomotic leakage. However, supporting scientific evidence for this traditional practice is lacking and there are potential benefits from early postoperative oral intake. The study encompassed 45 women with major abdominal gynaecological surgery between 1 November – 31 December 2016 in the Hospital Plodnost – Bitola, Macedonia, Special Hospital for Gynaecology and Obstetrics, and the IVF Centre. Also, the review of evidence from randomised controlled trials of early and delayed feeding after abdominal gynaecological surgery was performed.

The objectives were to assess the effects of early versus delayed (traditional) initiation of oral intake of food and fluids after major abdominal gynaecological surgery.

In conclusion, early postoperative feeding after major abdominal gynaecological surgery appeared to be safe, without increased gastrointestinal morbidities or other postoperative complications. The benefits of this approach include faster recovery of bowel function, lower rates of infectious complications, shorter hospital stay, and higher satisfaction.

Keywords: food intake, early feeding, surgery

PROPOSED DIETARY RECOMMENDATION FOR ACROMEGALY PATIENTS

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Acromegaly is a rare condition (prevalence range is 2.8 to 13.7 cases/100,000 people) characterized by the excess of the growth hormone (GH) and elevated insulin-like growth factor 1 (IGF-I), which is mainly attributed to a pituitary adenoma. The main symptom is gigantism, with concomitant conditions like sleep apnoea syndrome, type 2 diabetes mellitus, debilitating arthritis, carpal tunnel syndrome, hyperhidrosis, and hypertension. The symptoms of acromegaly can be present up to 5 years before the diagnosis.

The increasing prevalence of diabetes and hypertension around the globe shed a new light on acromegaly and nutrition. However, diet and the management of acromegaly with its concomitant conditions have not been properly researched. A systematic review of the available literature was conducted in the following databases: PubMed, Cochrane, MedlinePlus, and Web of Science. The key words used for the search were: acromegaly, nutrition, and diet. The last search was conducted on March 25, 2017.

Although limited, the following dietary recommendations for patients with acromegaly can be summed into: low consumption of sodium, high intake of unsaturated fatty acids, high intake of protein, and the consumption of a low glycaemic diet. Thus, we propose that defining a specific dietary approach for the patients could potentially alleviate some of the major symptoms of acromegaly.

Keywords: acromegaly, growth hormone, insulin-like growth factor, dietary approach, systematic review

CARDIOVASCULAR RISK IN CHILDREN AND ADOLESCENTS WITH THE RESTRICTIVE TYPE OF ANOREXIA NERVOSA

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Anorexia nervosa (AN), as one of the eating disorders today, represents one of the most common chronic diseases in adolescents with high mortality rate, mainly related to the female gender and adolescent age. The research conducted in collaboration with the Observational Retrospective study included 183 girls (2005 to 2015 period) from the Centre for Eating Disorders in Children and Adolescents in the Sestre milosrdnice University Hospital Centre Zagreb. The average age of the patients was 14.8 ± 2.5 (7 to 23), they were diagnosed with AN for an average of 12.8 ± 13.9 months (0.7 to 108 months). Their average BMI was 15.8 ± 1.9 kg/m² with IBW of 77.7 ± 9.9 %, and an average weight loss of 21.7 ± 9.9 %. 20.6 % of the patients had a normal menstrual cycle and 74.4 % of the AN patients had secondary amenorrhea. The increased cardiovascular (CVD) risk was found in one third of the AN patients (35.5 %) and in almost half of the restrictive type AN patients (47.4 %). The increased CVD risk correlates with worse anthropometric parameters ($p=0.018$) and amenorrhea ($p<0.001$). The results confirm the correlation between the increased CVD risk and the AN entotype, and confirm the importance of physical improvement as the main goal of the AN treatment.

Keywords: anorexia nervosa, children and adolescents, restrictive type, cardiovascular risk

FOOD AND PARKINSON`S DISEASE

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Parkinson's disease is the second most common neurodegenerative disorder, characterised by many motor and non-motor symptoms that have a negative influence on the patient's quality of life. The main pathological finding is the alpha synuclein deposit formed out of Lewy bodies and Lewy neurites located in different brain regions. The etiology of the disease is still unknown, with many environmental risk factors, such as heavy metals, well water, pesticides, herbicides, MPTP toxin, CO intoxication, etc. There is no clear evidence of the influence of food, but some papers reported that unsaturated fatty acid, coffee, and caffeine intake could lower the risk, while food containing animal fats could increase the risk of Parkinson's disease. There is a very well organised microbiota in the human gut, representing an ecological community of commensals, symbiotic and pathogenic microorganisms. Parkinson's disease patients, compared to healthy controls, have a higher incidence of microbiota dysbiosis, with the predominance of proinflammatory and a lowered number of antiinflammatory microorganisms. There is some evidence that gut microbiota dysbiosis could influence the appearance of alpha synuclein deposits in the gut neurons. This alpha synuclein, like a prion, travels from cell to cell to the brain across the vagal nerve. So, the gut and the gut neurons could be considered as a door to brain pathology in Parkinson's disease patients. The influence of the food, as a trigger factor for pathology, should be considered in the future research.

Keywords: Parkinson's disease, alpha synuclein, gut, food, dysbiosis

BLOOD ENZYMES AS SCREENING BIOMARKERS FOR SEVERE CLINICAL CONDITIONS

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Enzymes are energized protein molecules involved in almost all biochemical reactions in the body. Their activity is specific, which emphasizes their importance in clinical setting, i.e. diagnostic purposes. Also, their activity as well as concentration in the blood can be related to diet as well as other characteristics of a person like smoking, alcohol abuse or physical activity. Therefore, determining the activity of specific enzymes in the blood, plasma, erythrocytes, or tissue samples enables precise and timed diagnosis of specific clinically relevant conditions. The aim of this research was to analyze selected enzymes in otherwise healthy people, and on the basis of their elevation determine their screening potential for clinically relevant conditions. Blood of 100 people aged 29-79 years from the municipality of Veles, Macedonia were collected. The following enzymes were determined: LDH, aspartate aminotransferase (AST/GOT), alanine aminotransferase (ALT/GPT), creatine kinase (CK), and alkaline phosphatase (ALP) at the Clinical and Biochemical Laboratory at J.Z.U. General hospital-Veles according to the standardized procedures. The obtained results showed deviation from the normal values of the enzymes examined in only a small number of patients, which are indicative for certain pathological diseases, malnutrition, lack of vitamins or minerals. All alterations in the concentration of enzymes should be timely diagnosed and followed-up with additional clinical examinations to determine underlying causes.

Keywords: enzymes, disease biomarkers, screening

THE INTERACTIONS OF POLYPHENOLS WITH β -GLUCAN AND CELLULOSE

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Polyphenols are compounds found in plant foods, which show many potentially beneficial effects on the human health. One of their effects is their interaction with other food components, which can influence their actual bioaccessibility and bioavailability in the human organism. Dietary fibres are one of these compounds. Polyphenols can interact with dietary fibres, which can “carry” them to the lower parts of the digestive tract. Here, the polyphenols have the potential to show beneficial effects. The aim of this study was to describe the latest knowledge about the interactions between dietary fibres (β -glucan and cellulose) and polyphenols: The importance of the food matrix (are fruits and vegetables consumed alone or with other foods), the importance of polyphenol solubility under physiological conditions, the binding possibilities between polyphenol molecules and dietary fibres (hydrogen bonds, Van der Waals forces, and hydrophobic interactions), and the binding energy. One of the aims of this study is also to show improvements of the experimental methodology needed to analyze and explain the interactions (extraction methods) and to describe future perspectives.

Keywords: polyphenols, β -glucan, cellulose, interactions

AN EQUILIBRIUM AND KINETIC STUDY OF PHENOLIC ACIDS ADSORPTION ONTO β -GLUCAN

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Phenolic acids belong to the group of natural polyphenols, which are secondary plant metabolites. Polyphenols show many positive bioactivities, which are not completely investigated. One of these bioactivities is the polyphenol interaction with food compounds, such as lipids, proteins, and dietary fibres. The information about the interactions between polyphenols and dietary fibres can be obtained through the parameters of adsorption equilibrium models, like Freundlich, Langmuir, Dubinin-Radushkevich, and others. Also, the reaction order and the kinetic constants can be obtained through kinetic models, like pseudo-first and pseudo-second order models. The objective of this study was to obtain information about the interactions between phenolic acids, like, *p*-coumaric and caffeic acid, and β -glucan as a natural dietary fibre, through non-linear adsorption models and kinetic models of the pseudo-first and pseudo-second order. The adsorption was carried out at 25 °C for 16 h, in a model solution which contained polyphenol, β -glucan, and phosphate buffer pH 5.5. Kinetics was conducted at 25 °C during 1, 2, 5, 10, and 16 h. After reaching the adsorption equilibrium, the un-adsorbed polyphenols were separated from the adsorbed ones by ultrafiltration. The non-linear adsorption equilibrium models and kinetic models were determined. The results showed that the adsorption was favoured and chemical, and was best described by the pseudo-second order model.

Keywords: adsorption, kinetic, polyphenols, β -glucan

Functional food and dietary supplements /
Funkcionalna hrana i dodaci prehrani

FUNCTIONAL FOOD AWARENESS AND PERCEPTIONS AMONG CROATIAN AND MACEDONIAN UNIVERSITY STUDENTS: DIFFERENCES BY COUNTRY OF RESIDENCE AND FACULTY OF STUDY

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poster

Functional foods are natural or processed foods that contain bioactive compounds; which, in defined amounts, provide a clinically proven and documented health benefit for the prevention, management, or treatment of chronic disease. The objective of this study was to assess the awareness and perceptions of the health benefits related to functional foods among university students, with emphasis on the differences in the country of residence and faculty of study. In addition, the purpose of the survey was to identify the need for information related to functional foods among students. Croatian (n=100) and Macedonian (n=100) university students completed a researcher administered questionnaire created to collect information about functional foods; including current consumption, sources of information for functional foods, motivating factors for consumption, and awareness of health benefits. Half of the students from each country were students at faculties in the field of social sciences, while others studied at study programmes related to food science and nutrition. The general results indicate that there is a need for further information regarding functional foods in order to improve consumer perceptions and increase the consumption of functional foods, as a part of the healthy lifestyle of the students.

Keywords: functional food, questionnaire, nutrition, education, health benefits

STAVOVI I MIŠLJENJA LIJEČNIKA OBITELJSKE MEDICINE O DODACIMA PREHRANI

ATTITUDES AND OPINIONS OF GENERAL PRACTITIONERS ABOUT FOOD SUPPLEMENTS

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poster

Uvod: Posljednjih godina svjedoci smo porasta broja, vrsta i oblika dodataka prehrani. Dodaci prehrani izdaju se ne samo bez recepta, već i izvan ljekarni. S druge strane, potrošači su pod velikim utjecajima reklama iz različitih medija. Broj potrošača dodataka prehrani se povećava iz godine u godinu.

Cilj: Cilj ovog istraživanja je uvid u stavove i mišljenja liječnika obiteljske medicine o dodacima prehrani, percepciju proizvođača dodataka prehrani, kao i preporučivanje određenih dodataka prehrani pacijentima u ordinacijama obiteljske medicine, te zapitati se, je li ordinacija obiteljske medicine pravo mjesto za informiranje potrošača o dodacima prehrani.

Metode: Istraživanje je provedeno na temelju individualnih intervju s liječnicima obiteljske medicine na području 5 županija (Osječko-baranjska županija, Požeško-slavonska županija, Vukovarsko-srijemska županija, Virovitičko-podravska županija i Brodsko-posavska županija). Intervju je proveden na uzorku od 100 liječnika obiteljske medicine u njihovim ordinacijama.

Rezultati: Na temelju dobivenih odgovora došlo se do sljedećih rezultata: gotovo svi ispitanici (njih 97 %) bili su od svojih pacijenata pitani za savjet o dodacima prehrani, razmjerno veliki broj ispitanika (80 %) uputilo je svoje pacijente da se po pitanju dodataka prehrani obrate svom ljekarniku. Kao glavni izvor novih saznanja o dodacima prehrani liječnici su naveli stručne suradnike iz različitih firmi proizvođača ili/i zastupnika dodataka prehrani. Većina ispitanika (95 %) smatra da dodaci prehrani mogu preventivno pomoći u očuvanju zdravlja, ali nemaju utjecaj na izlječenje kod neke uznapredovale bolesti. Značajan broj ispitanika (77 %) naveo je da bi se sa savjetovanjem pacijenata o dodacima prehrani trebao baviti netko drugi, a ne liječnici obiteljske medicine.

Zaključak: Uslijed velikog izbora dodataka prehrani na tržištu, mnogobrojnih reklama, potrošači se za savjet najčešće obraćaju svom liječniku obiteljske medicine, ali liječnicima dodaci prehrani nisu u fokusu rada. Na osnovi ove spoznaje ostaje otvoreno pitanje kome se sve veći broj potrošača dodataka prehrani treba obratiti za savjet.

Ključne riječi: liječnici obiteljske medicine, dodaci prehrani, stavovi

Keywords: general practitioners, food supplements, attitudes

DIETARY SUPPLEMENTATION PRACTICES AMONG FOOTBALL PLAYERS

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Dietary supplements are foodstuffs, medicinal herbs, plant or animal extracts, and concentrates containing active compounds, the purpose of which is to supplement the normal diet, with the aim of gaining power and endurance, as well as muscular weight. The active compounds in them are nutrients (vitamins and minerals, fatty acids, proteins) or other substances with a physiological effect (enzymes, microorganisms, hormones). The most often used dietary supplements among athletes are fatty acids, whey proteins, fat burners, creatine, and isotonic drinks. Football players use dietary supplements as ergogenic aids, with the aim of fulfilling the elevated dietary needs and to fasten recovery. The aim of this study was to assess the dietary supplementation practices among football players. The cross-sectional study encompassed 20 active football players from Sarajevo. Data was collected using a short questionnaire, which included general characteristics of the study participant (age, height, weight, and residence), information on the frequency of dietary supplement use, type of supplement and dosage, as well as the reasons for supplementation and the source of recommendation for using it. The study participants most often reported taking omega-3-fatty acids, magnesium, whey proteins, and branched amino acids. Performance was the most frequently stated reason for supplementation. Supplementation was supervised and recommended by a nutritionist or self initiated, and practiced in the recommended dosage. In conclusion, dietary supplements can be ergogenic and enhance performance on one hand, and help with recovery on the other. Still, their usage should always be recommended and supervised by a specialist.

Keywords: dietary supplements, football players, recommendations

THE TREATMENT OF PAIN AND INFLAMMATION USING HERBAL THERAPY AND NUTRITION AMONG ATHLETES

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Athletes can be in pain during training and competition, or feel fatigue and pain in the locomotor system, as well as psychological tension. The use of conventional drugs is controlled by applying doping control tests, apart from some herbal substances which are authorized for use.

The aim of our research was to determine the effectiveness of herbal extracts and how safe it is for athletes to use them.

Materials and methods: We used data from two databases: <https://www.ncbi.nlm.nih.gov/pubmed> and <https://nccih.nih.gov>.

Results and discussion: 15 substances were analyzed in terms of research evidence, efficiency, and safety for use.

Conclusion: Most of the substances have already proven effective in reducing pain and inflammation (such as turmeric, ginger, polyphenols, bromelain, comfrey, golden root) if applied locally or taken orally, but there is evidence that some are not safe (arnica willow, devil's claw, Lord lineage).

Keywords: athletes, pain, herbal therapy

FIBRE INTAKE AS A TOOL FOR MANIPULATING GUT MICROBIOTA IN OBESE INDIVIDUALS

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oral presentation / usmeno priopćenje

Microbiota plays an increasingly important role for the wellbeing of the host. It has been correlated with a plethora of conditions, ranging from gastrointestinal to immunological and metabolic diseases. It is believed that microbiota plays an important role in the onset, development, and treatment of obesity, with exact mechanisms still unclear. Diet is one of the major factors affecting the microbiota - especially the intake of dietary fibres (prebiotics), which are believed to positively affect the composition of the microbiota. We tested the concept of modulating the composition of microbiota using prebiotics in a physically active obese male. The dietary intake and fibre intake was assessed at the beginning, using a food frequency questionnaire. The intervention consisted of daily supplementation with the commercial prebiotic Nutriose(R), till the recommended daily intake of fibre was achieved. No major changes of dietary style and calorie intake were recommended. The intervention was carried out for 30 days, during which body height, weight, and composition were measured and stool samples were taken at the beginning, after 15 days, and after 30 days of the intervention. The anthropometric parameters showed a 4.8 % decrease of body weight with a significant reduction of body fat (12.2 %), and a decrease in visceral fat from 15 to 13. Microbiota composition showed a significant increase of the beneficial bacterial genus *Bifidobacterium*, which increased tenfold during the intervention.

Keywords: microbiota, obesity, prebiotics, dietary supplements

THE EFFECTS OF *IN VITRO* GASTRO-INTESTINAL DIGESTION ON THE STABILITY AND BIOACCESSIBILITY OF OLIVE POLYPHENOLS

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Olive pomace extracts (OPE) contain various biologically active polyphenols (PPs). However, to exert any health beneficial effects, bioactive compounds should be bioavailable, and their bioavailability depends on their release from the matrix during gastro-intestinal (GI) digestion, and subsequent intestinal absorption. The aims of our research were to determine the *in vitro* GI stability, bioaccessibility, and dialysability of PPs, in terms of total phenolic content (TPC), antioxidant potential (AP), and concentration of hydroxytyrosol (HTS) and tyrosol (TS). The samples were OPE without an excipient (native extract, NE), and with the following excipients: β -CD (B), randomly methylated β -CD (RAMEB), hydroxypropyl β -CD (HPB), and γ -CD (G). The *in vitro* GI digestion consisted of two sequential steps; an initial pepsin/HCl digestion to simulate gastric conditions, followed by digestion with bile salts/pancreatin and dialysis tubing, to simulate duodenal digestion and absorption by passive diffusion. All the samples showed relatively high bioaccessibility. The highest dialysability (%) in terms of AP and TPC was obtained for the samples RAMEB and NE, and in terms of HTS and TS content, the highest yield was obtained for the HPB (16 mg/mL) sample.

Keywords: olive pomace polyphenols, bioaccessibility, dialysability, *in vitro* simulated gastro-intestinal digestion with dialysis

**SELEKTIVNA BIODISTRIBUCIJA APSORBIRANIH
POLIFENOLNIH SPOJEVA IZOLIRANIH IZ CVIJETA *Prunus
spinosa* L. U ORGANIMA C57BL/6 MIŠA**

**SELECTIVE BIODISTRIBUTION OF ABSORBED POLYPHENOLIC
COMPOUNDS FROM THE *Prunus spinosa* L. FLOWER EXTRACT IN
THE ORGANS OF A C57BL/6 MOUSE**

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In vivo farmakodinamički pokus apsorpcije i distribucije polifenolnih spojeva iz ekstrakta cvijeta trnine (*Prunus spinosa* L.) proveden je na modelu C57BL/6 miša. Rezultati pokazuju da je od ukupno detektiranih 30 vrsta polifenolnih spojeva koje nalazimo u ekstraktu trnine, apsorpcijom i biodistribucijom po organima u različitim vremenima bioakumulirane su različite vrste polifenolnih spojeva. Navedeni rezultati potvrđuju postavljenu hipotezu o selektivnoj preferenciji za bioakumulacijom i zadržavanjem pojedinog tipa polifenolnih spojeva unutar različitih organa. Primjerice u serumu i tankom crijevu je detektirano 18, u jetri 12, u bubregu i mozgu 16 polifenolnih spojeva i metabolita. U serumu je najzastupljeniji spoj 3-O-CaffeoQunic Acid, u svim analiziranim vremenima, u koncentracijama 3-3,27 µg/mL. U tankom crijevu, bubregu i mozgu je najzastupljeniji spoj protoancijanidin B1, u koncentraciji 30-33,13 µg/g tkiva. U jetri najzastupljenija je galna kiselina u koncentracijama 30-32,95 µg/g tkiva. Drugi najzastupljeniji spojevi po koncentracijama su: katehin u serumu, tankom crijevu, bubregu i mozgu u koncentracijama 0,6-1,59 µg/g tkiva. U jetri drugi po koncentraciji najzastupljeniji spoj je 3-O-CaffeoQunic Acid sa rasponom 0,7-1,45 µg/g tkiva. Također, rezultati su pokazali koji polifenolni spojevi uopće ne ulaze u organizam ili pojedine organe ili su prisutni u vrlo niskim koncentracijama i kratko se zadržavaju u pojedinim organima.

Ključne riječi: biodistribucija, *Prunus spinosa* L., polifenolni spojevi

Keywords: biodistribution, *Prunus spinosa* L., polyphenol compounds

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THERMAL DEGRADATION OF QUERCETIN IN AQUEOUS SOLUTION

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Quercetin is the most abundant dietary flavonol with the right structural features for free radical scavenging activity and, due to its positive impact on human health, it can be used as a nutraceutical or a food supplement. It has been shown that quercetin degrades at ambient temperatures in aqueous solutions and is susceptible to oxidation. The named degradation can be accelerated upon heating and/or the addition of metal catalysts. Except proton abstraction, the oxidative degradative mechanism involves a C-ring opening, which leads to the formation of lower molecular weight phenolic carboxylic acids. In this study, we investigated the thermal degradation of quercetin at 100 °C and at different times (2, 30, 60, 90, 120 min). The thermal degradation of quercetin was monitored by LC-MS/MS. The results showed that quercetin degraded at 100 °C and that longer heating times accelerated the degradation. Furthermore, the longest studied heating time yielded higher amounts of by-products. The main thermal by-product is the 3,4-hydroxybenzoic acid, followed by 3,5-dihydroxybenzoic acid and 2,4,6-trihydroxybenzoic acid. According to the obtained results, we confirmed the thermal degradation reaction of quercetin in aqueous solution.

Keywords: LC/MS-MS, quercetin, thermal degradation

PRIRODNI DODACI PREHRANI KAO NOSITELJI NUTRITIVNE KVALITETE, LJEKOVITOG POTENCIJALA I ODRŽIVOSTI PROIZVODA

NATURAL FOOD SUPPLEMENTS AS CARRIERS OF NUTRITION QUALITY, HEALTHFUL POTENTIAL, AND SUSTAINABILITY OF PRODUCTS

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Od davnina su ljudi hranu dobivali izravno iz prirode pa je tek krajem 19. i početkom 20. stoljeća došlo do ekspanzijskog razvoja moderne industrije koja je razvojem novih tehnologija omogućila i razvoj velikog broja prehrambenih i farmaceutskih proizvoda. Ovaj razvoj utjecao je i na razvoj lijekova čime se potisnula filozofija „hrane kao lijeka“ kroz gotovo jedno cijelo stoljeće. Zbog pojave mnogih bolesti tijekom 20. stoljeća moderna industrija svoj razvoj ponovno počinje temeljiti na obogaćivanju hrane prirodnim dodacima prehrani. Prepoznatljiv je trend proizvodnje „funkcionalne hrane“, odnosno hrane koja posjeduje povoljno djelovanje na zdravlje uz pripadajuća nutritivna svojstva. Uočeno je da je dodavanjem začinskih i ljekovitih biljaka moguće poboljšati okus i miris hrane. Veliki broj istraživanja dokazao je i da navedene skupine biljaka sadrže spojeve sa izraženim baktericidnim i fungicidnim djelovanjem, te kao prirodni dodaci prehrani sprječavaju kvarenje hrane i održivost namirnica. Pored toga izuzetno su snažni antioksidansi. Uporaba prirodnih dodataka prehrani danas je izražena kroz sve tehnologije proizvodnje, a najviše kroz proizvodnju mesa i mesnih prerađevina, mliječnih i pekarskih proizvoda te kroz uporabu u jestivim ambalažnim filmovima i punilima u prehrambenoj i farmaceutskoj industriji. Dodavanjem začinskih i ljekovitih biljaka u različite vrste proizvoda možemo značajno unaprijediti nutritivnu kvalitetu te ljekoviti potencijal i održivost proizvoda.

Ključne riječi: prirodni dodaci prehrani, funkcionalna hrana, biljke, nutritivna kvaliteta

Keywords: natural food supplements, functional food, plants, nutrition quality

WALNUT SHELLS AS A PROMISING NEW SOURCE OF XYLAN- DERIVED FUNCTIONAL SUPPLEMENTS

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Walnut shell is a lignocellulosic by-product material mainly used for combustion or as an abrasive. Due to the high content of xylan-type hemicellulose, it might be regarded as a promising novel source of xylan-derived functional products from renewable sources, such as xylooligosaccharides.

The aim of this study was to determine the impact of delignification and varying alkali concentration on the extractability of xylan from walnut shells.

Hemicellulose recovery was carried out by combining alkaline extraction (2M and 4M KOH + 20 mM NaBH₄, for 4 h) with or without sodium chlorite-acetic acid delignification pretreatment (2 h or 4 h). The obtained fractions consisted of soluble and insoluble hemicellulose and insoluble cellulosic residue. The respective yields were determined gravimetrically, while their monomeric composition was determined by HPLC-PDA with pre-column derivatization using 3-methyl-1-phenyl-2-pyrazoline-5-one (PMP).

Delignification enabled a significant increase in total hemicellulose yield (2.5 - 2.8-fold, compared to non-delignified samples), with a maximum obtained yield of 28.8 % of the original sample dry weight. Delignification time, as well as alkali concentration, only slightly influenced the yield. The highest total xylose recovery, 95 % of the initial content, was obtained for the 4 h delignified sample extracted for 4 h with 4M KOH. It predominantly accounted for the extracted xylan (91.8 % of initially present xylose), of which 43 % was in insoluble form.

Keywords: delignification, hemicellulose, PMP-derivatization, xylan, walnut shell

**FITONUTRIJENTI U LIŠĆU LUCERNE (*Medicago sativa* L.) I
CRVENE DJETELINE (*Trifolium pratense* L.)**

PHYTONUTRIENTS IN THE EXTRACTS OF ALFALFA (*Medicago sativa* L.) AND RED CLOVER (*Trifolium pratense* L.) LEAVES

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Lucerna i crvena djetelina su zeljaste višegodišnje krmne leguminoze i botanički su poznate kao *Medicago sativa* L. i *Trifolium pratense* L. U posljednjih nekoliko godina utvrđena su njihova značajna ljekovita svojstva zbog antioksidativnih fitonutrijenata fenola i flavonoida te kao takve smanjuju rizik od mnogih kroničnih bolesti. U radu su korišteni liofilizirani listovi 40 kultivara/populacija lucerne i crvene djeteline domaćeg i stranog podrijetla uzgojenih na Poljoprivrednom institutu Osijek (45° 32'S, 18° 44'E, nadmorska visina 90 m). Uzorci su prikupljeni u lipnju 2014. Ukupni fenoli u ekstraktu listova određeni su kolorimetrijski prema Folin-Ciocalteu metodi mjerenjem apsorbancije pri valnoj duljini 765 nm i u listovima lucerne njihova vrijednost je iznosila 25,45 mg GAE/g, a u crvenoj djetelini 46,61 mg GAE/g. Vrijednost ukupnih flavonoida mjerenih pri apsorbanciji 510 nm iznosila je u lucerni 11,68 mg kvercetina/g, a u crvenoj djetelini 47,57 mg katehina/g. Izoflavoni su analizirani RP-HPLC metodom i zabilježena je dominacija gliciteina (361,14 µg/g ST) i genisteina (707,80 µg/g ST) kod lucerne te formononetina (5104,90 µg/g ST) i biohanina (2872,80 µg/g ST) kod crvene djeteline. Prema dobivenim rezultatima, lucerna i crvena djetelina predstavljaju značajan izvor vrijednih farmakoloških fitonutrijenata.

Ključne riječi: lucerna, crvena djetelina, fitonutrijenti

Keywords: alfalfa, red clover, phytonutrients

KRMNE LEGUMINOZE KAO IZVOR FITOESTROGENA ZA FARMACEUTSKU INDUSTRIJU

FORAGE LEGUMES AS SOURCES OF PHYTOESTROGENS FOR USE IN PHARMACEUTICS

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Lucerna i crvena djetelina su najraširenije i najznačajnije višegodišnje leguminoze prvenstveno korištene kao kvalitetna krma za ishranu stoke. Ove su biljne vrste bogat prirodni izvor fitoestrogena (izoflavona, kumestana, flavonola, flavona), nesteroidnih supstanci estrogenog djelovanja čiji su povoljni učinci u prevenciji i liječenju nekih oblika karcinoma, osteoporoze, kardiovaskularnih bolesti te simptoma menopauze dokazani u brojnim znanstvenim studijama. Danas su na domaćem i stranom tržištu prisutni brojni biljni pripravci, a njihova je primjena u stalnom porastu, kao i sve veći zahtjevi konzumenata za okolišno prihvatljivom i zdravstveno sigurnom proizvodnjom biljnih vrsta koje se koriste kao izvori aktivnih supstanci. Lucerna i crvena djetelina su postale sve zanimljiviji alternativni izvori fitoestrogena zbog njihove široke rasprostranjenosti, mogućnosti organskog uzgoja, ali i značajnog povećanja površina pod genetski modificiranom sojom u većini zemalja EU. Najzastupljeniji fitoestrogeni u ovim krmnim leguminozama su genistein, daidzein, glicitein, formononetin, biohanin, kumestrol, kemferol i apigenin. Udio ovih supstanci pod značajnim je utjecajem brojnih čimbenika uključujući genotip, okolinu, primijenjenu tehnologiju uzgoja, razvojnu fazu biljke te pojedine biljne dijelove. Prvim preliminarnim istraživanjem udjela fitoestrogena u hrvatskim populacijama / sortama lucerne i crvene djeteline stvorenim na Poljoprivrednom institutu Osijek identificirani su materijali s visokim potencijalom za daljnje genetsko poboljšanje i oplemenjivački razvoj nove germplazme za specifičnu namjenu.

Ključne riječi: krmne kulture, lucerna, crvena djetelina, fitoestrogeni

Keywords: forage crops, alfalfa, red clover, phytoestrogens

***Lepidium meyenii* (Brassicaceae) I *Moringa oleifera* (Moringaceae) KAO
SUPERHRANA: GLUKOZINOLATI I OKSIDACIJSKA
STABILNOST**

***Lepidium meyenii* (Brassicaceae) AND *Moringa Oleifera* (Moringaceae)
AS SUPERFOOD: GLUCOSINOLATES AND OXIDATIVE
STABILITY**

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Glukozinolati su sekundarni biljni metaboliti koji se mogu pronaći u 16 porodica reda *Brassicales* među koje spadaju biljke iz porodica *Brassicaceae* i *Moringaceae*. Njihovom termičkom, enzimskom ili kemijskom razgradnjom nastaju hlapljivi spojevi, među kojima se ističu izotiocijanati, poznati po svojoj biološkoj aktivnosti. U okviru ovog rada istraživane su biljke maca (*Lepidium meyenii*) i moringa (*Moringa oleifera*) poznate kao superhrana zbog izuzetno visokog sadržaja fitonutrijenata. Glukozinolati kao karakteristični spojevi ovih biljaka određeni su indirektnom metodom preko njihovih razgradnih produkata. Hlapljivi izolati dobiveni različitim metodama hidrodestilacije i ekstrakcije analizirani su plinskom kromatografijom spregnutom sa spektrometrom masa (GC-MS) te infracrvenom spektroskopijom s Fourierovom transformacijom (FTIR). U *Lepidium meyenii* identificirani su sljedeći spojevi: fenilacetonitril i benzil-izotiocijanat (razgradni produkti glukotropeolina) i 3-metoksifenilacetonitril (koji potječe od glukolimnantina). GC-MS analizom hlapljivih izolata biljke *Moringa oleifera* nisu identificirani razgradni produkti glukozinolata, ali je potvrdu prisustva razgradnih produkata glukomoringina ukazala FTIR analiza.

Oksidacijski procesi predstavljaju raširen problem prehrambene industrije. Danas je vrlo popularan dodatak različitog bilja i začina u svrhu aromatiziranja ulja, kao i produljenja njihovog vijeka trajanja. Stoga je također ispitan učinak dodatka praškastih uzoraka ovih biljaka na oksidacijsku stabilnost ribljeg ulja primjenom metode ubrzane oksidacije korištenjem Rancimat uređaja.

Ključne riječi: glukozinolati, oksidacija ulja, GC-MS, FTIR, Rancimat

Keywords: glucosinolates, oil oxidation, GC-MS, FTIR, Rancimat

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BIOACTIVE COMPOUNDS OF *Stevia rebaudiana* BERTONI LEAVES

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Over the last decade, the interest for *Stevia rebaudiana* Bertoni (Stevia) extracts increased due to the presence of sweet-tasting diterpene glycosides (stevioside and rebaudioside A). Because of their low caloric value, stevia is an adequate replacement for sucrose, particularly for people who suffer from diabetes and obesity. Aside from steviol glycosides, the stevia plant is a valuable source of carbohydrates, protein, dietary fibre, vitamins, minerals, and essential amino acids. A wide range of bioactive compounds, such as alkaloids, polyphenols, xanthophylls, chlorophylls, and condensed tannins were found in the extracts. Flavonoids catechin, epicatechin, quercetin, rutin, and apigenin are the most abundant, while dominant phenolic acids are protocatechuic acid, chlorogenic acid, caffeic acid, and cinnamic acid. It is well known that these compounds have strong biological activities and proven health benefits. In conclusion, the content of a broad range of biologically active compounds makes Stevia extracts valuable ingredients, not only for functional food products, but also for cosmetic, medicinal, and pharmacological application, thus, it represents an economic raw material of great interest.

Keywords: *Stevia rebaudiana* (Bertoni), bioactive compounds, steviol glycosides

NOVEL TECHNOLOGIES FOR THE RECOVERY OF BIOACTIVE COMPOUNDS FROM STEVIA

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Stevia rebaudiana (Bertoni) is a plant cultivated worldwide, that originated in north-eastern Paraguay, South/Central America, and Mexico. Recently, it has gained increased interest from industry and food science as a non-caloric natural sweetener that represents an excellent alternative to sugar. The main sweetening components of stevia are steviol glycosides, with stevioside being the major sweet substance. Moreover, this plant contains various phytochemical constituents, including polyphenols, chlorophylls, carotenoids, labdanes, sterols, organic acids, inorganic salts, and other. Aside from the nutritive value in stevia, the presence of important biologically active compounds has medicinal and functional properties, since they influence different physiological functions in the human body. Thanks to the wide application and numerous positive effects, new techniques for the extraction of highly valued compounds are being developed. In contrast to conventional ones, novel extraction techniques allow higher yields in shorter time, less usage of organic solvents, reduced energy consumption, and higher quality extracts; thus, they are compliant with green extraction concepts. These novel techniques include microwave-assisted extraction (MAE), pressurized liquid extraction (PLE), supercritical fluid extraction (SFE), ultrasound-assisted extraction (UAE), and high voltage electrical discharge extraction (HVED).

Keywords: *Stevia rebaudiana* (Bertoni), novel technologies, extraction, bioactive compounds

AKTIVNI SASTOJCI BOROVICE I NJENA UPORABA U FARMACEUTSKE I PREHRAMBENE SVRHE

ACTIVE INGREDIENTS IN JUNIPER AND ITS USE FOR PHARMACEUTICAL AND FOOD PURPOSES

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Borovica (*Juniperus communis*) je rasprostranjena biljka na područjima zemalja balkanskog poluotoka. Nedovoljno je iskorištena u prehrambene i farmaceutске svrhe. Plodovi borovice nisu jestivi u svježem stanju, ali se u malim količinama koriste kao začín. Eterično ulje borovice ima antimikrobno djelovanje i daje specifičnu aromu jelu pa se na tim svojstvima temelji uporaba plodova kao začina i prirodnog konzervansa. Osim toga, borovica se koristi kod kiseljenja povrća, za proizvodnju gorkih biljnih likera i rakija (brinjevača, klekovača). Zbog mogućnosti predoziranja treba paziti s unosom pa se ne preporučuje više od 3 bobice po porciji. Drvo borovice koristi se pri dimljenju mesa.

Cilj rada bio je opisati aktivne komponente i biološko djelovanje borovice i ukazati na njene moguće primjene u prehrambene i farmaceutске svrhe.

Najznačajniji aktivni sastojci borovice su: terpeni, glikozidi (juniperin), flavonoidi (posebno oligomerni proantocijanidi), kiseline (mravlja, octena, jabučna, izolimunska kiselina), tanini, vosak. Od ostalih sastojaka treba navesti sirova vlakna, šećere, minerale i vitamine. Najčešći poluproizvodi koji se koriste u prehrambene i farmaceutске svrhe su: suhi plodovi, ekstrakti, eterično ulje, tinkture, čaj i čajne mješavine. Glavna aktivna supstanca koja se proizvodi je eterično ulje.

U narodu su dobro poznata ljekovita svojstva borovice i najčešće se navode podaci da ima antiinflamatorno, antioksidativno, diuretičko, baktericidno, antipruritičko, antireumatsko. Zbog toga se koristi kod akutnih i kroničnih upala bubrega, infekcija urinarnog trakta, dispeptičkih tegoba, gastritisa, reume, upale dišnih puteva, dijabetesa i u terapiji tumora. Farmaceutski proizvodi od borovice nisu standardizirani. U ljekarnama se mogu pronaći proizvodi od borovice kao jednokomponentni čaj, tj. sušeni plodovi borovice.

S obzirom na raspoložive resurse i rasprostranjenost borovice, kao i aktivne sastojke ona predstavlja potencijal na kome bi se mogao temeljiti razvoj specifičnih proizvoda u farmaceutске i prehrambene svrhe. Posebno bi bilo značajno istražiti funkcionalne farmaceutске i prehrambene proizvode koji bi sadržavali borovicu.

Ključne riječi: borovica, aktivni sastojci, hrana, farmaceutski proizvodi

Keywords: juniper, active compounds, food, pharmaceutical products

PROIZVODNJA VISOKO VRIJEDNIH DODATAKA HRANI OD TROPA GROŽĐA

THE PRODUCTION OF HIGH-VALUE FOOD INGREDIENTS FROM GRAPE POMACE

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Grape pomace, the residue remaining after the extraction of juice from grapes, is characterized by a high content of polyphenols. In this study, we produced a powder, a high-value food ingredient from grape pomace, made from indigenous grape varieties White and Black Noah, Othello, and Isabell. The grape pomace powder was produced by freeze drying grape pomace. The obtained powders had water content lower than 4 %. The water activity of powders was 0.237, 0.206, 0.201, and 0.198 for Black Noah, Isabell, White Noah, and Othello, respectively. The highest antioxidant activity (mmol Trolox/100mL) was found in the powder produced from the variety Isabell (4.82), followed by varieties Black Noah (3.39), White Noah (3.29), and Othello (2.74). In the investigated varieties, the main phenolic acid was chlorogenic acid, catechin was the representative of flavanols, and quercetin of flavanols. In the red grape varieties, the main polyphenols were cyanidine-3-glucoside and malvidin-3-glucoside (known as natural colorants). The results suggest that grape pomace powders can be used as high-value ingredients to increase antioxidant activity and to enrich colour, and in general, to increase the phytonutrient content of processed food products.

Keywords: freeze-drying, polyphenols, functional food

FORMULACIJA TAHINE SA MEDOM KAO FUNKCIONALNI PROIZVOD

FORMULATION OF TAHINI PASTE AND HONEY AS FUNCTIONAL PRODUCT

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Uvod: Med je najpoznatiji primarni proizvod pčelarstva. S obzirom na kvalitetu, kemijski sastav i utjecaj na zdravlje, med predstavlja namirnicu široke upotrebe kako u osnovnom obliku tako i obogaćen drugim funkcionalnim komponentama. Takva komponenta je tahin, pasta koja se dobiva mljevenjem sezama. Kombinacija meda i tahina je prisutna u brojnim kulinarskim receptima.

Cilj i metode rada: Cilj rada bio je prezentirati sastojke tahina i meda te njihov potencijalni utjecaj na zdravlje ljudi u kombinaciji s medom.

Rezultati: Tahin osim proteina i lipida sadrži grupu fenilpropanoidnih spojeva lignana koji imaju antioksidativnu aktivnost, smanjuju razinu kolesterola, povećavaju oksidaciju enzima masnih kiselina jetre i pokazuju antihipertenzivne efekte. Dvije glavne grupe lignana u sjemenkama sezama su lignani topljivi u mastima (sezamin, sezamolin, sezaminol, sezaminolol i pinorezinol) i glikozilirani lignani topljivi u vodi (sezaminol triglikozidi, pinorezinol triglikozidi, sezaminol monoglikozidi, pinorezinol monoglikozidi i dva izomera pinoresinol diglikozidi i sesaminol diglikozidi). Značajan je β -sitosterol u sezamovom ulju gdje je dominantan, zatim kampesterol i stigmasterol. Fitosteroli se koriste kao dodatak prerađenoj hrani koja se označava kao „hrana koja smanjuje kolesterol“. Tahin sadrži fitate koji su značajni u prevenciji raka, ali su i jaki helatori kao i fitati. Visok sadržaj fitinske i oksalne kiseline u sezamu ograničava bioiskoristivost minerala i proteina iz sezama.

U medu se nalaze nenutritivni biološki aktivni sastojci od kojih su značajni: polifenoli, flavonoidi, karotenoidi, terpeni, enzimi i drugi. Sadržaj aktivnih sastojaka je jako varijabilan i ovisi o strukturi ispaše medonosnih biljaka, a naročito sastavu nektara i polena. Fortifikacijom meda sa funkcionalnim komponentama poput tahina dobiva se proizvod sa dodanom vrijednošću koji može imati povoljnije djelovanje na organizam. Mogući su različiti omjeri kombinacije tahina i meda, a kombinacija makronutrijenata ovih proizvoda je komplementarna. Udio tahina može biti od 10 do 30 %. Veći udio daje dominantan okus tahina i smanjuje okus meda.

Zaključak: Za razliku od meda, sastojci iz tahina su sporo probavljivi zbog visokog sadržaja proteina i lipida. Ova kombinacija sastojaka je izvanredna i kao takva predstavlja kompletnu hranu (proteini, ugljikohidrati, lipidi, vitamini, minerali) neophodnu za funkcioniranje organizma. Osim toga, ima specifičnu aromu i okus koji mogu biti prihvatljivi za veći broj konzumenata. Tahin sadrži sastojke koji poboljšavaju lipidni status organizma, djeluju na regulaciju krvnog tlaka, a sastojci meda daju energiju i jačaju imunosni sustav. Ova kombinacija zaslužuje dalja intenzivna istraživanja sa znanstveno utemeljenim tvrdnjama njihovog utjecaja na zdravlje.

Ključne riječi: med, tahin, funkcionalni proizvod

Keywords: honey, tahini paste, functional product

**PROIZVODNJA I PRIMJENA PREPARATA NA BAZI MEDA I
LJEKOVITOG BILJA U PODRUČJU SJEVEROZAPADNE BOSNE I
HERCEGOVINE, S OSVRTOM NA PRAVILNO OZNAČAVANJE
PROIZVODA**

**THE PRODUCTION AND APPLICATION OF HONEY AND HERB
BASED PREPARATIONS IN THE NORTH-WESTERN PART OF
BOSNIA AND HERZEGOVINA, WITH AN OVERVIEW OF PROPER
PRODUCT LABELLING**

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Pored meda koji u malim količinama ima pozitivan biološki učinak, pčelarstvo na tržište plasira proizvode sa dodanom vrijednošću. Cilj ovoga rada bio je istražiti asortiman proizvoda sa dodanom vrijednošću u pčelarskoj proizvodnji Unsko-sanskog kantona te ih klasificirati s obzirom na vrste proizvoda, geografsku distribuciju, mjesto aplikacije te učestalosti primjene biljne vrste sa ljekovitim svojstvom. Dodatno, putem provjere navoda na deklaraciji istraženo je znanje pčelara i primjena Pravilnika o označavanju hrane ili lijekova.

Dobiveni rezultati pokazali su da 30 ispitanih pčelara na tržište pored 6 vrsta uniflornih i 4 vrste poliflornih medova plasiraju preko 80 vrsta različitih proizvoda. Među proizvodima sa dodanom vrijednošću dominiraju (48 %) med u kombinaciji sa ostalim pčelinjim proizvodima, zatim je 39,5 % proizvoda kombiniranih sa ljekovitim i začinskim vrstama bilja i 12,5 % je proizvoda u kombinaciji sa hranom. Najučestalije bilje koje se kombinira u pripravcima su čuvarkuća, borove iglice, oman, đumbir, sjeme i list koprive, smreka, čorokota, sjeme lana, a najučestalija hrana je orah, smokva, kesten i brusnica. S obzirom na mjesto aplikacije u liječenju najviše se proizvoda koristi za liječenje imunološkog sistema. Istraživani apiproizvodi imaju na deklaraciji upute o zdravstvenim učincima koje potvrđuje literatura, međutim nisu označeni u skladu sa propisima o označavanju hrane ili lijekova.

Ključne riječi: apiproizvodi, med, pčelinji proizvodi

Keywords: api-products, honey, bee products

**THE ESTIMATION OF KINETIC PARAMETERS OF THE SOLID-LIQUID EXTRACTION PROCESS OF THE LAVENDER FLOWER
(*Lavandula x hybrida* L.)**

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The use of medicinal plants has been well documented for the past several decades. Plants from the *Lavender* genus are used for culinary purposes, but also as part of herbal medicine, owing its benefits to essential oils and bioactive compounds. A detailed description of the extraction process dynamics is required to obtain the highest possible amount of bioactive compounds from lavender. In this study, a solid-liquid extraction of lavender flowers, using water as a solvent, was performed. Total polyphenols, dry matter, conductivity, and total dissolved solids were determined in regular time intervals and experimental data was further used for mathematical modelling. Peleg's, Page's, and logarithmic models were applied in order to describe the kinetics of lavender solid-liquid extraction. The initial extraction rate and extraction capacity were determined for three different extraction temperatures: 40, 60, and 80 °C. The obtained results indicated that the initial extraction rate and the extraction capacity was the highest at 80 °C. The adequacy of the applied mathematical models was estimated based on R^2 and SRMSE values, which indicated that the most adequate model for solid-liquid extraction of lavender was the Peleg model ($R^2 = 0.995$, for total polyphenols at 40 °C and $R^2 = 0.975$ for dry matter at 60 °C, respectively).

Keywords: lavender, solid-liquid extraction, mathematical modelling

FOOD-COMPATIBLE METHOD FOR THE STABILIZATION OF OLIVE POMACE POLYPHENOLS

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oral presentation / usmeno priopćenje

Waste from olive oil production represents a serious environmental issue, due to their heavy load of phenolic compounds. Many positive pharmacological effects of olive polyphenols have been reported and olive pomace has been recognized as their potential source. However, raw olive pomace extract (OPE) is characterized by poor technological properties and cannot be used as a functional food ingredient. The addition of encapsulation agents, such as cyclodextrins (CDs), to the extraction solvents represents a novel functional food formulation, providing more stable extracts. A stability study was conducted in order to select CDs which stabilize crude OPE the most during storage.

The effects of temperature and daylight were studied by monitoring: 1) total phenolic content, 2) antiradical potential, and 3) the amount of hydroxytyrosol (HTS) and tyrosol (TS), determined using HPLC-FLD. The study revealed that daylight had no effect on crude OPE stability. Among the CDs, randomly methylated β -CD (RAMEB) and hydroxypropyl β -CD (HPB) showed the greatest protection effect at all studied storage conditions regarding TPC and antiradical potential. The amount of HTS and TS increased in the extracts containing those two CDs, when stored at 60 °C for 45 days.

Keywords: olive waste, olive pomace polyphenols, cyclodextrins, stability study

DJEVIČANSKO MASLINOVO ULJE KAO FUNKCIONALNA HRANA

VIRGIN OLIVE OIL AS FUNCTIONAL FOOD

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Djevičansko maslinovo ulje smatra se primjerom prirodne funkcionalne hrane zbog sastojaka koji svojom aktivnošću pridonose preveniranju i liječenju raznih bolesti. Među tim sastojcima važno mjesto pripada antioksidansima. Najznačajniji antioksidansi u djevičanskom maslinovom ulju su fenolni sastojci. Fenolni sastojak u djevičanskom maslinovom ulju imenom oleokantal (dekarboksi metil ligstrozid aglikon) dijeli jedinstvena osjetilna i protuupalna obilježja s nesteroidnim protuupalnim lijekom ibuprofenom. Stoga je u središtu interesa znanstvenika u cilju istraživanja prirodnih sastojaka s farmakološkim djelovanjem. Beauchamp i suradnici su potvrdili da je oleokantal nadražujući fenol koji je odgovoran za iritaciju grla i usne šupljine pri čemu izaziva osjetljivo peckanje koje se doživjelo gutanjem djevičanskog maslinovog ulja te su ga prikladno nazvali oleokantalnim spojem (*oleo* = maslina, *canth* = peći, gorjeti i *al* = aldehid). Nakon što je potvrđena perceptivna sličnost između oleokantala i ibuprofena, isti su potvrdili da je put protuupalnog djelovanja također analogan među ovim spojevima. Rezultati istraživanja pokazuju da oleokantal inhibira enzime ciklooksigenazu 1 i 2 (COX 1 i 2) i zapravo imitira protuupalno djelovanje sintetičkog lijeka ibuprofena. Nadalje, utvrđeno je da oleokantal ima sposobnost da zaustavi ili odgodi početak Alzheimerove bolesti jer selektivno napada loše ADDL proteine u mozgu koji su odgovorni za koordinaciju neurotransfera jer uništavaju sinapse kao vodiče istih. ADDL proteini se vežu na sinapse u mozgu i zatvaraju ih. Oleokantal mijenja te proteine dovoljno da se ne mogu vezati za sinapse čime se zaustavlja napredovanje bolesti.

Smatra se da dugotrajna konzumacija djevičanskog maslinovog ulja koje sadrži oleokantal može pridonijeti zdravstvenim prednostima povezanim s mediteranskim načinom prehrane gdje je prisutno znatno manje problema sa srčanim bolestima, tumorima, moždanim udarima ili demencijom.

Ključne riječi: djevičansko maslinovo ulje, funkcionalna hrana, oleokantal, ibuprofen

Keywords: virgin olive oil, functional food, oleocanthal, ibuprofen

FUNCTIONAL PRODUCTS BASED ON *Satureja montana*

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oral presentation / usmeno priopćenje

Considering the growing consumer interest in phytomedicinal products, techniques of extraction and separation of valuable components from natural products are constantly developing, in order to obtain high-quality products. Well-known and documented classical methods of extraction, such as water vapour distillation and Soxhlet extraction, are commonly used for the separation of volatile and fat fractions from plants rich in essential oils. The problems which occur while applying these methods are: thermal degradation of high-value components, toxic solvent residue, and lengthy extraction time, which causes higher energy consumption. In order to improve the process of procuring products with desirable characteristics, new technologies of supercritical extraction by carbon-dioxide and subcritical water extraction were developed. Within this study, a comparison between the extracts obtained by classical and contemporary technologies was made. The *Satureja montana* herbal material, rich in essential oil, was subjected to extractions, and the attained extracts were chemically characterized by gas chromatography analysis. Based on the differences regarding the chemical composition of the products acquired by various extraction techniques, the benefits and drawbacks of the applied processes can be clearly classified. Products rich in components with valuable biological activity were set as the main goal.

Keywords: *Satureja montana*, supercritical carbon dioxide, subcritical water, carvacrol

PREHRAMBENA I ZDRAVSTVENA VRIJEDNOST SIRUTKE KAO FUNKCIONALNE HRANE

NUTRITIONAL AND HEALTH ASPECTS OF WHEY AS A POTENTIAL FUNCTIONAL FOOD

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Sirutka nastaje u proizvodnji sira, a ovisno o načinu podsiravanja mlijeka može biti kisela ili slatka. Kako proizvodnja sireva neprekidno raste, i količina nastale sirutke je u stalnom porastu pa je sirutka količinski najznačajniji sekundarni proizvod mljekarske industrije.

Sirutka sadrži u prosjeku 6-7 % suhe tvari koju čine laktoza, proteini sirutke, mineralne tvari (prije svega soli kalcija) te vitamini B skupine (poglavito riboflavin). Najvredniji su proteini sirutke (β -laktoglobulin, α -laktalbumin, imunoglobulini, proteoze peptoni) koji sadrže visok udjel esencijalnih aminokiselina pa im je biološka vrijednost veća nego u svih ostalih proteina životinjskog, ali i biljnog podrijetla. Oni su izvor brojnih bioaktivnih peptida s pozitivnim utjecajem na krvožilni, gastrointestinalni, imunološki i živčani sustav. Proteini sirutke odlikuju se i izvanrednim funkcionalnim svojstvima te se često koriste kao dodaci brojnim nemliječnim prehrambenim proizvodima. Zdravstvena vrijednost sirutke poznata je još od doba starih Grka, a tradicionalno se koristila u terapiji tuberkuloze, žutice i dizenterije te drugih sličnih oboljenja. Zbog određenih poteškoća prilikom prerade, potencijal sirutke kao funkcionalne hrane nedovoljno je iskorišten. Na tržištu se rijetko može naći konzumna sirutka i skuta (sir od sirutke), iako je široka paleta proizvoda poput napitaka ili deserata koji bi se mogli dobiti preradom sirutke.

Ključne riječi: sirutka, proteini sirutke, prehrambena vrijednost, sirutkini napici, sirevi od sirutke

Keywords: whey, whey proteins, nutritional value, whey beverages, whey cheeses

FIZIKALNO-KEMIJSKE ZNAČAJKE DIZAJNIRANIH I KONVENCIONALNIH JAJA

PHYSICO-CHEMICAL CHARACTERISTICS OF DESIGNED AND CONVENTIONAL EGGS

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U radu je korišteno 120 nesilica provenijencije Tetra SL, podijeljenih u dvije pokusne skupine (K i P) sa 60 nesilica po skupini (12 ponavljanja po 5 nesilica). Kontrolna skupina konzumirala je standardnu smjesu dok su nesilice pokusne skupine dobivale modificiranu smjesu u koju je dodano 5 % mješavine ulja, 0,5 mg/kg organskog selena, 200 mg/kg luteina i 200 mg/kg vitamina E. Za obradu rezultata korišten je statistički program SAS (SAS Institute Inc., 2000). Rezultati su obrađeni statističkom višefaktorijskom analizom varijance, a razlike su testirane testom po Scheffe-u. Korišteni hranidbeni tretmani u pokusu nisu imali značajnog utjecaja na masu jaja i osnovnih dijelova u jajima ($P > 0,05$). Statistički značajan utjecaj hranidbenog tretmana utvrđen je kod udjela bjelanjka i ljuske u jajima ($P < 0,01$). Kod pokazatelja kvalitete jaja utvrđen je utjecaj hranidbenog tretmana na vrijednosti Haugh units (HU), boje žumanjka i pH bjelanjka. Dizajnirana jaja u odnosu na konvencionalna jaja imala su veće vrijednosti HU (83,99 vs 80,81; $P = 0,042$) i intenzivniju boju žumanjka (14,38 vs 8,70; $P < 0,01$), te pH vrijednosti bjelanjka (8,39 vs 8,67; $P = 0,007$). Hranidbeni tretmani i vrijeme čuvanja jaja nisu značajno utjecali na oksidaciju lipida u žumanjcima jaja ($P > 0,05$). Istraživanja su obavljena u okviru projekta „Obogaćivanje konzumnih jaja funkcionalnim sastojcima“.

Ključne riječi: nesilice, dizajnirano jaje, Haugh jedinice, pH, TBARS

Keywords: laying hens, designed egg, Haugh units, pH, TBARS

DETERMINING THE ACCEPTABILITY OF NON-ALCOHOLIC BEVERAGES MADE FROM ORANGE JUICE, PREPARED TO MEET NUTRITION AND HEALTH CLAIMS CRITERIA

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Consumers' knowledge about the health benefits of food and beverages and their ingredients is growing over the last decade. Accordingly, the consumers' awareness of the relationship between diet and optimal health rises, particularly the interest and the demand for functional foods.

The acceptability of non-alcoholic beverages made from orange juice, with either the addition (iron, B vitamins, fibre, omega-3 fatty acids, or polyphenols) or reduction (sugar content) of selected nutrients was determined. The samples were prepared and labelled to meet the criteria for a particular claim under the Act on Nutrition and Health Claims and Food Enriched with Nutrients, taking into consideration the provisions of a specific regulation on fruit juices related to authorised ingredients in the production. The total of eight samples: two standard samples, four with nutritional claims, and two with health claims were prepared in one of the Croatian food producer research and development laboratories. Quantitative determination (hedonistic scale) was used as the main tool to determine the acceptability of the prepared samples within the selected group of 50 expected consumers.

The results of this study showed that the acceptability of non-alcoholic beverages made from orange juice mostly depends on the taste, regardless of the highlighted claim (6.7 ± 1.2 vs. 6.4 ± 1.8). But, if the organoleptic quality of the product is not significantly affected by the nutrition composition change, the claim can positively affect the acceptability (e.g. change from 6.7 ± 0.4 to 7.3 ± 0.5 for the juices with health claims).

Keywords: acceptability determination, fruit juices, nutrition and health claims

THE FUNCTIONAL POTENTIAL OF HELICHRYSUM (*Helichrysum italicum*) BASED EDIBLE FILMS REINFORCED BY PROTEINS AND HYDROGEL MICROPARTICLES

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Since most of the studies involving helichrysum (*Helichrysum italicum*) are focused on the properties and composition of the essential oil produced from this Mediterranean plant, the aim of this study was to develop edible films and hydrogels based on helichrysum water extract. Alginate and pectin (combined with whey protein, soy protein, and hemp protein) served as carriers for the formulation of biodegradable films and hydrogel beads. Films with various biopolymers and incorporated microparticles were prepared using the solvent casting method, while hydrogel particles were produced using ionic gelation. The bioactive profile (the content of total polyphenols, TPC and hydroxycinnamic acids, HCAC) and antioxidant capacity (AC) of the developed films and microparticles (as well as their combinations) were characterized using spectrophotometric methods. The physical (colour, thickness, dry matter content) properties of films and particles, and the sensory characteristics of the developed films were also evaluated. The highest TPC (31.31 mg GAE/g sample) and HCAC (27.20 mg CAE/g sample), as well as the highest AC (0.15 mmol TE/g sample), were determined in pectin based films. The addition of various proteins decreased the content of the examined bioactive parameters of formulated films, while the addition of hydrogel microparticles increased their thickness and dry matter content. The obtained results indicate a great application potential of developed biodegradable matrices as functional films for active food packaging.

Keywords: antioxidant capacity, coating films, helichrysum, ionic gelation, polyphenols

***Food Safety* / Zdravstvena sigurnost hrane**

PRIMJENA SPEKTROMETRIJE MASA U KONTROLI ZDRAVSTVENE SIGURNOSTI HRANE

MASS SPECTROMETRY IN FOOD SAFETY CONTROL

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Posljednjih godina sigurnost hrane je postala važno pitanje zahvaljujući incidentima vezanima za kontaminaciju različitih prehrambenih proizvoda, primjerice nedozvoljene koncentracije policikličkih aromatskih ugljikovodika u hladno prešanom ulju konoplje, akrilamida u keksima za djecu, mikotoksina u sokovima ili pesticida u jabukama. Ovi i slični incidenti su povećali interes kupaca za više informacija o proizvodima koji dolaze do njihovog stola, te naglasile važnost primjene pouzdanih analitičkih metoda u kontroli zdravstvene sigurnosti hrane i zaštiti javnog zdravlja. Vezani sustavi tekućinske ili plinske kromatografije (eng. *liquid and gas chromatography*, LC i GC) sa spektrometrijom masa (eng. *mass spectrometry*, MS) predstavljaju snažan alat za nedvojbenu identifikaciju i kvantifikaciju kemijskih opasnosti sigurnosti hrane često prisutnih u vrlo niskim koncentracijama, kao što su okolišni kontaminanti (rezidue pesticida, poliklorirani bifenili i policiklički aromatski ugljikovodici), prirodni toksini (mikotoksini, biljni toksini) te toksikanti nastali proizvodnjom i obradom hrane (akrilamid). Uvođenje tandemске spektrometrije masa u analitiku hrane te vezanje s kromatografskim tehnikama omogućilo je istovremeno određivanje velikog broja spojeva u kompleksnim matricama (multimikotoksinske i multirezidualne metode) bez potrebe za dugotrajnom pripremom uzoraka. Stoga se LC-MS/MS i GC-MS/MS metode često navode kao metode od izbora kada je u pitanju otkrivanje i kvantificiranje različitih kontaminanata i rezidua u prehrambenim proizvodima.

Ključne riječi: sigurnost hrane, spektrometrija masa, kromatografija

Keywords: food safety, mass spectrometry, chromatography

THE APPLICATION OF FLOW CYTOMETRY IN THE WATER AND FOOD SECTOR

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Flow cytometry is a relatively novel tool in the field of water and food quality assessment, despite being in use by medical research and clinical practice for several decades. In 2012, the Swiss Federal Office of Public Health acknowledged the usefulness of the method and recommended it to be applied for total bacterial cell counts in drinking water. In Austria, flow cytometry is experimentally applied in water works, such as monitoring of water resources and primary disinfection. In the food area, this method is represented in the field of biotechnological processes (fermentation performance) and in the beverage industry. A huge potential is seen in the cell viability characterisation in food preservation (e.g. non-thermal treatment). In this presentation, the applicability of flow cytometry in the microbiological analysis of food and water is described with its benefits and weaknesses. Cytometric fingerprinting, as part of data analysis in the analytical chain, is discussed, as well the combination of sequencing data obtained by Next Generation Sequencing (NGS). As a culture-independent methodology, flow cytometry represents a huge potential for gaining in-depth microbiological insight into different matrices and their dynamics under specific conditions (e.g. environmental, processing, and intrinsic factors).

Keywords: flow cytometry, total cell count, fingerprinting, live/dead

**PODJELA KONTAMINANATA I RASPOLOŽIVI KONTROLNI
MEHANIZMI ZA NJIHOVO PRAĆENJE IZ NADLEŽNOSTI
SANITARNE INSPEKCIJE**

**CLASSIFICATION OF FOOD CONTAMINANTS AND THE
AVAILABLE CONTROL MECHANISMS FOR MONITORING
WITHIN THE COMPETENCE OF THE SANITARY INSPECTION**

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Hrana je život i uživanje, ali može sadržavati i opasnosti koje mogu predstavljati ozbiljan rizik za zdravlje. Štetni sastojci ili njihovi ostaci mogu postati sastavni dio sirovina ili gotove hrane još u fazi primarne proizvodnje, djelovanjem okolišnih čimbenika ili mogu nastati tijekom pripreme hrane. Stoga se prema mjestu nastajanja kontaminanti dijele na: poljoprivredne, okolišne i industrijske. Na razini EU zakonodavni okvir u području kontaminanata uređen je Uredbama i Preporukama. Uredbe su pravni dokumenti definirani člankom 288. Ugovora o funkcioniranju Europske unije (UFEU) i imaju opću primjenu, obvezujuće su u cijelosti i neposredno se primjenjuju u svim zemljama Europske unije. EU - Preporuke nisu obvezujuće, već se njima institucijama omogućuje da iznesu svoja stajališta i predlože način djelovanja, a da pritom ne nameću nikakve pravne obveze onima kojima su upućene. Stoga sa stajališta zakonske obveze kontaminante dijelimo na obavezne, čije su maksimalne razine definirane propisom i preporučene, koji mogu i ne moraju imati alternativne oblike definiranih prihvatljivih razina (akcijske razine, indikativne razine). Aktivnosti koje provodi sanitarna inspekcija Ministarstva zdravstva obuhvaćaju sve navedene kategorije kontaminanata. U provedbi politike i kontrolnih mehanizama kontinuirano se uspostavlja ravnoteža između toksičnosti koji pojedini kontaminant predstavlja, njegove prisutnosti u hrani, faze u lancu hrane u kojoj nastaje, mogućnosti reprezentativnog uzorkovanja i odabira prikladne laboratorijske metode za određivanje i razumnog ograničavanja slobodne trgovine.

Ključne riječi: kontaminanti u hrani, podjela konataminanata, službena kontrola

Keywords: contaminants in food, classification of food contaminants, official control

**ULOGA ZAVODA ZA JAVNO ZDRAVSTVO U PREVENCIJI
ALIMENTARNIH TOKSOINFEKCIJA**

**THE ROLE OF PUBLIC HEALTH INSTITUTES IN THE
PREVENTION OF ALIMENTARY TOXOINFECTIONS**

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Alimentarne toksikoinfekcije predstavljaju javnozdravstveni problem za sve zemlje, pa i za one najrazvijenije. Alimentarne toksikoinfekcije su oboljenja koja nastaju kao posljedica konzumiranja higijenski nezdrave, kontaminirane ili otrovne hrane. Cilj rada je prikazati ulogu zavoda za javno zdravstvo u Bosni i Hercegovini u prevenciji alimentarnih toksikoinfekcija kroz djelatnost JU Zavod za javno zdravstvo Kantona Sarajevo na prevenciji alimentarnih toksikoinfekcija. U radu su korišteni podaci JU Zavoda za javno zdravstvo Kantona Sarajevo o kretanju zaraznih bolesti, zatim podaci o zdravstvenoj ispravnosti prehrambenih proizvoda i podaci o preventivno-promotivnim aktivnostima. Rezultati pokazuju da se alimentarne toksikoinfekcije nalaze na sedmom mjestu na ljestvici deset vodećih zaraznih oboljenja registriranih u Kantonu Sarajevo sa 158 oboljelih u 2016. godini. Tijekom iste godine u Kantonu Sarajevo urađeno je 38.054 analiza o zdravstvenoj sigurnosti prehrambenih proizvoda, od čega 3,00 % kemijskih analiza i 2,17 % mikrobioloških analiza prehrambenih proizvoda nije odgovaralo zdravstvenoj sigurnosti. Obuka iz sanitarnog minimuma obuhvatila je 1117 polaznika u 2016. godini, a preventivno-promotivne aktivnosti Zavoda usmjerene su na projekte za predškolsku i školsku djecu radi stjecanja znanja i jačanja svijesti o uporabi zdravstveno sigurne hrane. Neophodna je jača suradnja sa sanitarnom inspekcijom i ministarstvom zdravstva radi sprječavanja i suzbijanja alimentarnih toksikoinfekcija i epidemija trovanja hranom.

Ključne riječi: alimentarne toksikoinfekcije, zdravstvena sigurnost hrane, prehrambeni proizvodi, zdravstveno obrazovanje, sanitarni minimum

Keywords: alimentary toxoinfections, food safety, food products, health education, hygiene education-sanitary minimum

FAKTORI RIZIKA U LANCU SNABDIJEVANJA HRANOM

RISK FACTORS IN THE FOOD SUPPLY CHAIN

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U lancu snabdijevanja hranom niz je faktora koji utječu na zdravstvenu sigurnost hrane nakon što se ona počne distribuirati iz proizvodnih pogona u distributivne centre. U prvom redu to je transport, potom prijem proizvoda, njegovo izlaganje, rukovanje proizvodima, kao i primjena Dobre higijenske (DHP) i Dobre proizvođačke prakse (DPP) u pogonima gdje taj proizvod nastaje. Cilj ovog rada bio je na osnovu ispitivanih parametara napraviti „Rejting shemu higijene hrane“ za tri odabrana trgovačka centra u rasponu od 1 do 5. Najveća ocjena '5' znači da je utvrđeno da objekt ima 'veoma dobre' higijenske standarde, a niže ocjene znače da procedure samokontrole nisu na zadovoljavajućoj razini. Također, izvršena je i mikrobiološka analiza brisova uzetih sa različitih površina. Istraživanje je provedeno u periodu od 30 dana. Rejting shemom je utvrđeno da se u jednom prodajnom objektu postupci higijene najadekvatnije primjenjuju, gdje je razina higijene ocijenjena prosječnom ocjenom 3,35 dok je nivo higijene u drugom trgovačkom centru ocijenjen prosječnom ocjenom 3, što je najniža prosječna ocjena za sva tri prodajna objekta. Kako nijedan objekt nije dobio najveću ocjenu 5, neophodna su određena poboljšanja. Mikrobiološkom analizom utvrđeno je da je čistoća sva tri objekta zadovoljavajuća jer je broj nezadovoljavajućih brisova bio značajno manji od onog koji je dozvoljen prema važećim propisima u BiH.

Ključne riječi: trgovački centri, rejting shema higijene hrane, mikrobiološka čistoća

Keywords: shopping centres, Food Hygiene Rating Scheme, microbiological analysis

HACCP SUSTAV U PROIZVODNJI VOĆNIH SOKOVA

THE HACCP SYSTEM IN THE PRODUCTION OF FRUIT JUICES

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Prehrambena industrija, a tako i proizvodnja bezalkoholnih pića, zahtijevaju po svojstvima i sastavu proizvoda kao i prema zakonskim propisima stroge higijenske uvjete. Postoji veliki broj različitih vrsta voćnih sokova. Oni se u osnovi mogu razlikovati prema sirovini od koje su proizvedeni, kemijskom sastavu i načinu pakovanja. Sve navedeno usko je povezano sa kvalitetom i zdravstvenom ispravnošću gotovog proizvoda. Voćni sokovi spadaju u lako kvarljive namirnice zbog čega je primjena HACCP sustava jedan od glavnih faktora za proizvodnju zdravstveno ispravnih i sigurnih proizvoda. Cilj istraživanja bio je analizirati HACCP plan na praktičnom primjeru proizvodnje voćnih sokova kroz sedam HACCP načela. U svakoj procesnoj fazi dijagrama toka numeričkim pristupom analizirane su biološke, kemijske i fizičke opasnosti, nivo rizika i može bitnost njegove pojave. Provođenjem analize opasnosti, tj. prvog načela HACCP sustava, u procesu proizvodnje voćnih sokova utvrđeno je ukupno osam kritičnih kontrolnih točaka (CCP) i tri kontrolne točke (CP), što predstavlja drugo načelo HACCP-a. Za svaku CCP i CP uspostavljene su kritične granice (treće načelo), kao i adekvatan način nadziranja svakog procesa (četvrto načelo), gdje je definiran način kontrole, učestalost kontrole i izvođač kontrole. Nakon toga navedene su korektivne mjere u slučaju odstupanja od graničnih vrijednosti (peto načelo), te su uspostavljeni postupci verifikacije (šesto načelo) i procedure dokumentacije (sedmo načelo). Rezultati istraživanja pokazali su da je provođenje HACCP plana u proizvodnji voćnih sokova od izuzetnog značaja kako bi se dobio proizvod ujednačenog kemijskog sastava i senzornih svojstava te zdravstveno siguran za potrošača.

Ključne riječi: voćni sokovi, HACCP sustav, kritične kontrolne točke

Keywords: fruit juices, HACCP system, critical control points

COMMUNICATING THE INFORMATION ABOUT ALLERGENS AND SHELF LIFE ON FOOD

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Food labelling is one of the most complex issues related to food, as well as the most important moment in the communication between the food producer and the consumer.

Regulation (EU) No 1169/2011 on the provision of food information to consumers harmonizes the modalities according to which the information about the presence of substances or products causing allergies or intolerances must be provided on food. Allergens shall be indicated in the list of ingredients and shall be emphasized through a typeset that clearly distinguishes it from the rest of the list of ingredients, for example by means of the font, style, or background colour.

The main objective of this requirement is to ensure that consumers suffering from allergies or intolerance shall be able to easily identify the substance they are sensitive to.

The information about allergens is also mandatory for non-packed foods, including foods prepared and delivered by catering establishments or restaurants.

Date marking is a key element of food labelling, which aims to help consumers make safe and optimal use of a food. For such an indication to be effective, it needs to be properly applied by the food business operators and correctly understood by consumers. "Date of minimum durability" (best before) clearly refers to the quality attributes of food. "Use-by date" refers to the safety aspects and is defined as the date after which a food shall be deemed to be unsafe. This date should be used on foods which, from the microbiological point of view, are highly perishable and are therefore likely, after a short period of time, to constitute an immediate danger to human health. Confusion around these notions increases the risk of unsafe consumption and food waste.

Keywords: allergens, date of minimum durability, use-by date, food, consumers

**ZNANJA I STAVOVI POTROŠAČA O KVALITETI I SIGURNOSTI
HRANE U ODNOSU NA ŽIVOTNU SREDINU NA PROSTORU
OPĆINE TRAVNIK**

**KNOWLEDGE AND CONSUMER ATTITUDES ABOUT FOOD
QUALITY AND SAFETY IN RELATION TO THE LIVING
ENVIRONMENT IN THE AREA OF THE TRAVNIK
MUNICIPALITY**

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Uvod: Pravilna prehrana je jedan od najznačajnijih faktora fizičkog i mentalnog razvoja, psihičke uravnoteženosti, dobrog zdravlja i radne sposobnosti ljudi.

Cilj rada: Cilj rada bio je ispitati znanja i stavove potrošača o kvaliteti i sigurnosti hrane u odnosu na životnu sredinu na prostoru općine Travnik.

Metodologija: U istraživanje je uključeno 420 ispitanika iz četiri dobne skupine (210 ispitanika iz urbane sredine i 210 ispitanika iz ruralne sredine) na prostoru općine Travnik, a provedeno je tijekom 2017. godine. Kao instrument mjerenja korišten je anonimni anketni upitnik koji se sastojao od 17 pitanja (3 pitanja su se odnosila na opće informacije: dob, spol i stručna sprema, dok se 14 pitanja odnosilo na znanja i stavove potrošača o kvaliteti i sigurnosti hrane).

Rezultati: Dobiveni rezultati su pokazali da najveći postotak potrošača iz urbane sredine prehrambene proizvode najčešće kupuje u supermarketima (74,29 %), dok iz ruralne sredine potrošači prehrambene proizvode kupuju na tržnici (48,57 %). Istraživanje je pokazalo da 38,57 % potrošača iz urbane sredine uvijek čita deklaraciju na proizvodima koje kupuju, dok je niži postotak potrošača iz ruralne sredine koji uvijek čitaju deklaraciju na prehrambenim proizvodima (20,0 %).

Zaključak: Na osnovi dobivenih rezultata možemo zaključiti da u izboru mjesta kupovine prehrambenih proizvoda potrošači iz urbane sredine imaju više povjerenja u kupovinu istih u supermarketima, dok iz ruralne sredine imaju više povjerenja u kupovinu prehrambenih proizvoda na tržnici. Također, veći je udio potrošača iz urbane sredine koji uvijek čitaju deklaraciju na proizvodima koje kupuju u odnosu na potrošače iz ruralne sredine.

Ključne riječi: kvaliteta hrane, sigurnost hrane, potrošači

Keywords: food quality, food safety, consumers

JE LI TRIHINELOZA JOŠ UVIJEK PRIJETNJA ZDRAVLJU LJUDI U HRVATSKOJ?

IS TRICHINELLOSIS STILL A THREAT TO HUMAN HEALTH IN CROATIA?

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Trihinelozu je zoonoza iz skupine parazitarne zoonoze koja se prenosi mesom životinja koje je invadirano vitalnim ličinkama iz roda *Trichinella*. Trihinelozu je bila javnozdravstveni problem u Hrvatskoj u 90-tim godinama prošlog stoljeća, ali od tada je, do nedavno, zalaganjem znanosti i struka iz područja javnog zdravstva broj oboljelih ljudi bio u padu. Unazad nekoliko godina u Hrvatskoj je opaženo odstupanje od propisanih obveza u vezi s klanjem životinja za osobne potrebe, kao i unos zaraženih mesnih proizvoda iz susjednih zemalja koji je doveo do povećanja broja oboljelih. Tako je ove godine zabilježeno čak 37 oboljelih što je povećanje od preko osam puta u odnosu na prosjek broja oboljelih u zadnjih pet godina.

Od trenutka prepoznavanja ovoga javnozdravstvenog problema u Hrvatskoj se razvijaju djelatnosti u smislu poboljšanja sigurnosti dijagnostičkih metoda, ali i epidemioloških istraživanja, kako bi se otkrili i umanjili rizici oboljenja ljudi. Parazitarnim i molekularnim pretragama u Hrvatskoj je invazija trihinelama dokazana u dvije vrste domaćih, u pet vrsta divljih i u jednoj vrsti sinantropnih životinja. Na području Republike Hrvatske dokazana je prisutnost tri vrste trihinela, miješanje tzv. domaćeg i šumskog ciklusa kruženja kao i slučajevi invazije različitim vrstama trihinela u istom domaćinu.

Ključne riječi: trihinelozu, javno zdravstvo, epidemije, divlje životinje

Keywords: trichinellosis, public health, epidemics, wild animals

NALAZ BAKTERIJA *Listeria* U PREHRAMBENIM PROIZVODIMA NA PODRUČJU GRADA BIHAĆA

Listeria BACTERIA IN THE FOOD PRODUCTS IN THE TOWN OF BIHAĆ

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Rad je obuhvatio utvrđivanje potencijalne prisutnosti bakterija *Listeria* spp., uzročnika koji predstavljaju značajan javnozdravstveni problem i potencijalnu opasnost po ljudsko zdravlje. Ove bakterije imaju sposobnost preživljavanja u mnogim nepovoljnim uvjetima u odnosu na većinu drugih mikroorganizama. Činjenica je da *L. monocytogenes* može kontaminirati različite vrste prehrambenih proizvoda, gdje ima sposobnost razmnožavanja pri temperaturama od 2 do 4 °C. Najčešće se dokazuje u sirovom mesu i suhomesnatim proizvodima, raznim salatama, mlijeku i mliječnim proizvodima. Broj trovanja hranom je nizak u usporedbi s ostalim trovanjima, ali ukazuje na potrebu stalnog nadzora jer je stopa smrtnosti visoka (30 %).

U okviru ovog istraživanja ispitivano je prisustvo *L. monocytogenes* u mesu i proizvodima od mesa, mlijeku i mliječnim proizvodima, kolačima, voću i povrću. Od ukupno 300 istraživanih uzoraka ova bakterija nije izolirana niti u jednom uzorku, što je svakako dobar rezultat. Međutim, određeni broj uzoraka bio je pozitivan na prisustvo drugih vrsta iz roda *Listeria* spp. od kojih je najzastupljenija vrsta *L. innocua* koja je utvrđena u dvadeset pet uzoraka (8,33 %), od toga petnaest uzoraka (5 %) u kojima ne smije biti, i deset uzoraka (3,33 %) u kojima je dozvoljena u određenoj količini, a dominantna je bila u mliječnim proizvodima i proizvodima od mesa. *L. seeligeri* je utvrđena u četiri uzorka (1,33 %), *L. grayi* u četiri uzorka (1,33 %), od toga u tri uzorka (1 %) u kojima ne bi trebala biti. *L. welshimeri* je dokazana u jednom uzorku (0,33 %).

Ključne riječi: *Listeria monocytogenes*, bakterija, proizvodi, uzorak

Keywords: *Listeria monocytogenes*, bacteria, food products, example

MIKROBIOLOŠKA KONTAMINACIJA SVJEŽIH I POLUTVRDIH SIREVA U RH

MICROBIOLOGICAL CONTAMINATION IN FRESH AND SEMI- SOFT CHEESES IN CROATIA

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Proizvodnja sireva tradicionalno je udomaćena na poljoprivrednim gospodarstvima, a potražnja za „domaćim“ sirom i dalje je prisutna. Ipak, mlijeko koje se koristi za njihovu proizvodnju može biti kontaminirano mikroorganizmima, te mikrobiološka kakvoća sira predstavlja značajan javno-zdravstveni interes.

Cilj ovog istraživanja bio je dobiti uvid u mikrobiološku sliku (*Staphylococcus aureus*, *Listeria monocytogenes*, *Escherichia coli* O157:H7 i *Salmonella* spp.) tradicijski proizvedenih sireva koji se prodaju na tržnicama većih gradova u RH.

Uzorkovanjem su bili obuhvaćeni tradicijski (autohtoni) svježi i polutvrđi sirevi od kravljeg mlijeka proizvedeni na obiteljskim poljoprivrednim gospodarstvima, a koji se prodaju na tržnicama u Zagrebu, Osijeku, Splitu i Rijeci. Prvo uzorkovanje provedeno je u ljetnim, a drugo u zimskim mjesecima.

Rezultati su pokazali kako niti jedan uzorak sira nije bio kontaminiran patogenim bakterijama *L. monocytogenes* i *Salmonella* spp. Prosječna kontaminacija bakterijom *E. coli* u svježem siru iznosila je $1,3 \times 10^2$ CFU/g, a u polutvrdom siru $3,65 \times 10^1$ CFU/g, što predstavlja zanemarujući rizik za ljudsko zdravlje i ukazuje na dobru higijensku proizvodnju. Prosječna kontaminacija svježeg sira bakterijom *S. aureus* iznosila je $1,21 \times 10^1$ CFU/g, a u polutvrdom siru $2,01 \times 10^1$ CFU/g, što je odraz zadovoljavajućeg stanja i niske mikrobiološke kategorije rizika.

Ključne riječi: svježi i polutvrđi sirevi, mikrobiološka kontaminacija, sigurnost hrane

Keywords: fresh and semi-soft cheeses, microbiological contamination, food safety

MIKOLOŠKI PROFIL NESUKLADNIH UZORAKA MEDA
MYCOLOGICAL PROFILE OF INCOMPATIBLE HONEY
SAMPLES

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Za identifikaciju plijesni tijekom rutinske mikrobiološke pretrage nasumično je odabrano 38 izolata plijesni podrijetlom iz uzoraka uniflornih medova (kesten, bagrem, lipa, cvjetni) koji su bili nesukladni u odnosu na preporučeni kvantitativni kriterij (10 CFU/g) prema Vodiču za mikrobiološke kriterije za hranu (3. izmijenjeno izdanje). Makroskopskom i mikroskopskom identifikacijom iz poraslih kultura na selektivnim podlogama određeni su rodovi plijesni *Cladosporium* sp., *Botrytis* sp., *Paecilomyces* sp., *Acremonium* sp., *Penicillium* sp. i *Pestalotiopsis* sp. Identificirane plijesni široko su rasprostranjene u prirodi (na biljkama, voću, tlu, zraku), a mogu uzrokovati zdravstvene poteškoće kod ljudi djelovanjem njihovih mikotoksina ili kao alergeni. Mikološka ispravnost meda ovisna je o pravilnim postupcima dobivanja meda, skladištenju i čuvanju, te o edukaciji pčelara.

Ključne riječi: med, plijesni, identifikacija

Keywords: honey, mould, identification

**POJAVNOST BIOTOKSINA U DAGNJAMA I KAMENICAMA
IZLOVLJENIM U PODRUČJU ISTOČNE I ZAPADNE OBALE
ISTRE**

**THE OCCURRENCE OF BIOTOXINS IN MUSSELS AND OYSTERS
HARVESTED IN THE EASTERN AND WESTERN COAST OF
ISTRIA**

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Školjkaši su značajan izvor hranjivih tvari, ne sadrže aditive, lako su probavljivi i konzumiraju se minimalno procesirani ili sirovi, što ih čini nutritivno visokovrijednom namirnicom poželjnom u prehrani. Zbog načina hranidbe živih školjakaša moguće je nakupljanje kontaminanata u njihovom mesu, poput biotoksina, zbog čega su potencijalno opasna namirnica. Tijekom 2015. i 2016. godine prisustvo biotoksina ispitano je u 30 uzoraka dagnji (*Mytilus galloprovincialis*) i 30 uzoraka kamenica (*Ostrea edulis*) podrijetlom iz područja za izlov živih školjakaša smještenih na istočnoj i zapadnoj obali Istarskog poluotoka. Količine biotoksina (skupina koje uzrokuju gubitak pamćenja, proljev i paralizu) ispitivane su metodom tekućinske kromatografije visokog učinka u kombinaciji sa UV-DAD, fluorescentnom i masenom detekcijom. Njihovo prisustvo dokazano je u 27 % ispitivanih uzoraka, u rasponu od 46,8 do 117,5 µgkg⁻¹ za okadaičnu skupinu, te 0,08 do 0,3 mgkg⁻¹ za yesotoksine, a utvrđene koncentracije bile su manje od najvećih dopuštenih količina definiranih trenutno važećim propisima u Republici Hrvatskoj. Biotoksini čija je pojavnost utvrđena pripadaju skupini lipofilnih biotoksina i identificirani su u uzorcima dagnji, dok su u kamenicama koncentracije svih skupina biotoksina bile ispod granice određivanja primijenjenih analitičkih metoda. S obzirom na toksičnost morskih biotoksina i dokazano prisustvo u ispitivanim uzorcima, s ciljem zaštite zdravlja potrošača, postoji potreba kontinuiranog monitoringa zdravstvene ispravnosti živih školjakaša koji se stavljaju na tržište.

Ključne riječi: školjkaši, biotoksini, kontaminanti, sigurnost hrane

Keywords: shellfish, biotoxins, contaminants, food safety

IN VITRO ANTIBACTERIAL ACTIVITY OF VARIOUS OILS AND ETHANOL EXTRACT PROPOLIS AGAINST GRAM POSITIVE AND GRAM NEGATIVE BACTERIA

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For many years, medicinal plants and other natural products have been used as traditional treatments for numerous human infections and as food preservatives. Natural products are chemical compounds or substances produced by a living organism, or found in nature, which are pharmacologically or biologically active. Propolis is a natural resinous substance collected by honeybees from parts of plants, buds, and exudates, mixed with bees wax and salivary enzymes. Different biological properties have been attributed to propolis, but one of the most important properties is probably its antimicrobial activity. The *Nigella sativa* oil is used as a remedy for many diseases and also as a food preservative, condiment, carminative, and analgesic in all parts of the world. The oil from the coconut tree has various biological effects; strong antimicrobial activity is one of them. Among the benefits that the consumption of olive oil can exert on the human health, its antimicrobial activity emerges as a promising new property. The antibacterial activities of these natural products were tested in this study against the Gram positive and Gram negative reference bacterial strains: *Staphylococcus aureus*, *Rhodococcus equi*, *Salmonella enterica*, and *Listeria monocytogenes*, using the Kirby Bauer well diffusion method. The observation of the study was that propolis possesses strong antimicrobial potential against Gram positive pathogenic bacteria *Staphylococcus aureus* and *Rhodococcus equi*, but it didn't have any effect on Gram negative bacteria. The essential oil from *Nigella sativa* also showed a pronounced activity against *Staphylococcus aureus*, and it was less effective on Gram negative bacteria. Gram positive pathogens were more sensitive to the effects of coconut and olive oil as well.

Keywords: antimicrobial activity, *Cocos nucifera*, *Nigella sativa*, *Olea europea*, propolis

ODREĐIVANJE PRISUTNOSTI BJELANČEVINA SOJE U HRENOVKAMA MOLEKULARNOM METODOM

DETERMINING THE PRESENCE OF SOY PROTEINS IN FRANKFURTERS USING MOLECULAR METHODS

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U proizvodnji mesnih proizvoda učestalo se koriste bjelančevine soje zbog svoje velike sposobnosti vezivanja vode i povećanja stabilnosti emulzija, uz minimalan utjecaj na okus i boju krajnjeg proizvoda. Osim toga, bjelančevine soje karakterizira i visoka biološka vrijednost te laka probavljivost. No, kako soja pripada skupini osnovnih alergena u hrani, njezina prisutnost, ukoliko nije označena na deklaraciji proizvoda, može predstavljati potencijalnu opasnost za zdravlje ljudi osjetljivih na ovaj alergen. Stoga je cilj ovog rada bio uvesti molekularnu PCR (engl. *Polymerase chain reaction*) metodu za identifikaciju bjelančevina soje te potom ispitati prisutnost ovih bjelančevina u hrenovkama koje se kao namirnica široko konzumiraju u svim dobnim skupinama potrošača. Uzorkovano je ukupno 17 uzoraka hrenovki proizvedenih od strane različitih proizvođača te su rezultati ispitivanja uspoređeni s deklaracijom na proizvodima kako bi se utvrdila sukladnost u označavanju ovog alergena. U 5 uzoraka hrenovki bjelančevine soje bile su naznačene na deklaraciji i PCR metodom su iste i utvrđene. U preostalih 12 uzoraka prisutnost bjelančevina soje nije bila označena na deklaraciji, od kojih u 11 uzoraka prisutnost bjelančevina soje nije ni utvrđena, sukladno s deklaracijom, dok je u jednom uzorku utvrđena prisutnost bjelančevina soje bez označavanja prisutnosti ovog alergena. Rezultati istraživanja pokazuju da većina proizvođača hrenovki na hrvatskom tržištu ispravno označava svoj proizvod, ali ukazuju i na moguće nesukladnosti pri označavanju, te na potrebu stalne kontrole prehrambenih proizvoda na prisutnost alergena s ciljem zaštite osjetljive populacije potrošača.

Ključne riječi: soja, alergeni, hrenovke, PCR metoda

Keywords: soy, allergens, frankfurters, PCR method

**UČINKOVITOST DEZINFEKCIJE I MIKROBIOLOŠKA
ISPRAVNOST VODE ZA LJUDSKU POTROŠNJU
VODOOPSKRBNOG SUSTAVA GRADA ŠIBENIKA**

**THE EFFICIENCY OF DISINFECTION AND THE
MICROBIOLOGICAL QUALITY OF DRINKING WATER IN THE
TOWN OF ŠIBENIK**

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Kakvoća vode za ljudsku potrošnju u vodoopskrbnom sustavu uvjetovana je nizom čimbenika, a prije svega kakvoćom vode na mjestu zahvaćanja u prirodi (arteški bunar, jezero, vodotok), procesu prerade te sanitarno-tehničkim i higijenskim uvjetima u vodoopskrbnim objektima i pratećoj infrastrukturi.

Zdravstveno ispravnom vodom za ljudsku potrošnju smatra se voda koja: (i) ne sadrži mikroorganizme, parazite i njihove razvojne oblike u broju koji predstavlja opasnost za zdravlje ljudi, (ii) ne sadrži štetne tvari u koncentracijama koje same ili zajedno s drugim tvarima predstavljaju opasnost za zdravlje ljudi, (iii) ima vrijednosti parametara zdravstvene ispravnosti vode za ljudsku potrošnju u skladu s odredbama Zakona o vodi za ljudsku potrošnju (MZ HR, NN 56/2013) i Pravilnika o parametrima sukladnosti i metodama analize vode za ljudsku potrošnju (MZ HR, NN 125/13, 141/13, 128/15).

Cilj rada je statističkom obradom analitičkih izvješća o kakvoći vode za ljudsku potrošnju vodoopskrbnog sustava grada Šibenika tijekom petogodišnjeg razdoblja (2011.-2015.) utvrditi učinkovitost dezinfekcije na mikrobiološku ispravnost vode. Analizirani su dobiveni podaci o koncentraciji slobodnog klora te pojavnosti mikrobioloških parametara: broj kolonija na 22 °C i broj kolonija na 37 °C. Korelacijom i grupiranjem dobivenih podataka ovisno o dijelu godine utvrđena je i ovisnost kakvoće vode u vodoopskrbnom sustavu o godišnjem dobu s obzirom da temperatura vode i zraka značajno utječu na ispravnost vode za piće.

Ključne riječi: voda za ljudsku potrošnju, dezinfekcija, kloriranje, Šibenik

Keywords: water for human consumption, disinfection, chlorination, town of Šibenik

KONTROLA ZDRAVSTVENE ISPRAVNOSTI PITKE VODE PRIVATNIH BUNARA

HEALTH SAFETY CONTROL OF DRINKING WATER FROM PRIVATE WELLS

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Većina stanovnika Slavonije kao izvor vode od davnina je koristila bunare u vlastitom dvorištu. Bogatstvo podzemne vode na relativno malim dubinama, kao i pogodni sastav tla, omogućavao je iskapanje bunara na dubinama od desetak metara ili neznatno više od toga.

Razvojem tehnologije i podizanjem standarda stanovništva u Hrvatskoj je oko 80 % naselja pokriveno vodoopskrbnim sustavima. Nažalost, visoka cijena priključka na javni vodovod i teške materijalne prilike dijela stanovnika razlog su i dalje isključivog korištenja vode iz vlastitih bunara. Jedno od takvih naselja je i selo Pavlovci u Požeško-slavonskoj županiji, gdje oko 95 % domaćinstava i dalje koristi jedino vodu iz vlastitih bunara.

U radu je analizirana mikrobiološka ispravnost vode iz privatnih bunara u dva sela na području općine Brestovac u Požeško-slavonskoj županiji, odnosno njena zdravstvena ispravnost. Analizirana bunarska voda koristi se za sve potrebe u domaćinstvu, pa tako i za piće. Analize su obavljene u ovlaštenom laboratoriju Zavoda za javno zdravstvo Požeško-slavonske županije. Uzorci vode su analizirani na ukupne koliformne bakterije, *Escherichia coli*, Enterokoke, *Pseudomonas aeruginosa*, te ukupan broj kolonija na 37 °C i 22 °C. Analizom uzetih uzoraka utvrđeno je da niti jedan uzorak vode nije zdravstveno ispravan, odnosno ne odgovara zakonski propisanim maksimalno dopuštenim koncentracijama (MDK).

Ključne riječi: mikrobiološka ispravnost vode, bunar, *Escherichia coli*, Enterokoki, *Pseudomonas aeruginosa*

Keywords: microbiological safety of water, well, *Escherichia coli*, Enterococci, *Pseudomonas aeruginosa*

**MATERIJALI I PREDMETI KOJI DOLAZE U NEPOSREDAN
DODIR S HRANOM - OKVIRNO STANJE NA TRŽIŠTU
REPUBLIKE HRVATSKE**

**FOOD CONTACT MATERIALS – THE PROVISIONAL STATE ON
THE MARKET IN THE REPUBLIC OF CROATIA**

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Cilj ovog rada je informiranje i upoznavanje javnosti o rezultatima ispitivanja zdravstvene ispravnosti/sukladnosti materijala i predmeta koji dolaze u neposredan dodir s hranom koji se nalaze na tržištu Republike Hrvatske, a u cilju zaštite zdravlja ljudi i zaštite javnozdravstvenog interesa.

Nadzor nad područjem materijala i predmeta koji dolaze u neposredan dodir s hranom provodi sanitarna inspekcija Ministarstva zdravstva koja je nadležna nad proizvodnjom, uvozom te stavljanjem na tržište materijala i predmeta koji dolaze u neposredan dodir s hranom (food contact materials) i predmeta široke potrošnje.

Sanitarni nadzor obuhvaća provođenje monitoringa, odnosno kontinuiranog laboratorijskog ispitivanja radi praćenja zdravstvene ispravnosti/sukladnosti materijala i predmeta koji dolaze u neposredan dodir s hranom te provođenje ciljanih inspekcijskih nadzora u proizvodnji i na tržištu Republike Hrvatske.

Monitoring materijala i predmeta koji dolaze u neposredan dodir s hranom provodi se kontinuirano od 2014. godine.

Monitoringom za 2017. godinu planira se uzorkovati 140 uzoraka materijala i predmeta koji dolaze u neposredan dodir s hranom (posuđe, pribor, oprema), a koji su izrađeni od plastike, drveta, papira, metala, stakla, keramike i emajla.

Tijekom 2016. godine uzorkovano je 163 uzorka materijala i predmeta koji dolaze u neposredan dodir s hranom koji su dostavljeni na analizu u Hrvatski zavod za javno zdravstvo. Od ukupnog broja uzetih uzoraka 9 uzoraka, odnosno 2,9 %, materijala i predmeta koji dolaze u neposredan dodir s hranom bilo je zdravstveno neispravno. Od tog broja 6 neispravnih uzoraka bili su noževi sa sječivom izrađenim od nehrđajućeg čelika zbog pojave korozije, 1 uzorak emajliranog posuđa bio je neispravan zbog nepostojanosti emajla, a 2 uzorka metalnog posuđa nisu bila ispravna radi povećane količine teških metala.

Dobiveni rezultati monitoringa predstavljaju okvirno stanje zdravstvene ispravnosti/sukladnosti materijala i predmeta koji dolaze u neposredan dodir s hranom

na tržištu Republike Hrvatske. Temeljem rezultata monitoringa sanitarna inspekcija planira, priprema i obavlja službene kontrole s ciljem učinkovitije zaštite zdravlja ljudi i potrošača.

Ključne riječi: monitoring, materijali i predmeti koji dolaze u neposredan dodir s hranom, uzorkovanje, zdravstvena ispravnost/sukladnost

Keywords: monitoring, food contact materials, samples, safety, compliance

DEKLARIRANJE HRANE: DOBAR MARKETING ILI ZAKONSKA OBVEZA

LABELLING FOOD PRODUCTS: GOOD MARKETING VS. LEGAL OBLIGATIONS

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Deklariranje nutritivnih karakteristika i mogućih alergena sadržanih u proizvodu ili mogućnosti eventualne kontaminacije alergenima u procesu proizvodnje te informacije o rokovima i načinu sigurne pripreme i konzumiranja može biti od životne važnosti za kupce i konzumente. Zakonski okvir određuje minimalne obveze proizvođača i trgovaca na nekoliko razina. Pored međunarodnih, regionalnih i nacionalnih propisa, proizvođači i trgovci mogu dobrovoljno usvojiti i primjenjivati standarde koji su stroži od zakonski propisanih. Na taj način oni kupcima komuniciraju svoju brigu o njihovoj dobrobiti te moguće ostvaruju konkurentsku prednost nad proizvođačima koji ne iskazuju toliki stupanj društvene odgovornosti u poslovanju.

Ključne riječi: deklariranje hrane, zakonodavni okvir za deklariranje hrane, marketing hrane

Keywords: food labelling, legal framework for food labelling, food marketing

Food analysis / Analiza hrane

SEPARATION AND IDENTIFICATION OF CHLOROGENIC ACIDS USING THE HPLC METHOD

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Chlorogenic acids (CGAs) are a group of polyphenolic compounds distributed in different plants. CGAs are a family of different esters formed between the (-)-quinic acid and certain *trans*-cinnamic acids (caffeic, ferulic). In this study, the separation and identification of nine different CGAs isomers: 5-*O*-caffeoylquinic acid (5-CQA), 4-*O*-caffeoylquinic acid (4-CQA), 3-*O*-caffeoylquinic acid (3-CQA), 3,5-*O*-dicafeoylquinic acid (3,5-diCQA), 4,5-*O*-dicafeoylquinic acid (4,5-diCQA), 3,4-*O*-dicafeoylquinic acid (3,4-diCQA) and 5-*O*-feruloylquinic acid (5-FQA), 4-*O*-feruloylquinic acid (4-FQA), and 3-*O*-feruloylquinic acid (3-FQA) was performed in a model solution using high performance liquid chromatography (HPLC). The HPLC analysis was carried out on the HPLC system (Agilent) with a PDA detector using the C18 column and two mobile phases, 0.1 % phosphoric acid in water, and 100 % methanol. UV/Vis spectra were recorded in the wavelength range from 200 nm to 600 nm. Chlorogenic acids have shown the maximum absorbance at the wavelength of 320 nm. The order of elution of the individual chlorogenic acids is consistent with the literature data. All investigated chlorogenic acids are well separated, except the 3,4 – and 3,5-diCQA (the retention times are very close). The method has shown linearity in the range of concentrations from 20 mg/L to 300 mg/L, limit of detection (LOD) was $1.7 \cdot 10^{-5}$ mol/L and the limit of quantification (LOQ) was $5.7 \cdot 10^{-5}$ mol/L. This method could be applied in the analysis of chlorogenic acids in various beverages.

Keywords: chlorogenic acids, HPLC, validation

DETERMINATION OF POLYPHENOL AND ANTIOXIDANT CONTENT IN SELECTED FOODS

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Polyphenols are micronutrients with various health promoting effects, and as such have an important role in the prevention of degenerative diseases, for instance cancer and cardiovascular diseases. To this date, there are over 8 000 identified polyphenols found in plants and plant products, such as fruit, tea, coffee, etc. Polyphenol content in food has been determined by various analytical methods (over several hundred scientific publications) and compiled in the Phenol-Explorer database (more than 35 000 content values for 500 different polyphenols in over 400 foods). Our aim was to evaluate the content of polyphenols in selected foods (fruit and derived products) to identify the richest sources of polyphenols among them, in order to determine which of them contribute significantly to the polyphenol intake. Total polyphenol content was calculated as the sum of the contents of all individual polyphenols (determined by chromatography) and was compared with the content of antioxidants, which was extracted from the same database. Based on data obtained by comprehensive queries in the Phenol-Explorer database, the ranking of the polyphenol content in selected foods was made. Our results indicate that polyphenol content in selected food items varies from 3 448 mg per 100 g in cocoa powder to 10 mg per 100 ml in wine.

Keywords: polyphenols, antioxidants, Phenol-Explorer database

**PHYSICAL PROPERTIES OF RED CURRANTS (*Ribes rubrum* L.)
DRIED UNDER VARIOUS VACUUM DRYING CONDITIONS**

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Red currants (*Ribes rubrum* L.) are rich in bioactive compounds and a commonly used type of fruit in the food industry. In order to extend its shelf life and its usage throughout the year, red currants are usually preserved by drying or freezing. The disadvantages caused by convective drying of red currants could be successively dissolved using vacuum drying. In the framework of this research, physical properties of red currants dried under various vacuum drying conditions were investigated. Temperatures (-30, -20, -10, 0, 10, 20, 30, 40, 50, 60, and 70 °C) and drying pressures (0.01 and 20 mbar) were used as the investigated drying parameters, while moisture content, water activity, total colour change, rehydration power, and shear force were investigated as the most suitable quality indicators of the dried samples. The lowest moisture content and shear force were obtained in the samples dried at 60 °C and 20 mbar, and 20 °C and 0.01 mbar, respectively. Both the lowest water activity and the total colour change were observed in the red currant sample dried at 40 °C and 20 mbar. Finally, the highest rehydration power was noticed in sample dried at -10 °C and 0.01 mbar.

Keywords: physical properties, red currants, drying

THE EVALUATION OF β -GLUCANS AND AMYLOSE CONTENT IN DIFFERENT BARLEY VARIETIES

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Barley (*Hordeum vulgare* L.) is one of the major cereal crops cultivated in Croatia. It is mostly used as livestock feed and in the beer industry for malt production. Much of the research has been devoted to investigating potential health benefits of consuming barley. It has been suggested that incorporating barley in the human diet may help in lowering the amount of serum cholesterol and the risk of heart disease and diabetes, maintaining a healthy weight, and reducing the consequences regarding modern human life habits. Among cereals, barley grain is rich in dietary fibres, particularly in β -glucans. Based on its versatility, barley can be divided into two-rowed or six-rowed varieties by spike morphology, hulled or hull-less by hull adherence, and winter or spring types according to sowing time. The aim of this study was to evaluate the β -glucans and amylose content of eighteen different barley genotypes. Hull-less barley variety Osk. 6.24/2-12 gave the highest β -glucans content, while the lowest β -glucans content was observed for the two-rowed winter variety Vanessa. There were no considerable differences between the analysed varieties in amylose content.

Keywords: barley, cereal, β -glucans, amylose

PARTICLE SIZE DISTRIBUTION AND THE COLOUR OF WHITE CHOCOLATE WITH THE ADDITION OF ENCAPSULATED BLUEBERRY JUICE

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The cocoa bean is one of the richest known natural sources of antioxidants, which contains more phenolic compounds and has higher antioxidant activity than tea or red wine. Many epidemiological studies show that dark chocolate may lower blood pressure and the incidence of cardiovascular diseases. On the other hand, white chocolate is a confectionery product consisting of sugar and milk powder dispersed in cocoa butter as a continuous fat phase. Unlike dark and milk chocolate, white chocolate does not contain dark cocoa particles that are rich in polyphenols. Polyphenol compounds from berry fruits have also shown beneficial effects on human health and the reduction of risk of cardiovascular disease, type II diabetes, and cancer. Since the application of polyphenols in the creation of functional foods has recently attracted great interest in various research studies, our goal was to produce white chocolate enriched with 1 %, 3 %, and 5 % polyphenol compounds extracted from blueberries.

Blueberry encapsulate changed the values of lightness (L*), a* (red tone), and b* (yellow tone) measured on the surface of the enriched chocolate, in accordance with the applied concentrations, while the concentration of added encapsulates did not have any influence on the particle size distribution of the final product.

Keywords: white chocolate, blueberry juice encapsulate, particle size distribution, colour

PROCJENA KAKVOĆE MEDA SJEVERNE HRVATSKE
QUALITY ASSESSMENT OF HONEY FROM NORTHERN CROATIA

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Prema kemijskom sastavu med predstavlja složenu smjesu više od 70 različitih komponenti. Kemijski sastav meda ovisi o vrsti biljaka i/ili medljike od kojih je dobiven, geografskom podrijetlu, klimatskim uvjetima i načinu proizvodnje. U svrhu procjene kvalitete meda provedena je analiza aktivnosti dijastaze, električne vodljivosti, masenog udjela vode i udjela hidroksimetilfurfurala. Tijekom 2015. i 2016. godine sakupljeno je 85 uzoraka meda s područja sjeverne Hrvatske (Varaždinska, Međimurska, Koprivničko-križevačka i Bjelovarsko-bilogorska županija). Uzorci su na temelju peludne analize razvrstani u nekoliko skupina: cvjetni (30), bagrem (28), lipa (8), kesten (7), medljikovac (5), amorfa (3), livada (2), suncokret (2). Svi uzorci zadovoljavaju kriterij masenog udjela vode ispod 20 %, a izmjereni su u rasponu od 14,3 % do 20,0 %. Koncentracije hidroksimetilfurfurala su se kretale u rasponu od 0,1 do 43,3 mg/kg, a kod jednog uzorka utvrđena je koncentracija iznad propisane vrijednosti od 40 mg/kg. Vrijednosti električne vodljivosti kretale su se u rasponu od 0,09 do 1,34 mS/cm. Aktivnost dijastaze uzoraka meda kretala se od 12 do 44. Rezultatima analize utvrđeno je da 97,7 % uzoraka zadovoljava kriterije propisane Pravilnikom o medu te da se na području sjeverne Hrvatske proizvodi kvalitetan med.

Ključne riječi: med, fizikalno-kemijska analiza, sjeverna Hrvatska

Keywords: honey, physicochemical properties, Northern Croatia

GLUCOSE OXIDASE ACTIVITY AND HYDROGEN PEROXIDE ACCUMULATION IN CROATIAN HONEYS

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The ability of black locust, chestnut, lime, mint, and honeydew honeys to produce hydrogen peroxide upon dilution, as well as their glucose oxidase activity, was investigated in the present study. Glucose oxidase (GOX) activity was determined using the standard horseradish peroxidase/o-dianisidin method, while hydrogen peroxide concentration in honey solutions of five different mass to volume ratios (1:1; 1:2; 1:4; 1:8; 1:16) was determined with the semi-quantitative method using the MQuant™ test. The obtained results showed that chestnut, lime, honeydew and mint honeys exhibited high GOX activity (341.26 ± 128.78 , 350.16 ± 124.91 , 376.82 ± 69.02 , 402.47 ± 60.99 $\mu\text{g/h g}$), while black locust honeys exhibited much lower GOX activity of 25.58 ± 21.87 $\mu\text{g/h g}$. The hydrogen peroxide content in honey solutions of different mass to volume ratios varied from 0 to 294.1 $\mu\text{mol/L h}$. Lime and chestnut honeys generated the highest hydrogen peroxide content (264.71 ± 65.77 , 245.10 ± 84.90 $\mu\text{mol/L h}$) on average, while black locust, mint, and honeydew honeys generated the amounts that were at least two-fold lower (113.40 ± 50.84 , 127.45 ± 33.96 , 112.75 ± 98.42 $\mu\text{mol/L h}$). The lack of correlation between glucose oxidase activity and hydrogen peroxide content implies that glucose oxidase activity does not present a reliable parameter for the prediction of hydrogen peroxide content in honeys.

Keywords: honey, hydrogen peroxide accumulation, glucose oxidase activity

THE MULTIELEMENT PROFILE OF ITALIAN OAK (*Quercus frainetto* Ten.) HONEYDEW HONEY

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Italian oak (*Quercus frainetto* Ten.) honeydew honey production is characteristic for the geographical region of the Požega Valley, Croatia. This honeydew honey is produced in a specific way, from sweet fruit sap formed at a location where green acorns were discarded without the mediation of plant sucking insects. Our previous studies showed that Italian oak honeydew honey is characterised by negative specific rotation, unspecific for honeydew honeys, and very high phenolic content and antioxidant capacity. The objective of this study was to contribute to the overall characterisation of this specific honey type, through the macro and micro element determination in 10 Italian oak honeydew honey samples from two production seasons. The most abundant element was potassium, with the average value of 3110.9 mg/kg, followed by phosphorus, magnesium, and calcium, with average values of 228.9 mg/kg, 190.5 mg/kg, and 134.5 mg/kg, respectively. The determined manganese concentrations, ranging from 15.7 mg/kg to 43.7 mg/kg, are significantly higher than manganese concentrations in other honeydew honey types available in the literature. The content of potentially toxic elements (Cr, Cd, Pb) was very low or below the limit of detection, with the exception of one sample that had increased concentrations of Fe, Zn, and Al, aside from higher concentrations of the mentioned elements, indicating the improper storage conditions of honey.

Keywords: multielement analysis, oak honeydew honey, characterisation

**UDIO POLIFENOLA I UKUPNIH FLAVONOIDA TE
ANTIOKSIDATIVNA AKTIVNOST PČELINJEG POLENA NA
PODRUČJU TUZLANSKOG KANTONA**

**POLYPHENOL AND TOTAL FLAVONOID CONTENT, AND THE
ANTIOXIDANT ACTIVITY OF BEE POLLEN COLLECTED IN THE
TUZLA CANTON**

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Pčelinji polen je proizvod pčela koji nastaje aglutinacijom (sljepljivanjem) cvjetnog polena s tvarima slin i sastojcima nektara. S obzirom na to da ima iznimno jaka nutritivna i ljekovita svojstva, koristi se u tradicionalnoj medicini, a oduzima se od pčela na ulazu u košnicu.

S obzirom da na nutritivna i ljekovita svojstva pčelinjeg polena utječe udio polifenola, cilj ovog rada bio je utvrditi sadržaj ukupnih polifenola (Folin-Ciocalteu metodom) i ukupnih flavonoida (spektrofometrijski) te utvrditi antioksidativnu aktivnost pčelinjeg polena (DPPH, ABTS i FRAP metodama) sakupljenog na području Tuzlanskog kantona u periodima ožujak-travanj i svibanj-lipanj 2014. godine.

Rezultati su pokazali da polen prikupljen u periodu ožujak-travanj sadrži viši udio polifenola i ima veću antioksidativnu aktivnost od polena prikupljenog u svibnju i lipnju, pri čemu postoje velike varijacije u navedenim parametrima ovisno o mjestu prikupljanja i botaničkom podrijetlu.

Ključne riječi: pčelinji polen, polifenoli, FRAP, DPPH

Keywords: bee pollen, polyphenols, FRAP, DPPH

FLAVONOIDNE KOMPONENTE U PROPOLISU RAZLIČITOG GEOGRAFSKOG PORIJEKLA

FLAVONOID COMPONENTS IN PROPOLIS OF DIFFERENT GEOGRAPHICAL ORIGIN

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Propolis je prirodni proizvod medonosne pčele (*Apis mellifera* L), složenog kemijskog sastava koji je utemeljen na biljnom izvoru dostupnom pčelama i ima različita biološka i farmakološka djelovanja. Flavononi, zajedno sa flavonima, kava kiselinom i njenim esterima smatraju se odgovornim za antimikrobno djelovanje propolisa. Različiti uzorci propolisa zapravo su različite kombinacije kemijskih supstanci koje utječu na njegovo biološko djelovanje. Provedene kemijske analize dovele su do spoznaje da su flavonoidi glavne biološki aktivne komponente europskog propolisa. U radu su kemijskom analizom ispitane prisutnost i koncentracija flavonoidnih komponenti (kvercetin, galangin, krizin, pinostrobin, pinocembrin, naringenin) u 10 i 15 postotnom etanolnom ekstraktu propolisa (EEP) podrijetlom iz različitih geografskih regija Bosne i Hercegovine.

Ključne riječi: propolis, flavonoidi, kemijski sastav

Keywords: propolis, flavonoids, chemical composition

SELECTION OF NS RAPESEED GENOTYPES ACCORDING TO THE USEFUL VALUE OF OIL

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Rapeseed (*Brassia napus L.*) is the most common source of vegetable oils in Europe. Global production of *Brassica* oilseeds has increased faster over the past two decades than that of any other oilseed. Therefore, one of the main breeding objective is to create rapeseed genotypes with highly appreciated nutritional characteristics. The crude rapeseed oil is rich source of omega-3 fatty acids, antioxidants and other phytonutrients essential for good human health.

The aim of this study was to investigate fatty acid and tocopherol constituents (α -, β -, γ - tocopherols) in a collection of 37 NS rapeseed genotypes. This collection is used in the breeding program in order to improve the quality of the oil. The fatty acid profiles are obtained using the gas chromatography–flame ionisation detection which is sensitive method for determining the fatty acid compositions. Tocopherols were determined in rapeseed oil samples by using the normal-phase high-performance liquid chromatography with fluorescence detection.

Results revealed that major identified fatty acids oleic (57.80–69.20 %), linoleic (15.30–56.50 %), and linolenic acid (7.90–26.60 %). In rapeseed oil samples were quantified three tocopherols with prevailing α -tocopherol (40.65–523.91 mg/kg) and γ -tocopherol (167.75–353.54 mg/kg) and lesser levels of β -tocopherol (0.04–19.04 mg/kg). Obtained results showed that the investigated NS rapeseed genotypes are rich source of essential fatty acids as well as water-soluble vitamins (α - and γ -tocopherols). The predominant essential fatty acids were found to be (ω -6) linoleic acid followed by (ω -3) linolenic acid at ω -6 to ω -3 ratio of 2.2:1 for three investigated rapeseed genotypes which makes them nutritionally valuable. An ω -6/ ω -3 fatty acid ratio of 5:1 or less is desired for maintaining good health as suggested by nutrition experts. Due to these chemical properties some of investigated rapeseed genotypes (less than 2 % erucic acid in the oil and less than 30 μ mol/g glucosinolates) can be used as salad or salad dressing oils.

Keywords: rapeseed oil, fatty acids, tocopherols

CHEMICAL CHARACTERISTICS AND OXIDATIVE STABILITY OF DALMATIAN MONOVARIETAL OLIVE OILS

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Olive oils are proved to have various beneficial health effects due to a high content of monounsaturated fatty acids, as well as a high level of biologically active lipophilic and water-soluble compounds. In the coastal region of Dalmatia (Croatia), there is a long-standing tradition of olive cultivation and the production of high quality oils. Also, great attention has been given to native olive varieties. The objective of this study was to determine the chemical characteristics and the antioxidative potential of monovarietal olive oils from the native Dalmatian olive cultivars *Levantinka*, *Buharica*, and *Drobnica*. Free acidity and peroxide value, which are the primary indicators of fruit quality, as well as the handling procedures, were determined, along with the total phenolic content, using the Folin-Ciocalteu method. The individual phenolic and fatty acid composition was analysed by chromatographic techniques, while the oxidative stability of oil was tested using the Rancimat apparatus. According to the obtained results, there were significant differences among the investigated samples and the connection between their chemical composition and the related antioxidant properties was detected. The highest level of phenolics was detected for *Buharica* olive oil, while the longest oxidation inhibition period (11.35 h) was detected for *Drobnica* oil.

Keywords: monovarietal olive oils, chemical composition, phenolics, Rancimat, oxidative stability

This study has been fully supported by the Student Union the University of Split, under the project “Najbolje od Dalmacije: znanost potvrđuje tradiciju”.

THE PROXIMATE ANALYSIS OF OIL CAKES AFTER THE PROCESSING OF COLD-PRESSED OIL

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The waste or by-products that remain after the extraction of oil from seeds is called meal or cake. Owing to its composition, these materials can have different biotechnological applications, such as the production of enzymes (lipase, cellulase), antibiotics, mushrooms, vitamins, antioxidants, amino acids, organic acids, single-cell proteins, biologically active secondary metabolites, etc.

In order to expand the current knowledge on different cold-press oil cakes composition, the present study aims to determine the composition of three different cold-press oil cakes: hull-less pumpkin (*Cucurbita pepo* L.), flax (*Linum usitatissimum* L.), and hemp (*Canabis sativa* L.).

The contents of dry matter, ash, total and soluble proteins, ether extracts, neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL), total organic carbon (TOC), total carbohydrates, simple sugars, total polyphenols, and simple phenolic compounds were thoroughly analysed.

Keywords: hull-less pumpkin (*Cucurbita pepo* L.), flax (*Linum usitatissimum* L.), hemp (*Canabis sativa* L.), proximate analysis, oil cakes

SASTAV MASNIH KISELINA SLAVONSKE ŠUNKE

FATTY ACID COMPOSITION OF SLAVONIAN HAM

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Cilj rada bio je procijeniti utjecaj različitih vrsta soli (krupne morske, KMS i sitne kamene soli, SKS) na sastav masnih kiselina slavonske šunke. Određivanje sastava masnih kiselina provedeno je na kraju proizvodnog procesa, 238. dan. Nakon ekstrakcije masti pomoću standardiziranog *Soxhlet* postupka, metilni esteri masnih kiselina analizirani su pomoću plinske kromatografije s plameno-ionizacijskom detekcijom (*GC-FID*). Analiziran je i uspoređen sastav masnih kiselina s obzirom na skupine zasićenih (SFA), mononezasićenih (MUFA) i polinezasićenih (PUFA) masnih kiselina, kao i omjeri n-6/n-3 te PUFA/SFA. Rezultati određivanja sastava masnih kiselina slavonske šunke soljenih s KMS i SKS pokazuju da je oleinska kiselina (C18:1n9) najzastupljenija masna kiselina iz skupine MUFA (43,43 i 43,44 %), palmitinska kiselina (C16:0) iz skupine SFA (23,67 i 23,21 %) te linolna kiselina (C18:2n-6c) iz skupine PUFA (9,74 i 10,48 %). Vrste soli nisu statistički značajno utjecale na sastav masnih kiselina slavonske šunke ($p < 0,05$). Omjeri PUFA/SFA (0,29 - 0,32) i n-6/n-3 (19,60 - 19,88) za uzorke slavonske šunke soljene s KMS i SKS u skladu su s literaturnim podacima za različite hrvatske i europske šunke (pršute). Utvrđeni omjeri nisu u skladu s nutritivno preporučenim vrijednostima međunarodnih zdravstvenih organizacija (PUFA/SFA > 0,4; n-6/n-3 < 4).

Ključne riječi: slavonska šunka, masne kiseline, SFA, MUFA, PUFA

Keywords: Slavonian ham, fatty acids, SFA, MUFA, PUFA

**MASNOKISELINSKI SASTAV TRAJNIH I POLUTRAJNIH
KOBASICA NA HRVATSKOM TRŽIŠTU**

**FATTY ACID COMPOSITION OF FERMENTED AND SEMI-DRY
SAUSAGES ON THE CROATIAN MARKET**

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Meso i mesni proizvodi neophodan su dio ljudske prehrane, ali se zbog značajnog udjela masti i njenog sastava često navode u negativnom kontekstu. U ovom radu analiziran je profil masnih kiselina različitih vrsta kobasica te njihov potencijalni učinak na zdravlje potrošača. Ukupno 35 uzoraka iz kategorije trajnih (n = 20) i polutrajnih (n = 15) kobasica, proizvedenih u više hrvatskih mesnih industrija i nazočnih na hrvatskom tržištu, nasumično je prikupljeno tijekom 2016. i 2017. godine. Statistička obrada podataka nije pokazala značajne razlike ($p > 0,05$) u masnokiselinskom sastavu različitih vrsta kobasica. Zbog visokog udjela n-6 linolne kiseline te niskog udjela n-3 masnih kiselina, omjeri n-6/n-3 bili su karakteristično veći za ovakve vrste proizvoda u odnosu na zdravstvene preporuke. Omjer polinezasićenih i zasićenih masnih kiselina (PUFA/SFA) je za većinu proizvoda (0,35-0,38) nešto manji u odnosu na donju granicu preporučenih vrijednosti ($> 0,4$). Vrijednost manja od 1 predstavlja zdravstvenu preporuku za parametre kvalitete masti koji se temelje na funkcionalnim svojstvima masnih kiselina i to aterogenom (AI) i trombogenom indeksu (TI). AI je za sve vrste proizvoda bio u skladu sa preporukom, dok je TI, koji se dovodi u vezu s rizikom zgrušavanja krvi, bio nešto veći (1,18-1,28). Većina dobivenih rezultata objašnjava današnju potrebu proizvođača za modifikacijom masnokiselinskog profila mesnih proizvoda s ciljem poboljšanja nutritivnih svojstava i pozitivnih učinaka na zdravlje potrošača.

Ključne riječi: kobasice, mesni proizvodi, sastav masnih kiselina, kvaliteta masti, nutritivni omjeri

Keywords: sausages, meat products, fatty acid composition, fat quality, nutritional ratios

SALT CONTENT IN DRIED CURED INDUSTRIALLY PRODUCED AND HANDCRAFTED SAUSAGES RETAILED IN NOVI SAD, SERBIA

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Processed food is the major contributor to the high-salt intake of the population and consequently to cardiovascular diseases (CVD), especially hypertension. The highest level of salt is determined in cured meat products and sausages, accounting for over 20 % of the total dietary salt intake. The high consumption of cured sausages is characteristic of the dietary pattern in the Pannonian region. The aim of the paper was to determine the salt content in industrially produced and handcrafted dried sausages retailed in Novi Sad, and to determine the contribution of the salt contained in a 30 g portion to the recommended daily salt intake for healthy persons and persons with a risk of a CVD. The average salt content in the 50 controlled samples was 3.48 ± 0.87 g/100g, ranging from 1.83 to 5.64 g/100g. The comparison of the salt content in the two groups of sausages using the Student's t-test showed statistically significantly higher concentrations in industrially produced sausages (3.83 ± 0.75 g/100g) than in the handcrafted sausages (2.90 ± 0.75 g/100g) ($p < 0.05$). The average salt content in a 30 g portion of cured sausages contributes to the recommended daily salt intake of 5 g/day/person with 20.71 % for healthy, and with 27.61 % for persons with a risk of a CVD, with a lower recommended daily salt intake (3.75 g/person/day). The meat industry is urged to cut salt in cured meat products, considering their high contribution to the high salt intake of the population.

Keywords: sodium chloride, hypertension, cured sausages, processed food

THE SENSORY PROPERTIES OF SAUSAGES MADE BY DIFFERENT PRODUCERS IN BOSNIA AND HERZEGOVINA

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Introduction: The development of meat processing shows a trend of rapid and continuous growth, because those products are required to have a distinctive taste and smell, as well as organoleptic and other characteristics. There is a recorded increase of the number of industrial manufacturers engaged in this activity, some of them retained the traditional production model, but an increasing number of them are turning to technological achievements and following new industry trends. The acceptability of the product is mostly measured by sensory assessments, while food safety is a legal obligation.

The aims of the paper were to analyze the sausages made by five different manufacturers and determine the level of difference and the degree of consumer acceptability among the producers, based on the established sensory analysis parameters.

Methods of work: A scoring method was used for the sensory analysis. A standardized scoring system was also defined, in the frame of the analysed and evaluated selected representative quality properties of a certain sausage. The evaluated lists for the sausages had the maximum score of 20 points for each individual property. The selection of evaluators for the sensory analysis was performed according to ISO 8586-1/1993. The differences in the acceptability of the sausages were determined by ranking, using ISO 8587/2006. All the samples were coded with numbers from 1 to 5.

Results: The total average grade of the sausage producer P1 (92.07 ± 7.07) was statistically significantly higher ($p < 0.01$) than the average total sensory evaluation of the sausage producer P2 (73.73 ± 2.49) and the producer P3 (71.40 ± 6.31), and with a statistical significance of $p < 0.05$, it was statistically significantly higher than the rating of the manufacturer P4 (76.47 ± 12.00) and the producer P5 (77.77 ± 7.40). In all cases, the average overall rating of all five producers was statistically significantly lower ($p < 0.01$) than the maximum rating (100).

Conclusion: The variety in the production processes, systems of control, and product analysis results in different product quality. The ratings given to some producers are in correlation with their market recognition.

Keywords: sausage, sensory properties

UTJECAJ RAZLIČITIH ČIMBENIKA NA KEMIJSKE PARAMETRE I SOMATSKE STANICE U SIROVOM I UHT MLIJEKU

THE INFLUENCE OF VARIOUS FACTORS ON THE CHEMICAL PARAMETERS AND SOMATIC CELLS IN RAW AND UHT MILK

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Mlijeko je proizvod mliječne žlijezde dobiveno mužnjom jedne ili više zdravih muznih životinja, identificiranih, pravilno hranjenih i držanih, koje nije zagrijavano na temperaturi većoj od 40 °C. Osim kemijskog sastava kvaliteta mlijeka određuju pokazatelji higijenske ispravnosti, ukupan broj mikroorganizama i broj somatskih stanica. Istraživanje je rađeno na različitim vrstama mlijeka istoga proizvođača i to: sirovo mlijeko, UHT mlijeko sa 3,2 %, 2,8 %, 1,5 % i 0,9 % mliječne masti. Uzorci su skladišteni sa i bez konzervansa na temperaturama 22-25 °C i 4-6 °C, a analiza je rađena nakon 24 i 48 sati. Kao konzervans su korištene tablete azidiola. Određivali su se kemijski parametri (mliječna mast, protein, laktoza, bezmasna suha tvar i suha tvar) FTIR spektrofotometrijom te somatske stanice fluoro-opto-elektronskom metodom. Rezultati su pokazali da konzervans stabilizira uzorke UHT mlijeka kada su u pitanju kemijski parametri jer ne dolazi do njihove velike promjene. Uzorak sirovog mlijeka koji je čuvan bez konzervansa na sobnoj temperaturi pokazao je za 16,44 % veći nivo mliječne masti nakon 24 sata u odnosu na prvobitnu analizu dok se nakon 48 sati analiza nije mogla ni uraditi zbog neadekvatnosti uzorka. Stajanjem uzorka broj somatskih stanica u sirovom mlijeku se smanjuje za 10,34 %. Na osnovi provedenog istraživanja može se zaključiti da konzervans, temperatura i vrijeme skladištenja ne utječu na kvalitetu UHT mlijeka, dok kod sirovog mlijeka ima znatnih promjena.

Ključne riječi: konzervans, temperatura, vrijeme skladištenja, mlijeko

Keywords: preservative, temperature, storage time, milk

FIZIKALNO-KEMIJSKA KAKVOĆA VODE ZA PIĆE NA PODRUČJU SREDNJOBOSANSKOG KANTONA U PERIODU OD 2012. DO 2016. GODINE

PHYSICOCHEMICAL QUALITY OF DRINKING WATER IN THE CENTRAL BOSNIA COUNTY IN THE 2012-2016 PERIOD

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Uvod: Osiguranje dovoljnih količina zdravstveno ispravne vode za piće jedan je od osnovnih preduvjeta za očuvanje i zaštitu ljudskog zdravlja. Zahtjevi i standardi koje voda za piće mora ispunjavati propisani su Pravilnikom o zdravstvenoj ispravnosti vode za piće BiH (Sl. novine br. 40/10 Aneks I dio B i C), dok uzorkovanje i laboratorijsko ispitivanje trebaju biti u skladu s definiranim standardnim normama. Laboratorij za fizikalno-kemijsku analizu Zavoda za javno zdravstvo SBK/KSB akreditiran je prema normi BAS EN ISO/IEC 17025:2006.

Cilj: Na osnovi fizikalno-kemijskih parametara dobivenih analizom vode za piće u laboratoriju ZZJZ SBK/KSB utvrditi njenu zdravstvenu ispravnost.

Metode: Ovo istraživanje obuhvaća prikaz rezultata fizikalno-kemijskog ispitivanja vode za piće s područja Srednjobosanskog kantona u periodu od 2012. do 2016. godine.

Rezultati: U periodu od 2012. do 2016. godine na području SBK/KSB ukupno je za fizikalno-kemijsku analizu uzorkovano 5526 uzoraka vode za piće iz gradskih vodovoda i ostalih vodnih objekata. U 2012. godini ukupno je uzorkovano 929 uzoraka vode za piće, od kojih je bilo neispravno 69 uzoraka ili 7,42 %. U 2013. godini ukupno je uzorkovano 1020 uzoraka vode za piće, od kojih su bila neispravna 33 ili 3,23 % uzoraka. U 2014. godini ukupno je uzorkovano 980 uzoraka vode za piće, od kojih je 7 bilo neispravno ili 0,71 %. U 2015. godini uzorkovano je 967 uzoraka vode za piće od kojih je 5 bilo neispravno ili 0,51 %. U 2016. godini ukupno je uzorkovano 947 uzoraka vode za piće, od toga su 2 bila neispravna ili 0,21 %. Uzroci fizikalno-kemijske neispravnosti vode za piće bili su povećana mutnoća vode u periodu povećanih padalina, kao i neredovito kloriranje vodnih objekata.

Zaključak: Iz navedenih rezultata fizikalno-kemijske analize vode za piće na području SBK/KSB u periodu od 2012. do 2016. godine vidljivo je da se iz godine u godinu smanjuje broj neispravnih voda za piće. Redoviti monitoring vode za piće i osiguranje zdravstveno ispravne vode za piće ima veliki javno-zdravstveni značaj.

Gljučne riječi: voda za piće, fizikalno-kemijska analiza vode za piće, očuvanje i zaštita ljudskog zdravlja

Keywords: drinking water, physicochemical analysis of drinking water, preservation and protection of human health

THE LEVEL OF CITRIC ACID IN FRUIT JUICES AVAILABLE ON CROATIAN MARKET

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The aim of this study was to check the level of citric acid in fruit juices (lemon, orange, apple and fruit-mix) available on Croatian market. The level of citric acid was determined by use of high performance liquid chromatography (HPLC). UV/Vis detector was set at 214 nm, mobile phase (50 mM phosphate buffer, pH= 2.8) flow rate at 0.5 mL/min and separation was performed on RP-18 column (125.0 x 4.6 mm, 5 µm; LiChrospher, Merck, Darmstadt, Germany). Calibration curve obtained from citric acid working standards (0.125 to 1.0 g/L) was linear ($R^2=0.9998$), repeatability (expressed as relative standard deviation, RSD) was less than 5 %, the limit of detection was 0.02 g/L and the limit of quantification was 0.06 g/L, indicating that developed method is sensitive and reliable for determination of citric acid. The level of citric acid in fruit juice samples (n = 5) ranged from 1.6 g/L to 3.98 g/L. The manufacturer did not declare the level of citric acid, however in two orange juice samples the level of citric acid was higher than recommended by Commission regulation EU No. 1129/2011 (3.0 g/L), implying to the importance of monitoring the level of citric acid in products intended for human consumption.

Keywords: citric acid, fruit juices, high performance liquid chromatography, monitoring

HPLC ANALYSIS OF VITAMIN C IN VEGETABLE JUICES AND THE ESTIMATION OF THEIR CONTRIBUTION TO THE RECOMMENDED DIETARY INTAKE

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Fruit, vegetables, and products are the most important sources of vitamin C in the human diet. Due to their low energy value and the presence of many essential food constituents, the consumption of vegetable juices, as well as the pallet of products on the market, is increasing. Vitamin C encompasses the group of compounds that possess the biological activity equivalent to L-ascorbic acid, and is one of the most important antioxidants in the human body. Furthermore, L-ascorbic acid is often added to food products as an antioxidant food additive. The vitamin C content was determined in commercial tomatoes, carrots, beetroots, and sour cabbage juices using high performance liquid-chromatography (HPLC) with a photo-diode array detector (PDA). The determined values ranged from below the quantification limit up to 36.19 mg/100 mL, with the lowest values in tomato juice and the highest in carrot juice. Although these values seems to be low, the consumption of only one serving of juice per day (250 mL/day) could substantially contribute to the estimated average requirements, while some of them contribute to daily requirements completely.

Keywords: vitamin C, vegetable juice, HPLC method, dietary intake

UTJECAJ ADITIVA SERVOMYCES NA KAKVOĆU PIVA

THE INFLUENCE OF THE ADDITIVE SERVOMYCES ON BEER QUALITY

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Pivo se procesom alkoholnog vrenja proizvodi iz slada, hmelja, vode i pivskog kvasca. U proizvodnji piva koriste se odabrani sojevi pivskog kvasca vrste *Saccharomyces uvarum* za tzv. lager piva (piva donjeg vrenja), dok se za proizvodnju ale piva (piva gornjeg vrenja) koristi vrsta *Saccharomyces cerevisiae*, a mogu se koristiti i različiti hibridi tih kvasaca. U toku vrenja kvasac fermentira šećere iz sladovine u alkohol i CO₂. Proizvodi njegova metabolizma su i nusproizvodi kao što su vicinalni diketoni (VDK) koji značajno utječu na aromu i kvalitetu piva. Posebna se pažnja posvećuje procesu propagacije kvasca. Servomyces je jedan od aditiva koji je proizveden kao dodatak za potrebe pivarske industrije. Cilj ovoga rada bio je utvrditi utječe li dodatak Servomycesa na kvalitetu piva. Tijekom procesa fermentacije praćeni su prividni ekstrakt i koncentracija VDK, a na kraju fermentacije izmjeren je stupanj prevrelosti i postotak mrtvih stanica kvasca. Redukcija VDK se pratila 6 – 9 dana nakon završetka glavnog vrenja. Utvrđeno je da je redukcija VDK ista ili neznatno brža uz dodatak Servomycesa, uz nešto nižu koncentraciju na kraju glavnog vrenja (početak mjerenja), te da je udio prividnog ekstrakta ostao nepromijenjen. Broj mrtvih stanica kvasca bio je manji u kvascu s dodatkom Servomycesa.

Ključne riječi: pivo, kvasac, aditivi

Keywords: beer, yeast, additives

UTJECAJ GEOGRAFSKIH I KLIMATSKIH UVJETA NA TVARI BOJE I AROME U BIJELIM VINIMA BARANJSKOG VINOGRORJA

THE INFLUENCE OF GEOGRAPHIC AND CLIMATIC CONDITIONS ON COLOUR AND AROMA COMPOUNDS IN WHITE WINES FROM THE BARANJA VINEYARDS

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Aroma vina predstavlja kemijski kompleks koji sadrži preko tisuću hlapljivih spojeva, na osnovu kojih se može odrediti i kvaliteta vina, a igra i veliku ulogu kod odabira vina od strane potrošača. Dio tih spojeva potječe od same sorte grožđa, dok se ostali oslobađaju tijekom procesa fermentacije i tijekom odležavanja i dozrijevanja vina.

Dosadašnja istraživanja utvrdila su pozitivan utjecaj umjerene konzumacije crnih vina na ljudsko zdravlje zbog većeg sadržaja polifenola. Međutim, novija istraživanja pokazuju da polifenoli u bijelim vinima imaju jače antioksidacijsko djelovanje. Ovisno o sorti grožđa i načinu prerade sadržaj polifenola je različit, a najčešće su to spojevi iz grupe tanina i tvari boje. Danas se pažnja posvećuje njihovoj nutritivnoj i zdravstvenoj vrijednosti, antioksidacijskom, antibakterijskom, antikancerogenom djelovanju i dr.

Cilj ovog istraživanja bio je utvrditi sadržaj aromatičnih spojeva, polifenola, flavonoida te antioksidacijsku aktivnost u bijelim vinima baranjskog vinogorja istočne Slavonije (uzorci: chardonnay i graševina, berba 2012. i 2013.). Rezultati su pokazali da sorta, geografski položaj i klimatski uvjeti utječu na sadržaj navedenih spojeva. Sorte chardonnay iz 2012. i 2013. imale su veći sadržaj spojeva arome, flavonoida (najveći sadržaj kod chardonnay iz 2012.) i polifenola u odnosu na graševinu, ali su imale manju antioksidacijsku aktivnost (najveća je kod graševine iz 2012.).

Ključne riječi: tvari arome, flavonoidi, polifenoli, antioksidacijska aktivnost

Keywords: aroma compounds, flavonoids, polyphenols, antioxidant activity

THE EVALUATION OF COLOUR COMPONENTS DURING THE VINIFICATION OF *BABICA* AND *CRLJENAK KAŠTELANSKI*

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Babica and *Crljenak kaštelanski* are historic and autochthonous red grape cultivars of the Kaštela wine region (Central Dalmatia, Croatia). In the last few years, *C. kaštelanski* has been getting distinguishable attention, since it was discovered that it is a parent of the popular *American* variety *Zinfandel* and Italian *Primitivo*. Therefore, *C. kaštelanski* has become economically important and it has been increasingly cultivated in Croatia, while other cultivars, like *Babica*, have almost vanished from the Dalmatian vineyards. As the colour of red wines is an important element of wine quality and it is the first feature that influences its commercial acceptance, this study was conducted with the aim of investigating the evaluation of the colour components and anthocyanins in *Babica* and *C. Kaštelanski* wines. The anthocyanin profile was determined using HPLC, while monomeric anthocyanins and basic colour characteristics of wine (density, hue, chromatic structure, and brilliance) were detected spectrophotometrically. The total monomeric anthocyanins in *Babica* were higher than in *C. kaštelanski*, and the dominant anthocyanin in both wines was malvidin-3-glucoside, with over 71 % of all detected anthocyanins in *Babica* and with over 52 % in *C. kaštelanski*. The other colour parameters were mainly higher for *C. kaštelanski*, probably due to the almost six-fold higher content of cyanidin derivatives in *C. kaštelanski* wine.

Keywords: red wine, vinification, colour, anthocyanins, HPLC

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ANTI-INFLAMMATORY AND ANTIOXIDANT ACTIVITY OF GRAPE POMACE

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Grape pomace is a waste product that remains after the winemaking process and it represents a rich source of bioactive phenolic compounds. The objective of this study was to determine the content of total phenolic compounds (TP), total flavonoids (TF), and total proanthocyanidins (TPA), as well as individual phenolic compounds (phenolic acids and flavan-3-ols), antioxidant activity (DPPH assay), and anti-inflammatory activities (lipoxygenase – LOX and hyaluronidase – HAase inhibition assays). Four different grape pomaces (two red - RGP, and two white - WGP) were analysed. They originated from different grape varieties: RGP-1: Cabernet Frank, Syrah, and Gamay; RGP-2: Isabella and Noa; WGP-1: Incrocio Manzoni, Muscat white, and Sauvignon; WGP-2: Graševina.

The sample RGP-1 showed the highest amount of phenolic compounds (TP = 107.88 mg_{GAE/gdb}, TF = 55.07 mg_{CE/gdb}, TPA = 13.65 mg/g_{db}), the highest antioxidant activity (AA = 0.46 mg_{inh.DPPH/gdb}), and anti-inflammatory activity in the performed assays (LOX: IC₅₀ = 0.06 mg/mL; HAase: IC₅₀ = 0.29 mg/mL). The results showed that the samples with higher phenolic compound content had lower IC₅₀ value, i.e. better anti-inflammatory potential. Flavan-3-ols that were present in all the samples are (+)-catechin (1.87-8.64 mg/g_{db}), (-)-epicatechin (2.37-5.51 mg/g_{db}), procyanidin B1 (0.35-0.72 mg/g_{db}), and procyanidin B2 (0.28-1.23 mg/g_{db}). Gallic acid was the dominant phenolic acid in all the samples (0.09- 0.35 mg/g_{db}).

Keywords: grape pomace, antioxidant activity, anti-inflammatory activity, phenolic compounds

POLIFENOLNI SASTAV I ANTIOKSIDATIVNA AKTIVNOST BISKE - TRADICIONALNE ISTARSKE TRAVARICE

POLYPHENOLIC PROFILE AND ANTIOXIDATIVE ACTIVITY OF BISKA – THE TRADITIONAL ISTRIAN SPIRIT DRINK

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Biska je tradicionalna istarska travarica koja se proizvodi maceracijom lišća imele u alkoholnoj bazi, najčešće rakiji komovici. Tijekom maceracije iz imele se u alkoholnu bazu ekstrahiraju različiti spojevi koji biski daju karakterističnu aromu, boju i okus, te biološki aktivni spojevi (polifenoli, lektini, viskotoksini) koji imaju pozitivno djelovanje na zdravlje. Cilj rada je istražiti i usporediti polifenolni sastav i antioksidativnu aktivnost u 14 uzoraka biske (5 industrijskih i 9 proizvedenih na obiteljskim poljoprivrednim gospodarstvima). Polifenolni sastav uzoraka biske određen je tekućinskom kromatografijom visoke djelotvornosti (HPLC), te spektrofotometrijski pomoću Folin-Ciocalteu reagensa, a antioksidativna aktivnost FRAP i DPPH metodom. Rezultati su pokazali da se količina polifenolnih spojeva u uzorcima znatno razlikuje. Na različit sadržaj polifenolnih spojeva u uzorcima biske utječe količina, podrijetlo i kvaliteta imele koja se macerira, različita jakost alkoholne baze, temperatura na kojoj se provodi maceracija, te dodatak šećera ili meda tijekom maceracije. HPLC analizom je utvrđeno da su najzastupljeniji polifenolni spojevi u uzorcima biske protokatehinska kiselina i derivati flavonola. Nadalje, prosječni sadržaj ukupnih polifenola u biski iznosio je 196 ± 15 mg GAE L⁻¹, te je u pozitivnoj korelaciji s antioksidativnom aktivnosti, što upućuje na činjenicu da prisutnost polifenolnih spojeva značajno doprinosi i antioksidativnoj aktivnosti uzoraka biske. Najveći sadržaj polifenola u uzorku biske iznosio je 545 mg GAE L⁻¹. S obzirom da neki uzorci sadrže visok udio polifenola i imaju visoku antioksidativnu aktivnost, mala do umjerena konzumacija biske (prema preporukama EU: 1 piće/dan za žene ili 2 pića/dan za muškarce) može imati pozitivno djelovanje na zdravlje.

Ključne riječi: biska, imela, travarica, polifenoli, antioksidativna aktivnost

Keywords: biska, mistletoe, herb spirit, polyphenols, antioxidative activity

THE ANTIOXIDANT POTENTIAL OF POLYPHENOLS PRESENT IN CULINARY HERBS

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Epidemiological studies have shown that polyphenols, biologically active compounds present in herbs, as well as in fruit and vegetables, have various health beneficial effects. However, due to the fact that polyphenols generally have low bioavailability (nM range), their biological activity can be ascribed to their colon catabolites, which are present in the circulation in higher concentrations (μM range). The majority of structurally complex polyphenols undergo colon metabolism, and produce a common set of simple phenols and hydrobenzoic acids, which are also widely present in the plant kingdom. The antioxidant activity of selected polyphenols (apigenin, luteolin, and quercetin) and their catabolites (caffeic acid, hydrocaffeic acid, protocatechuic acid, homoprotocatechuic acid, 4-methylcatechol, catechol) was studied *in silico* using the DFT approach. The geometry optimizations and frequency calculations were carried out using the M05-2X functional and the 6-311++G(d,p) basis set, in conjunction with the SMD continuum solvation model. Two radical scavenging mechanisms were studied, the hydrogen atom transfer (HAT) and the sequential proton loss electron transfer (SPLET). The obtained results indicate the selected polyphenols, originally present in herbs (angelica, celery, chives, coriander, common verbena, dill, fennel, fenugreek, oregano, marjoram, rosemary, anise, sage, lemon balm, wild marjoram, spearmint, tarragon, to name a few), and their catabolites as excellent free radical scavengers, with the average BDE values of 336.39 kJ/mol (BDE1) and 310.45 kJ/mol (BDE2), and the average ETE values of 321.75 kJ/mol (ETE1) and 316.31 kJ/mol (ETE2). The Gibbs free energy change for the HAT/SPLET mechanism of the studied compounds with a particular free radical was also calculated. The obtained results indicate these compounds as efficient deactivators of various free radicals, with the average $\Delta_r G_{BDE1}$ for scavenging of the HOO· radical of -22.26 kJ/mol and the $\Delta_r G_{BDE2}$ of -48.54 kJ/mol, and the average $\Delta_r G_{PA1}$ of -34.39 kJ/mol and the $\Delta_r G_{PA2}$ of -63.55 kJ/mol.

Keywords: polyphenols, antioxidant activity, density functional theory (DFT)

THE VOLATILE PROFILES OF CURRY POWDER

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Curry powder is a mixture of different spices, usually ginger, turmeric, cumin, coriander, fenugreek and cayenne pepper. The aroma profiles of curry powder and the individual spices of which curry consists were studied using headspace solid phase microextraction coupled with gas chromatography mass-spectrometry (HS-SPME/GC-MS). The obtained headspace profiles of curry powder and the individual spices were compared. Also, the origin of the individual aromatic compounds identified in curry was related to the corresponding spice, as follows: linalool (34.22 %) with coriander, cuminaldehyde (24.20 %) with cumin, Ar-curcumen (3.94 %), zingiberene (5.83 %) and β -sesquiphellandrene (3.28 %) with ginger and turmeric, β -tumerone (3.28 %), Ar-tumerone (3.30 %) and α -tumerone (1.71 %) with turmeric, limonene (1.14 %) with fenugreek and cayenne pepper, and *trans*-anethole (2.08 %) with cayenne pepper.

Keywords: curry powder, spices, HS-SPME/GC-MS

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**TAKSONOMSKA I EKOLOŠKA KARAKTERIZACIJA SUNČANICE
(*Lepomis gibbosus* L.) IZ AKUMULACIJE MODRAC**

**THE TAXONOMIC AND ECOLOGICAL CHARACTERISATION OF
THE SUNFISH (*Lepomis gibbosus* L.) FROM THE MODRAC
RESERVOIR**

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Sunčanica (*Lepomis gibbosus* L.) je mala riba i danas vrlo brojna u mnogim vodama. Stanište su joj južni dijelovi Sjeverne Amerike. U Europi je ova vrsta uvedena u mnoge riječne sisteme i danas se nalazi u Zapadnoj i Centralnoj Europi, na Iberijskom poluotoku i u Crnom moru. Prvi primjerci *Lepomis gibbosus* L. su uvedeni iz Kanade u Francusku, a u Njemačku je sunčanica uvedena 1885. god., u Poljskoj je njezina prisutnost zabilježena samo u rijeci Odri. Ova vrsta je prisutna u svim vodama na području sjeveroistočne Bosne, a brojni su podaci o njenom rasprostranjenju u gotovo svim vodama Bosne i Hercegovine gdje se vrlo dobro prilagodila. Istraživanja morfološko – taksonomskih i ekoloških karakteristika sunčanice iz jezera Modrac provedena su u periodu od svibnja 2012. do lipnja 2013. godine i sastojala su se iz terenskog i laboratorijskog dijela. Izloženo je 150 jedinki sunčanice iz akumulacije Modrac. Koristile su se metode prikupljanja i konzerviranja jedinki, te statistički testovi. Na cjelokupnom uzorku su analizirana 23 morfometrijska i 8 merističkih karaktera sunčanice. Također, cilj je bio saznati što više o ekološkim i hranidbenim osobinama ispitivane vrste.

Ključne riječi: *Lepomis gibbosus* L., morfološko-taksonomske karakteristike, jezero Modrac

Keywords: *Lepomis gibbosus* L., morphological and taxonomic characteristics, Modrac Lake

DANDELION (*Taraxacum officinale*) AS A POSSIBLE INDICATOR OF WARTIME CONTAMINATION IN EASTERN CROATIA (ICP-MS METHOD)

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Dandelion (*Taraxacum officinale*) leaves are traditionally used in the diet and as a medical remedy (tee, herbal drops, tinctures, etc.), so, from the food safety point of view, it is important to know the concentrations of potentially toxic elements contained in them. Dandelion is known for its beta-carotene, beta-sitosterol, lutein, caffeic acid, saponin, stigmasterol, and p-coumaric acid content. For these reasons, the concentrations of Al, As, B, Ba, Cd, Co, Cr, Cu, Fe, Hg, Li, Mg, Mn, Mo, Ni, P, Pb, Sb, Si, Sr, Se U, V, and Zn were determined in dandelion leaf samples collected at 28 sites in eastern Croatia. The maximum concentrations of the analyzed elements were higher, but not significantly, in the areas of high intensity combat activities (HICA). The mean LICA (low intensity combat activity) and HICA concentrations of As (85.2 and 127.7 $\mu\text{g kg}^{-1}$), Cd (30.10 and 76.10 $\mu\text{g kg}^{-1}$), Hg (2.8 and 0.4 $\mu\text{g kg}^{-1}$), and Pb (173.6 and 230.1 $\mu\text{g kg}^{-1}$) were below those fixed by the Croatian Ministry of Environment. Though the results can be considered good in general, there is still a presence of war associated elements, such as Cd (max=970 $\mu\text{g kg}^{-1}$), Sb (max= 106 $\mu\text{g kg}^{-1}$), and Pb (max= 1980 $\mu\text{g kg}^{-1}$), in isolated areas - environmental “hot spots”, such as the HICA location Hrastin.

Keywords: dandelion, toxic elements, war, Croatia, ICP-MS

Production of safe food and food with added nutritional value /
Proizvodnja zdravstveno sigurne i nutritivno vrijedne hrane

**CHOLINE CHLORIDE BASED DEEP EUTECTIC SOLVENTS AS AN
ECO-FRIENDLY AND EFFECTIVE ALTERNATIVE IN THE
EXTRACTION OF RUTIN FROM *Ruta graveolens* L.**

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Ruta graveolens L. (rue), mostly grown in the Mediterranean region, has been used in traditional medicine all over the world for various clinical conditions. Since it is a very pharmacologically active compound, rutin is often found in many medicinal preparations. The extraction of rutin from *Ruta graveolens* L. leaves in this study was performed using a new generation of solvents, choline chloride based deep eutectic solvents (DESSs). DESSs are often characterized as green and sustainable mixtures of nontoxic and cheap components, which, combined together, form an eutectic mixture. Firstly, rutin extraction was performed in five different DESSs, pure DESSs, and with different amounts of water added (25 % and 50 % v/v), for different times (1 h, 3 h and 6 h), in order to find the best DES for further optimization. Optimization was performed in choline chloride: Citric acid (1:1) DES considering extraction time, temperature, and water content, using response surface methodology (RSM). Rutin content was determined by HPLC and varied from 0.55 g/100 g of the plant to 1.81 g/100 g of the plant, depending on the applied conditions. The best conditions for rutin extraction were found to be: temperature of 70 °C, extraction time of 52 min, and using water content of 27 % for the extraction of 1.88 g /100 g of the plant.

Keywords: rutin, *Ruta graveolens*, deep eutectic solvents, extraction, optimization

**SUPERCRITICAL CO₂ EXTRACTION OF *Salvia officinalis* L.
LEAVES TARGETED ON OXYGENATED MONOTERPENES,
 α -HUMULENE, VIRIDIFLOROL, AND MANOOL**

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A comprehensive approach was applied to optimize the supercritical CO₂ (SC-CO₂) extraction conditions of *Salvia officinalis* L. (sage) leaves. Different extraction parameters (pressure 10-30 MPa, temperature 40-60 °C, and CO₂ flow rate 1-3 kg/h) were investigated: The extraction yield, the extracts' chemical profile (determined by GC-MS), and the optimal extraction conditions by response surface methodology (RSM) for the targeted most abundant components. Within the range of the applied extraction parameters, the major compounds of all SC-CO₂ extracts were oxygenated monoterpenes, namely, 1,8-cineole (6.56-27.26 mg CE/g), α -/ β -thujone (11.56-44.82 mg CE/g), and camphor (38.23-104.71 mg CE/g), followed by α -humulene (39.90-90.73 mg/g), viridiflorol (48.07-97.01 mg CE/g), and manool (113.90-335.36 mg CE/g). The pressure exhibited the most significant influence on the yield (0.242-7.361 mass %) and significantly influenced the amount of 1,8-cineole, α -/ β -thujone, and camphor (within the range 15 or 20 MPa). In contrast, the highest amount of α -humulene, viridiflorol, and manool was obtained at the lowest pressure (10 MPa). The results showed that the second order polynomial model can be effectively used for the optimization and prediction of targeted compounds.

Keywords: *Salvia officinalis* L., supercritical CO₂ extraction, GC-MS, response surface methodology

SUPERCRITICAL CO₂ EXTRACTION OF OIL FROM ROSE HIP (*Rosa canina* L.) AND CORNELIAN CHERRY (*Cornus mas* L.) SEEDS

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Rose hip (*Rosa canina* L.) and Cornelian cherry (*Cornus mas* L.) seeds are a waste product from the manufacture of juice, syrup, puree, jams, or wines, and contain a significant amount of oil. Rose hip seed oil has an effect on improving lipid metabolism, a possible anticancer effect, and a positive effect on skin diseases, including dermatoses, ulcers, and the effects of skin aging. Cornelian cherry seed oil shows the possibility for recovery and regeneration of external and internal epidermal tissues and possesses significant antimicrobial activity.

Special emphasis in the last few decades has been given to the “green” supercritical CO₂ extraction technique, which is environmentally friendly and enables better extraction yield, better quality of the extract, and resource saving. The aim of this study was to investigate the influence of different extraction parameters, pressure (119-331 bar), and temperature (36-64 °C) on: (1) oil yield, (2) peroxide value, (3) determining the optimal extraction conditions by response surface methodology (RSM), using Central Composite Rotatable Design (CCRD). The fatty acid composition was determined by gas chromatography and mass spectrometry (GC-MS).

The oil yield of rose hip seeds varied between 3.26-7.75 %, in the cornelian cherry seeds it was between 2.35-5.18 %, and the peroxide values varied between 4.70-29.69 % and 0.55-7.36 mmol O₂/kg, respectively, depending on the applied extraction conditions.

Keywords: *Rosa canina*, *Cornus mas*, supercritical CO₂ extraction, oil, response surface methodology

SEPARATION OF ACTIVE COMPOUNDS FROM THE FOOD BY-PRODUCT – COCOA SHELL BY USING SUBCRITICAL WATER EXTRACTION

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oral presentation / usmeno priopćenje

In the agricultural and food industries large amounts of residues are produced, and they present an economical deficit and an ecological problem, as well as the loss of biomass and phytonutrients. Currently, the waste shells from cocoa processing are usually burnt for fuel or used as mulch in gardens, to add nutrients to soil and to suppress weeds.

“Green” technologies, such as supercritical/subcritical fluid processes, which are in accordance with the principles of sustainable development, have a low impact on the environment, and have several advantages over the existing classical methods, e.g. higher capacities, less processing stages, easier cleaning, accelerated processes, oxidation is prevented, etc. The use of these new processing routes opens the possibility for achieving better product qualities and/or even allowing for the development of completely new products for the use in the food, beverage, cosmetic, and pharmaceutical industry as natural ingredients.

The objectives of this study were: a) separation of the valuable compounds from cocoa shells by applying a sustainable separation process - subcritical water extraction; b) identification and quantification of active compounds in the obtained extracts using HPLC; c) characterization of the antioxidative activity of extracts; d) optimization of separation processes using response surface methodology (RSM).

Depending on the applied extraction conditions, different concentrations of theobromine, caffeine, theophylline, catechin, epicatechin, chlorogenic acid, gallic acid, and 5-(Hydroxymethyl)furfural were determined in extracts obtained by subcritical water.

Keywords: cocoa shell, subcritical water extraction, active compounds, response surface methodology

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MICROWAVE-ASSISTED EXTRACTION OF ANTIOXIDANTS FROM THE AREAL PARTS OF CANNABIS AND PROCESS MODELLING

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Nowadays, cannabis (*Cannabis sativa* L.) is one of the most controversial medicinal plants. The usage of cannabis and its derived products is based on the biological activity of the present pharmacologically active compounds; firstly cannabinoids and then many others: phenols, terpenoids, fatty acids, tocopherols. Today, cannabinoids are in the focus of scientific and medical research. That is why this research was focused on phenols and other bioactives in cannabis.

Microwave-assisted extraction was applied for the extraction of phenolic compounds from areal parts of cannabis, sort Helena. The effects of different extraction parameters (ethanol concentration (30-70 %), extraction time (10-30 min), and liquid/solid ratio (5-15 mL/mg)) on the extraction yield, total phenols, total flavonoid content, antioxidant activity, and reductive capacity were investigated as part of the analysis of the extraction process. Box-Behnken's design was chosen as the experimental design. The content of total phenols in extracts was from 10.34 to 15.79 mg EGK/g of the drug and the content of total flavonoids was from 4.97 to 9.68 mg CE/g of the drug. The experimental results were described by the second order polynomial model. The model was estimated using the analysis of variance (ANOVA). The optimization process was carried out for all parameters simultaneously, to obtain the maximum yields of polyphenol compounds, antioxidant activity, and reductive capacity.

Keywords: *Cannabis sativa*, microwave-assisted extraction, phenols, antioxidants

FUNCTIONAL CHARACTERIZATION OF AUTOFERMENTED CHAMOMILE EXTRACTS

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Apigenin, the phytochemical associated with numerous beneficial health effects, is synthesized by many plants, but chamomile flower heads are considered to be the most important of its sources. The apigenin content is an important factor of the biological activity of chamomile. In the frame of this study, the transformation (hydrolysis) of apigenin-7-O- β -glycoside into free aglycone in chamomile ligulate flowers was achieved by activating the β -glucosidase naturally present in the plant. The obtained autofermented chamomile flowers were further extracted and the obtained extract was characterized in terms of its biological activity and functionality. The antioxidant properties of the extract, examined for their radical scavenging activity against hydroxyl radicals and inhibition of lipid peroxidation, confirmed its antioxidant potential. The antidiabetic ability of the extract was evaluated by its ability to inhibit the activity of α -amylase and α -glucosidase. The inhibitory effect of tyrosinase was also tested in order to detect its potential uses in controlling hyperpigmentation problems. Furthermore, the anti-proliferative activity of this extract was determined against the panel of human tumour cells *in vitro*. The results demonstrated that the autofermented chamomile extracts exhibited significant pharmacological activity. The observed results could be useful for designing novel bio-products for food and pharmacological applications.

Keywords: apigenin, chamomile, antioxidants, natural agents, novel functional perspectives

APPLICATION OF EMULSION SYSTEMS TO ENHANCE THE BIOLOGICAL POTENTIAL OF POLYPHENOLS

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Cultivated blueberry (*Vaccinium corymbosum* L.) represents one the richest natural sources of polyphenols. Numerous studies reported a huge range of the biological potential of polyphenols. The aim of this study was to determine the effect of phenolic extracts from cultivated blueberry obtained from raw plant material, as well as from plant material treated by different techniques (pasteurization, freeze-drying, and the use of high intensity ultrasound), on the oxidative stability of extra virgin olive oil. In order to enhance the biological potential of different phenolic extracts from blueberries, the application of oil in a water emulsion system was used. The prepared emulsions have been treated by mechanical and high pressure homogenization. The results showed that the oxidative stability of extra virgin olive oil, measured by the Rancimat apparatus, was significantly prolonged after the use of phenolic extracts with emulsions. The emulsions obtained by high pressure homogenization did not show any effect on the prolongation of the oxidative stability of extra virgin olive oil.

Keywords: polyphenols, oxidative stability, Rancimat, emulsions

THE EFFECT OF THE ADDITION OF APPLE PUREE ON THE THERMOSTABLE FRUIT FILLINGS BASED ON SOUR CHERRIES

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Fruit fillings, as a component of bakery products, have to possess high thermal stability, since the pastry has to remain intact when cut after baking. Modified starches are usually used for that purpose. Also, the sensory quality of fruit fillings should retain the “fresh-made” characteristics. The aim of this study was to develop low-cost thermostable fruit fillings based on sour cherries with the addition of apple puree and the lower content of modified starch.

In order to characterize the created fruit filling, its nutritional composition and sensory properties were compared to commercial sour cherry fruit filling. In the developed fruit filling, 50 % of sour cherry was substituted with apple puree as a cheaper raw material. In addition, the amount of starch used for thickening was reduced to half. The basic chemical composition was determined using standard AOAC methods. The thermal stability of the fruit fillings was determined using a standard bakery test. The colour was measured using the Minolta Chroma Meter CR-400, equipped with the attachment for soft samples (CR-A33f), while the texture parameters were measured using the TA.XT Plus Texture Analyser. The sensory properties were assessed by an expert sensory panel using a scoring method.

Fruit content, total soluble solids content, and thermal stability of both tested samples were on the same level. The created fruit filling had acceptable sensory properties, with desirable consistency and without visible syneresis. Compared to commercial fruit filling, the taste and odour received slightly lower scores, with no observable taste and odour of apples. The developed fruit filling had lower firmness and stickiness.

It could be concluded that apple puree could be successfully applied as a substituent for sour cherries in the formulation of thermostable fruit fillings based on sour cherries, at the same time lowering the required amount of modified starch.

Keywords: fruit fillings, sour cherry, apple puree, texture, sensory analysis

VACUUM DRYING OF WILD GARLIC (*Allium ursinum* L.) AS A WAY TO PRESERVE ITS BIOACTIVITY

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Wild garlic (*Allium ursinum* L.) is a rich source of phytonutrients and it is recognized as having significant and wide biological activities. The potential health benefits of wild garlic have been mainly attributed to the sulphur containing compounds, like thiosulphinates and (poly)sulphides, and phenolic compounds, which are the most important constituents in terms of pharmacological activity. Antioxidant, antiplatelet, cardio protective, cytostatic, antimicrobial, and antiinflammatory potential of wild garlic has been recorded so far, which makes it an important ingredient in healthy diets. However, after harvest it is very perishable and thus has a short period of availability as a fresh product during spring season. Therefore, drying could be a viable strategy for preserving and increasing the shelf life of this product, and ensuring its use during the whole year. The objective of this study was to investigate the influence of different drying temperatures (40-70 °C) during the vacuum drying process, in order to avoid the negative effects on the composition of thermo sensitive compounds during drying. The changes in quality indicators such as moisture content, colour change, phenolic compounds, and thiosulphinates were monitored in order to obtain products with the best characteristics.

Keywords: *Allium ursinum*, wild garlic, vacuum drying, bioactive compounds

SHELF LIFE OF VACUUM IMPREGNATED NEW POTATOES STORED UNDER MODIFIED ATMOSPHERE PACKAGING

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The aim of this study was to investigate the shelf life of vacuumed impregnated new potato cubes treated with solutions of 3 % salt substitute-SS, 2 % ascorbic acid-AA, 0.2 % calcium chloride-CC, and 2 % calcium ascorbate-CA. The samples were packaged into 90 µm and 130 µm PA/PE bags under different low oxygen modified atmospheres (with 5, 10 % or without air/30 % gas mixture: 95 % N₂, 5 % CO₂). During 12 days of storage at 4 °C, the concentration of O₂ and CO₂ in the packaging headspace was monitored, as well as the colour and firmness of untreated and treated potato cubes. The analysis of some chemical composition parameters (total and soluble dry matter, content of sodium chloride, phenolic compounds), as well as microbiological analyses (aerobic mesophilic bacteria-AMB, aerobic psychrophilic bacteria-APB, yeast and moulds) were carried out on “0” and on day 6 and day 12 of storage at 4 °C. The potato cubes treated with the combination of 3 % SS, 2 % AA, and 0.2 % CC, packaged in 130 µm PA/PE bags under 5 % air and 30 % gas mixture (95 % N₂, 5 % CO₂) recorded the best results regarding all the analysed parameters and minimum spoilage compared to other treatments. AMB and APB counts in these samples after 12 days were even below the permitted levels for fresh vegetables (<10⁴ CFUg⁻¹).

Keywords: potato, shelf life, vacuum impregnation, modified atmosphere

THE OPTIMIZATION OF PRODUCTION OF FERMENTED CABBAGE JUICE: CHEMICAL AND BIOLOGICAL PROPERTIES

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Cabbage is a cruciferous vegetable of high biological value, rich in minerals, vitamin C, dietary fibres, and especially phytochemicals. Its traditional use in nutrition as a fermented product is quite present. The process of fermentation enriches the functional properties of cabbage by changing its sensory characteristics and enabling the creation of new health-beneficial compounds. During the process of fermentation, fermented cabbage juice is created as a by-product.

This study investigated the chemical and biological properties of fermented cabbage juice, based on which its potential for further use in producing new functional products was defined. In order to produce juice of the highest quality in terms of chemical and pharmacological values, the influence of different processes of fermentation - starter culture concentration (0, 0.5, and 1 dL), salt content (6, 7, and 8 % NaCl), and process temperature (18, 22, and 26 °C) on the chemical composition and antioxidative activity of the juice was investigated.

By applying the HPLC instrumental analysis, the content of vitamin C and organic acids (acetic, formic, lactic, oxalic, and succinic acid) was determined in fermented cabbage juice samples. The content of lactic acid was in the range between 2.85 and 4.47 mg/mL, while the highest content of vitamin C was found in a sample obtained under combined conditions: 8 % NaCl, 0.5 dL started culture concentration, and 18 °C temperature.

Keywords: cabbage juice, fermentation, vitamin C, organic acids, antioxidative activity

GENETSKI POTENCIJAL URODA ČUVANIH SORATA KUPUSA

THE GENETIC YIELD POTENTIAL OF CABBAGE CONSERVATION VARIETIES

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Kupus je vrlo stara povrtna kultura, a uzgajao se u Europi prije Grčke i Rimske civilizacije. U Hrvatskoj kupus ima veliki značaj kao povrtna i ljekovita kultura. Cilj ovoga rada je procijeniti i utvrditi razlike u urodu čuvanih sorata i odabrati najrodniju za lokaciju Osijek. Pokus je postavljen po slučajnom blok rasporedu na lokaciji Osijek (N 45°31', E 18°40') tijekom 2015. i 2016. godine u dva ponavljanja s tri hrvatske čuvane sorte i jednim standardom. Sjetva je obavljena u stiroporne plitice, a presadnice su presađene u polje na sklop od 28.600 biljaka/ha. Berba kupusa je počela u prvoj polovini rujna, odnosno kada su vanjska obilježja glavica bila zadovoljavajuća za svaku sortu. Prema rezultatima analize varijance između godina ispitivanja i sorata dobivene su statistički visoko značajne razlike ($p < 0,01$), a između interakcije sorta x godina statistički značajne razlike ($p < 0,05$). Za lokaciju Osijek prema dobivenim podacima mogu se preporučiti sorte kupusa ogulinski i čepinski koje su imale najveći urod.

Ključne riječi: kupus, urod i čuvane sorte

Keywords: cabbage, yield, and conservation varieties

VISCOELASTIC PROPERTIES OF DOUGH PREPARED WITH THE ADDITION OF EXTRUDED FOOD INDUSTRY BY-PRODUCTS

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The application of food by-products as improvers of nutritional quality of bakery products has been increasingly popular in the last decade. The rheological properties of dough could be significantly altered due to the increased content of dietary fibre in the by-products of plant-based food. The aim of this study was to examine the influence of the addition of extruded food industry by-products on the rheological properties of dough prepared from whole grain wheat flour.

For that purpose, corn grits coextruded with various food by-products (brewer's spent grain, sugar beet pulp, and apple pomace) in the ratio of 55:45 were used to replace different percentages (30 %, 20 %, 10 %, or 0 %) of whole grain wheat flour. The amount of added water was determined using Microdough Lab, targeting the optimal consistency. The dough samples were taken after the development time of the dough was reached. The viscoelastic properties of the samples were determined using a Haake MARS rheometer (Thermo Scientific, Karlsruhe, Germany) at 25 °C, equipped with a parallel plate geometry PP35 (35 mm diameter and 2 mm gap). Frequency sweeps were recorded over the range of 0.1-10 Hz at the stress of 10 Pa, which was within the linear viscoelastic region, as previously determined.

In all cases, the storage modulus (G') was higher than the loss modulus (G''), indicating that the dough behaved as a viscoelastic solid. G' and G'' increased as the level of substitution increased. Dough with the addition of brewer's spent grain and sugar beet pulp had higher G' and G'' values than dough prepared with apple pomace. The tangent of the phase angle ($\tan \delta$) decreased with the addition of all by-products, also pointing to increased dough elasticity.

Keywords: brewer's spent grain, sugar beet pulp, apple pomace, wholegrain wheat flour, viscoelasticity

SUGAR BEET PULP AS AN INGREDIENT IN VALUE ADDED BREAD FROM WHOLE GRAIN WHEAT FLOUR

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One of the main nutrients originating from food waste is dietary fibre, which could also be applied as texture improver for baking products. The aim of this study was the creation of value added bread from whole grain wheat flour with the addition of corn grits coextruded with sugar beet pulp.

Corn grits coextruded with sugar beet pulp (SBP) in the ratio of 55:45 were used to replace 30 %, 20 %, and 10 % of whole grain wheat flour (WGWF). The test baking procedure included 120 min of bulk fermentation and 70 min of proofing, both at 30 °C, as well as baking at 220 °C for 15 min. The control bread was produced from WGWF. All the samples were evaluated 2 h and 24 h after baking, regarding moisture content, volume, texture, and colour, while the sensory properties were assessed by an expert sensory panel using a 7-point hedonic scale.

After extensive experiments, the substitution with 10 % of SBP was found to produce the best technological quality of bread. The volume of the 10 % SBP bread was approximately 25 % lower than the volume of the control bread, while its moisture was slightly higher when compared to control. Bread prepared with 10 % of SBP was 50 % harder than the control bread 2 h after baking, while 24 h after baking this difference was more pronounced (10 % SBP bread was nearly 100 % harder than the control bread). There were no differences between the control samples and the 10 % SBP sample in terms of colour. The sensory scores for all the evaluated parameters were similar to the control sample, with slightly lower scores given for taste and overall acceptability. Those results are promising for food by-product valorisation, possibly including them as a raw material in the bakery industry.

Keywords: food by-products, sugar beet pulp, whole grain wheat flour, bread

VALORIZACIJA NUSPROIZVODA PREHRAMBENE INDUSTRIJE KROZ RAZVOJ NUTRITIVNO OBOGAĆENIH FINIH PEKARSKIH PROIZVODA

VALORISATION OF FOOD INDUSTRY BY-PRODUCTS THROUGH THE DEVELOPMENT OF NUTRITIONALLY ENRICHED COOKIES AND CRACKERS

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Nusproizvodi prehrambene industrije predstavljaju jeftinu i lako dostupnu sirovinu sa velikim nutritivnim potencijalom. Podrijetlom iz različitih grana prehrambene industrije, mogu predstavljati značajan izvor proteina, prehrambenih vlakana i drugih biološki vrijednih komponenti, ali s druge strane često su nestabilni i skloni biorazgradnji. Ekstrudiranjem se značajno povećava njihova stabilnost, a time i mogućnost njihove implementacije u prehrambene proizvode. Zastupljenost keksa i srodnih proizvoda u strukturi dnevnog obroka omogućava da se promjenom njihovog sastava pojedine nutritivno vrijedne komponente uspješno uvedu u prehranu ljudi. Ipak, svaka promjena u sirovinskom sastavu neminovno utječe na kvalitetu proizvoda. Odstupanje od uobičajenog okusa, izgleda ili boje za danu vrstu proizvoda može rezultirati odbacivanjem proizvoda od strane potrošača i neuspjehom na tržištu. Dodatak pojedinih nusproizvoda prehrambene industrije u proizvodni proces ima za cilj povećanje nutritivne vrijednosti finalnih proizvoda, njihovu bolju valorizaciju u ekonomskom pogledu i smanjenje ukupnog otpada. U radu će biti dan pregled dosadašnjih rezultata istraživanja po pitanju fizikalno-kemijskih karakteristika ekstrudata kukuruzne krupice obogaćene pivskim tropom, pšeničnom klicom, izluženim repinim rezancima i tropom jabuke, a zatim i utjecaja zamjene dijela pšeničnog brašna navedenim dodacima na reološka svojstva tijesta i karakteristike tvrdog keksa i čajnog peciva (senzorska ocjena, tehnološka svojstva, nutritivna vrijednost).

Ključne riječi: prehrambena industrija, nusproizvodi, keks, karakteristike proizvoda

Keywords: food industry, by-products, cookies, product characteristics

PHYSICOCHEMICAL, TEXTURAL, AND SENSORY PROPERTIES OF BISCUITS ENRICHED WITH CORNELIAN CHERRY PULP

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Recent worldwide consumer interest in healthy food has increased the demand for alternative, high quality fruit, such as cornelian cherry (*Cornus mas* L.), which is an excellent source of natural antioxidant substances. This study aimed to investigate the quality of biscuits with added native cornelian cherry pulp.

Three different samples of wholemeal flour (WMF) were used for biscuit production: Barley WMF 100 %; barley/wheat mixture WMF 50/50, and 100 % wheat WMF, according to the procedure described in the AACC method 10-52 with some modifications. All flour samples were incorporated with cornelian cherry pulp originating from B&H (10, 20, and 30 % on the flour basis). The physical analysis of the biscuit samples included determining the diameter (DI) and thickness increase (TI), spread ratio (SR), and specific volume (SV), while the chemical analysis included determining the titratable acidity (TA), pH, antioxidant activity (AO) by FRAP, and total phenol content (TPC) by the Folin-Ciocalteu method. The biscuit texture (TX) was measured using a TA.TX.plus texture analyzer. The sensory evaluation by QDA was conducted using the scores on a scale of 1-5 on 4 properties: taste, aroma, melting, and overall acceptability.

The statistical analysis (Two-Way Analysis of Variance) showed a significant influence ($P < 0.05$) of used flour and the amount of added cornelian cherry pulp on DI, SR, pH, TA, TX, AO, and TPC, while flour had no influence on TI and SV. On the other hand, both flour and the amount of cornelian cherry pulp caused no significant differences on the sensory properties. The antioxidant activity significantly increased with the increase in the share of cornelian cherry pulp in all biscuit samples.

Keywords: cornelian cherry (*Cornus mas* L.), biscuits, physicochemical properties, textural properties, sensory properties

PROPERTIES OF EXTRUDED SNACK PRODUCTS ENRICHED WITH *Camelina sativa* L. CAKE

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Extruded snack products are popular among all age groups. Various by-products can be incorporated into the extruded snacks, and one such product is *Camelina sativa* L. cake, a by-product of oil production, rich in polyphenols, fibre, and protein. Defatted *Camelina sativa* L. cake (DCC) was added to corn grits in ratios of 3, 6, and 9 % d. m., 1 % of pectin was added and the moisture of the mixture was set to 15 %. The prepared samples were extruded in a laboratory single screw extruder with a 4 mm round die, screw compression ratio of 4:1, at the temperature profile 135/170/170 °C. The obtained extrudates were air-dried and their physical properties and their soluble and insoluble dietary fibre content were determined.

The obtained results showed that the addition of DCC resulted in a decrease of the expansion ratio (ER) and an increase of bulk density (BD) of the obtained snack products. Furthermore, the addition of DCC and the extrusion process resulted in a significant colour change, proportional to the amount of DCC. The extrusion process resulted in the increase of the water absorption index (WAI) and the water solubility index (WSI), whereas the addition of DCC did not influence the WAI significantly, and it decreased the WSI. The soluble and insoluble fibre content increased with the addition of DCC.

The concluding remark is that DCC was successfully applied in the nutritional fortification of extruded snacks, serving as a good example for the development of new products.

Keywords: *Camelina*, snack, fibre

DIFFERENCES BETWEEN THE SECOND AND THE THIRD GENERATION OF SNACK PRODUCTS ENRICHED WITH DEFATTED HAZELNUT CAKE

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Snack products are one of the most popular products worldwide, tasty, easy to consume, but poor in nutritional quality. They can be directly (second generation / 2G) or indirectly expanded (third generation / 3G). The nutritional quality of the product may be increased by supplementation with different additives.

One of them is hazelnut cake, a by-product of hazelnut oil production rich in proteins, fibres, and phenolic compounds. Defatted hazelnut cake was added to corn grits in ratios of 3, 6, and 9 % d. m. The prepared samples were extruded in a laboratory single screw extruder. For the production of 3G snacks, supercritical CO₂ (injection pressure: 140 bar) was added during the extrusion process, between the second and the third heating zone, which were at lower temperatures than for the production of 2G snacks. The obtained extrudates were air-dried, and then the 3G products were expanded by microwave heating. Resistant starch (RS) content was determined according to the AOAC 2002.02 method, the polyphenol content by the Folin-Ciocalteu, and soluble and insoluble dietary fibre according to AOAC 991.43.

The contents of all three analyzed parameters increased with the addition of defatted hazelnut cake. 3G snacks had lower polyphenol content than 2G snacks, and a higher content of RS and soluble and insoluble dietary fibre.

The obtained results show that hazelnut cake can be successfully applied in the production of nutritionally improved 2G and 3G corn snack products, and supercritical CO₂ can be used for the production of 3G snacks.

Keywords: hazelnut cake, supercritical CO₂, third generation snacks

PROIZVODNJA I STABILIZACIJA HLADNO PREŠANOG ULJA KOŠTICE ŠLJIVE

THE PRODUCTION AND STABILIZATION OF COLD-PRESSED PLUM KERNEL OIL

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Koštica šljive je nusproizvod prehrambene industrije iz kojeg se prešanjem sjemenke može dobiti jestivo hladno prešano ulje. Ulje koštice šljive je visokocijenjeni proizvod jer sadrži različite bioaktivne komponente te se njegova konzumacija povezuje sa smanjenjem rizika obolijevanja od kroničnih bolesti. Cilj ovog rada je ispitivanje utjecaja procesa hladnog prešanja sjemenki šljive na efikasnost proizvodnje ulja. Prilikom prešanja mijenjani su procesni parametri: frekvencija elektromotora, temperatura zagrijavanja glave preše i nastavak za izlaz pogače. Prešanje je provedeno primjenom kontinuirane pužne preše. Primjenom standardnih metoda određeni su osnovni parametri kvalitete proizvedenog hladno prešanog ulja. Na proizvedenom ulju ispitao se utjecaj dodatka antioksidanasa (prirodni, sintetski) na promjenu oksidacijske stabilnosti primjenom testa održivosti na 98 °C. Antioksidansi korišteni u istraživanju su ekstrakt ružmarina, ekstrakt zelenog čaja, eterično ulje čaja vrijeska i oktil galat. Dobiveni rezultati pokazuju da ispitivani procesni parametri hladnog prešanja utječu na iskorištenje ulja. Veća proizvodnja hladno prešanog ulja postignuta je kod temperature glave preše 100 °C, frekvencije elektromotora 25 Hz i nastavka za izlaz pogače 10 mm. Ispitivani antioksidansi povećavaju stabilnost ulja prema oksidacijskom kvarenju

Ključne riječi: ulje koštice šljive, hladno prešanje, procesni parametri, oksidacijska stabilnost, antioksidansi

Keywords: plum kernel oil, cold pressing, process parameters, oxidation stability, antioxidants

THE EFFECT OF THE ADDITION OF LAUREL EXTRACT AND PLANT MATERIAL ON FISH OIL OXIDATIVE STABILITY

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Fish oils that contain high levels of polyunsaturated fatty acids have a very important role in the human diet. However, due to their specific chemical composition, they are more susceptible to lipid oxidation than other fats and oils. Lipid oxidation is a complex process that causes rancidity, off-flavours, and losses of nutritional value and functional properties of foods. At ambient conditions it occurs slowly, so several accelerated methods (employing high temperatures and air-flow supply) have been developed to estimate the oxidative stability and shelf life of oil-containing products in a relatively short time. Tocopherols are usually used to stabilize fish oil; however, their activity is not always effective, especially in the presence of high concentrations of metals. The aim of this study was to explore the effect of the addition of laurel (plant material and extract) on the stability of fish oil, using a Rancimat apparatus. According to the obtained results, the addition of laurel plant material caused prolonged oil stability and the effect was influenced by the size of the plant material particles and by the added amount of plant material. The same effect was obtained by extract addition (50 and 100 µL), while a higher concentration of phenolics caused the opposite effect and accelerated fish oil oxidation.

Keywords: *Laurus nobilis*, Rancimat method, oxidation, antioxidants, phenolics

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UTJECAJ HOMOGENIZACIJE I SASTOJAKA NA REOLOŠKA SVOJSTVA MAJONEZE S DODATKOM PULPE MANGA

THE INFLUENCE OF HOMOGENISATION AND INGREDIENTS ON THE RHEOLOGICAL PROPERTIES OF MAYONNAISE WITH THE ADDITION OF MANGO PULP

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U prehrambenoj industriji reološka svojstva predstavljaju bitan čimbenik kod definiranja parametara kakvoće hrane. U ovom radu ispitan je utjecaj procesa homogenizacije i sastojaka na reološka svojstva majoneze s dodatkom pulpe manga. Od procesnih parametara homogenizacije ispitivani su utjecaj vremena homogenizacije, brzine rotora i tip rotor-stator sustava. Ispitivani sastojci su ugljikohidrati (glukoza, saharoza, maltodekstrin), žumanjak jajeta (svježi, pasterizirani, cijelo jaje u prahu) i mliječna komponenta (punomasno mlijeko u prahu, obrano mlijeko u prahu, sirutka u prahu). Proces homogenizacije majoneze proveden je sustavom rotor-stator pri brzini rotora 10000, 12000 i 15000 °/min u vremenu od 1, 2 i 3 minute. Mjerenje reoloških svojstava proizvedene majoneze provedeno je pri temperaturi 25 °C na rotacijskom viskozimetru s koncentričnim cilindrima. Na temelju dobivenih rezultata istraživanja možemo zaključiti da proces homogenizacije i upotreba različitih sastojaka ima utjecaj na reološka svojstva majoneze s dodatkom pulpe manga. Porastom brzine rotora homogenizatora raste i viskoznost majoneze. Veća viskoznost i konzistencija majoneze postiže se s dodatkom punomasnog mlijeka u prahu, cijelog jajeta u prahu i maltodekstrina.

Ključne riječi: majoneza, pulpa manga, homogenizacija, reološka svojstva, sastojci majoneze

Keywords: mayonnaise, mango pulp, homogenisation, rheological properties, mayonnaise ingredients

PROIZVODNJA SIRUTKINIHI PROTEINA KAO NUTRITIVNO VRIJEDNE HRANE

PRODUCTION OF WHEY PROTEINS AS NUTRITIONALLY VALUABLE FOOD

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Sirutka je niskokalorični serum mlijeka koji se dobiva u procesu proizvodnje sireva ili kazeina nakon odvajanja gruš. Sastav i svojstva sirutke ovise o tehnologiji proizvodnje sira i kakvoći mlijeka, a čine ju većim dijelom voda te laktoza, proteini, vitamini, minerali, i enzimi, hormoni i čimbenici rasta. Sastojci sirutke imaju važnu nutritivnu i funkcionalnu vrijednost zbog čega udovoljavaju i fiziološkim zahtjevima dijetetske hrane. Povećanjem temperature toplinske obrade mlijeka količina proteina se smanjuje (denaturacija), povećavaju se sirna zrnca, a denaturirani proteini integriraju u gruš. Proteini sirutke frakcija su približno 20 % mliječnih proteina koji prelaze u sirutku, a najzastupljeniji su albumin i globulin. Separacija proteina sirutke može se provesti primjenom membranskih procesa, ali i precipitacijom, često kombiniranim djelovanjem kiseline i povišene temperature, ili se precipitacija kombinira s centrifugiranjem. Također, mogu se separirati i frakcionirati na osnovu molekularne mase, naboja i hidrofobnosti.

Činjenica da sadrže mnoštvo nutritivnih i funkcionalnih komponenti, kao što su esencijalne aminokiseline, bioaktivni peptidi, antioksidansi i sastojci koji poboljšavaju imunitet, lansirala je proteine sirutke na vrh funkcionalnog sektora hrane. Budući da su se prednosti primjene proteina sirutke istaknule uslijed dramatičnog porasta metaboličkih i degenerativnih zdravstvenih problema populacije, imperativ je iskorištenje njihovog potencijala.

Ključne riječi: fiziološki zahtjevi, mlijeko, nutritivna vrijednost, proteini sirutke, sirutka

Keywords: physiological requirements, milk, nutritional value, whey protein, whey

THE ADDITION OF GUM ACACIA TO FERMENTED MILK: THE INFLUENCE ON THE PRODUCTION PROCESS AND THE FINISHED PRODUCT

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Acacia gum was evaluated for its effect on the durability, sensory properties, and health benefits of fermented milk with probiotics. For this purpose, viable cells and pH development were evaluated during the fermentation and storage of three fermented milks enriched with 1.5 % fructooligosaccharides (FOS), 0.75 % FOS + 0.75 % acacia gum, and 1.5 % acacia gum. The carbohydrate profile, dietary fibre content, texture, and sensory analyses of the final product at specific intervals during the storage were also examined. The addition of acacia gum to fermented milk will enrich the product with prebiotics, which have prolonged fermentation in the distal colon, without significantly modifying the production protocols. Except for the prebiotic effect, several other advantages of acacia gum were noticed: Lower lactose levels and the absence of fructose in the final product, which are in favour of intolerant consumers, as well as potential benefits to diabetics for lowering the blood glucose levels. Texture evaluation demonstrated small and non-significant differences in most attributes. The overall preference of the consumer panel was in favour of the FOS enriched fermented milk, which might be explained by the sweetening effect of FOS and the familiarity of the consumers, who are accustomed to the existing sensory profile of the fermented milk on the market. These differences in taste could be overcome by flavouring and/or sweetening the fermented milk.

Keywords: fermented milk, prebiotics, fructooligosaccharides, gum acacia

THE POSSIBILITY OF THE APPLICATION OF FRUIT JUICES IN THE COAGULATION OF MILK FOR COOKED CHEESE PRODUCTION

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Cooked cheese is traditionally produced in Croatia with the use of vinegar. This study was conducted to examine the possibility of the application of fruit juices in the production of new types of value-added cooked cheeses. Aside from the traditionally used vinegar, five kinds of natural acidifiers – juices, extracted from lemon, lime, orange, grapefruit, and pineapple, were used to assess some quantitative and qualitative properties of cooked cheese. The evaluated parameters included processing parameters, cheese yield, physicochemical composition, colour, textural properties, and sensory quality. Cheese made with the use of vinegar recorded the highest yield, but all samples showed high values (13.29-15.54 %). The results of the chemical analysis showed that the protein content of cheese samples cooked with fruit juices were higher, while the fat content in total solids and the acidity of the same cheeses were lower than in traditionally produced cooked cheese. In terms of water content in non-fat matter (62.98-69.08 %), all samples belonged to the group of semi hard cheeses, and in terms of fat content in dry matter (40.94-48.64 %), they belonged to the group of full-fat and fat cheeses. No significant difference was observed in the textural properties of produced cheeses. According to the scoring test, all samples received high sensory scores.

Keywords: cooked cheese, vinegar, natural acidifiers, fruit juices, value-added cheese

ORIGINALNI SIR TRAPIST

ORIGINAL TRAPPIST CHEESE

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oral presentation / usmeno priopćenje

Originalni sir trapist, samostana Marija Zvijezda iz Banjaluke, proizvodi se više od 135 godina.

Posebnost ovoga sira je tajnost recepture koja se prenosi usmenim putem sa redovnika na redovnika. Nakon početaka proizvodnje 1882. godine, sir je postao sinonim za polutvrde sireve na području jugoistočne Europe. Nakon II. svjetskog rata redovnici su ga proizvodili samo za svoje potrebe, u krugu Samostana Marija Zvijezda, pa nije bilo prilike, a ni interesa, od strane tadašnjih vlasti da se točno opišu njegova organoleptička svojstva i osobine. Budući da je 2008. g. ponovno pokrenuta proizvodnja, možemo pokušati ispraviti ovu nepravdu.

Sir trapist karakterizira oblik koluta mase 1,6- 2,0 kg, sa svojom prirodnom korom koja je žućkasta, tanka i glatka. Konzistencija tijesta je mekana, elastična, nježna i lako reziva. Prerez je gladak, bez ili sa jako malo okaca, svjetložućkaste boje tijesta. Odlikuje se čistim mirisom po mlijeku, umjereno je slankast i lako topiv.

Sadržaj mliječne masti po Gerberu iznosi oko 32 %, sadržaj vode iznosi oko 41 %, dok je sadržaj suhe tvari 56 %.

Umjesto zaključka možemo samo poželjeti da redovnici nastave njegovu proizvodnju i da na nju neće imati utjecaj političke prilike kao do sada.

Ključne riječi: mlijeko, samostan Marija Zvijezda, sir Trapist

Keywords: milk, Marija Zvijezda monastery, Trappist cheese

TOTAL PHENOLIC CONTENT IN THE BREAST MEAT OF CHICKENS FED WITH FEED MIXTURES ENRICHED WITH PROPOLIS AND/OR BEE POLLEN

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The aim of this study was to determine the total phenolic (TP) content in the breast meat of chickens fed with feed mixtures enriched with various amounts of propolis and/or bee pollen. This study was conducted on 200 Ross 308 chickens divided into five groups (control group, i.e. group C, fed with feed mixture, and four experimental groups, i.e. groups E1-E4, fed with feed mixtures supplemented with propolis and/or bee pollen, each supplement separately, or combined in a certain proportion). The TP content in breast meat samples was determined by the Folin-Ciocalteu method. The mean values of the TP content (mg GE/g) in all groups were: 78.52±13.73 (C), 95.32±10.55 (E1), 87.42±16.84 (E2), 92.94±14.67 (E3), and 88.56±9.82 (E4). The study showed statistically significant differences between group C and group E1 ($p=0.007$), and between group C and group E3 ($p=0.020$). It was concluded that the addition of a combination of propolis and bee pollen, as well as the addition of a high concentration of propolis, to feed mixtures enabled the largest incorporation of phenolic compounds in chicken breast meat. Such an innovative technological solution in broilers feeding enables the production of healthier meat that can be considered functional food.

Keywords: functional food, propolis, bee pollen, chicken breast meat, phenolic compounds

**FIZIKALNO-KEMIJSKA I SENZORSKA SVOJSTVA ŠUNKI OD
CRNIH SLAVONSKIH SVINJA I KRIŽANACA IZMEĐU VELIKOG
JORKŠIRA, ŠVEDSKOG LANDRASA I DUROKA**

**PHYSICOCHEMICAL AND SENSORY PROPERTIES OF HAM
MADE FROM BLACK SLAVONIAN PIGS AND CROSSINGS
BETWEEN THE LARGE YORKSHIRE, SWEDISH LANDRAS, AND
DUROC**

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Istraživana su fizikalno-kemijska svojstva (pH, a_w , boja – CIE*, NaCl, osnovni kemijski sastav) i senzorska svojstva (izgled presjeka, miris, čvrstoća, okus) slavonskih šunki od crnih slavonskih svinja ($n = 10$) i od križanaca između velikog jorkšira, švedskog landrasa i duroka ($n = 10$), tovljenih do 130 kg tjelesne mase. Senzorska svojstva šunki: izgled presjeka (1 - 8 bodova), miris (1 - 10 bodova), čvrstoća (1 - 10 bodova) i okus (1 - 15 bodova) ocjenjivalo je povjerenstvo od pet članova. Meso šunki (*M. semimembranaceus*) od crnih slavonskih svinja, u odnosu na meso šunki od križanaca, imalo je manji stupanj svjetloće CIE L^* (35,50 : 39,35), veći stupanj crvenila CIE a^* (18,60 : 17,00), manje sirovih proteina (27,55 % : 29,95 %), više sirovih masti (10,50 % : 7,25 %) i više ocjene za senzorna svojstva: miris (9,00 : 8,50), čvrstoću (8,45 : 8,00) i okus (14,00 : 12,00). U pogledu drugih istraživanih pokazatelja (a_w , CIE b^* , sadržaja vode i pepela) nisu utvrđene značajne razlike između analiziranih skupina.

Ključne riječi: šunke, crne slavonske svinje, križanci s durokom

Keywords: hams, black Slavonian pigs, crossbreeds with Duroc

PRIMJENA OZONA U PROCESIMA OBRADE VODE ZA PIĆE

OZONE APPLICATIONS IN DRINKING WATER TREATMENTS

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Voda je esencijalna tvar za ljudski organizam. Udio vode u organizmu ovisi o nizu čimbenika, a prije svega o dobi, spolu, zdravstvenom stanju i fizičkoj aktivnosti pojedinca. Kakvoća vode koju čovjek konzumira, u mikrobiološkom i kemijskom smislu, može značajno utjecati na njegovo zdravlje. Stoga je neophodno poduzeti sve mjere kako bi se stanovništvo opskrbilo zdravstveno-ispravnim vodom za piće. Voda za piće koja se distribuira potrošačima putem vodoopskrbnih sustava može potjecati iz podzemnih ležišta ili se zahvaća iz površinskih izvorišta, a podrijetlo, te mikrobiološki i kemijski sastav vode primarno određuju vrstu i obim tehnološkog procesa neophodnog kako bi voda udovoljavala odredbama Zakona o vodi za ljudsku potrošnju (MZ HR, NN 56/2013) i Pravilnika o parametrima sukladnosti i metodama analize vode za ljudsku potrošnju (MZ HR, NN 125/13, 141/13, 128/15).

Niz je konvencionalnih i suvremenih tehnologija koje je moguće primijeniti u cilju postizanja željene kakvoće vode za piće, a često uspješnost pojedine tehnologije ovisi o predpripremi vode za tehnološki proces. Jedan od takvih postupaka je i doziranje ozona. Ozon je snažan oksidans koji oksidacijom velikog broja organskih i anorganskih spojeva doprinosi povećanju učinkovitosti njihova naknadnog izdvajanja u procesima obrade vode, a zbog svojih dezinfekcijskih učinaka ozon sve češće zamjenjuje klor i spojeve klora u procesima dezinfekcije vode. U ovom radu opisane su mogućnosti i načini primjene ozona u procesima obrade vode za piće.

Ključne riječi: voda za piće, ozon, oksidacija, dezinfekcija

Keywords: drinking water, ozone, oxidation, disinfection

Popular presentations / Popularna priopćenja

BREAD DIFFERENT FROM ALL

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Highly nutritional bread was introduced as an innovation in late 2015 at the world science innovation show “INVEST-INVENT” in Iasi, Romania and it won the gold medal. There were many improvements to showcase at the 10th Food for Health, so the bread can be sorted in the functional food category. It is made of 7 types of flour (smooth white wheat T-550, coarse white wheat flour T-400, barley flour, corn flour, rye flour, buckwheat flour, and oat flour). The flour mix consisted of 50 % smooth wheat flour, 44 % was the mix of barley, corn, coarse wheat, integral rye, buckwheat, and oat flour (in our tests we established the right ratios of the above mentioned flours in cascading ratios), and the remaining 6 % mix consisted of medicinal and spice herbs. We used flours, powders or integral flours, and fine diced herbs from: hemp, flax, St. Mary's thistle, chia, amaranth, grape seeds, turmeric, ginger, chokeberry, cardamom, Ceylon cinnamon, clove, Muscat nut, shallot, parsley leaf, oregano, black pepper, garlic, and cayenne pepper. For 1000 g of the powder mix we added 50 mL of oil mix, which consisted of 6 different types of oil: sunflower, rapeseed, soybean, corncob, pumpkin and extra virgin olive oil, 120 mL of yogurt, 2 eggs, 500 mL of water, 10 g of meadow honey, 4 % salt on the total dough mass, and 14 g of instant dry baker's yeast. After rising, the dough was manually mixed, split in two, formed in loafs, and left to rise for another 40 minutes (at 25 °C). It was baked in a classic oven at around 190 °C for 35-40 minutes (depending on the shape).

Keywords: bread, 7 types of flour, 6 types of oil, medicinal herbs, spices, functional food

TYPES OF FOOD THAT IMPROVE MALE SEXUAL FUNCTION

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Contemporary science is trying to identify food with special effect on sexual function and define the mechanisms that influence sexual ability. Food has advantages over pharmaceutical substances due to its minor side effects, easy availability, and lower prices. Different types of food, supplements, and herbal products are currently used to enhance sexual function. Food can contain different ingredients that increase the libido and affect fertility and erectile function. Some ingredients have a dominant effect on the endocrine system, others on the vascular system, and some on the nervous system.

The biochemical mechanism of sexual function is complex. In this regard, the common explanation includes the metabolic pathways of nitric oxide biosynthesis, or the action of cyclic adenosine monophosphate (cAMP), and some mechanisms are described by different ways of inducing relaxation of the smooth muscle.

The most often mentioned foods with special effects on sexual function are: meat, oysters, honey, chocolate, nuts, bananas, cherries, watermelon, pumpkin seeds, okra, paprika, poppy, ginkgo and ginseng. In traditional medicine, many spices and herbal preparations are used for improving sexual function, such as *Horny Goat Weed*, *Tribulus terrestris*, *Tribulus*, *ginseng root*, *Ginseng*, *Maka*, *Saffron*, *Persimmon*, *Satureja essential oil khuzestanica* (SKEO), and others. Components based on the *African plum*, *pumpkin seeds*, *saw palm*, coenzyme Q10, alpha lipoic acid, etc. are used as preparations.

Food can contain anaphrodisiacs. Some common anaphrodisiacs are: alcohol, tobacco, morphine, heroin, hydrocodone, and plants: *chaste tree*, *coriander*, *hops*, *liquorice*, *marjoram*, *soy*, *wild lettuce*, and so on. Army often uses potassium bromide. Studies have shown a high risk of using yohimbine, *Spanish fly*, and the *Mad Honey* "Bufo toad", so they should be avoided.

The prerequisite for sexual function is a balanced diet. At present, there is a lack of data on clinical trials, and the existing data are often incomplete and methodologically flawed. Future research should be carried out to further elucidate the efficacy and safety of these products.

Keywords: food, herbal preparations and food supplements, sexual function

RAŠTIKA I TUŠAC, ČOVJEKOVO ZDRAVLJE IZMEĐU JEDNOG KUPUSA I JEDNOG KOROVA

COLLARD AND PURSLANE, HUMAN HEALTH BETWEEN A BRASSICA AND A WEED

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Kada je Stvoritelj stvorio ovaj naš svijet, stvorio ga je na način da je ljudsko biće dobilo sve što mu treba, samo ako dobro otvori oči i bude vrijedan. I bude učio o svijetu oko sebe, poštovao ga i čuvao.

Kao mnogogodišnji chef de cuisine, od svojih velikih učitelja i uzora sam naučio da chef i postaje i opstaje samo ako je ugrađen u svoje vrijeme, svoj klimat i svoje prirodno okruženje zemlje na kojoj živi i kuha.

Prvo o tušcu ili tuštu...

Portulaca oleracea je u mojoj dragoj Hercegovini jedva uništivi korov u vinogradima i kukuruzima, koji sam radi nestašluka, za kaznu kod svojih dragih dede i bake, morao brati u vrećama za - krave. Zatim bi smo večerali kakvu čorbu od grahorica uz ponekad suhog mesa. I krave i mi bi bili prezadovoljni.

Jedno jutro, sjećam se i godine u Antwerpenu, 1987. od snabdijevača krumpirom, za vlasnika Giannija Castellina, stigla je i prva vreća tušca tog proljeća. Samo prvom farmer je častio, sve druge su bile oko 20 - 30 E u tadašnjim BEF. Ručak samo za nas dvojicu je bio carski, salata od tušca i dimljenog lososa, krem juha od tušca i rižoto na istom! Ni danas ne znam boljeg menua. Vrijeme, doslovce zaljubljenost u tu moćnu travu, dalo mi je i ugled dobrog chefa u gradu u kojem je tada bilo 1/4 Michellinovihi zvijezdica u cijelom svijetu. No jedna epizoda s biciklistima, digla je to na novu razinu. Pošto smo bili sponzori jednom lokalnom biciklističkom klubu, dio tog sponzorstva je bio i ručak pred trening, gdje sam im morao osigurati dovoljne količine proteina, ugljikohidrata, vitamina i minerala bez mnogo ili ikakvih masnoća, da bi bez problema odvozili trening od stotinjak kilometara. Par dana sam ih uporno hranio sokom od svježeg tušca, celera, mrkve, jabuke i neprskanog limuna, salatam od jaja, svježe bamije (usput, visokoproteinske biljke), tušca, dimljene ribe, maslinovog ulja i limuna, juhom od više vrsta grahorica s posnim ovčjim sirom. Vožnje su na zaprepaštenje trenera, također amatera, bivale sve bolje i brže, a najednom nestaju i problemi bolnih leđa i upaljenih mišića na nogama, te grčevi u stopalima?! Pomeli su državno prvenstvo, na opće zaprepaštenje svih polu- i profesionalnih ekipa! No i izazvali znatizelju svih sportskih liječnika, osobito svojom svježinom i relaksiranom vožnjom. Nije bilo interneta, no znatizelja me sastala s jednim moćnim profesorom koji je klimajući glavom potvrdio sve što mi je tušac otkrio. Činjenice o toj biljci su jednostavne. 100 g tušca ima 20 kcal, sadrži 0,4 g masnoće, 45 mg natrija, 3,4 g ukupnih ugljikohidrata te 2 g proteina. Usput, tušac sadrži više omega 3 od i jedne znane biljke. Kokoši nesilice, hranjene samo tušcem, daju jaja koja sadrže omega 3 i koja

sam mnogo koristio kao dio prehrane sportaša pred velika natjecanja. Ipak, zaboravio sam je. Već godinama ne radeći, oštećenog zdravlja i već djelomično reumatiziran, slučajno sam naletio na nju šetajući poljima u susjedstvu. Uživao sam danima kuhajući je na razne načine za obitelj jedva primjećujući da leđa sve manje bole! Tušac je radio svoje ondje gdje je najjači, a najjači je protuupalno! Vrijeme je da dobije i svoje znanstveno i svoje gastronomsko mjesto i u svakodnevnoj prehrani, jednako kao i u prehrani onih potrebitijih po raznim osnovicama, od liječenja do sporta! Usput, kada se malo okrenete, tušac je svuda, od kukuružišta i vinograda, do ulica!

Raštika...

Dugo sam vjerovao da je taj moćni kupus ekskluzivna namirnica moje Hercegovine. Srećom nije. Ipak, poglavito je mediteranski kupus, a u Italiji, *cavolo nero* uživa kraljevski status! *Brassica oleracea* "Lacinato"! U rodnoj mi Hercegovini, raštika je skoro jedini izvor zdrave hrane zimi i u rano proljeće kada je najpotrebnija. Danas je popularnija nego ikada, a dostupnost informacija o hrani, s vremenom će je staviti nezaobilaznom namirnicom svih onih koji drže do zdravlja. Puna je antioksidanata da nadilazi svo drugo vrtno bilje, mnogo vitamina A, C i K, vlakana, kalcija, magnezija i željeza. Mnogo studija, osobito u SAD-u i Velikoj Britaniji sugerira da pomaže kod prevencije raka. Ipak, kao i svo drugo povrće, osjetljivo je na naše tradicionalno prekuhavanje čime gubi skoro sve svoje vrijednosti. Svakako joj treba redefiniranje pripreme i bitno ozbiljniji pristup, tada i ona poput tušca postaje hrana koja liječi. A kako bi se pridonijelo promicanju njezine uporabe u kulinarstvu u predavanju će biti izneseno i nekoliko prijedloga za njezinu pripremu!

Ključne riječi: raštika, tušac, zdravlje

Keywords: collard, purslane, health

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