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FOOD INGREDIENTS, FOOD STRUCTURE, ADDITIVES, SUPPLEMENTS, FORTIFICATION

I

DETERMINATION OF OPTIMAL CONCENTRATION OF ORGANIC SELENIUM ON EGG PRODUCTION IN LAYING HENS

Vezir Januzi[1], Lumturi Sena[2], Njazi Bytyqi[3*]

**[1]Faculty of Food Sciences and Technology,
University for Business and Technology, Kalabria nr, 10000 Pristina, Kosovo
[2]Faculty of Agriculture and Environment,
Agricultural University of Tirana, Kodër Kamëz, 1029 Tirana, Albania
[3]Faculty of Agriculture and Veterinary, University of Pristina,
Boulevard "Bill Clinton" nn, 10000 Pristina, Kosovo**

[*]e-mail: njazi.bytyqi@uni-pr.edu

Abstract

Feed supplemented with organic selenium have positive effect from different aspects as: keeping normal spermatogenesis, improved hatchability and better viability of one-day offspring's, the cells oxidative protection, improved immune status and production and quality of eggs and meat. This research aims to highlight the effect and importance of supplementing chicken rations with organic selenium (Sel-Plex®) as an indicator of their performance in terms of egg and meat production.

The experiment was conducted for a period of 11 weeks in a poultry farm near Podujeve (Kosovo). A total of 300 Lohman Brown layers were divided into three groups as follows: control group (C), experiment 1 (E1), experiment 2 (E2). For the three groups, the same feed formula was applied, but if the control group was fed with the basic feed, and the feed formulas of the other two consequent ones were supplemented with organic selenium (Se) Sel-Plex® (Alltech), with 0.3 and 0.4 ppm respectively. During the experimental period, the following parameters were consistently recorded, monitored and evaluated with the method of comparison and description of results as the live weight of the egg, egg production, egg mass, egg quality and feed conversion ratio (FCR). For the analysis of gained results we used ANOVA test.

At the end of the study, it was shown that the performance indicators of poultry including egg production, egg weight, egg mass, and weight of hens were not affected by the level of supplement selenium in the poultry diet. In the group supplemented with 0.4 ppm selenium, the food was saved in the mass of 1.63% compared to control, and 1.2% compared to E1 (a significant difference of $P \leq 0.05$).

A tendency for improving egg quality is seen by increasing the Se dose. Although, the egg weight of E2 was respectively 3.7 and 2% larger than control and E1, so can say that there is only a trend for higher weight, because the differences are statistically unconfirmed. The hens of the best group reached the lower weight compared to the standard hybrid.

Supplementation of poultry feed rations with organic selenium with two different concentrations 0.3 and 0.4 ppm has shown positive effect on poultry performance indicators during egg production. The group, in whose food ration was supplemented that at 0.4 ppm, showed the tendency to improve fertility, egg weight and its components, egg mass, as well as for higher body weight.

***Key words**: Egg production, Egg quality, Layer, Selenium.*

EGG PHYSICAL CHARACTERISTICS, FATTY ACID PROFILE AND HEALTH LIPID INDEXES OF STORED EGGS FROM HENS FED DIETS SUPPLEMENTED WITH MIXTURES OF FLAXSEED MEAL AND CAROTENOIDS

Petru Alexandru Vlaicu[1*], Tatiana Dumitra Panaite[1], Violeta Nour[2], Raluca Paula Turcu[1], Gabriela Maria Cornescu[1], Petruta Visinescu[3]

[1]Department of Animal Physiology,
National Research Development Institute for Animal Biology and Nutrition,
Calea Bucuresti 1, 077015 Balotesti, Romania
[2]Department of Horticulture and Food Science,
Faculty of Horticulture and Food Science, University of Craiova,
Al Cuza 13, 200585 Craiova, Romania
[3]SC Avitor SRL, Dragos Voda village, Islazului 27, Romania

[*]e-mail: alexandru.vlaicu@outlook.com

Abstract

In the last decades, consumption of functional foods has increased considerably, especially the omega-3 (n-3 PUFA), enriched eggs, which have been shown to possess positive effects on human health. However, n-3 PUFA increase the degree of unsaturation in egg yolk which may enhance the sensitivity to lipid oxidation affecting the freshness and quality of eggs during storage. This study aimed to evaluate the effect of flaxseed meal used together with kapia pepper, sea buckthorn meal and/or carrot mixtures in laying hens' diets, on production performances, egg physical characteristics, yolk coloration, fatty acid profile and health lipid indexes for human consumption of the eggs after storage at 4 ^{0}C for 28 days.

For that, 168 Tetra SL laying hens, divided into 4 groups (48 hens/group with 24 repetitions) were subjected for four weeks, to the following dietary treatments: standard diet (C), based on corn and soybean meal as main ingredients. All experimental diets included 6% flaxseed meal (as a source of n-3) supplemented with 2% kapia pepper (FKP), 2% sea buckthorn meal (FSB) and/or 2% carrot (FC) as natural sources of antioxidants. The production performances were calculated weekly. Eggs physical characteristics were determined with an egg analyzer, yolk color was determined by the Roche yolk color fan and the egg white and yolk pH with a Five Go F2-Food kit Metler Tolledo pH meter. The fatty acid profile was determined by gas chromatography and health lipid indices were calculated.

Significant improvements were observed for the weekly performances calculated among the groups, especially for the FSB and FC groups, in terms of egg weight and laying intensity compared with the C group. From the egg physical characteristics, yolk colour determined by Roche yolk color fan significantly increased in FKP and FSB groups compared with C group. Also, Haugh units (egg protein quality) were significantly higher in FSB group compared with C group. The use of experimental diets significantly reduced the content of myristic, pentadecanoic and stearic fatty acids compared with C eggs. All n-3 fatty acids significantly increased in FKP, FSB and FC groups compared with the C group, while all n-6 fatty acids and n-6/n-3 ratio decreased, especially in FKP and FC groups compared with the FSB and C groups. The thrombogenicity indices (TI), elongase (E) and Δ5 + Δ6 - desaturase (n-3), decreased in all experimental groups while, thioesterase (T), Δ9-desaturase and Δ5 + Δ6 desaturase (n-6) increased, with no significant alteration for other indices. This indicates that eggs enriched in n-3 PUFA and antioxidants could maintain their effectiveness in retarding atherosclerosis and the risk of cardiovascular disorders.

Overall, the diets used showed some significant improvement in egg quality stored for 28 days when comparing them with those from C group.

***Key words**: Laying hens, Fatty acids, Flaxseed, Carotenoids, Egg quality, Storage time.*

ETHOLOGICAL AND BIOCHEMICAL STUDIES IN BROILERS WITH THE ADDITION OF ESSENTIAL OILS OF ROSEMARY, LAVENDER AND OREGANO

Nadya Bozakova[1*], Magdalena Oblakova[2]

[1]Faculty of Veterinary Medicine, Trakia University, Student`s campus nn, 6000 Stara Zagora, Bulgaria
[2]Department of Breeding and Technologies in Poultry and Rabbit Farming, Agricultural Institute, Pazarska 13, 6000 Stara Zagora, Bulgaria

[*]e-mail: nadiab@abv.bg

Abstract

In order to reduce the use of antibiotics, broiler production is increasingly taking advantage of supplements with essential oils from various herbs whose antibacterial, antioxidant and antitoxic effects lead to stress reduction and stimulate broiler growth. The aim of the present study was to monitor changes in behavior, corticosterone and testosterone levels, and blood biochemical parameters in broiler chickens under the influence of 0.02% of essential oils of rosemary, lavender, and oregano.

The experiment included 120 broiler chickens, divided into 4 groups - one control (I) and three experimental, with 0.02% addition of essential oil of rosemary (II -RZ), lavender (III-LV), and oregano (IV - OR). The broilers were fattened up to 1 to 38 days of age. The behavior of broilers was studied by video cameras and ethograms. Blood levels of corticosterone and testosterone were determined using commercial ELISA kits (for the hormones concerned) and an ELISA reader. Biochemical parameters - blood glucose, cholesterol, total protein, triacylglycerols, uric acid, etc. were determined by an automatic biochemical analyzer. Processing of the results of the statistical analysis was performed by ANOVA using GraphPad InStat 3.06 software, at a significance level $P < 0.05$.

After 38 days of treating broilers with 0.02% essential oil of rosemary, lavender, and oregano, significantly lower corticosterone concentrations, or: $P < 0.01$; $P < 0.01$; and $P < 0.05$ respectively were determined compared to the control group. The testosterone levels in experimental birds were lower than in the control group and significantly lower in those birds in which oregano essential oil was added, $P < 0.05$. The treatment with essential oils increased the number of birds performing comforting behavior - dust bath and feather cleaning, $P < 0.001$; $P < 0.001$; $P < 0.001$, relative to the control group. The number of aggressive birds

was lower in all experimental groups compared to the control, whereas there was a significant difference in chickens that had oregano oil added to their diet, $P < 0.05$. In the experimental groups, there was a decrease in the levels of uric acid and triglycerides compared to the control group.

The 38-day supplementation with 0.02% essential oil of rosemary, lavender, and oregano had a positive effect on the ethological and biochemical parameters of broiler chickens.

***Key words**: Broilers, Rosemary, Lavender, Oregano essential oils, Behaviour, Hormones, Biochemistry*.

PHYSICO-CHEMICAL AND MICROBIOLOGICAL PROPERTIES OF PROBIOTIC YOGHURT ENRICHED WITH INULIN AND HONEY

Milka Stijepić[1*], Radoslav Grujić[1], Nikolina Malinović[1], Ilija Stijepić[1]

**[1]School of applied medical sciences Prijedor,
Nikole Pašića 4A, 79000, Prijedor, Bosnia and Hercegovina**

[*]e-mail: stijepicmilka@gmail.com

Abstract

The therapeutic properties of yoghurt can be improved by adding probiotic bacteria to yoghurt culture. On the other hand, the addition of inulin and honey as prebiotics, can reduce the fermentation process and improve the rheological and sensory product properties. The purpose of this study was to examine the effect of inulin addition and the combination of inulin and honey on: fermentation speed, viscosity, syneresis, microbiological properties and microstructure of probiotic yoghurt during 21 storage days.

Cow's milk with 1.5% fat after the addition of 1% inulin was thermally treated at 95 ^{0}C/10min. After cooling to 55 ^{0}C, honey was added in concentrations of 2% and 6%. A control sample was also produced, without supplement. Samples were inoculated at a concentration of 0.0025% with a mixed probiotic culture (*Streptococcus thermophilus*, *Lactobacillus bulgaricus*, *Lactobacillus acidophilus*, and *Bifidobacterium* ssp.) at 37 ^{0}C, and incubated until a pH of 4.6 was reached. Observation of pH, lactic acid content, viscosity and syneresis intensity was performed on: 1st, 7th, 14th and 21st day, while the change in the number of bacteria was determined on 1st and 21st day. The pH values of milk and yoghurt were measured with a pH meter (Eutech Instruments, England). The viscosity of the samples was measured for 3 minutes (value was reading every 30 s.) at a spindle rotation speed (Ø4) of 20rpm, using a digital viscometer, DV-E (Brookfield engineering laboratories, USA). Sigma 2-6 laboratory centrifuges (Germany) was used to determine syneresis by Keogh and O'Kennedy method. Syneresis was expressed as a percentage (%) of isolated serum by centrifugation at 2,000 rpm for a period of 10 minutes. The SEM (scanning electron microscopy) technique on JSM-6460LV (Oxford instruments, England) was used to study the microstructure of yogurt. Changes in the number of bacteria in yoghurt on the 1st and 21st storage day were determined using the classical dilution method, and isolation was performed on MRS agar after incubation at 37 ^{0}C under anaerobic conditions. The results were statistically processed (Tukey test, $p < 0.05$) in SigmaPlot 11.0 (Systat Software, Inc. USA) and Microsoft® Excel 2007.

The obtained results showed that inulin accelerated the fermentation process, while the honey addition shortened the fermentation time even faster. Also, the synergistic effect of inulin and honey resulted in a significant reduction in whey secretion ($p < 0.05$) compared to the control sample during storage, but did not significantly affect the change in viscosity. On the other hand, the positive effect of inulin and honey on the growth of probiotic bacteria has been shown. However, during the 21st storage day, there was a slight decrease in the number of bacteria, on average by two logarithmic units, but their number was above the therapeutic minimum in all samples. Micrography of the samples were directly related to the results obtained for syneresis and viscosity. The results showed that a finer and more cross-linked structure of yogurt was achieved, as well as better compactness of protein chains by increasing of honey concentration, and on that way syneresis was reduced and to a lesser extent the viscosity increased.

In general, variants of functional probiotic yogurts with better physicochemical, microbiological and rheological characteristics, and better microstructure were obtained, by using probiotic starter culture for milk fermentation and using different concentrations of honey in combination with inulin. In the future with the possible application of some more parameters, the obtained results of research could have applicative significance regarding practical application and expansion functional foods range in our market.

***Key words**: Probiotic yoghurt, Inulin, Honey, Syneresis, Viscosity, Microbiological properties.*

POSSIBILITIES OF USING *SACCHAROMYCES CEREVISIAE* AS A DIETARY SUPPLEMENT IN SHEEP PRODUCTION

Nadya Bozakova[1*], Veselin Ivanov[2]

[1]Faculty of Veterinary Medicine, Trakia University, Student`s campus nn, 6000 Stara Zagora, Bulgaria
[2]Faculty of Medicine, Trakia University, Armeyska street 11, 6000 Stara Zagora, Bulgaria

[*]e-mail: nadiab@abv.bg

Abstract

Due to the excessive use of antibiotics in livestock, including sheep, and the rapid spread of antibiotic resistance in microorganisms, alternative methods are being sought to reduce antibiotic use and focus on boosting immunity and preventing disease in lambs and sheep. The yeast *Saccharomyces cerevisiae* and its active products, like: beta-glucans, mannan oligosaccharides, and nucleotides, are potential alternatives to antibiotics and play an important role in stimulating growth and immunity in small ruminants. The purpose of this research was to review the possible use of *Saccharomyces cerevisiae* and its active products as a dietary supplement to stimulate immunity, improve the rumen microbiome and activate the antiparasitic action, thus stimulating the growth of lambs and sheep.

To achieve this, we reviewed official documents and reports from the Food and Agriculture Organization - FAO, the official website of the European Commission, as well as approximately 80 scientific publications through PubMed, Research Gate, and Elsevier related to the active ingredients derived from the yeast *Saccharomyces cerevisiae*, and their positive effects on the body of sheep In this publication, we summarize the stimulating effect of yeast on sheep immunity by activating globulin production, expression of IgA, IgG, and IgM, phagocytic activity of granulocytes and monocytes, expression of one of the most important antibacterial peptides in the rumen - sheep β -defensin- 1. We emphasize the stimulating effect of *S. cerevisiae* on the microbiome and the development of rumen cellulolytic microflora in young animals. In addition, we summarize data on the antiparasitic effect of this yeast species on the gastrointestinal parasite *Haemonchus contortus* in sheep.

In conclusion, the yeast *S. cerevisiae* and its active ingredients have the ability to be used successfully to stimulate immunity, improve the rumen microbiome

activity in ruminants and thus improve the growth and productivity of lambs and sheep in pasture rearing.

***Key words**: Saccharomyces cerevisiae, Immune stimulation, Rumen microbiome, Sheep growth.*

DIETARY FIBER IN GLUTEN-FREE PRODUCTS

Iulia - Elena Susman[1], Alina Culeţu[1*], Livia Apostol[1]

[1]National Institute of Research and Development for Food Bioresources - IBA Bucharest, Dinu Vintilă 6, 021102 Bucharest, Romania

[*]e-mail: alinaculetu@gmail.com

Abstract

Dietary fiber represents the edible portion of plant food that is resistant to digestion and adsorption in the small intestine by the gastric enzyme. According to EU Regulation No. 1924/2006, a food product with "high fiber" claim contains at least 6 g fiber/ 100 g, while a "source of dietary fiber" claim corresponds to at least 3 g fiber/ 100 g. Dietary fiber are classified as insoluble fiber such as cellulose, hemicellulose, and lignin, and soluble fiber, such as pectin, gum, and mucilage. Although the addition of fiber has nutritional benefits in the gluten-free formulation, they also influence the technological properties. For example, insoluble fiber tends to reduce technological quality, while soluble fiber has a positive effect. The addition of insoluble fiber (oat bran fiber and resistant starch) leads to a decrease of the bread volume, while soluble fiber addition such as inulin has been an improvement in the overall technological quality of the bread, with a higher volume and lower crumb hardness. The aim of this research was focused on the literature review regarding the fiber content from different gluten-free bakery products.

Thus, the Web of Science database was electronically searched for research articles, where the article title/abstract contains "gluten-free" as well as "fiber"; a number of 21 articles were considered. Also, this research was conducted regarding the fiber content of gluten-free products available on the Romanian market.
The following main sources of fibre were identified: psyllium, pea, corn, apple, oat, flaxseed, buckwheat, millet, lentil, soybean, rice bran. The available gluten-free products on the market had a board range of fibre concentrations and were classified into categories as follows: flour (0.9 - 13%), bread (5.4 - 7.4%), pizza dough, toast, pita and couscous (4.6 - 5.8%), pasta (1.1 - 10%), cookies (2.1 - 4.8%), biscuits (0.6 - 6.7%), waffle (3.1 - 5.2%), expanded rice slices (1.2 - 5.4%), flakes (3.4 - 10.1%), crackers (2.2 and 7.6).

We can conclude that the highest fibre content was found in gluten-free flour used for black bread and the lowest fibre content in palm oil biscuits.

***Key words**: Dietary fiber, Gluten-free, Pasta, Bread, Cookies.*

INFLUENCES OF THE PROBIOTIC ZOOVIT ON GROW INTENSITY PERFORMANCES AND BLOOD COMPOSITION IN LAMBS

Georgi Kalaydzhiev[1*], Ivan Slavov[1], Nikolay Ivanov[1], Stayka Laleva[1], Vasil Vasilev[1]

[1]Agricultural Institute Stara Zagora, Radnevo road nn, 6000 Stara Zgora, Bulgaria

[*]e-mail: gopo@abv.bg

Abstract

This research is important in order to establish the true beneficial effect of probiotics directly on microbiome and indirectly on the traits associated with the intensity of growth, as well as the welfare of the animal's organism. The aim of the study is to evaluate the Influences of the probiotic ZOOVIT on grow intensity performances and blood composition in lambs.

The study was conducted in the sheep farm of the Agricultural Institute - Stara Zagora. 60 lambs were included, weaned from their mothers on the 5th day of their birth, and divided equally into 2 groups: experimental and control. The animals from the experimental group taken 4 g of ZOOVIT probiotic per day with milk replacer. Blood analyses are derived on automated haematology instrument Mindray Auto Hematology Analyzer BC-2800 Vet and automated biochemical analyzer MNCHIP Chemistry Analyzer Celercare® cV5. The consummated feed and residual were weighted every day and the lambs every 3 days by mechanical scales. Descriptive statistics and t-tests for comparison the values of some biochemical and intensity of growth parameters was obtained by using software product SPSS 13.0.

Lambs in experimental group had larger average body weights, greater daily weight gain, increased average daily intake and a better feed efficiency, compared to control group. Animals in experimental group had average body weight of 21.42 kg and daily average gain 0.357 gr, control group had average body weight of 19.68 kg and daily average gain 0.328 gr. Differences between groups on grow intensity performances is statistically significant ($P < 0.05$). Total protein in the blood in the experimental group is higher than in control 64.18 g/L and 58.60 g/L respectively, from here comes and statistically significant ($P < 0.05$) higher concentration of albumin and globulin in blood in the experimental

group. It is noticeable higher levels of red blood cells and the hemoglobin in the experimental group RBC - 10.93 x 10^{12}/L, HGB - 93.85 g/L compared to RBC - 10.09 x 10^{12}/L, HGB - 90.57 g/L with the control group, differences between groups are statistically significant ($P < 0.05$). We established higher mortality rate of 3.33% in the control group than the experimental.

There are positive overall benefits from using probiotic ZOOVIT as supplement for the development of lamb organism.

***Key words**: Probiotics, Grow intensity performances, Blood composition, Lambs, Mortality.*

STUDY OF GAS PRODUCTION, DIGESTIBILITY AND METABOLIC ENERGY IN ROUGH AND SUCCULENT FEEDS, WITH FRESH AND LYOPHILIZED RUMEN FLUID

Stayka Laleva[1], Georgi Kalaydzhiev[1*], Nikolay Ivanov[1], Daniela Yordanova[1], Vladimir Karabashev[1], Vasil Vasilev[1]

[1]Agricultural Institute Stara Zagora, Radnevo road nn, 6000 Stara Zgora, Bulgaria

[*]e-mail: gopo@abv.bg

Abstract

Rough hay and straw, and succulent silage and feeds are essential for feeding ruminants. Their quality depends on the phase of harvesting, technology and method of storage. Digestibility and energy value studies are vital for a balanced diet of ruminants. The aim of the study was to determine the gas production, digestibility and metabolic energy of straw, alfalfa hay and corn silage using *in vitro* methodologies in fresh and lyophilized rumen fluid.

By means of a probe and a vacuum machine we collected inoculum (rumen fluid) from rams 2 - 3 years old from the breed Bulgarian dairy synthetic population (BDSP). An *in vitro* methodology was used to perform analyzes of rough and succulent feed's with the Ankom RF Gas Production System. Digestibility and metabolic energy was evaluated and gas production was analyzed at four levels: 24, 48, 72 and 120 hours of incubation, with fresh and lyophilized rumen fluid.

The obtained results show lower values for digestibility of silage, alfalfa hay and straw in the lyophilized rumen fluid compared to fresh - 68.72%, 62.33%, 29.48% and 64.92%, 58.48%, 26.93% respectively. The values of metabolic energy (ME) in straw are higher in lyophilized inoculum compared to fresh - 5.904 and 5.676 ME, respectively. In alfalfa hay higher values were obtained with fresh rumen fluid 6,813 ME compared to lyophilized 5.637 ME. No differences were found in silage - 5.89 and 5.88 ME. In the case of maize silage, the values are closest in fresh and lyophilized inoculum at 24 hours of incubation - 99.019 and 92.730 dm/mL, respectively. The released gases are lower at the lyophilized rumen fluid by 15.5%, 13.4% and 13% at 48 h, 72 h and 120 h incubation respectively. Gas production in alfalfa hay with lyophilized rumen fluid as well as in corn silage is lower compared to fresh silage. The largest differences were found at 24 hour - 84.41 dm/mL for lyophilisate and 124.67 dm/mL for fresh inoculum. In the wheat

straw, gas production at 24 hour is higher in the lyophilized rumen fluid 99.55 dm/mL compared to fresh 88.77 dm/mL. At the following levels, the released gases increase slightly and have close values.

The obtained results in metabolic energy have divergent values for alfalfa hay and straw for different types of rumen fluid. Gas production in alfalfa hay as well as in corn silage with lyophilized rumen fluid is lower compared to fresh, and in straw the results for both types of inoculum are similar, with a slight increase in lyophilized rumen fluid.

***Key words**: Gas production, Digestibility, Metabolic energy, Lyophilized, Rumen fluid, Feeds.*

STUDY OF GAS PRODUCTION, DIGESTIBILITY AND METABOLIC ENERGY IN DIFFERENT VARIETIES OF CEREALS WITH FRESH AND LYOPHILIZED RUMEN FLUID

Stayka Laleva[1*], Georgi Kalaydzhiev[1], Nikolay Ivanov[1], Daniela Yordanova[1], Vladimir Karabashev[1], Vasil Vasilev[1]

[1]Agricultural Institute Stara Zagora, Radnevo road nn, 6000 Stara Zgora, Bulgaria

[*]e-mail: stalajj@abv.bg

Abstract

Cereals are a major component in the rations of ruminants and their management in it has a significant role. The aim of the study is to determine the influence of the variety and cultivation technologies of wheat, barley and corn on gas production, digestibility and metabolic energy through in vitro methodologies in fresh and lyophilized inoculum.

By means of a probe and a vacuum machine we collect inoculum (rumen fluid) from rams 2 - 3 years old from the breed Bulgarian dairy synthetic population (BDSP). An *in vitro* methodology was used to perform analyzes of rough and succulent feed's with the Ankom RF Gas Production System. Digestibility and metabolic energy was evaluated and gas production was analyzed at four levels: 24, 48, 72 and 120 hours of incubation, with fresh and lyophilized rumen fluid.

Determined energy value with fresh rumen fluid in these varieties of corn is 10 - 16% higher than in lyophilization. The trend is similar for barley. In the case of wheat varieties, the lowest levels of the total amount of released gases in both types of inoculum (fresh and lyophilized) were found at 24 h incubation. At 48 and 72 hours these quantities increase, the most significant being in the variety Miryana - from 130.20 dm/mL to 195.41 dm/mL at 24 and 48 hours, and the least in the variety Sobel - 160.30 dm/mL and 176.01 dm/mL respectively. In the case of barley, the increase in gas production is more significant at 48 hours compared to 24 hours, and insignificant at 72 hours compared to 48 hours. For Krasi variety this increase is the smallest - from 147.38 dm/mL to 172.30 dm/mL at 24 and 72 hours respectively. The most significant increase was in gas production in the Obzor variety - from 117.88 dm/mL to 170.38, respectively.

The data show lower emissions of maize using lyophilised inoculum at the three incubation levels compared to fresh. This trend is maintained in all four varieties

of corn. Digestibility in different wheat varieties is high with close values of lyophilized and fresh rumen fluid. The trend is similar for barley and corn. The established metabolic energy is higher in all wheat varieties with lyophilized inoculum compared to fresh.

***Key words**: Cereals, Inoculum, Variety, Incubation, In vitro*.

A SHELF-STABLE DELIVERY SYSTEM FOR PROBIOTICS BY VALORISATION OF BLUEBERRY POMACE

Nicoleta Eugenia Dermengiu[1], Ștefania Adelina Milea[1], Bogdan Păcularu-Burada[1], Gabriela Elena Bahrim[1], Gabriela Râpeanu[1], Nicoleta Stănciuc[1*]

[1]Faculty of Food Science and Engineering, Dunarea de Jos University of Galati, Domneasca 111, 800201 Galati, Romania

[*]e-mail: nsava@ugal.ro

Abstract

Processing of berries in juices leads to significant amount of pomace, which represents a remarkable source of phytochemicals. There is an enormous interest in the sustainable valorisation of the berries pomace in different industries, such as food, cosmetics and pharmaceuticals, consequently with significant benefits both the environment and the economy. The blueberry pomace containing seeds, skins and pulp residue, is the represents 20 - 30% of the fruits. The aim of our study was to develop a technological approach for sustainable valorisation of blueberry pomace into shelf-stable delivery system for lactic acid bacteria through freeze-drying.

Therefore, the blueberry pomace was enhanced with pectin, inoculated with 10.5 Log CFU/mL of *Lactobacillus acidophilus* and freeze-dried. The obtained powder was characterized for advanced phytochemical profile, using spectrophotometric and chromatographic methods, cells viability (pour plate technique) and *in vitro* digestion of anthocyanins, and lactic acid bacteria by using a static digestion model, including the use of a simulated gastric and intestinal juice.

The HPLC profile evidenced a high concentration (mg/100 g dry weigh) in caffeic acid (57.05 ± 5.07), myricetin (95.64 ± 5.65), hesperidin (56.44 ± 8.65), quercetin (79.52 ± 2.01), quercetin 3-β-D-glucoside (76.52 ± 3.03), delphinidin 3-O-β-D-glucoside (64.82 ± 0.33), cyanidin 3-O-glucoside (220.99 ± 1.16), pelargonidin 3-O-glucoside (160.75 ± 1.42), peonidin 3-O-glucoside (269.08 ± 1.72), and malvidin 3-O-glucoside (305.54 ± 2.74). The initial inoculum prior freeze-drying was 10.5 log CFU/g DW, whereas a 1.17 log reduction by the end of freeze-drying was achieved, leading to a dark purple powder, with a viable cells content of 4.75×10^8 CFU/g DW. The bioaccesibility of anthocyanin's was 37.8%, whereas in simulated intestinal juice, a decrease to 101.08 ± 3.23 µg C3G/g DW at the beginning to

intestinal digestion to 84.94 ± 4.86 µg C3G/g DW was found. The respective count of probiotic at the end of *in vitro* digestive process were approximately 4.3 Log CFU/g, with a survival rate of 49.56%.

Our results are promising, may be extended to other berry pomaces, and selected probiotics. Our study continues by testing the powder addition in different food matrices.

***Key words**: Blueberry pomace, Probiotic strains, Freeze-drying, In vitro digestion.*

PHYSICO-CHEMICAL PROPERTIES OF CHOCOLATE BROWNIES ENRICHED WITH BLACK JASMINE RICE FLOUR

Nutsuda Sumonsiri[1,2*], Sakonwan Takjirawut[1], Kanistha Serepong[1]

[1]Department of Agro-Industrial, Food, and Environmental Technology, King Mongkut's University of Technology North Bangkok, 1518 Pracharat 1 Road, Wongsawang, Bang Sue, 10800 Bangkok, Thailand
[2]Food and Agro-Industry Research Center, King Mongkut's University of Technology North Bangkok, 1518 Pracharat 1 Road, Wongsawang, Bang Sue, 10800 Bangkok, Thailand

[*]e-mail: nutsuda.s@sci.kmutnb.ac.th

Abstract

Black jasmine rice is a pigmented rice variety that has gained popularity due to its high nutritive value, sensory characteristics, and health benefits. The purpose of this research was to investigate the physicochemical properties of chocolate brownies enhanced with black jasmine rice flour to raise the product's value and nutrition.

All-purpose flour was substituted for various concentrations of black jasmine flour (25, 50, 75, and 100% w/w) during the brownie preparation, whereas the control sample contained 28.19% sugar, 18.6% egg, 16.91% dark chocolate, 15.78% all-purpose flour, 14.09% butter, 6.20% cocoa powder, and 0.23% vanilla extract. Following preparation, the products were examined in terms of their volume, color, texture (hardness, chewiness, cohesiveness, and adhesiveness) (texture profile analysis using a texture analyzer), and water activity (by Aqualab water activity meter). Then, the sensory acceptance (using a 7-point hedonic scale), and proximate composition (according to AOAC, 2005) of selected samples were evaluated. All analyses were performed in triplicate. The data was analyzed using IBM SPSS Statistics version 26. The analysis of variance (ANOVA) with Duncan's multiple range test (DMRT) was applied to indicate a significant difference at a 95% confidence level.

The result showed that the volume of brownies significantly increased ($p < 0.05$) as the concentration of black jasmine rice flour increased above 75%. When more black jasmine rice flour was added, the L* and a* values of the samples tended to decrease, but there was no significant difference in the b* values of the samples ($p \geq 0.05$). Additionally, as black jasmine rice flour was added, the hardness, chewiness, cohesiveness, and adhesiveness of product samples tended to decrease, while

no significant difference in water activity among samples was found. When compared to the control sample, the brownies enhanced with black jasmine rice flour received somewhat lower acceptance scores for odor, flavor, texture, and overall acceptability. There was, however, no statistically significant difference in appearance or color across the samples ($p \geq 0.05$). The brownies enriched with black jasmine rice flour contained higher moisture, protein, carbohydrate, and fat content than the control sample.

In conclusion, black jasmine rice flour can potentially be supplemented in brownies with minor effects on physicochemical properties while retaining acceptable sensory characteristics.

***Key words**: Black rice, Brownies, Black jasmine rice flour, Pigmented rice.*

IMPROVEMENT OF SHELF-LIFE OF BEEF USING LACTIC ACID, ASCORBIC ACID MIXTURE AND POTASSIUM SORBATE

Munkhnasan Enkhbold[1*], Attila Lőrincz[2], Majd Elayan[1], László Friedrich[1], József Surányi[1], Adrienn Tóth[1]

[1]Department of Livestock and Food Preservation Technology, Hungarian University of Agriculture and Life Sciences, Menesi 44, H-1118 Budapest, Hungary
[2]VADEX Mezőföldi Erdő- és Vadgazdálkodási Zrt., Petőfi Sándor 275, 8123 Soponya, Hungary

[*]e-mail: munkhnasan.e@gmail.com

Abstract

Certain parameters are considered as markers of fresh meat shelf life. Lactic acid, ascorbic acid, and potassium sorbate are a generally regarded as safe antimicrobial agent commonly used in meat and meat products for decontamination. Bio preservatives can be useful in extending shelf life of foods. The aim of this work was to define a shelf-life and storage recommendation for beef.

The treatment was performed by spraying and immersing methods. A mixture of 2% lactic acid with 0.5% ascorbic acid, 2% lactic acid with 1% ascorbic acid, 2% lactic acid with 2% ascorbic acid, and 1%, 2%, and 5% potassium sorbate was applied to beef samples. After vacuum packaging immediately the samples were stored at 4 ± 1 ^{0}C for 17 days. Quality parameters as pH, color, and total mesophilic aerobic count were measured on days: 0, 4, 10, and 17. The pH values were determined with a digital pH meter. Beef surface color was determined using a colorimeter. L*, a* and b* values were measured and hue angle and chroma were calculated. In microbiological testing after treatments samples were examined in 24 hours for mesophilic aerobes and *Enterobacteriaceae* cell counts by classical methods.

Initial aerobic plate count of control and treated samples ranged from 4.25 to 6.32 log cfu/g with counts to a range of 3.13 to 6.83 log cfu/g after 17 days of storage. The results suggest that use of potassium sorbate treatment using spray method provided a synergistic effect in controlling microbial growth. But mixture of lactic acid and ascorbic acid did not produce significant inhibitory effects on microbial growth. Color measurement data indicate that there was not noticeable color change in control sample during the 17 days display, while there was a little color change in the other treated samples. For pH measurement it was established

that lactic acid and ascorbic acid mixture are decreasing pH of beef. This initial decrease might be attributed to the acid treatment.

Therefore, lactic acid, ascorbic acid, and potassium sorbate treatments may be an alternative to extend beef shelf life.

***Key words**: Beef, Lactic acid, Ascorbic acid, Potassium sorbate, Immersion, Spray, Meat quality.*

SHELF LIFE EXTENSION FOR RAW MINCED MEAT

Dominika Gubała[1*], Władysław Migdał[1]

[1]Department of Animal Products Technology, Faculty of Food Technology, University of Agriculture in Krakow, ul. Balicka 122, 31-149 Krakow, Poland

[*]e-mail: dominika.gubala@student.urk.edu.pl

Abstract

Is it possible to extend the shelf life of raw minced meat? During storage, a number of chemical reactions occur in meat, which affect its nutritional value and suitability for consumption. The most unfavourable changes result from oxidation of proteins and lipids. These reactions are the result of excess of free radicals in meat tissues. Minced meat undergoes oxidation processes much faster due to the increased surface area that comes in contact with oxygen. To prevent these reactions, antioxidant substances are used, increasingly often, preparations of natural origin. One of the natural sources of antioxidants is acerola fruit. The aim of this study was to examine if it is possible to prolong shelf life of ground meat using dried acerola fruit.

There were prepared pork-beef minced meat with 0.5% of acerola fruit extract additive, dissolved in minimal amount of water and a control sample without additive. Each sample was divided into three parts and packed under modified atmosphere (10% of O2, 70% of N2, and 20% of CO2). The acid number (titration method with KOH according to PN-EN ISO 660:2021-03), and peroxide number (iodometric method according to PN-EN ISO 3960:2017-03) were determined in the samples at 1st, 3rd, and 7th day of storage.

The meat with acerola did not show the presence of peroxides. However, on the first day of storage, the control sample had a peroxide value of 0.26 [milliequivalents of O2/g of sample]. The acid value in meat with acerola was 2.105, while in the control sample 1.51 [mg KOH/kg of sample]. According to the Polish Standard for the fresh pork fat the above values are acceptable.

Above data suggest that the addition of acerola resulted in a partial reduction of lipid oxidation in raw ground meat. It should be considered whether the use of a higher dose of acerola will reduce the acid number values in raw meat.

***Key words**: Raw meat, Acerola, Antioxidants, Storage.*

BAKERY PRODUCTS FROM THE SEAWEED *SACCHARINA LATISSIMI*

Liviu Gaceu[1*], Mihaela Badea[1], Bianca Oana Oprea[1]

[1]Faculty of Food and Tourism, Transylvania University of Brasov, Castelului 148, 500036 Brasov, Romania

[*]e-mail: gaceul@unitbv.ro

Abstract

Saccharina latissima seaweed is attracting increasing interest as a sustainable food source in European countries because of their nutritional properties, especially due to high fibers and minerals content. The paper presents some research related to the use of sugar kelp (*Saccharina latissima* (class *Phaeophyceae*)) in the bakery industry, both for bread and snacks.

The seaweed obtained from a Spain ecological farm was dried at 5% humidity by using microwave under vacuum and milled under the size of 30 microns. Four degrees of replacement of white wheat flour (type 480) from the bread recipe were used: 1.5%, 3%, 4.5%, and 6%. For these, flour mixtures the main rheological characteristics were analyzed, and baking tests were performed by direct method. Analysis started with: bread specific volume, porosity and crust/crumb colour. The bread specific volume was determined using the rape seed displacement method according to SR 91:2007, AACC 2000. For porosity measurement, knowing the mass and density, the porosity was expressed % by measuring the total scale of holes, in a known crumb volume. The colour was evaluated using the Image-J software on the bread slices scanned with a HP2100 scanner. Further, a sensory analyses was performed, as follows: a group of 10 specially trained panelist, with ages between 25 and 60, evaluated the bread samples, giving grades from 1 (lowest intensity) to 5 (highest intensity). Also, there has been made a consumer overall acceptability determination in a 9-point hedonic scale (from 9 = i like it extremely to 1 = i dislike it extremely), where 35 untrained panelists with ages between 21 and 60 (70% females and 30% males) have tasted the samples that were coded with 3 random letters in order to not influence their perception, and the results were expressed as mean. All bread samples of flour mixtures P1-P4 were compared to the standards of 2 control samples P0 (wheat flour type 480 – white bread) and PN (wheat flour type 1250 - black bread).

The results show a good rheological behavior up to a degree of replacement of 4.5%, but due to the pronounced after-taste, consumers indicated a maximum

acceptable level of 3% degree of replacement with algae. Other products developed and tested referred to snacks and biscuits, were after taste was reduced by using 2% of caraway seeds.

In conclusion, the sugar kelp seaweed flour could be use with good results as functional ingredient in bakery by addition in wheat flour up to a 3% replacement degree.

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***Key words**: Bakery, Algae, Sugar kelp, Rheological and sensorial analysis.*

FOOD PRODUCTION, ENGINEERING, PROCESSING AND SUSTAINABILITY

II

ROLE OF OXIDATIVE STRESS BIOMARKERS IN THE ASSESSMENT OF METABOLIC STATUS IN THE RUMINANT

Galina Nikolova[1], Yanka Karamalakova[2], Magdalena Oblakova[3*], Veselina Gadjeva[1], Nasko Vasilev[2]

[1]Department of Medical Chemistry and Biochemistry, Medical Faculty, Trakia University, Armeiska 11, 6000 Stara Zagora, Bulgaria
[2]Department of Obstetrics, Reproduction and Reproduction Disorders, Faculty of Veterinary Medicine, Trakia University, Students town nn, 6000 Stara Zagora, Bulgaria
[3]Agricultural Academy, Agricultural Institute - Stara Zagora, Radnevsko road 1, 6000 Stara Zagora, Bulgaria

[*]e-mail: moblakova@abv.bg

Abstract

Studies on the role of oxidative stress in the physiology and pathology of ruminants are relatively recent. Their importance as an additional tool for assessing metabolic status has increased and makes research in this area a challenge for veterinary medicine. Of interest is the study of the oxidative/antioxidant status of ruminants in various pathological conditions, including those that are important for reproduction and the overall benefit to individuals. Such studies are sporadic and are based on diseases such as mastitis, retained placenta and others. The wide varieties of methods for assessing the oxidative status of animals are available to researchers and clinicians, but make it difficult to compare results, even in studies that appear to be quite similar. The aim of the present review is to summarize and discuss the various biomarkers described in the literature and methods for their determination, which are used to assess the oxidative/antioxidant status of ruminants. Biomarkers for oxidative stress as an additional tool for assessing the overall metabolic status in pregnant ruminants have also been studied. In addition, the possibilities of using bioactive additives with antioxidant action to improve reproductive potential in factors important for reproduction and periods are considered.

Oxidative stress (OS), expressed through the unbalanced production of Reactive Oxygen Metabolites (ROM) and damaged antioxidant defence system, plays an important role both in the natural aging process and in the pathogenesis and development of many diseases and their treatment. The imbalance between the produced ROMs and their location during physiological and pathological conditions in the body leads to accumulation, and deregulation of metabolic

pathways. ROMs are unstable and extremely active against biomacromolecules such as proteins, lipids, carbohydrates and nucleic acids. They cause cell damage through oxidative chain reactions and lipid peroxidation under normal conditions. There is a wide variety of methodologies for assessing oxidative status in animals that are available to researchers and clinicians, each with its own advantages and disadvantages. Differences in models and methodologies make it difficult to make adequate comparisons, even for studies that seem quite similar. OS is associated with a number of pathological processes and diseases in ruminants, including sepsis, mastitis, acidosis, ketosis, enteritis, and pneumonia, respiratory and joint diseases. The compromised immune system can also lead to increased morbidity, difficult treatment, and increased mortality in animals, which can affect the efficiency of animal husbandry. The increase in antioxidant defenses could, at least partly, improve immunity by maintaining the structural and functional integrity of important immune cells. A number of studies have proven the protective effects of antioxidants such as vitamin C, Vitamin A (retinol), carotenoids, and others, which can prevent oxidative damage caused by drugs and other pathogens. One of the most effective antioxidants is Vitamin E in combination with selenium, which is a co-factor of GSH-Px, acts synergistically with vitamin E in protecting organisms from free radicals. In ruminants the activity of OS biomarkers may be influenced by diet and season. The clarity of understanding the OS pathophysiology in ruminants will allow the development of specific antioxidant therapies. Methods for quantifying OS include direct or indirect measurement of oxidants and antioxidants levels, and their quantification often requires specialized equipment and considerable experience. ROS are formed continuously as normal by-products of cellular metabolism and in low concentrations are essential for many physiological processes. In excess, ROMs can damage cellular function, as it may interact with the cellular lipids, proteins, and DNA. ROMs plasma levels are considered an indicator of free radical production. The test has been validated using electron paramagnetic resonance (EPR), and is considered the 'gold standard' for measuring total oxidative state.

The assessment of the oxidative/antioxidant status of ruminants in various pathological conditions, including conditions related to reproduction and general well-being of individuals, should be based on the results of several parameters and several different methods. Examination of possible relationships between markers of oxidative/antioxidant status and other relevant indicators (serum glucose, triglycerides, cholesterol, non-esterified fatty acids, urea, creatinine, total protein, albumin, alkaline phosphatase, etc.) will reflect the status of as well as the general internal physiological state of the animals.

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***Key words**: Oxidative status, Antioxidants status, Biomarkers, Ruminants, Pathological conditions, Method.*

BIOCHEMICAL CHARACTERISTICS OF TOMATO LANDRACES FROM GENE BANK OF REPUBLIC OF SRPSKA

Sonja Rašeta[1], Sanda Stanivuković[2,1], Biljana Kukavica[3], Marina Antić[1,2*]

[1]Institute of genetic resources, University of Banja Luka, Bulevar v. Petra Bojovica 1A, 78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina
[2]Faculty of Agriculture, University of Banja Luka, Bulevar v. Petra Bojovica 1A, 78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina
[3]Faculty of Natural Sciences and Mathematics, Dr Mladena Stojanovića 2, 78000 Banjaluka, Republic of Srpska, Bosnia and Herzegovina

[*]e-mail: marina.antic@igr.unibl.org

Abstract

Erosion of crops genetic resources is happening due to replacement of traditional landraces with high genetic diversity by modern commercial varieties with high genetic uniformity. Due to good resistance to climatic conditions and on the basis of previous pomological and sensory analyses, it is assumed that the tomato landraces have good quality of fruit and better taste compared to modern commercial varieties. Tomato landraces are characterized by high content of vitamins and minerals and other antioxidants. . The aim of this research was to determine differences in biochemical characteristics between different tomato landraces from Gene Bank of Republic of Srpska.

The 2-year research (2018 and 2019) was conducted on 10 tomato landraces from the Gene Bank of Republic of Srpska: GB00874, GB01107, GB01110, GB01123, GB01126, GB01128, GB01129, GB01132, GB01238 and GB01239. Analyzed biochemical characteristics were: total soluble solids content (by the digital refractometer), lycopene (spectrophotometrically), total phenolic (Folin-Ciocalteu - FC colorimetric method) and total flavonoids (colorimetric method with aluminum chloride).

Total soluble solids ranged from 4.4 °Brix (GB01238) to 7.8 °Brix (GB01129) in 2018 and from 5.2°Brix (GB01123) to 7.8 °Brix (GB01110) in 2019. Lycopene content in yellow fruit color landraces ranged from 0.26 mg/kg (GB01238) to 1.06 mg/kg (GB01132) in 2018 and from 0.51 mg/kg (GB01238) to 0.74 mg/kg (GB01132) in 2019. Lycopene content in red fruit color landraces ranged from 24.9 mg/kg

(GB01239) to 148.3 mg/kg (GB01110) in 2018 and from 28.3 mg/kg (GB01123) to 174.7 mg/kg (GB00874) in 2019. Considering the content of phenols, the highest amount was measured in the landrace GB01128 which had and the highest flavonoid content.

This is the first insight in nutritional biochemistry of tomato landraces from Gene Bank of Republic of Srpska. Tomato landraces show high diversity in all analyzed biochemical characteristics, which suggest they possess high genetic diversity, good fruit quality and good base for further nutrition research on this landraces.

***Key words**: Tomato accessions, Biochemistry, Diversity, Ex situ, Fruit quality.*

MORPHOLOGICAL VARIABILITY OF *PRIMULA VERIS* L. (*PRIMULACEAE*) PLANT SPECIES

Kimete Lluga-Rizani[1], Smajl Rizani[2*], Vanesa Pajaziti[1], Sonata Kazlauskaite[3]

[1]Department of Biology, Faculty of Mathematical and Natural Sciences, University of Prishtina, Nena Tereza nn, 10000 Pristina, Kosovo
[2]Department of Food Science and Technology, University for Business and Biotechnology (UBT), Lagjja Kalabria nn, 10000, Pristina, Kosovo
[3]Department of Biology and Plant Biotechnology Institute, Faculty of Agronomy, Vytautas Magnus University, Donelaičio 58, 44248 Kaunas, Lithuania

[*]e-mail: smajl.rizani@ubt-uni.net

Abstract

This research contributes to better understanding of *Primula veris* L. plant species morphology grown in three different habitats and the results obtained can help farmers who cultivate this plant for medicinal or culinary use to choose more optimal habitat for their growth. The object of our research was *Primula veris* L. plant species. This species belongs to *Primulaceae* family. The main purpose of this research has been to study morphological variability of this species in Kosovo.

Individual plants (48) were collected from three different habitats in three different villages (Kuqishte, Drele, Boge - Peja Municipality). Information on ecological factors as: humidity, insolation, temperature, altitude, inclination etc. were obtained from Kosovo Hydro meteorological Institute. The collected material was dried and prepared for further morphometric measurement such as: number of leaves, stem height, number of flower in inflorescence and inflorescence weight (before and after the inflorescences were dried) by classical methods.

The obtained results have shown that there is a morphological variability between plants grown in different habitats due to the ecological factors that they are exposed to, such as: humidity, insolation, temperature, altitude, inclination etc. Average values of leaf number, number of flowers in inflorescence and number of inflorescence per m^2 are higher in Boga village, whereas the average values of stem height are higher in habitat in Drele, while the difference of the inflorescence weight before and after they were dried is lower in in Boga village.

According to gained results, we ca conclude that Boga village seems to be a better and optimal habitat for cultivation of *Primula veris* L. species in order to yield more leaves and flowers for medicine and culinary purposes.

***Key words**: Primula veris L., Variability, Morphology, Habitats.*

PERFORMANCE OF DAIRY FARMS IN KOSOVO DURING THE COVID 19

Medin Zeqiri[1], Valon Durguti[1*], Suzana Aliu[1], Fidan Feka[1], Ylli Biçoku[2]

[1]Department of Food Sciences and Biotechnology, University for Business and Technology, Kalabria p.n., 10000 Prishtina, Kosovo
[2]Agricultural University of Tirana, Paisi Vodica nn., 1025 Tirana, Albania

[*]e-mail: valon.durguti@ubt-uni.net

Abstract

This research is important because milk production is considered as an activity of nutritional, social and economic importance in Kosovo. Cow's milk dominates the production of raw milk in Kosovo. Dairy cows (about 132,500 heads) produce 277,599 tons of milk. The purpose of this paper is to analyze the impact of Covid-19 on the performance of cow milk producers in Kosovo.

It was used descriptive and quantitative survey. The random sampling technique was used to select respondents from a 242 dairy farms in the seven regions of Kosovo (Gjilan, Prishtina, Ferizaj, Peja, Gjakova, Prizren, and Mitrovica). Interviews have included the farms with the capacity of 5 - 120 dairy cows. Data on milk production, sales and farm incomes for each farm were recorded during the period of January - April 2021 and the comparison was made for a calendar year with that of 2019/2020.

The average milk produced by farmers per year was 73052.94 liters in 2019, and it decreased to 71255.27 liters in 2020. In 2020, 93.1% of farmers said they have not been able to sell all the milk they produced, on average the surveyed farms could not sell milk at all in the amount of 12503.43 liters per year in 2020, and this represents an increase of 275 times compared to the amount of the previous year where there was only 45.38 liters per year of unsold milk destined for the market. The average farm revenues from milk were € 13892.37 in 2020, while in 2019 it was considerably higher, with an average of 19881.49 € per farm. Farmers reported that the restrictive measures taken as a result of Covid-19 have affected milk production negatively in terms of sales, revenues and returns.

Advisory services should sensitize farmers to farm diversification so that losses from such situations as pandemics are kept to a minimum.

***Key words**: Performance, Dairy Producers, Covid-19, Milk Production, Sales, Kosovo.*

STUDY REGARDING THE INFLUENCE OF THE SWEETENERS ON SOME ARABICA COFFEES

Petre Savescu[1*], Gabriel Badescu[1]

[1]Faculty of Agronomy, University of Craiova, A. I. Cuza 13, PC 200585 Craiova, Romania

[*]e-mail: petre.savescu@edu.ucv.ro

Abstract

For many consumers on various continents, coffee is an important beverage, part of their daily eating habits. For consumers, it is very important to know the effects of sweeteners on the change of the chemical composition and the structures of some coffee bio-compounds. The paper presents the major effects produced by certain natural and synthetic sweeteners on the active forms of caffeine and on the redox balances - in which many valuable bio-compounds are involved which was the aim of this research.

Studied coffee was of the Arabica type and was decaffeinated by extraction with the help of supercritical fluids (SFE). For both Arabica coffee Types (caffeinated and decaffeinated), were tested the effects of using 3 types of natural sweeteners (white sugar, fructose, stevioside syrup) and 3 other types of artificial sweeteners (low-calorie: monosodium saccharin, buffered saccharin, sodium cyclamate. In order to evaluate major effects produced by certain natural and synthetic sweeteners on the active forms of caffeine and on the redox balance we used following methods: UV-Vis molecular spectrophotometry techniques, AAS atomic absorption spectrometry techniques, SFE supercritical extraction techniques, the monitoring techniques of NAD- and FMN-dependent coenzymes (of important oxidoreductases).

The obtained results are very important: were established the sugar and the sodium cyclamate as the best sweeteners for Arabica coffee (with caffeine or decaffeinated by SFE), and also the possibility to develop a portable system that can determine the optimal sweeteners for any type of coffee. Using a database with molecular absorption spectra curves in the UV and Viz range, signal processing methods and linear and nonlinear analysis, a system of optical sensors - coupled through the interface with an intelligent device (with Octa-Core processor) can develop a mobile system Biosensors Lab-On Smartphone for coffee sweetening control.

In conclusion, the paper presents an innovative strategy that uses reagent-free techniques and technologies to accurately determine the effects of additives on the food environment.

***Key words**: Arabica coffee, Sweeteners, NAD- and FMN-dependent coenzymes.*

SUPERCRITICAL FLUIDS AS A TOOL FOR SUSTAINABLE MANUFACTURING OF ADDED VALUE PRODUCTS

Maša Knez Marevci[1*], Željko Knez[2]

[1]Faculty of Chemistry and Chemical Engineering, University of Maribor, Smetanova 17, 2000 Maribor, Slovenia
[2]CINS d.o.o., Aljaževa 15, 2000 Maribor, Slovenia

[*]e-mail: masa.knez@um.si

Abstract

A "green" revolution as a part of necessary sustainable development, use also high pressure as a working tool. The main impetus for this conversion is driven by a concern to the environment to reduce the usage of solvents and energy and to attain natural products with completely new characteristics. The aim of this research was to present the possibility of utilization of compounds present in natural materials in the sense of economic importance in the food industry and their beneficial health effects.

Using high pressure as a processing tool can overcome the legal limitations for solvent residues and restrictions on the use of conventional solvents in chemical processes. Additionally, particulate products can also be achieved by means of supercritical fluid (SCF) processing. This contribution will give a limited overview of applications of subcritical fluid and SCF and will present features compared with conventional production methods. Considering these qualities, SCFs could certainly be applied as a replacement for conventional solvents in extractive and non-extractive processes, as a nontoxic, inexpensive, non-flammable, and non-polluting solvent. Many applications, such as high pressure sterilization, jet-cutting, thin film deposition for microelectronics, and the separation of value-added products from fermentation broths in the biotechnology field, have been developed on an industrial scale to produce marketable food products. This comes from the unique thermo-dynamic and fluid-dynamic properties of different gasses used as dense fluids, e.g. sub- or super-critical fluids.

We could summarize that extraction of substances from solids or liquids and their integrated formulation in products with specific properties form one of the very promising applications of SCFs, and several laboratory-scale as well as industrial-scale applications, including fundamental data for design of high pressure processes, will be presented.

***Key words**: Extraction, Supercritical fluids, Formulations, Phase equilibria, Food processing.*

RESEARCH ON COMPARISON BETWEEN TWO SUSTAINABLE EXTRACTION METHODS APPLIED TO SEA BUCKTHORN LEAVES

Mona Elena Popa[1*], Violeta Alexandra Ion[2], Andreea Barbu[2], Oana-Crina Bujor[2], Elisabeta Elena Popa[1], Paul Alexandru Popescu[1], Mihaela Draghici[1], Amalia Carmen Mitelut[1]

[1]Faculty of Biotechnology, University of Agronomic Sciences and Veterinary Medicine from Bucharest, Marasti 59, 011464 Bucharest, Romania
[2]Research Center for Studies of Food Quality and Agricultural Products, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Marasti 59, 011464 Bucharest, Romania

[*]e-mail: monapopa@agral.usamv.ro

Abstract

The extraction technique named accelerated solvent extraction - ASE (also known as pressurized fluid extraction - PFE, or pressurized liquid extraction - PLE) is the method what was first described in 1995. In the ASE system, the extraction process is carried out at temperatures exceeding the boiling point of a solvent what implies that the pressure inside the extraction cell must be kept high to maintain the solvent in a liquid state. Both temperature and pressure influence the process efficiency. Ultrasound represents one of the key-technologies for achieving the objective of sustainable "green" chemistry and extraction. Ultrasound is well known to have a significant effect on the rate of various processes in the chemical and food industry. Using ultrasound, full extractions can now be completed in minutes with high reproducibility, reducing the consumption of solvent, simplifying manipulation and work-up or giving higher purity of the final product. The aim of this study was to make a comparison between ASE and US assisted extraction through characterization of obtained extracts in terms of antioxidant activity and total phenolic content.

The extraction of powder samples from sea buckthorn leaves was conducted by the ASE using a Dionex ASE 350 system equipped with a solvent controller (Dionex, Sunnyvale, CA, USA). About 0.2 g of sample was mixed with 0.04 g of diatomaceous earth and then placed into 10 mL stainless-steel extraction cells that contained a glass filter at the bottom of each cell. The extraction conditions were: pressure (1500 psi), rinsing volume (50%), nitrogen purge time (90 s), and heat time (5 min). Regarding the ultrasound (US) assisted extraction, a Biobase

UC-40A system was used. 0.2 g of sample was mixed with 20 mL ethanol and then placed into 50 mL Falcon conical tubes. The set extraction volume (20 mL) for both methods was stored at - 80 ^{0}C in the dark prior to analysis. Eight experimental conditions were used for both methods of extraction, varying the temperature (40 ^{0}C/60 ^{0}C), time (5/15 min.) and ethanol concentration (50%/70%). For the obtained extracts, total phenolic content (Folin Ciocalteu method) and antioxidant activity (DPPH (2,2-diphenyl- 1-picrylhydrazyl) radical scavenging test) were determined.

The highest value of antioxidant activity was obtained for extractions performed at 60 ^{0}C. For the total phenolic content, the highest values were obtained for ASE extraction method. The best performance of the extraction methods in term of quality of extracts were in two cases: 40 ^{0}C; 15min.; 50% and 60 ^{0}C; 15min; 50%. Overall, for antioxidant activity the values obtained by both extraction methods are similar.

Obtained extracts presented similar properties in terms of antioxidant activity and total phenolic content, concluding that either of the two extraction methods could be further used in experimental research, obtaining extracts with similar characteristics.

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***Key words**: Extraction methods, Accelerated solvent extraction, Ultrasound assisted extraction*.

INTENSIFYING BREAD AROMA THROUGH SOURDOUGH FERMENTATION PROCESS - A REVIEW

Şerban Eugen Cucu[1,2*], Gabriel Sorin Mustățea[1], Elena Mirela Cucu[1], Mona Elena Popa[2]

[1]National Research and Development Institute for Food Bioresources, Ancuța Băneasa 5, 020323 Bucharest, Romania
[2]Faculty of Biotechnology, University of Agronomic Sciences and Veterinary Medicine from Bucharest, Marasti 59, 011464 Bucharest, Romania

[*]e-mail: serban2serban@yahoo.com

Abstract

Nowadays, consumer appraisement has increased regarding sourdough bread for the reason that they appreciate the stronger aroma of sourdough bread compared to yeast bread and naturally for the greater information on its nutritional attributes. Technological support, like natural antimicrobial composites or the use of sourdough, can be a very practical instrument to raise the flavor and the quality of bread, but also shelf life of bread. The aim of this paper is to review the literature for various state-of-the-art technological solutions to improve bread flavor and nutritional quality.

The resources for this work were find electronically on Web of Science database, among research articles and reviews published in the last decades. In the bread-making process, the use of sourdough still plays an important role and has a long tradition. The sourdough is generally produced by spontaneous fermentation of a mixture of flour, water and salt; however, in recent years there is a more and more use of controlled fermentation process and specific cultures. Used in baking process, sourdough with its ability to extend the shelf life of bread and to improve the quality and has been widely studied, and special interest is shown in the impact of processing conditions on the microbial quality of par-baked wheat and sourdough breads. All aspects of bread quality (shelf life, texture, flavor, and nutritional quality) are determined by the use of sourdough in the preparation of bread.

It is important to say that the aroma of the bread aside from the type of cereal flour, the baking conditions and the characteristics of the dough preparation is also determined by the metabolism of the fermenting microorganisms.

***Key words**: Bread, Phytic acid, Sourdough, Whole-wheat bread.*

EFFECT OF MILKING METHOD ON MILK QUALITY, YIELD AND MILKING TIME OF BUFFALOES

Mentor Thaqi[1*], Njazi Bytyqi[2]

[1]Department of plant and livestock production, Faculty of Agriculture and Veterinary, University of Pristina, Boulevard "Bill Clinton" nn, 10000, Pristina, Kosovo
[2]Department of Agroeconomy, Faculty of Agriculture and Veterinary, University of Prishtina, Boulevard "Bill Clinton" nn, 10000 Pristina, Kosovo

[*]e-mail: mentorth@hotmail.com

Abstract

The buffalo live body weight varies from 500 to 700 kg per mature animal. Buffalo population in Kosovo is around 400 heads in total and they belong mainly to Mediterranean type. Buffalo milk production is characterized by low yield (for the period about 240 days milk production is around 950 kg/lactation). There is a small number of households in Kosovo with two to five buffalo heads, with similar housing and feeding conditions. Despite an extremely stable profit realized through sales of dairy (mainly butter and cheese), the overall profitability of these farms is extremely low. Buffalo is generally hand milked (HM) twice a day in the morning and evening.

A twenty day assessment was performed to evaluate the effects of bucket machine and hand milking on milk yield, milking time and milk quality (total bacterial and somatic cell count) of buffaloes on a farm in Kosovo. A standard A4 (ICAR) sampling method was used. BactoScan device (Foss) was used to determine the bacterial load in milk (CFU), while Fossomatic Minor (Foss) was used to determine somatic cell count (SCC). The obtained results are compared with Administrative Instruction MA no. 20/2006 on standards for the quality of fresh milk. Statistical analyses of the data were done by using JMP- starter packet, of SAS program. Minitab 18 Software is used to perform a two sample T-test.

The average milk yield was 8.45 litters by machine milking (MM) compared to hand milking - 7.5 litter, and milking time was 5.4 min by machine milking, while 9.6 min. for hand milked buffalo. The average milk yield was 8.45 kg for the machine milking compared to 7.5 kg for hand milking. Milking time was 5.4 min by machine milking compared to 9.6 min for hand milking. Total count of bacteria was 47.200 CFU/mL for hand milking compared to 42.400 CFU/mL for machine

milking. Somatic cell count was 75.000 SCC/mL for hand milking compared to 69.000 SCC/mL for machine milking

Research show that buffalo machine milking has been much more efficient than hand milking, as it has resulted in higher amounts of milk, shorter milking time, and smaller number of bacteria and somatic cells. Results from this work demonstrated that machine milking of buffalo herds will increase milk yield of buffaloes.

***Key words**: Buffalo, Hand milking, Machine milking, Bacteria count, Somatic cell count.*

THE INFLUENCE OF POT AND GROUND PRODUCTION ON GROWTH AND YIELD OF HIGH BUSH BLUEBERRY PLANT

Mentor Thaqi[1*], Lyra Hoxha[1], Njazi Bytyqi[2]

[1]Department of plant and livestock production, Faculty of Agriculture and Veterinary, University of Pristina, Boulevard "Bill Clinton" nn, 10000, Prishtina, Kosovo
[2]Department of Agroeconomy, Faculty of Agriculture and Veterinary, University of Prishtina, Boulevard "Bill Clinton" nn, 10000 Pristina, Kosovo

[*]e-mail: mentorth@hotmail.com

Abstract

Blueberries can be planted in the ground or in pots. A big benefit of growing them in pots is the easily control of soil conditions, mainly soil's acidity levels. In this study, we compared the growth, development, yield and qualities of pot grown compared to ground grown blueberries.

Large pots were used for blueberry production and stable substrates to maintain plants in the same pot for a long period in order to increase yield, reduce labor and costs. A trial was set up to study the influence of production of blueberries on pot and ground on growth and yield of Duke highbush blueberry plant. The number of plants was 5,000 per hectare on ground, compared to 8,300 plants per hectare on pot. Statistical method for gained data analysis used was SPSS paired sample t-test.

The experiment showed that plants on ground ripened over 95% two weeks earlier compared to plants on pot. Planting site had no effect on crown width between rows ($t(5) = 0.34$; $p > 0.05$) and crown width in row ($t(5) = 0.7$; $p > 0.05$). However, the planting site had a significant impact on crown height ($t(5) = 4.07$; $p < 0.05$). Planting site had no effect on leaf width ($t(5) = 0.24$, $p > 0.05$), on leaf index ($t(5) = 0.08$, $p > 0.05$) on the total weight of leaves ($t(5)) = 1.05$, $p > 0.05$), but had a significant effect on leaf length ($t(5) = 5.13$, $p < 0.05$) and on leaf area in cm^2 ($t(5) = 4.33$, $p < 0.05$). The number of fruits on ground was 1,099 compared to 3,308 fruits on pot, resulting on higher number of fruits per blueberry seedling on pots ($t(5) = 36.99$; $p < 0.05$). Yield per plant and per hectare was recorded, where the yield per plants on ground was 1, 57 kg compared 4, 96 kg per plant on pots. The yield per ha was 7,855 kg on ground compared to very significantly higher yield of 41,179 kg on pots.

Result showed that planting method, respectively planting in pots, is a key factor affecting the growth and yield of blueberries.

Key words*: Blueberry plant, Production on pot and ground, Planting site, Fruits per plant; Yield per plant and per hectare.*

EFFECT OF CROP MANAGEMENT ON FATTY ACID PROFILE IN SUNFLOWER

Igor Balalić[1*], Vladimir Miklič[1], Jovan Crnobarac[2], Velimir Radić[1]

[1]Institute of Field and Vegetable Crops,
Maksima Gorkog 30, 21000 Novi Sad, Serbia
[2]Faculty of Agriculture, University of Novi Sad,
Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia

[*]e-mail: igor.balalic@nsseme.com

Abstract

Fatty acid composition is the main determinant of oil quality. Genotype (G), environment (E) and its interaction (G × E) determine oil fatty acid composition. This research was conducted to evaluate changes in the fatty acid composition in sunflower hybrids depending on genotype and different crop densities.

Five confectionery hybrids (NS Goliat, NS Slatki, NS Gricko, Vranac, and Cepko) and one for birds feeding (NS-H-6485) were sown in six crop densities from 20,000 - 70,000 plants per hectare (increasing step of 10,000) in a randomized complete block design with four replications. Fatty acid composition was determined by gas chromatography. Data were statistically analyzed using ANOVA in the STATISTICA 12.0 package computer program (StatSoft). Least significance difference (LSD) test at $P \leq 0.05$ and $P \leq 0.01$ was used to compare the differences among treatment means.

For palmitic, stearic and oleic acid content highly significant differences were stated for hybrids and crop densities. Palmitic acid (C16:0) content varied from 4.4% (Cepko) to 4.98% (NS Slatki). The lowest palmitic acid content (4.62%) was in the lowest crop density (20,000), and the highest (4.86%) in the highest density (70,000). Cepko had significantly lowest stearic acid (C18:0) content (3.63%) and Vranac showed the highest value (5.22%). Crop density significantly influenced the content of stearic acid, showing highest value (4.56%) in the lowest density (20,000). The stearic acid content (4.28%) decreased until highest density (70,000). Significantly highest oleic acid (C18:1) content was found in Cepko (36.55%), and the significantly lowest in NS Goliat (30.56%). With the increase in density the oleic acid content decreased. The highest significant oleic acid content (35.72%) was found at the lowest density (20000) and the lowest (33.71%) at the highest density (70,000).

Our results indicate that fatty acid composition of sunflower oil show diversity depending on the genotype and the crop density.

Key words: *Crop density, Hybrid, Fatty acids, Sunflower.*

COMMUNITY STRUCTURE OF THE EPT GROUP (*INSECTA*) IN THE MAIN ALBANIAN RIVERS

Bledar Pepa[1*], Anila Paparisto[2], Hajdar Kicaj[1]

**[1]Department of Biology,
Faculty of Technical and Natural Sciences, "Ismail Qemali" Vlora University,
Kosovo nn, 9404 Vlora, Albania
[2]Department of Biology, Faculty of Natural Sciences,
Tirana University, Boulevard Zogu I 1, 1001, Tirana, Albania**

[*]e-mail: bled_pepa@hotmail.com

Abstract

In recent decades, monitoring of benthic fauna in Albanian rivers is an important environmental component at a time when their flow and watershed area have been greatly modified by anthropogenic influences. Given the importance of these organisms in aquatic bio-ecological studies defined in the EU (European Union) directive, this study completes the taxonomic panorama of studies in the main rivers of our country.

This research was conducted in a period from 2007 to 2019 aimed to give an overall assessment of the EPT group (*Ephemeroptera-Plecoptera-Trichoptera*) of benthic macro-invertebrates distributed in the seven rivers of Albania, namely: Drin, Mat, Shkumbin, Osum, Devoll, Drinos and the Shushica-Vlora River. The collection of the benthic macro invertebrates was realized by using the Kick-net sampling methodology (rectangular net, 500 micron mesh). A total of 33 stations with different ecological and geophysical typologies have been selected in all rivers. Using the Kick-net sampling a total of 8154 specimens' representatives of 28 families were collected.

Caddisflies, or *Trichoptera* order, were dominant both in number of species (8 species) and in abundance (74.3% of all individuals). Meanwhile Mayflies (*Ephemeroptera*) and Stoneflies (*Plecoptera*) contributed much less to species richness and abundance. The presence of 20 EPT families of macro-invertebrates in the the Shushica River study testifies the highest degree of biodiversity. The river with the lowest diversity of EPT species represents (8 families) is the Drini River. Representatives of 28 insect families collected with Kick-net were: *Ephemerellidae*, *Baetidae*, *Heptagenidae*, *Caenidae*, *Oligoneuridae*, *Potamanthidae*, *Ephemeridae*, *Isonychidae*, *Leptophlebiida*e, *Siphlonuridae*, *Leuctridae*, *Perlodidae*, *Perlidae*, *Chloroperlidae*, *Nemuridae*, *Capniidae*, *Brachycentridae*, *Hydropsychidae*,

Hydroptilidae, *Glossosomatidae*, *Philopotamidae*, *Rhyacophilidae*, *Beraeidae*, *Leptoceridae*, *Polycentropidae*, *Helicopsychidae*, *Sericostomatidae*, and *Goeridae*.

We can conclude that taxonomic panorama of the main rivers of our country is represented by small differences of taxon diversity between the rivers in the northern, middle and southern part of our country. The changes are not only due to the typological conditions of the rivers but also due to the influence of the anthropogenic factor mainly in the urban area.

***Key words**: EPT, River, Benthic, Macroinvertebrates.*

THE EFFECT OF ADDING EGG WHITE POWDER ON LIQUID EGG PRODUCTS PROPERTIES

Majd Elayan[1*], Csaba Németh[2], Munkhnasan Enkhbold[1], Adrienn Tóth[1]

[1]Department of Refrigeration and Livestock Products Technology, MATE University, Ménesi út 43-45, 1118 Budapest, Hungary
[2]Capriovus Ltd., Dunasor, 073/72, 2317 Szigetcsép Szigetcsep, Hungary

[*]e-mail: Elayan.majd10@gmail.com

Abstract

Eggs are well known for their good amount of essential micro and macro nutrients such as minerals and vitamins that are needed to support cell growth and replacement. Due to an increase in egg demand a significant growth in egg and egg products utilization has occurred across the globe. The need for new egg products with diverse applications combined with the increase in egg consumption created the need for egg product manufacturing in the late 1980s. The high amount of protein content in liquid eggs and egg white products allows them to be considered as functional food. Pasteurizing egg products is important for product microbiological content. This study is designed to evaluate the physical and chemical properties of liquid whole egg (LWE) and liquid egg white (LEW) after fortifying both products with powdered egg white protein and heat treat products at different temperatures.

LWE and LEW were fortified with white powdered egg protein with different percentages 0, 3, 5 and 10%, and heat treated at three different temperatures: 60, 65, and 70 ^{0}C for LWE and 50, 55, and 60 ^{0}C for LEW for 15 minutes, and then cooled down immediately. pH, color and viscosity were measured to evaluate the effect. The pH was measured at 4 ^{0}C using a portable digital pH meter (206-pH2, Testo SE & Co. KGaA, Titisee-Neustadt, Germany). Tristimulus color measurements were performed with a Konica-Minolta CR-410 chroma-meter (Konica Minolta Sensing Inc., Osaka, Japan) at 4 ^{0}C. Viscosity measurement was performed by MCR 92 rheometer (Anton Paar, Les Ulis, France) at 15 ^{0}C.

The L value of all LEW decreased with the increase of the added protein and temperature, on the other hand it was the opposite for LWE. All samples of LEW showed an increase in A values at all temperatures, however that does not apply to the 3% concentration at all temperatures and 5% at temperature 60 which showed a decrease in A values in comparison to control. On the other hand the A value

was decreased in LWE with the increase of both concentration and temperature. B values were increasing with the increase in concentrations and temperatures in comparison with the control for LEW, meanwhile it were decreasing with the increase in concentrations and temperatures in comparison with the control in LWE As for pH values it decreased with the increase of protein percentages and temperature. Viscosity was significantly affected and this could be due to protein coagulation while heating.

Fortifying egg products with egg protein will affect the pH, color, and viscosity in all four liquid egg products. The importance of this research underlines the fact that a new egg product fortified with extra egg protein for better nutritional value and functional properties can be created.

***Key words**: Liquid egg products, Liquid whole eggs, Liquid egg white, Heat treatment.*

MANAGEMENT OF MARINE-WATER RESOURCES THROUGH EU DIRECTIVES IMPLEMENTATION AND CHALLENGES AHEAD FOR ALBANIA

Erjola Keçi[1*]

[1]Faculty of Professional Studies, "Aleksander Moisiu" University, Currilave nn, 2001 Durres, Albania

[*]e-mail: erjolakeci@yahoo.it

Abstract

Marine management is focused on discrete aspects of anthropogenic pressures or ecosystem components: nutrients are managed by the nitrates and urban wastewater treatment directives, coastal eutrophication by the Water Framework Directive, commercial fishing by the Common Fisheries Policy (CFP), and conservation by the Habitats Directive. While these directives all address management of specialized elements of the marine system, Directive 2008/56/EC (the Marine Strategy Framework Directive - MSFD) seeks to sustainably manage European seas in a holistic manner by establishing common principles on the basis of which Member States have to draw up their own strategies, in cooperation with other Member States and third countries, to achieve a good ecological status in the marine waters for which they are responsible. The aim of this research is to review and discusses the present situation with regard to the Directive implementation in Albania and its rationale behind.

MSFD is remarkable because it requires the implementation of an 'ecosystem approach', which is a management methodology considering the entire ecosystem, including its human component. Implementation of MFD is proving to be difficult because this is a comprehensive Directive covering many diverse subjects linked to various fields of science and disparate commercial sectors) and provides some basic findings and gaps identified, their impact and respective recommendations. There are many implementation challenges because the rationale behind the MSFD is to manage the marine ecosystem to a healthy and productive state by harmonizing existing policies and filling gaps left by other pieces of legislation. The implementation of the MSFD in Albania is at the initial steps; the main structure and the establishment of the competent authorities in charge of the drafting of marine environment strategy have been appointed. Albania needs to structure and strengthen its capacities for the water management and implementation of the EU water acquis. There are no management actions for coastal waters management according to WFD requirements.

As main conclusion of this analyses is the need of a number of provisions to be included into Albanian legal framework in order to transpose the Water Management Directives such as: Provisions which sets out the area of the sea and the sea bed to which the Regulation applies; provisions that imposes a duty on the Ministry/Council of Ministers to develop a marine strategy; Regulations to set out how the Ministry/Council of Ministers, other relevant Ministries, and the administration (also on local and regional level) will work together to develop and implement the marine strategy. Provisions that place a duty on public authorities, as well as Ministers, to have regard to the marine strategy in exercising their functions; provisions that require the development of the five elements of the marine strategy and set a deadline for doing so, etc. In one word, there are lot of coastal waters management actions for according to WFD requirements to be done.

***Key words**: Marine water quality, EU Marine Strategy Framework Directive, EU Water Framework Directive, Implementation of the EU acquis, Fisheries, Consumer safety.*

EVALUATION OF SHELF-LIFE OF EGG WHITE BASED FRUIT FLAVOURED DRINKS

Adrienn Varga-Tóth[1*], Csaba Németh[2], Majd Elayan[1], Munkhnasan Enkhbold[1], Attila Nagy[2], Olívia Tóth[1], László Friedrich[1]

[1]Department of Livestock and Food Preservation Technology, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, Ménesi 43 - 45, 1118 Budapest, Hungary
[2]Capriovus Ltd., Dunasor 073/72, 2317 Szigetcsép, Hungary

[*]e-mail: toth.adrienn@uni-mate.hu

Abstract

Today's consumers follow new, alternative diets which are often free from dairy products. In this aspect, a current challenge for food industry is to replace the functionality (like probiotic effects) and their techno functional properties (like foaming ability) of dairy products. In our study the shelf-life of egg white based, fruit flavored dairy alternative drinks are investigated. The aim was to develop fruit flavoured egg white based drinks with a shelf-life of at least 21 days at cooled temperature.

The egg white drink and 100% fruit juices were mixed in a ratio of 50 to 50%. Three different fruit juices were examined: apple, orange, and pineapple. From all flavouring 3 different products were prepared: one with no additives, one with inulin (as a prebiotic compound, 2 m/m%), and one with peptidase beef collagen (as a popular protein source, 2m/m%). After heat treatment (70 ^{0}C, 3 hours) a 28-day long shelf-life experiment between 2 - 5 ^{0}C was carried out. The mesophilic aerobic cell count (MSZ ISO 4833:2003), pH-value, colour attributes (CIE Lab: L* a* & b*), and vitamin C content (MSZ EN 14130:2003) of the samples were investigated.

Our results showed that in the samples only a slightly microbiological cell count growth was determined before day 21, stored at 1 - 3 ^{0}C. The pH-value of samples was not influenced by the storage time. The color of the drinks was highly influenced by the specific fruits used, but not by inulin or collagen addition. A slightly decrease in vitamin C concentration was observed directly after heat treatment and between day 21 and 28.

Concluding our results, the examined products were shelf-stable for 21 day in a cooled temperature between 0.5 and 3 ^{0}C with a great vitamin C concentration and with potential several health prevention effects.

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***Key words**: Egg white, Dairy replacement, Functional food.*

INFLUENCE OF AGE ON THE LEVEL OF PRODUCTIVE TRAITS IN THRACIAN MERINO EWES

Stanimira Slavova[1*], Petya Slavova[1], Nevyana Stancheva[2]

[1]Agricultural Institute, Radnevo road, 6000 Stara Zagora, Bulgaria
[2]Agricultural Institute, 3 Simeon Veliki Boul., 9700 Shumen, Bulgaria

[*]e-mail: mirka_sl@abv.bg

Abstract

In sheep, development of adequate selection criteria requires to establish the mean values of productive (and functional) traits and to study the effect of various factors on animal performance. This research focused on the influence of age on the breeding traits in Thracian merino ewes.

Study was conducted at the experimental sheep farm of the Agricultural Institute - Stara Zagora, Bulgaria, and included 210 ewes. Live weight (at birth, weaning, at 9 and 18 months, at 2.5, 3.5, 4.5 and 5.5 years), prolificacy (number of lambs born per ewe from I to IV lambing), and wool production (staple length at 18 months, 2.5, 3.5, 4.5 and 5.5 years, wool production and pure fiber at 18 months and 2.5 years) were investigated. Data for the level of the studied traits were taken from own records on the animal performance in the farm according to the Instruction of the breeding association. The influence of age on the number of lambs born per ewe, live weight and wool traits were established using program Statistica for Windows.

It was found that live weight of ewes was the highest at the age of 5.5 years - 60.507 kg. Its difference to the previous ages was mathematically proved with different level of significance ($p < 0.01$; $p < 0.001$; $p < 0.05$). The prolificacy level was established the highest at the 3rd lambing - 1.3 lambs. The difference between 1st and 2nd lambing and 1st and 3rd lambing was highly significant (<0,001) and between the 2nd and 3rd lambing proved with a medium level of significance (< 0.01). Wool production was the highest at 3.5 years of age - 6.955 kg, as the difference between ages was statistically proven ($p < 0.01$; $p < 0.001$; $p < 0.05$).

The obtained results indicated that the Thracian merino ewes, included in the study, reach an optimal level of productive performance at the age of 3.5 years, when body development is fully completed.

***Key words**: Thracian merino ewes, Age, Live weight, Fertility, Wool production.*

THE HIGH LEVELS GAMMA IRRADIATION ACTIVATION ON *PORTULACA OLERACEA* EXTRACT

Galina Nikolova[1], Veselin Ivanov[2*], Svetlana Momchilova[3], Petko Denev[4], Yanka Karamalakova[1]

[1]Department Chemistry and Biochemistry, Medical Faculty, Trakia University, Armeiska 11, 6000 Stara Zagora, Bulgaria
[2]Department of Social Medicine, Health Management and Disaster Medicine, Medical Faculty, Trakia University, Armeiska 11, 6000 Stara Zagora, Bulgaria
[3]Department of Lipid Chemistry, Institute of Organic Chemistry with Centre of Phytochemistry, BAS, Acad. Georgi Bonchev 9, 1113 Sofia, Bulgaria
[4]Laboratory of Biologically Active Substances, Institute of Organic Chemistry with Centre of Phytochemistry, Ruski Boulevard 139, 4000Plovdiv, Bulgaria

[*]e-mail: veskoasenov@abv.bg

Abstract

Portulaca oleracea (POE) is an annual green herb, containing omega-3 fatty acids, gallotannins, kaempferol, quercetin, apigenin, and glutathione. The stems and leaves with high-energy values (303.9 Kcal/100g) and minerals (K, Na, Ca, Fe, Zn) are containing proteins, lipid and fibers. POE phytochemical composition is responsible for its biological effects, e.g., antioxidative, antiseptic, antibacterial, anti-inflammatory, antiasthma, and antiradiation (till 9 kGy) effects. Studies show that POE have inhibitory effects on lipopolysaccharide (LPS), interferon-γ (IFN-γ) induced NO production and against oxidative stressors as 9 kGy radiation. In recent years, food irradiation has been used to protect against oxidative toxicity, and this methodology is internationally recognized for effective long-term storage (EU Directive 1999/3/EN 1787). The present study reported radiation-protective properties of POE from Bulgarian flora, against 0-10-25 kGy radiation.

The dried POE samples collected from Plovdiv region were irradiated at 60Co-dosimeter (BioMax, at 8200 Ci), powdered and extracted by 30% ethanol solvent (v/v) to 88%purity. Electron paramagnetic resonance (EPR)-X-band spectrometer e-scan (Bruker ER 116 DS) as promising techniques for food-stuffs identification, antioxidant capacity and regulatory requirements was used scavenging the free radicals. EPR measurements of all tested samples were conducted at room temperature (18 - 23C^0) on X-band EMXmicro, spectrometer Bruker, Germany,

equipped with standard Resonator. Quartz capillaries were used as sample tubes. The sample tube was sealed and placed in a standard EPR quartz tube (i.d. 3 mm) which was fixed inside the EPR cavity. All EPR experiments were carried out in triplicate and repeated. Spectral processing was identified by Win EPR and Sim-Fonia software. The ability of POE to scavenge *in vitro* short-lived radicals the spin-traps 5-tert-Butoxycarbonyl-5-methyl-1-pyrroline-N-oxide (BMPO•), 4-hydroxy-2,2,6,6-tetramethylpiperidine-N-oxyl (TEMPOL), and 2,2-diphenyl-1-picrylhydrazyl (DPPH•) was expressed. The kinetics of 0-10-25 kGy radiation-induced EPR signals was studied for a period of 5th day-3 and 6 months post-storage. Gained data were analyzed by Statistica 8.

In the 0 kGy POE ethanol solution, a single, symmetrical signal is recorded, characterized by g-factor 2.0023. The irradiated ethanol POE are characterized by an increased g-factor at 10 kGy (g = 2.0034) and 25 kGy (g = 2.0036). It should be point out that stable radical structures were registered for the mentioned periods (period of 5th day-3 and 6 months post-storage) for 10 kGy irradiation. In the case of the adduct formations, the signal intensity increases for POE after 10 kGy (till to 3th month). The high dose radiation (25 kGy) statistically significantly decreased ROS-adducts scavenging.

It is obvious that POE extract irradiated at 25 kGy shows prooxidant properties in the Fenton system and in addition the extract exhibits stronger prooxidant activity compared to non-irradiated and irradiated at 10 kGy. This discovery is not surprising, because a number of studies have shown an acceleration of the Fenton reaction rate using flavonoid compounds.

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***Key words**: Portulaca oleracea, Gamma irradiation, Activation.*

EMPLOYMENT OF RESPONSE SURFACE METHODOLOGY IN OPTIMIZING MICROWAVE-ASSISTED EXTRACTION OF BIOACTIVE COMPOUNDS FROM *TEUCRIUM MONTANUM* AND *GLECHOMA HEDERACEA*

Ana Mandura Jarić[1], Danijela Šeremet[1], Aleksandra Vojvodić Cebin[1], Draženka Komes[1*]

[1]Faculty of Food Technology and Biotechnology, University of Zagreb, Pierotti 6, 10000 Zagreb, Croatia

[*]e-mail: dkomes@pbf.hr

Abstract

Bioactive diversity and the economic accessibility of plant species have been the main factors for their integration into human diet and lifestyle since ancient times. In the last decade, the popularization of a healthy lifestyle along with increased consumption of phytochemicals from sources of natural origin has notably supported the trend of developing functional food products to prevent various health diseases. Arising from the presence of polyphenols as noteworthy carriers of bioactive potential, *T. montanum* and *G. hederacea* from the *Lamiaceae* family represent insufficiently explored aromatic plants. In the scope of integrating sustainable and "clean" solutions in food processing, multiple response modeling of microwave-assisted extraction (MAE) of bioactive compounds from *T. montanum* and *G. hederacea* was conducted.

Dried areal parts of *T. montanum* from Vučevica (county of Splitsko-Dalmatinska), and *G. hederacea* (Bilogora, county of Bjelovarsko- bilogorska) were extracted with water according to chosen variables - temperature (50, 70, and 90 ^{0}C), time (3, 6, and 9 min) and solid-to-solvent ratio (1 : 100, 1 : 40, and 1 : 25 g/mL). The influence of process parameters was monitored by response factors, i.e. total phenolic content (TPC) and antioxidant capacity applying 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid (ABTS) radical scavenging assay. Correlation between predicted and experimental values, as well as, the fit of statistical parameters for both plants implied the reliability of each proposed regression model.

Thus, a significant influence of temperature and the solid-to-solvent ratio on the final extraction yield was confirmed for both plants. For achieving maximum TPC and antioxidant capacity, optimum conditions and predicted results were defined as follows: 70 ^{0}C, 6.00 min., 1 : 40 g/mL for *T. montanum* (TPC: 696.34 mg GAE/L,

ABTS: 3.18 mmol TroloxE/L) and 90 ^{0}C, 8.84 mmol TroloxE/L, 1 : 25 g/mL for *G. hederacea* (TPC: 1468.37 mg GAE/L, ABTS: 7.43 mmol TroloxE/L).

This approach to extraction modeling has proven to be effective for defining the significant process variables and their interactions to maximize extraction yield and cost- effectiveness.

***Key words**: Teucrium montanum, Glechoma hederacea, Microwave- assisted extraction, Bioactive content, Response surface methodology.*

FOOD ANALYSIS, FOOD MICROBIOLOGY, CHEMISTRY, BIOCHEMISTRY, SENSORY AND INFORMATION TECHNOLOGY SCIENCES

III

EVALUATION OF PHYSICO-CHEMICAL PARAMETERS OF FRESH PASTA PREPARED WITH DIFFERENT RECIPES

Alketa Shehaj[1*], Lefter Muxhaj[1]

**[1]Department of Agricultural Food,
Faculty of Biotechnology and Food,
Agricultural University of Tirana, Paisi Vodica nn,
Koder-Kamez, 1029 Tirana, Albania**

[*]e-mail: ashehaj@ubt.edu.al

Abstract

Fresh pasta is a portion of incredibly delicious and nutritious food that can be cooked very fast and gives us an excellent meal to enjoy. There are a lot of varieties of different ingredients in fresh pasta and the purpose of this study is to evaluate physicochemical parameters in fresh pasta packaged in a modified atmosphere.

Nine commercial types of fresh pasta were purchased at different points of sale, dividing them into three different categories: simple, pasta with eggs and pasta with filling. The physical parameters measured in the samples were: water activity and moisture. The chemical parameters measured were: ash, protein and fat, which are responsible for the quality of the pasta and the nutritional value. All the measurements were made according to the: AACC 44-15A, AOAC 930.25, AACC 08-01, AACC 30-20, and AOAC 978.18 standard method for: moisture, protein, ash, fat and water activity determination respectively.

All the data that we evaluate showed that they were according to the label and also found that the water activity ranges from 0.95 - 0.97 in simple fresh pasta, from 0.95 - 0.96 in fresh pasta with eggs and 0.92 - 0.93 in fresh filled pasta. The moisture was found to be from 30 - 32.8% in fresh pasta, from 27.33 - 29.56 % in fresh pasta with eggs and 26.28 - 30.26% in filled fresh pasta. The ash was found to be higher in the filled pasta (2.98%) compared with the other samples. The level of protein was found higher in the fresh pasta with eggs, in comparison with the other samples where the protein varies from 16% in the simple pasta to 15.66% in the filled fresh pasta. The fat level was found to be higher in the filled pasta with 11% in comparison with the other samples where the values range from 2 - 2.3 % in pasta with eggs to 0.8 - 1.2% in simple pasta.

We recommend that additional measures should be done to evaluate the food safety, because of the high level of water activity found in fresh pasta.

***Key words**: Fresh pasta, Eggs, Filled pasta, Nutritional value, Protein, Fat.*

GOAT WHEY-BASED FERMENTED BEVERAGE: INFLUENCE OF FERMENTATION FACTORS ON OVERALL SENSORIAL ACCEPTABILITY

Sandra Stamenković Stojanović[1], Ivana Karabegović[1], Bojana Danilović[1*], Stojan Mančić[1], Nada Nikolić[1], Miodrag Lazić[1]

[1]Faculty of Technology, University of Niš, Bulevar Oslobodjenja 124, 16000 Leskovac, Serbia

[*]e-mail: bojana_d@yahoo.com

Abstract

Milk whey is formed as a by-product of the technological process of cheese production. Even though it contains high levels of many important nutritive compounds, whey has not been widely accepted by consumers because of its unappealing taste and texture. Whey fermentation could improve its sensory properties and result in functional beverages with appealing characteristics and potential health beneficial effects. Therefore, this work aimed to develop a goat whey-based beverage fermented with kefir and to examine the influence of fermentation temperature and inoculum size on the overall sensorial acceptability of the product.

Goat whey was fermented with kefir (inoculum size: 0.35 - 10%) at different temperatures (18 - 30 ^{0}C). Response surface methodology (RSM) along with the central composite design was used to estimate the linear and combined effect of the chosen factors. The sensory profile of the samples was evaluated by the panel of 15 assessors. Mean values of overall acceptability, measured on a 9-point hedonic scale, were used as responses for optimization. The experimental data were fitted to a quadratic model.

The proposed model was significant according to a 95% confidence interval (F test and p-value) and had a good fitting. Both factors (temperature and inoculum size) had a positive influence on overall sensorial acceptability, which varied from 3.5 to 7.5. The best overall sensory acceptance of whey-based fermented beverage was obtained at 27.5 ^{0}C and 7% inoculum size. After that point, further increasing of the factor doesn't influence the response value significantly. A negative quadratic term of temperature and inoculum size suggests that for higher levels of these factors their effect becomes negative.

In conclusion, the RSM approach is a useful tool for optimization of process conditions in order to improve sensory characteristics of developed beverage, which is a basic precondition for consumer acceptance.

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***Key words**: Goat whey, Kefir, Response surface optimization, Sensory acceptance.*

ELECTROCHEMICAL DETERMINATION OF ANTIBIOTICS AT NANO-MODIFIED CARBON PASTE ELECTRODE

Nevila Broli[1,2*], Majlinda Vasjari[1,2], Sadik Cenolli[1,2], Loreta Vallja[1,2], Sonila Duka[1,2], Alma Shehu[1]

[1]Department of Chemistry, Faculty of Natural Science, University of Tirana, Bulevardi Zogu I nn, 1001 Tirana, Albania
[2]Nano-Alb, Academy of Sciences of Albania, Fan Noli 7, 1001 Tirana, Albania

[*]e-mail: nevila.broli@fshn.edu.al

Abstract

Antibiotics represent one of the most important therapeutic classes, with a huge impact on the human health. Their presence in the environment is contributing to the increase in the number of multi-resistant bacteria, with subsequent serious implications for human and animal health. In this context, the aim of this research was to investigate modified nanocomposite sensors that were developed for the voltammetric determination of β-lactam antibiotics.

Electrochemical behavior of penicillin G and amoxicillin at modified nanocomposite sensors was investigated using cyclic and square wave voltammetry in acetate buffer solution pH = 4. The effect of different modifiers (natural nanomaterial enriched with rutile, gold nanoparticles and surfactant trimethyl-tetradecylammonium chloride (TTDC)) at carbon paste electrode CPES response towards β-lactam antibiotics were estimated by comparing the electroanalytical signal of modified sensors with the bare electrode. Based on the anodic oxidation of penicillin G and amoxicillin at high potential, the enhanced peak current at modified sensors can be attributed to the catalytic effect of modifiers (rutile, surfactant TTDC, Au-np) incorporated into carbon paste electrode. Different experimental parameters such as frequency, amplitude, pH, etc., were optimized for voltammetric determination of penicillin G and amoxicillin. Gained data were analyzed by statistics program Origin 10.

Under optimized conditions, the best results regarding the sensitivity 0.66 μA/μM, correlation coefficient (R2 = 0.9915), repeatability (RSD 0.5%), and reproducibility (RSD 4.2%) were obtained using a carbon paste sensor modified with rutile and surfactant TTDC.

The proposed sensor was successfully used for the detection of penicillin G and amoxicillin in a real sample.

***Key words**: Carbon paste electrode, Nanocomposite, ß-lactam antibiotic, Square wave voltammetry.*

STUDY OF NEWLY LACTOBACILLI STRAINS TO BE USED AS DELIVERY SYSTEMS FOR METABIOTICS

Marina Pihurov[1*], Bogdan Păcularu-Burada[1], Mihaela Cotârleț[1], Mihaela-Aida Vasile[1], Leontina Grigore-Gurgu[1], Gabriela-Elena Bahrim[1]

[1]Faculty of Food Science and Engineering, Dunarea de Jos University of Galati, Domneasca Street 111, 800201 Galati, Romania

[*]e-mail: Marina.Pihurov@ugal.ro

Abstract

The lactic acid bacteria (LAB) strains produce metabiotics (prebiotics, probiotics, postbiotics and paraprobiotics) with *in vitro* and *in vivo* implications. The aim of this research was the isolation and screening of probiotic lactic acid bacteria strains with the ability to ferment unconventional substrates.

Unconventional flour-based substrates (red lentils, okara, sweet potato peels) were fermented by 32 LAB strains (15 strains isolated from kombucha, milk and water kefir grains) from the Microorganisms Collection (acronym: MIUG) of „Dunărea de Jos" University of Galați, Romania. The fermented products were analysed regarding the acidification and antioxidant potential. The antimicrobial activity against *Aspergillus niger* and *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus*, and *Listeria monocytogenes* was also evaluated. Additionally, 1 strain of *Lactiplantibacillus plantarum* (MIUG BL 21) and 3 strains of *Lacticaseibacillus paracasei* (MIUG BL 13, MIUG BL 80, MIUG BL 87) were screened for *in vitro* probiotic characteristics: resistance to low pH (2 and 3) and 0.3% (w/v) bile salts, survival after gastric digestion (90 min., pH = 2), hemolysin assay, antibiotic resistance, and adhesion to human epithelial intestinal cells HT-29. Moreover, the production of the lactate dehydrogenase (LDH) enzyme and nitric oxide was assessed.

The total titratable acidity varied between 14.61 - 16 mL NaOH 0.1 N, whereas, for the antioxidant potential were determined values between 0.97 - 2.37 mM TE/mL. The 4 strains possess antimicrobial activity. These strains' safety was demonstrated by no haemolytic activity. Furthermore, MIUG BL 21 strain showed susceptibility to some antibiotics. This strain showed survival rates of 80.21% (pH = 2), 96.81% (pH = 3), 91.54% at 0.3% (w/v) bile salts, and 54.88% after 90 min of gastric digestion. MIUG BL 21 adhered to HT-29 cells, and it was effective in destroying the membrane of these cells.

Newly isolated lactobacilli have the ability to ferment unconventional substrates and can be used as valuable vectors for metabiotics production. Future studies will be focused on *Lactiplantibacillus plantarum* MIUG BL 21 strain which demonstrated valuable probiotic properties.

***Key words**: Lactobacilli, Fermentation, Agri-food by-products biovalorisation, Metabiotics.*

FACTORIAL DESIGN AS A TOOL FOR THE ASSESSMENT OF MATRIX INTERFERENCE

Edlira Baraj[1], Kledi Xhaxhiu[2], Rajmonda Totoni[1], Besnik Baraj[2*]

[1]Department of Chemistry,
Faculty of Mathematical Engineering and Physical Engineering,
Politechnic University of Tirana, S. Delvina nn, 1001 Tirana, Albania
[2]Department of Chemistry, Faculty of Natural Sciences,
Tirana University, Boulevard Zogu I nn, 1001 Tirana, Albania

[*]e-mail: barajbesnik@gmail.com

Abstract

During the analysis of the biological, geological, brines and seawater samples, the matrix can have a significant effect on the quality of the obtained results. Due to matrix effect, the reduction or enhancement of the instrument signal is observed, causing severe interferences, likely occurring both types of proportional and constant systematic errors. While factorial design is used in order to optimize technological processes, methodology, yield of different chemicals, rarely is found used in analytical chemistry for the assessment of matrix interferences. Normally, the study of interference is performed by univariate method, which is not economic and do not take into account the interaction between factors. Our experience has shown that factorial design is a very useful tool to point out the influence of constituents of the matrix on the instrumental signal of the solutes. The assessing of the effects of Cu, Cd and exposure period on metallothionein production in gills of mussel by this technique has been studied as well. In this work are shown applications of factorial design on study of matrix interferences in seawater, brines and soil samples.

The techniques used for lithium determinations in seawater and brines samples were atomic absorption spectroscopy (AAS). In brines major constituents of matrix are Na, K, Ca and Sr. In soil, in which Al and Fe are abundantly found, the determination of fluoride by ion selective electrode (ISE) was applied. The ratio of the constituents of the prepared samples have been according the concentrations found in natural samples. Previously, some hundreds natural samples have been analyzed.

The regression coefficients found in the models demonstrated a significant interference of Fe, with an even more pronounced interference for Al during ISE determination of fluoride. While for lithium determination by AAS, Na and Ca

showed significant interferences. Following the application of standard addition method is found the source type of systematic error, constant or proportional.

From the factorial design plans, applied for hard matrix samples, it is concluded, that the regression coefficients found in the models, demonstrated significant interferences of studied factors, including their interaction terms. Clearly factorial design has shown significant advantages over classical method of studying interferences. Therefore, we strongly recommend it in the analysis of complicated samples.

***Key words**: Factorial design, Matrix interference, AAS, Ion selective electrode.*

OPPORTUNITIES OF ICT SUPPORT TO MANAGEMENT SYSTEMS IN FOOD COMPANIES IN THE BALKAN COUNTRIES

Igor Grujić[1*], Branko Latinović[1], Radoslav Grujić[2]

[1]Faculty of Information Technology, Paneuropean University Apeiron, Vojvode Pere Krece 13, 78102 Banja Luka, Bosnia and Herzegovina
[2]State College School of Medicine - Prijedor, Nikole Pašića 4A, 79000 Prijedor, Republic of Srpska, Bosnia and Herzegovina

[*]e-mail: igor.r.grujic@apeiron-edu.eu

Abstract

Food companies are increasingly realizing the importance of applying information and communication technologies (ICT) in their business. They use ICT to share information, apply innovation and technological development. However, they make little use of ICT in management systems (MS). The aim of this paper is to determine the possibility for food companies to apply ICT in their quality management systems (QMS), food safety management systems (FSMS), environmental management systems (EMS), occupational health and safety management systems (OHSMS) and other management systems.

The survey (by e-questionnaire) was conducted in four Balkan countries (Bosnia and Herzegovina, Serbia, Macedonia, and Montenegro) and covered 92 companies in the food sector. A special questionnaire was designed for this research. The obtained results were statistically processed using IBM SPSS Statistics 26. D

During the research, the authors identified areas where companies are already implementing ICT and their plans related to the integration of ICT into management systems (MS) in the coming period. The companies listed 12 areas in which they most often apply some type of ICT, and which are related to MS. They have developed and use several e-databases (e-database of employees - 86 companies, e-database of suppliers - 81, e-database of customers - 80, etc.). One third of the companies use the e-database of environmental protection aspects, the e-database of incidents and injuries at work, and the e-database of reports on laboratory analyzes. Some companies use specific software to manage individual production operations (32) and software to identify and trace products (36). The companies, which do not currently use e-databases, claim that they will establish them in the coming years (for a maximum of 5 years) and that they will use ICT in product safety risk assessment systems and environmental assessment systems. The surveyed companies are well aware of the benefits of applying ICT, and

they plan to develop and implement an integrated information system in their business, which will include management system support.

The survey showed that companies in the food sector in the 4 Balkan countries use different forms of ICT, to have clear plans for the development and implementation of ICT in their business, including management systems. On the other hand, most companies that currently use ICT on a small scale, plan to develop e-databases and specific software in the next 5 years, which will make their business easier, including QMS, FSMS, EMS and OHSMS. It is encouraging that most companies are working on the development of an integrated information system.

***Key words**: Management systems, ICT, Implementation plan, Food sector.*

CHARACTERIZATION AND DISTRIBUTION OF PHOSPHOROUS IN SEDIMENTS. CASE STUDY: KUNE VAINI LAGOON SYSTEM (LEZHA, ALBANIA)

Loreta Vallja[1*], Sonila Duka[1], Alma Shehu[1], Nevila Broli[1], Majlinda Vasjari[1]

[1]Department of Chemistry, Faculty of Natural Sciences, University of Tirana, Boulevard Zogu 1, 1001 Tirana, Albania

[*]e-mail: loreta.vallja@fshn.edu.al

Abstract

Phosphorus (P) is often the limiting nutrient for algal growth in lakes, estuarine and some other waters and may limit marine productivity. Exchange with bottom sediments place an important role in making P available for algae and contributes, therefore to eutrophication. Phosphorus is found in several forms other than orthophosphate, the most readily form consumed directly by algae. Because the forms of phosphorus are constantly changing and recycling, it is necessary to measure various forms of phosphorus besides the total content. The aim of the present study was to investigate the spatial and seasonal distribution of different forms of phosphorus in sediments as well as the evaluation of pollution levels of phosphorus from one of the most important lagoon complex in Albania.

Sediments of Kune Vain lagoon complex samples were collected at five stations of the Kune Vaini lagoon complex during September 2018 - March 2019, with a frequency of every two months. Samples were analyzed for their total phosphorus (P) concentration and P fractions such as: total, inorganic and organic P, and extractable NaOH and HCl acid (extractable, using a sequential extraction procedure (SMT protocol).

Obtained results showed that the total phosphorus in sediments was relatively high, ranged from 376.1 mg/kg to 515.6 mg/kg. This can be considered dangerous, because insoluble phosphorus forms undergo bacterial decomposition (mineralization) and the phosphorus could be transformed into the soluble orthophosphate to the water deteriorating the trophic state and the quality of the water. Inorganic phosphorus (IP) was the major constituent of the total extractable phosphorus, ranged from 164.9 to 427.6 mg/kg; apatite phosphorus (AP) was the dominant inorganic form, while non-apatite phosphorus (NAIP) was identified as the minor constituent. The average concentration of organic

phosphorus in sediments was 127.3 mg/kg (46.3 - 197 mg/kg), and the percentage of organic phosphorus (OP) to total phosphorus (TP) ranged from 20 to 43%. The concentration of the different forms of phosphorus in sediments followed the order TP > IP > AP > OP > NAIP while the variation between the sampling stations as well as between the sampling periods estimated as standard deviation ranged between 18.19 mg/kg (NAIP) to 69.8 mg/kg (IP).

The results indicate that sediments of Kune Vaini lagoon complex were slightly contaminated by phosphorus according to the applied indices. Distribution of phosphorus forms in sediments are affected by several factors, such as sediment type, organic matter content, mineralization rate, water depth, redox condition and Ca, Al and Fe content.

***Key words**: Phosphorus, Distribution, Sediments, Lagoon, Extraction.*

DETERMINATION OF THE AMOUNT OF VITAMIN C AND VITAMIN A IN THE CROP OF PEPPER IN PHYSIOLOGICAL AND TECHNICAL RIPENING

Mufail Salihaj[1*], Emine Daci Zejnullahi[1], Diellon Salihaj[2]

[1]Department of Food Sciences and Biotechnology, UBT- Higher Education Institution, Kalabria nn, 10000 Pristina, Kosovo
[2]Faculty of Biotechnical Science, University St Kliment Ohridski Bitola, 1 Maj bb, 7000 Bitola, Macedonia

[*]e-mail: mufail.salihaj@ubt-uni.net

Abstract

The main reason for consuming vegetables in general and spices in particular is the content of vitamin C (ascorbic acid) and vitamin A (retinol). Vitamins that are very necessary for every individual to have a normal metabolism. In practical terms, many consumers do not have enough knowledge in which stage of fruit ripening is contained the most concentrated amount of vitamin C and vitamin A. In this experiment we focused on determining the amount of vitamin C and vitamin A, at different stages of maturation in the culture of the peppers.

In this study we obtained two cultivars of the peppers during the vegetation of 2020. The traditional cultivars have been selected, which in Kosovo conditions have been planted for decades, such as the cultivar "Somborka" and the well-known cultivar "Duga bella", a long white pepper. Sampling started since the formation of the peeper fruits. Samples were taken every 7 days and continued until full physiological maturation for both cultivars. Such samples were sent to our laboratory. Vitamins C and A amounts at different stages of maturation in the culture of the peppers were determined by the ultraviolet-visible (UV-Vis) spectroscopy.

The amount of vitamin C has increased with the advancement of the phenological phase of maturation in both cultivars. From the first sample that represents the beginning of technical ripening of fruits where the lowest point of vitamin C is 237 mg/100 g fruit. In the full stage of physiological maturation we have a significant increase in the concentration of vitamin C where it reaches the maximum point at 379 mg/100 g. Also the results for vitamin A fluctuations showed that we have a direct proportion of vitamin A growth from the technical maturation stage to the physiological maturation stage. The increase continued from the first sample to the fourth sample with a much higher intensity compared to the increase of vitamin C.

Laboratory results have shown that the amount of these vitamins varies, depending on the stages of fruit ripening in both cultivars of the pepper that we did evidence.

***Key words**: Vitamins, Pepper, Physiological ripening, Technical ripening, Experiment.*

SOYBEAN PROTEIN HYDROLYSATES AS THE SOURCES OF BITTER-TASTING SEQUENTIAL MOTIFS

Anna Iwaniak[1*], Monika Hrynkiewicz[1], Justyna Bucholska[1], Piotr Minkiewicz[1], Małgorzata Darewicz[1]

[1]Food Biochemistry Department, Faculty of Food Science, University of Warmia and Mazury in Olsztyn, Pl. Cieszynski 1, 10-719 Olsztyn, Poland

[*]e-mail: ami@uwm.edu.pl

Abstract

Soybean proteins are known from their health-beneficial properties resulting from the presence of biologically active components like: isoflavones, saponins, protease inhibitors, and peptides. Peptides derived from soybean proteins are responsible for variety of activities, including bitter taste. Hence, sensory acceptance is a challenge for the scientists and technologists aiming the production of such functional foods. The aim of work was to analyze soybean proteins as the sources of bitter-tasting motifs.

In silico part of studies was based on simulation of hydrolysis of soybean proteins using bromelain, ficin, papain, and proteinase K. Hydrolysis was simulated using the BIOPEP-UWM "Enzyme(s) action" tool. Potentially released peptides (i.e. parent peptides) were analyzed for the presence of bitterness indicators using fragmentomic protocol. Then, in silico results were verified using reversed-phase HPLC (RP-HPLC) and liquid chromatography with tandem mass spectrometry (LC-MS-MS).

All released peptides contained bitter-tasting fragments, including bitterness indicators. However, results obtained using in silico and in vitro approaches were divergent. 10 potentially bitter parent peptides were in vitro identified in soybean protein concentrate hydrolysates while in silico hydrolysis enabled releasing 339 such sequences. The most effective enzymes to release peptides in silico were: bromelain > papain > ficin > proteinase K. In the laboratory scale effectiveness of enzymes was as follows: ficin > bromelain > papain.

Despite above discrepancies, our results may contribute to providing more knowledge on the taste of foods, especially if unwanted. It needs to be noted that introducing a food product to the market requires to carry out sensory analyses to confirm (or not) its bitter taste.

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***Key words**: Bitter peptides, BIOPEP-UWM database, Enzymes, Food proteins, Soybean, Protein hydrolysates.*

PRODUCTION OF XYLANASE USING WHEAT BRAN BY SUBMERGED FERMENTATION BY *THERMOMYCES LANUGINOSUS*

Jelena Bakrač[1], Ivana Gazikalović[1], Nevena Luković[2], Jelena Mijalković[2], Nataša Šekuljica[1], Zorica Knežević-Jugović[2*]

[1]Innovation Center of Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11 000 Belgrade, Serbia
[2]Department of Biotechnology and Biochemical Engineering, Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11 000 Belgrade, Serbia

[*]e-mail: zknez@tmf.bg.ac.rs

Abstract

The application of hydrolytic enzymes, such as xylanases, have proven to be very valuable in the industry. Their application ranges from paper industry, animal feed, food additives, silage and baking industry, and many others. These versatile enzymes were found to be produced by many microbial species. The aim of this research was to establish whether the fungi *Thermomyces lanuginosus* has xylanase production potential.

The strain was screened for xylanase activity on a selective plate containing beech wood xylan. Production of xylanase enzyme was done by submerged fermentation (SMF) in wheat bran broth medium (WBBM) over a period of 10 days at 50 ^{0}C, by using wheat bran as a substrate. Xylanase activity of the produced enzyme was measured according to 3,5-dinitrosalicylic acid (DNS) assay for reducing sugars for each day of fermentation. Total protein content was determined by Bradford method. Cellulase, mannanase, amylase and pectinase enzyme activities were determined by DNS assay, while protease activity was measured using azo-casein as substrate. The effect of substrate concentration on the enzyme activity was investigated by DNS method.

The maximum activity of 17.74 ± 0.48 IU/mL was reached on day 7 of fermentation. pH and temperature optimum were analyzed and it was determined that the optimum pH for the enzyme activity was 6, showing the high activity also in the pH range 5 - 7.5. Temperature optimum was 60 0C. The research has shown that the enzyme was stable even after 5 hours of incubation at optimal conditions, reaching maximum activity after 2 hours. In the presence of metal ion Mn2+ the

activity of enzyme was increased. All other tested enzymes were found to be present in the crude enzyme extract.

The tested strain *T. lanuginosus* is a good producer of xylanases, and may be used for hydrolysis of lignocellulosic waste materials. Due to its temperature stability and wide pH range of activity, it shows potential for application in many different industries.

***Key words**: Xylanases, Xylan, Thermomyces lanuginosus, Submerged fermentation, Fungi.*

SYNERGISTIC EFFECT BETWEEN GINGER AND INDUSTRIAL HEMP AND THE EFFECT OF DECARBOXYLATION ON THE MIXTURE

Taja Žitek[1*], Željko Knez[1,2], Maša Knez Marevci[1]

[1]Faculty of Chemistry and Chemical Engineering, University of Maribor, Smetanova 17, SI-2000 Maribor, Slovenia
[2]Faculty of Medicine, University of Maribor, Taborska ulica 8, SI-2000 Maribor, Slovenia

[*]e-mail: taja.zitek@um.si

Abstract

Ginger and hemp are medicinal plants with many positive effects for human body. Whilst ginger is known of its antioxidant activity, hemp has strong antimicrobial and anti-cancer effects. According to the literature review, previous studies were based on the investigation of individual herbs without focusing on the synergistic effect of the combination. The aim of our research was to investigate the synergistic effect of ginger and hemp resulting in the final extract. Proper pretreatment of the material before the extraction is the key step to attain an extract with a high biological activity. Further processing steps comprise selection of the proper extraction methods, where new methods such as ultrasonic wave methods and supercritical fluid extraction have been favorized.

In our research, the both materials (ginger purchased from Alfred Galke and hemp obtained from local growers in Slovenia) were mixed at a ratio of 1 : 1 and extracted by supercritical fluid extraction using ethanol co-solvent. For comparison, the materials were also extracted separately. Extraction was followed by decarboxylation at different temperatures and times, so that acidic cannabinoids have been converted into their active forms (CBD, THC, etc.). Extracts were analyzed by liquid chromatography with tandem mass spectrometry (LC-MS-MS).

The recovery of CBD in the mixture was 15% higher. As well, time and temperature of decarboxylation have proven to be significant factors. The Design-Expert software determined the adherent decarboxylation point at 137 ^{0}C and 40 min.

The study revealed a synergistic effect between natural materials (ginger and hemp) while performing supercritical extraction. The synergistic effect resulted

in an increased content of the CBD component, which reached its highest point in decarboxylation percentage at a temperature of 137 ^{0}C and a time of 40 min.

***Key words**: Cannabinoids, Decarboxylation, Supercritical fluid extraction.*

OBTAINING A HIGH-QUALITY INDUSTRIAL HEMP PRODUCT WITH A MECHANICAL PROCESS OPTIMIZATION

Vesna Postružnik[1], Taja Žitek[2*], Željko Knez[1,2], Maša Knez Marevci[1]

**[1]Laboratory for Separation Processes and Product Design,
Faculty of Chemistry and Chemical Engineering,
University of Maribor, Smetanova 17, SI-2000 Maribor, Slovenia
[2]Faculty of Medicine, University of Maribor,
Taborska 8, SI-2000 Maribor, Slovenia**

[*]e-mail: taja.zitek@um.si

Abstract

Industrial hemp is a versatile, environmentally friendly plant used broadly for various food, cosmetic, pharmaceutical, agricultural, phytoremediation, construction, and other industries. Most industrial applications of the plant arise from the fibers and seeds, while the inflorescences are used mainly for their essential oils and pharmaceuticals. Our aim was to utilize the buds of the plant and improve the preparatory process in order to obtain a product with high content of biologically active substances.

Therefore, stems and seeds were removed from the harvest. Plant buds were collected, coarsely crushed, and sieved through a 1,000-micron circular sieve for the pre-treatment process. High Performance Liquid Chromatography (HPLC) analysis was performed to determine the content of cannabinoids and tannins in pre-treated (sieved) material and material without the pre-treatment.

The content of cannabidiol in the prepared material was about 52%. At the same time, the material without the pre-treatment was tested for the same active ingredients, and the content of cannabidiol was about 45%.

This confirms the optimization of the preparation process, as most of the cannabinoids and tannins were successfully sieved through the sieve and thus concentrated.

***Key words**: Industrial Hemp, Sieving, Active ingredients, Cannabidiol, Tannins.*

NATURAL MICROBIOTA OF WINE GRAPE BERRIES

Sabo Jozef[1], Kunová Simona[2], Galovičová Lucia[1], Kačániová Miroslava[1,3*]

[1]Institute of Horticulture, Faculty of Horticulture and Landscape Engineering, Slovak University of Agriculture, Tr. A. Hlinku 2, 94976 Nitra, Slovakia
[2]Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture, Trieda A. Hlinku 2, 94976 Nitra, Slovakia
[3]Department of Bioenergy, Food Technology and Microbiology, Institute of Food Technology and Nutrition, University of Rzeszow, Zelwerowicza 4, 35601 Rzeszow, Poland

[*]e-mail: miroslava.kacaniova@gmail.com

Abstract

Grapes have a complex microbial ecology including filamentous fungi, yeasts and bacteria with different physiological characteristics and effects upon wine production. Some species are only found in grapes, such as parasitic fungi and environmental bacteria, while others have the ability to survive and grow in wines, constituting the wine microbial consortium. The aim of the present study was to identify bacteria and yeasts in grape samples from Slovakia.

A total amount of 13 grapes, or more precisely 9 white and 4 red were collected from August until November 2021, from a local Slovak winemaker, including 1. Irsai Olivér, 2. Feteasca regala, 3. Chardonnay, 4. Green Veltliner, 5. Mūller Thurgau, 6. Palava, 7. Rhein Riesling, 8. Welschriesling, 9. Sauvignon Blanc, 10. Alibernet, 11. Blue Frankish, 12. Cabernet Sauvignon, and 13. Dornfelder grapes samples were also used in our study. The microorganisms were cultivated on following way: at 25 ^{0}C for five days aerobically on malt extract agar (MEA) for yeasts, at 37 ^{0}C for 24 - 48 h aerobically on plate count agar (PCA) for total count of bacteria, and at 30 ^{0}C for 48 - 72 hour microaerophilic on de Man, Rogosa and Sharpe agar (MRS) for lactic acid bacteria. MALDI-TOF MS Biotyper mass spectrometry was used for identification of bacteria and yeasts, and microscopic filamentous fungi were identified via Samson, Samson and Frisvad and Pitt and Hocking manuals.

A total of 152 isolates were identified with mass spectrometry. Total bacterial counts on different wine grape berries ranged from 2.32 ± 0.05 in to 5.21 ± 0.02 log CFU x g^{-1}. Lactic acid bacteria ranged from 3.22 ± 0.06 to 3.96 ± 0.07 log CFU x g^{-1}. Yeast count ranged from 1.25 ± 0.04 to 3.11 ± 0.09 log CFU x g^{-1}. The most

identified yeast species were *Hanseniaspora uvarum* and *Priestia megatherium*, and *Lactococcus lactis* for bacteria.

Natural microbiota of grape berries is very diverse. In our study, the bacterial species were the most isolated microorganisms.

***Key words**: Grape berries, Lactic acid bacteria, Yeasts, Total count of bacteria, Mass spectrometry.*

CRANBERRY (*VACCINIUM VITIS-IDAEA*) BIOACTIVE CONSTITUENTS AND ITS ANTIMICROBIAL POTENTIAL

Azra Osmić[1], Taja Žitek[1], Gal Slaček[1], Maša Knez Marevci[1*], Željko Knez[1,2]

[1]Faculty of Chemistry and Chemical Engineering, University of Maribor, Smetanova 17, 2000 Maribor, Slovenia,
[2]Faculty of Medicine, University of Maribor, Taborska ulica 8, 2000 Maribor, Slovenia

[*]e-mail: masa.knez@um.si

Abstract

Cranberry (*Vaccinium vitis-idaea*) is a small evergreen shrub belonging to the *Ericaceae* group. Recent research suggests that berry fruits are a rich source of numerous phytochemicals with a wide range of bioactivity and effects on human health. Several berry fruits have recently attracted attention because of their effects *in vitro* and/or their associations in observational studies with lower risk for some chronic diseases. Randomized clinical trials have advanced in recent years to the point where meta-analyzes of these results have now been conducted. Cranberry (*Vaccinium macrocarpon*) is a particularly rich source of (poly)phenols that have been associated in vitro with: antibacterial, antiviral, antimutagenic, anticarcinogenic, antitumorigenic, antiangiogenic, anti-inflammatory (*E. coli*, *S. aureus*, etc.), and antioxidant properties. The aim was to determine the optimal conditions for the extraction of cranberries and to find the most suitable extraction method to achieve a high content of active components.

In the present research, the extracts from cranberry from Alfred Galke GmbH (Samtgemeinde Bad Grund, Germany) were prepared by conventional methods (Soxhlet extraction, Ultrasonic extraction, cold maceration) with three different solvents, namely water, ethanol, and ethanol : water (70 : 30). Determination of total phenols was performed spectrophotometrically using Folin-Ciocalteu reagents. The antimicrobial potential, defined by the determination of minimum inhibitory concentration (MIC), was also measured for the selected extract.

Extract obtained by ultrasonic extraction contained the highest proportion of total phenols (703.54 mg/100 g ext). The MIC of the extract for Gram positive bacteria, *Staphylococcus aureus*, was 1.934 mg/mL, for Gram negative *Escherichia coli* was 4.105 mg/mL, and for *Candida albicans* it was 16.35 mg/mL. The most suitable conventional method is ultrasonic extraction, in which water was used as a solvent.

The results show that the extracts have antimicrobial potential against *S. aureus*, reaching the highest inhibition threshold.

***Key words**: Cranberry, Extraction, Antimicrobial potential, Total phenols.*

PRELIMINARY RESEARCH ON NISIN ANTIMICROBIAL ACTIVITY

Elisabeta Elena Popa[1], Mihaela Lăpădatu[1], Paul Alexandru Popescu[1], Maria Rapa[2], Mihaela Draghici[1], Amalia Carmen Mitelut[1], Carmen Gabriela Constantin[3], Andreea Barbu[3], Mona Elena Popa[1*]

[1]Faculty of Biotechnology,
University of Agronomic Sciences and Veterinary Medicine from Bucharest,
Marasti 5, 011464 Bucharest, Romania
[2]Faculty of Material Science and Engineering,
University Politehnica of Bucharest,
Splaiul Independentei 313, 060042 Bucharest, Romania
[3]Research Center for Studies of Food Quality and Agricultural Products,
University of Agronomic Sciences and Veterinary Medicine of Bucharest,
Marasti 59, 011464 Bucharest, Romania

[*]e-mail: monapopa@agral.usamv.ro

Abstract

The microbiological safety of food products during storage is the most important factor, considered by the food manufactures. The chemically synthesized compounds commonly used as preservatives in the food industry are no longer meeting the consumer's expectations looking for safe, more nutritious, and tasty foods. Nisin is the most famous antimicrobial protein of class I bacteriocins, which is produced by *Lactococcus lactis*. Nisin has been used commonly in the food sector as an antimicrobial agent. The aim of this work is to present some preliminary results on nisin antimicrobial activity.

First of all, nisin solutions (0.1%, 0.3%, 0.5%, and 0.7% și 1% in sterile distilled water) were tested on three fungal strains (*Aspergillus brasiliensis* ATCC 16404, *Aspergillus flavus* and *Penicillium expansum*) by incorporation of nisin solutions in the culture media and application of 2 µL spore suspension in the centre of the plate and two bacterial strains (*Bacillus cereus* and *Bacillus subtilis*) using the disc diffusion method with the application on discs of 20 µL and 40 µL of nisin solution. The results obtained showed that nisin did not present antifungal activity on any of the tested fungi. Regarding the antibacterial activity, it was observed an increase in the diameter of the halo with the increasing concentration of nisin for both the amount of 20 µL/disc and the amount of 40 µL/disc for the bacterial strain *Bacillus subtilis*. Regarding the antibacterial activity on *Bacillus cereus* strain, it was observed that nisin did not have a different effect depending on the

concentration, the size of the halos being similar for the concentrations and the quantities studied.

Further, nisin was deposed by electrospinning on some polylactic acid (PLA) and polyhydroxyalkanoates (PHA) materials. The tested samples had a different effect on the tested bacteria. In the case of *Bacillus cereus*, a halo was observed around the tested materials, which indicates the inhibitory action of these materials, while in the case of the *Bacillus subtilis* no halo was observed around the samples, but it was observed that the bacterium did not develop on contact surface with the sample. Antibacterial action was generally observed for samples containing antimicrobial agent, compared with control samples.

In this study, the tested nisin solutions did not present any antifungal activity, fact also stated in other studies, generally not having antifungal activity or having a reduced such activity. However, the tested solutions presented antibacterial activity, including in terms of developed packaging materials, making them suitable for further food packaging applications and food safety. Further investigation will be performed in vivo on specific food products.

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***Key words**: Nisin, Antifungal activity, Antibacterial activity, Packaging applications.*

THE NUTRITIONAL PROPERTIES OF HOMEMADE AJVAR - A PEPPER BASED RELISH

Sasa R. Savic[1*], Sanja M. Petrovic[1]

[1]Faculty of Technology, University of Nis,
Bulevar oslobodjenja 124, 16000 Leskovac, Serbia

[*]e-mail: sasa.fondmt@gmail.com

Abstract

Ajvar is pepper-based relish that represents a mixture of roasted sweet peppers. As domestic agricultural food product none as vegetable caviar, ajvar consumes in a small portions, cold, in addition to the main meal or as a spread. Aim of this paper is to investigate the composition of domestic ajvar made of *Capsicum annuum* L. sweet peppers.

Ajvar was produced from the pepper that originated from the territory of Leskovac. Macro, micro and trace elements, moisture, ash, crude protein and total fat content were analyzed. Moisture and ash content are determined by using gravimetric methods. Kjeldahl method was used for determination of crude proteins, while Soxhlet extraction is used for total fats content determination. The content of 25 elements (As, Ag, B, Ba, Bi, Ca, Cd, Co, Cr, Cu, Fe, Hg, In, K, Li, Mg, Mn, Na, Ni, P, Pb, Si, Sr, Tl, and Zn), in ajvar sample have been also investigated by Inductively coupled plasma-optical emission spectrometry. Preparation of samples for macro- and micro analysis was done by wet digestion.

The obtained results showed that of all examined macro elements potassium concentration was the highest, 1852.43 mg $\times$ kg^{-1}. In a group of investigated heavy metals, arsenic, cadmium, and mercury were detected below the limit of detection, until the concentration of lead was near the permitted daily intake. The analytical analysis showed the moisture of 73.04 %, ash of 2.53 %, crude proteins of 1.78%, and total fat content of 9.21%.

These results imply that a notable consumption of ajvar could significantly increase the intake of macro and microelements. Macroelements detected in higher amounts are potassium, magnesium and phosphorus. The obtained results show a much higher yield of zinc, iron and copper of all analyzed microelements that are also essential for normal organism functioning.

***Key words**: Ajvar, ICP-OES, Nutrition, Minerals, Food.*

EFFECT OF ULTRAVIOLET IRRADIATION ON COMMERCIAL SODIUM COPPER CHLOROPHYLLIN: UHPLC-DAD-ESI-MS STUDY

Sanja Petrovic[1*], Sasa Savic[1], Jelena Zvezdanovic[1], Aleksandar Lazarevic[1]

[1]Faculty of Technology, University of Nis, Bulevar oslobodjenja 124, 16000 Leskovac, Serbia

[*]e-mail: milenkovic_sanja@yahoo.com

Abstract

Chlorophyllins are naturally derived colors that provide green hues to food products in oil- and water-based systems. Due to good antimicrobial activity, in order to increase the shelf life and safety of food products and to avoid contamination on the food surface, the use of commercial chlorophyllin is common in the form of antimicrobial films that would coat food, both fresh and processed. Effect of ultraviolet irradiation on commercial sodium copper chlorophyllin was studied to assess the potential application risk of this chlorophyll derivative for use in foods and cosmetics.

Photodegradation of an aqueous 1 x 10^{-4}M commercial sodium copper chlorophyllin solution was monitored after ultraviolet irradiation. The samples were irradiated in a period of 0 - 60 min., in cylindrical photochemical reactor "Rayonnet" with 8 symmetrically placed lamps, having an emission maximum at 300 nm and total energy flux of 12 W/m^2. Ultrahigh liquid chromatography coupled with diode array and electrospray ionization mass spectrometry was used to monitor the loss of major components of sodium copper chlorophyllin after irradiation as well as to detect possible new products.

The rate of photodegradation of all detected sodium copper chlorophyllin compounds was found to follow first-order kinetics. Analysis demonstrated loss of the major chlorophyllin component, copper chlorin e6, at a rate faster than overall detected components, in the range of 7.02 x 10^{-2} min^{-1}. Observed photosensitivity of sodium copper chlorophyllin was lower compared to the natural chlorophylls and raises the possibility of use in food and cosmetic products. The main detected photoproducts are oxidized compounds of chlorophyllin.

Furthermore, the implication of rapid loss of copper chlorin e6, a reported bioactive

component of commercial sodium copper chlorophyllin, upon irradiation, may result in alteration of potential dietary benefits such as antimutagenic and antioxidant activity.

***Key words**: Chlorophyllin, E141, Degradation, Irradiation, UHPLC-DAD-ESI-MS.*

EVALUATION OF THE ANTIOXIDANT CAPACITY OF SEA-BUCKTHORN (*HIPPOPHAE RHAMNOIDES*) BERRIES BY-PRODUCT EXTRACTS FOR FURTHER VALORIZATION

Mihaela Neagu[1*], Cristina Mihaela Luntraru[1], Adriana Florina Popescu[1], Justinian Andrei Tomescu[1], Livia Apostol[2]

[1]Hofigal Export - Import SA, 2 Intrarea Serelor 2, 042124 Bucharest, Romania
[2]National Research and Development Institute for Food Bioresources - IBA, Dinu Vintila 6, 21102 Bucharest, Romania

[*]e-mail: mihaela.neagu@hofigal.eu

Abstract

Globally, throughout the whole chain of the agri-food industry, very large quantities of waste and by-products are generated, so their recovery is an important desideratum but also a great challenge. Sea-buckthorn (*Hippophae rhamnoides*) berries have important nutritional and pharmaceutical properties conferred by the polyphenols, flavonoids, vitamins, minerals, and fatty acids content, also by their antioxidant capacity. The by-product from the production of the sea-buckthorn juice could be further used as ingredient for food and nutraceuticals, being a valuable source of bioactive compounds. The aim of this research was the recovery of the sea-buckthorn by-product by obtaining and characterizing two extracts that could be further valorized in food and nutraceuticals.

For this purpose, the sea-buckthorn - from a plantation in Gorj County, Romania - by-product obtained from juice extraction was used to obtain two ethanolic extracts through maceration and through ultrasound extraction, followed by concentration. The by-product and the extracts were characterized for the total polyphenols and antioxidant capacity. The total polyphenols content was evaluated using Folin-Ciocâlteu method and the antioxidant capacity was evaluated by two methods, namely CUPRAC assay, used to measure the cupric ion reducing ability of polyphenols, vitamin C, and vitamin E, and FRAP II assay, used for the measurement of total antioxidant power of plants.

Obtained results show that polyphenols were extracted better by the ultrasound process than the other method. Additionally, the antioxidant capacities of the ultrasound extract sample were 438.66 mg/g (expressed in Trolox equivalents) and 416.66 mg/g (expressed in Fe^{2+} equivalents), and for the maceration extract

229.38 mg/g (expressed in Trolox equivalents) and 287.93 (expressed in Fe^{2+} equivalents).

From the obtained results, it can be seen that both maceration and ultrasound extractions are promising processes for the recovery of polyphenols and antioxidant capacity but the ultrasound extraction process showed better results.

***Key words**: Sea-buckthorn berries, By-product, Polyphenols, Antioxidant capacity.*

EFFECT OF THE COMPLEXITY OF TWO-/THREE-COMPONENT MORIN/CHITOSAN/LIGNIN SYSTEMS ON THEIR *IN VITRO* ANTIMICROBIAL POTENTIAL

Zvezdelina Yaneva[1*], Georgi Beev[2], Nikolina Rusenova[3], Donika Ivanova[1,4], Daniela Stoeva[2], Monika Toneva[1]

[1]Chemistry Unit, Department of Pharmacology, Animal Physiology, Biochemistry and Chemistry, Faculty of Veterinary Medicine, Trakia University, Students Campus nn, 6000 Stara Zagora, Bulgaria
[2]Department of Biochemistry, Microbiology and Physics, Faculty of Agriculture, Trakia University, Students Campus nn, 6000 Stara Zagora, Bulgaria
[3]Veterinary Microbiology Unit, Department of Veterinary Microbiology, Infectious and Parasitic Diseases, Faculty of Veterinary Medicine, Trakia University, Students Campus nn, 6000 Stara Zagora, Bulgaria
[4]Department of Chemistry and Biochemistry, Faculty of Medicine, Trakia University, Armeiska 11, 6000 Stara Zagora, Bulgaria

[*]e-mail: zvezdelina.yaneva@trakia-uni.bg

Abstract

As natural biopolymers, chitosan and lignin characterize with good biocompatibility, high biodegradability and satisfactory biosafety. The active polymers functional groups are responsible for the biomaterials potential as carrier matrices in the construction of polymer-drug conjugates with prospective applicability in the fields of medicine, food, and agriculture in recent years. Hence, aim of this research was to place substantial emphasis on the antimicrobial potential of flavonoid/biopolymer complex systems by assessment of the probable arising synergetic, additive or antagonistic effects as a function of the system complexity.

In the present study comparative *in vitro* studies of the antimicrobial activity of two- and three-component complex systems containing the natural plant flavonoid morin, the hetero polysaccharide chitosan and the complex biopolymer lignin in various qualitative and quantitative combinations were conducted. The effect of the individual components on the bioactivity of the complex systems was discussed and clarified on the bases of the experimental data. Agar well diffusion method was used to screen the antibacterial activity against *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853 and the clinical isolate - *Bacillus cereus*. The plates were incubated at 37 ^{0}C for 24

h under aerobic conditions. Antimicrobial activity was detected by measuring the inhibition zone (IZ, mm).

The antimicrobial activity of the system chitosan/lignin surpassed that of the single component suspensions, which is an indication of an additive effect against *S. aureus*. Increased activity of the systems lignin/morin and chitosan/morin was registered. The antimicrobial potential of the three-component system chitosan/lignin/morin was higher than that of the three single biocompounds. Thus, undoubtedly the combination of the flavonoid with both biopolymers in a conjugated system leads to an improvement of its activity against *S. aureus*. Pure chitosan and the system chitosan/lignin/morin inhibited the growth of *P. aeruginosa*, while antimicrobial activity against *E. coli* was registered solely for the three-component system. The single component systems did not display antimicrobial activity against *B. cereus*, but the potential of the two- and three-component systems was commensurable or slightly lower to that against *S. aureus*.

The joint implementation of morin, chitosan and lignin in conjugated two- and three-component formulations provoked synergistic effects on their antimicrobial activity against the tested bacterial strains: *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, and the clinical isolate - *Bacillus cereus*, which is a prerequisite for the potential of their application in the construction of novel drug-carrier formulations with improved bioactivities.

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***Key words**: Antibacterial activity, Morin, Chitosan, Lignin.*

THE POTENTIAL OF THE PLANT BY-PRODUCTS OBTAINED AT INDUSTRIAL SCALE AND THEIR VALORIZATION BY SUPERCRITICAL CARBON DIOXIDE EXTRACTION

Liliana Mihalcea[1*], Adelina Ștefania Milea[1], Gigi Coman[1], Nicoleta Stănciuc[1], Iulia Cucolea[2], Mădălin George Dănilă[2]

[1]Faculty of Food Science and Engineering, Dunarea de Jos University of Galati, Domneasca 111, 800201 Galati, Romania
[2]Cromatec Plus SRL, Research Center for Instrumental Analysis SCIENT, Petre Ispirescu 1, 077176 Tâncabești, Romania

[*]e-mail: liliana.gitin@gmail.com

Abstract

Plants have been used as raw materials because they contain the bioactive compounds. Recent developments have led to an increased interest in oil production from unconventional fruit seed sources, including those of the *Rosaceae* and *Elaeagnaceae* family. The aim of this study was to perform the extraction of bioactive materials from the *H. rhamnoides* pomace obtained at industrial scale, and the whole *Rosa canina* fruits.

As raw materials for this research we used: *H. rhamnoides* pomace obtained at industrial scale from the factory from Olt city, Romania and whole *Rosa canina* fruits collected from the Moldova region, Romania. The bioactives from the food matrices mentioned above were extracted using supercritical carbon dioxide (SFE-CO_2), at different temperatures and pressures, allowing for obtaining four fractions according to both separators.

Highest carotenoid content of 396.12 mg/g D.W. was found in the sea-buckthorn pomace, at extraction parameters of 35 ^{0}C/45 MPa, yielding an antioxidant activity of 32.10 mMol TEAC/g dry matter. All enriched supercritical carbon dioxide extracts contained alfa-, beta- and gamma-tocopherol and significant fatty acids, with a predominance of linoleic acid.

Our results are valuable because they allow identifying the different profiles of extracts with many different applications in food, pharmaceutics, nutraceuticals and cosmeceuticals.

***Key words**: Sea buckthorn pomace, Rosa canina fruit, CO_2 supercritical fluid extraction, Oleoresins, Polyunsaturated fatty acids, Carotenoids.*

COLLAGENOLITIC ACTIVITY OF CULTURES OF BASIDIAL FUNGI

Mark Shamtsyan[1*], Boris Kolesnikov[1], Sergey Sorokin[1]

[1]Department of Technology of Microbiological Synthesis, Saint Petersburg State Institute of Technology, Moskovsky prospect 26, 190013 Saint Petersburg, Russia

[*]e-mail: mark.shamtsyan@yandex.ru

Abstract

Nowadays, collagenolytic enzymes are used in medicine, cosmetology, veterinary medicine, food and leather industries, etc. The main consumer of collagenolytic enzymes is the pharmaceutical industry. They are part of many drugs intended for cleansing purulent wounds and trophic ulcers, removing scars, etc. In the food industry, these enzymes are used for the processing of meat processing waste, changing the characteristics of minced meat with a high content of connective tissue and for tenderizing meat. The use of these enzyme preparations in the technology of production of meat products makes it possible to intensify the technological process and involve non-traditional, lower-grade raw materials in the process. Currently used collagenases have a number of significant drawbacks. Our work is devoted to the search for producers of highly active collagenases among cultures of basidiomycetes.

Culture liquids of 35 submerged cultures of basidiomycetes which are potential enzyme producers were investigated. The collagenolytic activity in culture liquids was determined by the ninhydrin method. Fruit-bodies of the mushrooms were collected mostly from the forests of North-Western region of Russia and parks of Saint Petersburg. Basidiomycets were introduced into culture and characterized. As a result of screening conducted among 35 species of basidiomycetes, cultures of fungi from the genera of *Coprinus* and *Funalia* with the most pronounced collagenolytic activity were selected for further research.

Several carbon and nitrogen sources were studied. Optimal concentrations and ratios of carbon and nitrogen sources were determined. The use of higher fungi as the producers of collagenase provides an opportunity to realize production of this enzyme under controlled conditions and environments.

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***Key words**: Submerged cultivation, Basidiomycetes, Collagenase.*

FOOD QUALITY AND SAFETY

IV

DEVELOPMENT OF INNOVATIVE HURDLE SYSTEMS USING MINIMAL PROCESSING TECHNIQUES FOR MEAT PRESERVATION

Endrit Hasani[1,2*], Barbara Csehi[1], Adrienn Tóth[1], István Dalmadi[1], György Kenesei[1]

[1]Department of Livestock Products and Food Preservation Technology, Institute of Food Science and Technology, Ménesi út 43-45, 1118 Budapest, Hungary
[2]Department of Food Technology and Biotechnology, Faculty of Agriculture and Veterinary, University of Prishtina, George Bush 31, 10000 Prishtina, Kosovo

[*]e-mail: endrithasani96@gmail.com

Abstract

With the new technological innovations in the food industry, consumer habits have been shifted from conventional processing towards minimal processing techniques which provide more nutritious food with improved sensory attributes. In recent years, among minimal processing techniques, sous-vide technology and high hydrostatic pressure effects on the quality and safety of meat products have had a growing attention among researchers. This paper aims to highlight the possibilities of a combination of both techniques hurdles which would act as innovative hurdle systems for meat preservation.

Recently sous vide technology has had an increasing application for meat processing in the catering industry, restaurants, and households. This technique provides meat products with higher water-holding capacity, minimal impact on nutritional properties, and better sensory characteristics. Sous vide technology is an example of a hurdle system that includes vacuum packaging, mild heat treatment, and rapid chilling of meat. However, applying such mild heat treatment could possibly present a food safety risk especially regarding heat-resistant microorganisms. In this regard, high hydrostatic pressure processing depending on pressure and time has been shown to be an effective technology for the inactivation of pathogenic bacteria in meat products without altering their sensorial and nutritional properties. Pressure treatments at 400 - 600 MPa have been shown effective in significantly decreasing the pressure-resistant Gram-positive bacteria such as *Listeria monocytogenes*, and *Staphylococcus aureus*. However, it has been reported that very high-pressure treatments could

potentially cause changes in the texture and color properties of the meat.

This review could help in developing innovative hurdle systems using the combination of sous vide and high hydrostatic pressure as minimal processing technologies for the preservation of meat products. However, it is necessary to optimize the pressure and heating parameters and the order of the minimal processing techniques to achieve safe and high-quality meat products.

***Key words**: Sous-vide, High hydrostatic pressure, Meat, Hurdle technology.*

DETERMINATION OF NITRATES IN LETTUCE (*LACTUCA SATIVA* VAR. *CAPITATA*) FROM VARIOUS PRODUCERS BY ION-SELECTIVE ELECTRODE

Lucia Zeleňáková[1*], Silvia Jakabová[1], Marek Šnirc[1], Jana Žiarovská[2], Ivana Mezeyová[3]

[1]Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra (SUA), Andreja Hlinku 2, 949 76 Nitra, Slovak Republic
[2]Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, SUA in Nitra, Andreja Hlinku 2, 949 76 Nitra, Slovak Republic
[3]Institute of Horticulture, Faculty of Horticulture and Landscape Engineering, SUA in Nitra, Andreja Hlinku 2, 949 76 Nitra, Slovak Republic

[*]e-mail: lucia.zelenakova@uniag.sk

Abstract

Growers are trying to meet the requirements for low tolerance of nitrates in cultivated crops through appropriate management of cultivation practices, paying attention to the timing, speed and form of nitrogenous substances used. However, external conditions during crop development are also crucial, such as light intensity and quality or air temperature, as well as the method and daily timing of harvest. Traders also pay attention to the quality and health safety of the sold vegetables, including salads. The goal of the study was to analyze the content of nitrate (NO^{3-}) in lettuce (*Lactuca sativa* var. c*apitata*).

Samples from various producers were collected during six months (all seasons) from four various retail chains, some came from domestic Slovak growers. Presence of NO^{3-} in selected samples was determined by using an ion selective electrode (ISE). All data were first tested for normality using the Shapiro Wilk test. The tested data did not have a Gaussian distribution, so the Kruskal-Wallis test was used to test statistical differences in nitrate content in individual months. Spearman's correlation was used to determine the relationship between the months. All calculations were performed using the statistical program R Studio, version 1.2.5033.

Results showed, that all samples met the conditions set out in Commission Regulation (EU) No. 1258/2011 relating to maximum permitted levels for nitrates

in fresh lettuce. The highest average nitrate content of 2038.99 mg x kg^{-1} was identified in November, while in May was found the lowest average level of 774.78 mg x kg^{-1}. Interesting were the differences when comparing samples with the same country of origin, which were obtained from different retail chains in the same month. When comparing samples obtained from domestic growers, we did not notice a significant difference in the average nitrate content (May 1085.82 mg x kg^{-1} and June 1098.95 mg x kg^{-1}), and however, the values from domestic samples in both months were higher compared to the results obtained in the analysis of lettuce from commercial chains. Statistically significant differences in nitrate content were recorded in the four evaluated months evaluated, but of different statistical significance: January and February ($p < 0.01$), June ($p < 0.001$) and May ($p < 0.0001$). In contrast, no statistical differences in nitrate content in salads were recorded in October and November ($p > 0.05$).

The results showed that lettuces available on the market either in the colder or warmer months, domestic or imported from abroad, do not pose a risk to health in terms of nitrate content.

***Key words**: Lettuce, Nitrates, Analyse, Ion selective electrode, Vegetable.*

LONG-TERM CHANGES IN THE EPIDEMIOLOGY OF FOODBORNE INTOXICATION IN SLOVAKIA FOR PAST 20 YEARS

Lucia Zeleňáková[1*], Lucia Benešová[1]

[1]Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture, Tr. A. Hlinku 2, 94976 Nitra, Slovakia

[*]e-mail: lucia.zelenakova@uniag.sk

Abstract

The goal of the study was to analyze the changes in the epidemiology of bacterial alimentary intoxications in Slovakia in the last 20 years using the Epidemiological information system (EPIS).

The epidemiological situation in the occurrence of reported alimentary intoxications in the Slovakia is extremely favorable in comparison with the world. In the years 2000 - 2020, only 4,085 cases of diseases were recorded by the epidemiological information system (average morbidity of 3.78/100,000 inhabitants). Staphylococcal intoxications dominated among them (49.01%) and so-called unspecified bacterial food poisoning (44.95%). The frequency of other analyzed diagnoses did not exceed 5% in the monitored period. Statistical analysis of the collected data was performed using non-parametric tests, which are ideal for comparing independent values. For testing two selections was chosen the Mann-Whitney test, for verifying the differences in three or more files, it was necessary to use its direct generalization in the form of the Kruskal-Wallis test. Existence of a statistically significant difference was at the level of significance $\alpha = 0.05$.

In terms of regional distribution the highest concentration of cases (51%) was recorded in western Slovakia ($p > 0.05$). An increased frequency of the disease was observed in the summer months, evenly in both sexes, 2,047 in men and 2,038 in women ($p > 0.05$). The maximum morbidity 29% in children aged 0 - 14 years were represented ($p < 0.05$). There are demonstrably two specific categories, namely pre-productive and productive age, there is statistically significant difference. Most of those injured became infected after eating a mixed diet (45%), but other frequently reported transmission factors included contaminated food (18%), poultry (10%) or beverages (7%). The highest numbers of those infected were recorded in catering establishments at workplaces, schools, medical facilities, fast food stalls and public catering establishments.

Bacterial food intoxications are a serious global problem and their prevention must be one of the top priorities of the food safety system. An essential part of preventive measures is also the increase of food education, the need to comply with the prescribed production process and consumer information, each of which should master the principles of proper storage and processing of food.

***Key words**: Foodborne intoxication, Food, bacteria, Epidemiological information system, Slovakia.*

IN SILICO APPROACH IN THE ANALYSIS OF ALLERGENIC PROFILINS AND OLEOSINS OF *AMARANTHUS* SPP.

Matúš Kyseľ[1], Silvia Farkasová[2], Veronika Štefúnová[2], Lucia Zeleňáková[3], Jana Žiarovská[2*]

[1]Research Centre AgroBioTech, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic
[2]Institute of plant and environmental sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic
[3]Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic

[*]e-mail: jana.ziarovska@uniag.sk

Abstract

Allergens of food resources possess great variability at the proteomic and genomic sequences and an actual part of research activities because of the raising number of food allergies worldwide. Actually, only a few in silico based allergen nucleotide sequences comparing study exist, in spite of the great variability in the individual allergen families and with the regard to understand biological background of naturally hypo- and hyperallergenic plants. The aim of the study was to analyze the mutation potential of allergen sequences variability relevant for primer design allergens in different plant species in comparison to the amaranthus, one of the allergenic safe specie, that provide many nutrition benefits and is an alternative for cereals.

Here, NCBI GenBank Nucleotide and WHO/IUIS Allergens Nomeclature Sub-Commitee databases data mining were acquired a nucleotide sequence records of pollen allergens as bioinformatic data for evaluation of the potential of *Amarathus* spp. allergen. Data mining was performed in the nucleotide sequence records of cross-reactive pollen allergens (oleosins and profilins) created automatically with a computational algorithm translated from protein sequence records as bioinformatic material. 7 sequences of oleosins and 7 sequences of profilins were manually modified and analysed. A universal 3-step method of data processing identified and quantified mutations with a help of terms hierarchy.

Definitively, the least substituted base is G, the most frequent substitution is T > C, and the most reproducible substitutions are C > G and G > C (profilins) and A > T (oleosins). The final description of sequence relationship is based on oleosin and profilin substitutions of 4 different glances (substitutions Profiles, single substitutions, group substitutions and fused substitutions) seeming Sal k 4 > Ole e 2 > Bet av 2 > Ama v 1 > Vac f 1 > Cro s 1 > Che a 1 > Koc s 2 > Pro j 1 > Ama r 1, where Sequence Pro j 1 is the most related to the matrix sequence of Ama r 1.

The rising amount of sequence records in GenBank database will influence a sequential likelihood of conclusions at the time, but substitution frequency, sequence order, and reproducibility should be kept stable.

***Key words**: Pollen allergens, Oleosins, profilins, SNPs, Primers.*

DETERMINATION OF ANTIMICROBIAL ACTIVITY OF FENNEL ESSENTIAL OIL AND SUPERCRITICAL EXTRACT AGAINST *LISTERIA MONOCYTOGENES* IN MINCED PORK

Bojana Danilović[1*], Natalija Đorđević[1], Ivana Karabegović[1], Sandra Stamenković Stojanović[1], Bojana Milićević[1], Aleksandar Veličković[1], Dragiša Savić[1]

[1]Faculty of Technology, University of Niš, Bulevar oslobođenja 124, 16000 Leskovac, Serbia

[*]e-mail: bojana_d@yahoo.com

Abstract

The possibility of essential oils application in meat preservation is a subject of interest in modern science. The essential oils of many plants have shown excellent activity against foodborne pathogens. The aim of this study was to examine the possibility of using fennel essential oil and supercritical extracts to control the growth of *L. monocytogenes* in minced pork during storage.

Essential oil and anethole standard were added at concentrations of 0.150 and 0.300 μL/g, while supercritical extracts were added at concentrations of 0.300 and 0.600 μL/g. The samples were stored at a temperature of 4 ^{0}C for 12 days, and sampling was performed in a 2 day interval. The enumeration of *L.monocytogenes* was performed by serial dilution method and plating on Listeria Oxford agar plates.

The initial number of *L. monocytogenes* in all samples was 3.5 log CFU/g. By the end of the storage period, the number in the control sample reached a value of 5.58 log CFU/g. The addition of fennel essential oil to minced pork resulted in a reduction of *L. monocytogenes* number by 0.5 log units, regardless the applied concentration. Anethole showed a slightly more intense inhibitory effect compared to essential oil, reducing the number by almost 1 log CFU/g. Supercritical extracts in concentration of 0.300 μL/g showed similar inhibitory effect with the reduction of bacterial number for 0.4 log CFU/g. The increase of concentration to 0.600 μL/g resulted in the reduction of *L. monocytogenes* at the end of monitoring period for 0.6 log CFU/g, compared to the control sample.

The results showed that fennel essential oil and supercritical fluid extracts can control the *L. monocytogenes* growth during the minced pork storage for 4 days.

The good antimicrobial potential of analyzed extracts and essential oil opens the possibility of future use as natural preservative, in order to prevent spoilage and extend the shelf life of minced pork.

***Key words**: Essential oils, Fennel, Antimicrobial activity, Pork, Listeria monocytogenes.*

NITRATES LEVELS IN COMMERCIAL BOTTLED DRINKING WATER OF TIRANA, ALBANIA AND HUMAN HEALTH RISKS

Sonila Duka[1*], Loreta Vallja[1], Majlinda Vasjari[1], Alma Shehu[1], Nevila Broli[1]

[1]Department of Chemistry, Faculty of Natural Sciences, Tirana University, Boulevard Zogu I nn, 1001 Tirana, Albania

[*]e-mail: sonila.duka@fshn.edu.al

Abstract

Many people now prefer bottled water to tap water for a number of reasons. They may not like the taste, smell, or color of tap water. Others are worried about their health and see bottled water as more natural, pure, and a healthier alternative to tap water. The maximum contaminant level (MCL) recommended by for nitrate in public drinking water supplies in the United States of America is 10 mg/L as nitrate-nitrogen (NO_3-N). This concentration is approximately equivalent to the World Health Organization (WHO) guideline of 50 mg/L as NO_3 or 11.3 mg/L NO_3-N. In Italy, a limit of 1 mg/L NO_3-N has been recommended for the water destined to infants and pregnant woman. Considering epidemiologic studies, the strongest evidence for a relationship between drinking water nitrate ingestion and adverse health outcomes (besides methemoglobinemia) is for colorectal cancer, thyroid disease, and neural tube defects. The main purpose of this study was to evaluate the levels of nitrates in the most consumable and very high sales brands in Albania market and to compare them with values printed on their labels.

16 bottles of bottled drinking water were bought randomly in selected shops situated in different parts of Tirana capital in Albania, during 2019. Water analyses were conducted by using standard methods reported on the 'Standard methods for the examination of water and waste water' (APHA, 2017). Spectrophotometric determinations for the study were carried out with a UV-VIS Spectrophotometer, Shimadzu 2401. Also, other items were analyzed for each water samples were: pH, conductivity, total dissolved solids (TDS), total hardness (TH), calcium (Ca^{2+}), magnesium (Mg^{2+}), bicarbonate, sulphate and chloride (Cl^-).

Generally, the physical and chemical constituents of examined waters lie within the acceptable boundaries established by International Bottled Water Association (IBA), Food and Drug Administration (FDA), and World Health Organization for drinking water. Total hardness values classified most of the studied brands into soft to moderate hard waters. Based on the results of nitrates levels in the bottles

of drinking water analyzed during this study only in one sample exceeded the limit of 1 mg/L NO_3-N (drinking water bottle coded n.13).

We can conclude that regarding levels of nitrates, most consumable and very high sales brands in the Albania market are within given international limits, and experimental data shows no significant difference with the value reported on the label. However, since one bottled water is not within set limits we recommend more frequent controls on bottling water, especially for the brand which showed exceeding limits of NO_3-N.

***Key words**: Nitrates levels, Bottled drinking water, Human health risk, Albanian market.*

FOOD INDUSTRY APPLICATIONS OF PROPOLIS: A REVIEW

Yulian Tumbarski[1*], Mariyana Topuzova[2], Mina Todorova[3]

[1]Department of Microbiology, University of Food Technologies, Maritsa Blvd. 26, 4002 Plovdiv, Bulgaria
[2]Department of Organic Chemistry and Inorganic Chemistry, University of Food Technologies, Maritsa Blvd. 26, 4002 Plovdiv, Bulgaria
[3]Department of Organic Chemistry, "Paisii Hilendarski" University of Plovdiv, Tsar Asen 24, 4000 Plovdiv, Bulgaria

[*]e-mail: tumbarski@abv.bg

Abstract

Nowadays, the increasing consumer's demands for fresh and minimally processed foods without chemical additives attracted the research attention on some novel methods in food industry and use of natural compounds as alternative of chemical preservatives. As a unique natural product obtained from beekeeping, propolis possesses a wide range of biological activities and health benefits that can be used in food production and biopreservation. Propolis (bee glue) is a sticky resinous substance that is collected and processed by honey bees (*Apis mellifera* L.) from various plant sources such as flowers, leaf buds and tree exudates, and serving as a building and defensive material in their hives. This review discusses the trends in application of propolis as a safe, innovative and promising approach to quality improvement and natural preservation of different food products.

The broad antimicrobial spectrum of propolis against spoilage microorganisms and foodborne pathogens offers a great variety of applications in food industry for biopreservation of meat, fish and poultry products, eggs, milk and dairy products, perishable fruits, vegetables, fruit juices and other beverages. In addition to its antimicrobial potential, the strong antioxidant properties of propolis can contribute to increase the nutritional value of the products or to retard the lipid oxidation and protein degradation of processed foods. For this purpose, propolis can be added directly to the food matrix in the form of an extract, to be applied on the surface of the product as a bioactive film or edible coating, or to be included in the composition of food biopackaging materials, thus preventing the food spoilage and enhancing the storage life of the food products.

The present study on the applications of propolis in the food industry worldwide and its valuable properties reveals the potential of this natural product as a food

additive, as a functional food ingredient, and as a prospective food biopreservative agent prolonging the shelf-life and improving the quality of food products.

***Key words**: Propolis, Bee products, Natural products, Food biopreservation, Functional foods.*

THE USE OF RETROSPECTIVE ANALYSIS OF MICROBIAL POULTRY PRODUCTS CONTAMINATION AND DETECTION OF VIABLE NONCULTURABLE BACTERIAL CONTAMINANTS FOR FOOD INFECTION COMBATING

Asiat M. Abdullaeva[1*], Larisa P. Blinkova[2], Yury D. Pakhomov[2], Rumiya K. Valitova[1,2], Tatiana A. Karachina[1], Yuliya V. Ambrazheevich[1], Valentina G. Lobanova[1]

[1]Faculty of Veterinary, Veterinary and Sanitary Examination and Agro Safety, Moscow State University of Food Production, Volokolamskoye sh. 11, 125080 Moscow, Russia
[2]Mechnikov Research Institute of Vaccines and Sera, Maly Kazyonniy per. 5a, 105064 Moscow, Russia

[*]e-mail: labpitsred@yandex.ru

Abstract

Requirements for topical issues of microbiological safety and the effectiveness of sanitary control of food products are being improved on the basis of new scientific and industrial information. The aim of the work was to obtain information for 5 years (2015 - 2019) on the frequency, seasonality and level of microbial contamination of industrial poultry products, as well as on viable but nonculturable bacteria (VBNC) in commercial poultry products.

For an analysis of poultry products, we used data for 4,899 samples from the "Vesta" automated laboratory bacteriological research system. The criteria for the assessment were the above-standard indicators of the total number of mesophilic, aerobic and facultative anaerobic microorganisms (MAFAnM), *Salmonella* spp., *Listeria* spp., and other microorganisms. Tested samples were placed on appropriate nutrient agars for CFU/mL determination. Viable cells were determined using Live/Dead® kit, while for statistical analysis was used with criteria ($X \pm m$), and the limit of fluctuation, $p < 0.05$.

An annual (in June-August) high MAFAnM content was established with statistically equivalent data of the contamination. Analysis of the contamination frequency showed fluctuations in annual values for MAFAnM are 66 - 100%, and *Salmonella* spp. 33.3 - 83.3% respectively. The contamination frequency for *Listeria* spp. remained statistically equal (from 41.6 to 59%) and *Listeria* spp.

infection values by years were also equal. In some years the infection values were higher, for example, for MAFAnM in 2019, for *Listeria* spp. and *Salmonella* spp. in 2017. Excess infection of poultry products was detected for MAFAnM from April to September, maximum in July, and for *Listeria* spp. from February to December. *Salmonella* spp. infection was not observed only in January but most detected in July. The "purest" poultry products were in January (97.5% of samples) and February (91.9%) annually VBNC (99.99%) were detected in commercial minced chicken that corresponded to microbiological standards. Unlike vegetative cells, they did not multiply after 5 hours of storage. During contamination monitoring VBNC not counted.

Thus, mass contamination of poultry products was noted in particular months, in which it is necessary to strengthen preventive measures. It is advisable to identify dangerous VBNC bacteria in food.

***Key words**: Chicken mince, Contamination, Bacteria, Monitoring, VBNC.*

PRESENCE OF *SALMONELLA* SPP., IN POULTRY FOR EGG PRODUCTION IN KOSOVO

Hyzer Rizani[1], Naser Kamberi[1], Shkëlzim Ukaj[1*], Magbule Rizani[1]

**[1]Faculty Food and Biotechnology Sciences,
University for Business and Technology UBT - Kalabria nn,
10000 Prishtina, Kosovo**

[*]e-mail: shkelzimukaj@hotmail.com

Abstract

Salmonella spp. are known as the most important salmonellae's appearance pathogens around the world. The aim of this research was to investigate the presence of *Salmonella* spp. in poultry for eggs production.

The study was conducted in poultry and private farms in the region of Suhareka, Prizren and Dragash, Kosovo. 300 samples of feces, eggs (whitened, vitelus and eggshell), and organs (liver, spleen, intestines and cloaca) were examined with standard method for detection of *Salmonella* spp. (ISO 6579:2002).

We found that 27 of samples or 9% were confirmed to be *Salmonella* spp. total number of samples. The largest percentage of the total isolated strains was found in Prizeren region with 44.44%, 29.62%% in Suhareka, and 25.92% in Dragash. Regarding the type of sample and the total number of isolated strains in this study, the largest number of isolates was found in feces samples - 16 strains or 59.25%, while from the eggs were isolated 8 strains (29.62%), and from the organs 3 strains or 11.11%.

Increasing the percentage of *Salmonella* spp. presence in poultry and their products is often associated with the outbreak of Salmonella epidemics in animals and humans, and poultry and poultry farms are the main reservoir of infections. Poultry farming in region of Suhareka, Prizeren, Dragash and wider in Kosovo is developing quickly, especially in the production of eggs and poultry meat. Although the similar results are also found in other researches that have been done in other countries of the world, constant control of salmonella spp. will give indices about their geographical distribution, and the epidemiological, economic and health consequences.

***Key words**: Salmonella spp, Pathogens, Poultry, Serovars, strains.*

THE EFFECT OF HEAVY METALS CONCENTRATION ON FISH GROWTH IN VLORA BAY, ALBANIA

Sonila Shehu[1*], Flora Qarri[2], Pranvera Lazo[1]

[1]Department of Chemistry, Faculty of Natural Sciences, University of Tirana, Zogu I Boulevard 25/1, 1001 Tirana, Albania
[2]Department of Chemistry, Faculty of Technical and Natural Sciences, University "Ismail Qemali", Pavarsia Square nn, 9400 Vlorë, Albania

[*]e-mail: sonila.kane@gmail.com

Abstract

Vlora Bay is one of the most important coastal zones of Albania, as it constitutes resources of high ecological and economic values for the country. Unfortunately, this area has suffered from the significant population growth and increase of human activities in recent years. The most delicate phenomena of the contamination of marine coastal waters are the heavy metal pollution from industrial and urban discharges and/or emission. Some metals, present in trace quantity, are essential for aquatic life. But when they exceed certain limits they may be a concern for the aquatic organisms due to their toxic effects, especially in fishes. Aquatic organisms absorb the pollutants directly from water and indirectly from food chains. The aim of this study was to determine the heavy metal content in sea water of Vlora bay and to evaluate their impact on aquatic life.

For this purpose, seawater samples were collected according to a network of six sampling points. Total dissolved heavy metal content was determined by furnace - Atomic Absorption Spectroscopy (AAS) (Cu, Pb, Zn, Hg, Cr and Cd) and Cold Vapor-AAS (Hg), known as a very sensitive analytical method.

It was found that the main sources of heavy metals in sea water of Vlora Bay are: the traffic exhaust, soil and re-suspended road dust, the discharges from the delta of Vjosa River, discharges (in the past) of some industrial activities, untreated urban and rural wastes discharged in the sea and the harbor activities. In general, their content in sea water of Vlora Bay, resulted in normal levels, with an order of distribution as follows: Hg < Cr < Cd < Pb < Cu < Zn.

Based in heavy metal concentration and in standards for the protection of seawater life, the seawater of Vlora Bay is quite good.

***Key words**: Vlora Bay; Seawater, Heavy metals, AAS; Fish growth, Toxic effect.*

THE ROLE OF TEMPERATURE IN THE SUSTAINABILITY OF PACKAGED POTATO PRODUCTS

Fidan Feka[1], Smajl Rizani[1*], Agran Halimi[1], Suzana Aliu[1], Pajtim Bytyçi[1]

[1]Department of Food Science and Technology, University for Business and Biotechnology (UBT), Kalabria nn, 10000 Pristina, Kosovo

[*]e-mail: smajl.rizani@ubt-uni.net

Abstract

Determination of elemental nitrogen in food products packaged under the influence of the temperature is very important for the preservation of their freshness and safety. Packaged potato products if exposed to high temperatures, the concentration of elemental nitrogen can change and the possibility of growth of microorganisms is very high. The paper aims to analyze elemental nitrogen and elemental oxygen under the influence of temperature to maintain the quality and longevity of packaged potato products.

A total of 35 samples were taken for analysis. All samples are potato chips such as: Papyrus chips (35 g and 140 g), Ketchup chips (35 g and 140 g) and Classic Chips (35 g). Samples for analysis were taken at Vipa Chips Company - Kosovo from the storage. The level of elemental nitrogen concentration is determined by the indirect method, determining the level of oxygen concentration by the methods whith OxyBaby apparatus. Samples were kept at 20 ^{0}C and 40 ^{0}C in the incubator, and monitored for 8 days. The percentage of nitrogen and oxygen is measured after 4 and after 8 days.

Temperature is a very important parameter maintaining the freshness of processed potatoes. From the results achieved at 20 ^{0}C the percentage of nitrogen element was 98.81%, while at temperature of 40 ^{0}C, monitoring after 8 days showed that the percentage of nitrogen has decreased by about 1%, or more exactly 97.8%.

From the obtained results we can conclude that the percentage of nitrogen element decreases under the influence of temperature, therefore special care should be taken regarding the exposure of these products to sunlight i.e. temperatures up to 40 ^{0}C.

***Key words**: Potato products, Elemental nitrogen, Temperature.*

IRRIGATION WATER QUALITY IN KOSOVO

Smajl Rizani[1], Hyzer Rizani[1*], Perparim Laze[2], Pajtim Bytyçi[1]

[1]Faculty of Food Science and Biotechnology, UBT-Higher Education Institution, Kalabria, nn, 10000 Pristina, Kosovo
[2]Department of Plant Production, Faculty of Agriculture and Environment, Agricultural University of Tirana, Paisi Vodica nn,1025 Tirana, Albania

[*]e-mail: hyzer.rizani@ubt-uni.net

Abstract

The plant production among others factors depends also from the quality of irrigation water. Therefore the aim of this research was to evaluate quality of irrigation water in Kosovo.

During the period of two years (2014 - 2016) samples from 36 locations throughout Kosovo were collected. Samples were taken in 1000 mL, clean plastic bottles from rivers, canals and reservoirs. The analyses for heavy metals content (Zn, Fe, Cu, Mn, Ni, Co, Pb, Cr, Cd, Mo) in the water samples were carried out by microwave plasma atomic emission spectrometry-MP-AES 4100 (Hettipathirana, 2011). The classification used to assess quality and adequacy of irrigation water is based on FAO's and USSL's classification criteria for irrigation water.

The results of the analysis of the physical-chemical parameters of irrigation water we gained, compared to a set of international water quality standards for irrigation showed that none of the water sources present any potential risk hazard in terms of trace elements content.

These water sources could be used for irrigation purposes without any hazardous effect in soil and plants.

***Key words**: Water, Irrigation, Plants, Physic-chemical parameters, Trace elements.*

PRELIMINARY DATA ON THE IMPACT OF WASTE DISPOSAL SITES ON THE QUALITY OF SURFACE AND GROUNDWATERS

Alma Shehu[1*], Julian Shehu[2]

[1]Department of Chemistry, Faculty of Natural Sciences, University of Tirana, Boulevard Zogu I nn, Tirana 1001, Albania
[2]Research Center of Flora and Fauna, Faculty of Natural Sciences, University of Tirana, Boulevard Zogu I nn, 1001 Tirana, Albania

[*]e-mail: alma.shehu@fshn.edu.al

Abstract

Contamination of surface and ground water occurs when urban waste materials, such as domestic garbage, are disposed without any pre-treatment, causing deterioration of the water quality. Groundwater pollution happens mostly due to percolation of pluvial water and the infiltration of contaminants through the soil while surface water pollution happens due to untreated leachate discharge. The purpose of this preliminary investigation was the evaluation of water quality due to the impact of two existing dumpsites, located in Vlora city and Orikumi city in Albania.

Samples of surface water, groundwater and leachate were collected during December, 2021, after a period of heavy rains. The assessment of water quality was based on the analysis of the main water quality indicators such as: pH, DO, Conductivity, COD, BOD5 N-NH^{4+}, N-NO^{3-}, PO_4^{3-}, total N, total P as well as major components including Ca^{2+}, Mg^{2+}, Cl^-, SO_4^{2}. Only standard methods of analysis were used for the determination of each parameter, including UV-VIS spectrophotometry and titrimetry. Physico-chemical parameters such as pH and conductivity were measured in situ by potentiometry using glass electrode and platinum electrode, respectively. Water quality was evaluated by comparing obtained data with current Albanian National Regulations as well as the EU Directives for surface and groundwater quality, respectively Surface water regulations from 1989, and Directive 2006/118/EC of the European Parliament and of the Council of from 2006.

Obtained results showed that among the analyzed samples, concentration of water quality indicators such as ammonia (N-NH^{4+}), nitrates (N-NO^{3-}) and phosphates (P-PO_4^{3-}), total N and P as well as COD and BOD5 have resulted to be higher in the leachate sample, collected at the base of the dumpsite in Vlora city. Pollution from the site has also effected the quality of surface water, which can be confirmed

by the increase in concentration of pollutants in the main drainage channel that passes in the vicinity of the area. The quality of groundwater collected in Vlora city showed poor quality compared to the quality of groundwater in Orikumi city.

Analysis of water bodies in the areas of existing dumpsites are important tools aiming to evaluate the environmental and health hazards due to untreated disposed wastes. Preventive management is recommended for water safety and new landfill construction methods should be designed to prevent pollution of water bodies.

***Key words**: Water quality, Dumpsite, Leachate, Pollution index.*

ANTIFUNGAL ACTIVITY OF *SALVIA SCLAREA* ESSENTIAL OIL AGAINST *PENICILLIUM* SPP. STRAINS DETERMINED BY DISC DIFFUSION AND VAPOR CONTACT METHODS

Veronika Valková[1,2*], Hana Ďúranová[1], Lucia Galovičová[2], Petra Borotová[1], Nenad L. Vukovic[3], Milena Vukic[3], Miroslava Kačániová[2,4]

[1]AgroBioTech Research Centre, Slovak University of Agriculture, Tr. A. Hlinku 2, 94976 Nitra, Slovakia
[2]Institute of Horticulture, Faculty of Horticulture and Landscape Engineering, Slovak University of Agriculture, Tr. A. Hlinku 2, 94976 Nitra, Slovakia
[3]Department of Chemistry, Faculty of Science, University of Kragujevac, Jovana Cvijica 66, 34000 Kragujevac, Serbia
[4]Department of Bioenergy, Food Technology and Microbiology, Institute of Food Technology and Nutrition, University of Rzeszow, Zelwerowicza 4, 35-601 Rzeszow, Poland

[*]e-mail: veronika.valkova@uniag.sk

Abstract

The search for natural agents to replace synthetic preservatives is currently one of the main trends in the food industry. From the possible natural alternatives to extend the shelf-life of products, application of essential oils (EOs) appears to be suitable for such purposes. The main objective of the present study was to evaluate the antifungal potential of *Salvia sclarea* (SC) essential oil (EO) - SCEO, in various concentrations (62.5; 125; 250; 500 µL x L^{-1}) against the growth of selected *Penicillium* spp. strains (*P. expansum*, *P. citrinum*, *P. crustosum*) inoculated on wheat bread (*in situ*).

The volatile substances of the SCEO were evaluated by a gas chromatograph coupled to a mass spectrometer (GC/MS), and its antioxidant properties were tested by free radical-scavenging capacity (DPPH assay). Disc diffusion method and vapor contact method were applied to determine the antifungal activity of SCEO in *in vitro* and *in situ* conditions, respectively. The obtained data was statistically evaluated using One-way analysis of variance (ANOVA) followed by Tukey's test.

GC/MS analysis revealed that 39 components were present in SCEO chemical composition. The major constituents were linalyl acetate (49.1%), linalyl (20.6%),

and (E)-caryophyllene (5.1%). The antioxidant activity of the SCEO was weak with the value of inhibition 0.7 ± 0.3%, which corresponds to 56.0 ± 2.7 μg TEAC x mL^{-1}. From the results it is clearly evident that the in vitro antifungal efficacy of the *Salvia sclarea* EO against the analyzed *Penicillium* spp. depended on its concentration, and with increasing concentration its values increased ($P < 0.05$). In this sense, the values of the inhibition zones ranged from 0.00 ± 0.00 mm (62.5 μL x L^{-1} for *P. citrinum*) to 7.33 ± 1.53 mm (500 μL x L^{-1} for *P. expansum*). A similar increasing trend was also observed in in situ analyzes where SCEO displayed the most effective inhibitory effectiveness against *P. expansum* (250 and 500 μL x L^{-1}) growing on a slice of bread.

Finally, the use of the SCEO in the vapor phase against the growth of *Penicillium* strains appears to be a promising alternative to the substitution of chemical inhibitors used to extend the shelf-life of bakery products during their storage.

***Key words**: Essential oil, Salvia sclarea, Chemical composition, DPPH assay, Antifungal activity, Bread.*

PHYSICO-CHEMICAL CHARACTERISTICS OF SUNFLOWER OIL IN MARKET

Milidin Bakalli[1*], Julis Selamaj[2]

[1]Faculty of Professional Studies,
University of Aleksandër Moisiu - Durres,
Currila nn, 2001 Durres, Albania
[2]Laboratory of Chemistry,
Central Laboratory of Armed Forces,
Myslym Keta nn, 1002, Tirana, Albania

[*]e-mail: bakallim@gmail.com

Abstract

Edible oil consumption in Albania is about 30 million tons in the year. Despite health benefits, overconsumption may cause obesity and cancer from toxic substances during frying process. The aim of the study was to investigate the quality of sunflower oil in market in Tirana.

Three oil samples (O1, O2 and O3) were analyzed during this study. Physicho-chemicals parameters density, refractive index, saponification value, acid value and peroxide value were determined by standard methods were determined by standard methods, and these data are compare with Albanian standard for quality of sunflower oil (SSH 203:2003).

The density of samples shows that maximum (0.922) in O3 oil and O1showed minimum 0.919. Average acid value varied from 0.378 mg/KOH/g at O1 oil to 0.223 mg/KOH/g to O2 oil. Highest refractive index were observed in O2 1.474 and lowers in O1 - 1.467. Maximum saponification values were observed at only O2 sample 282 mg/KOH/g and minimum in O3 oil 181 mg/KOH/g. The peroxide values varied from 4.66 to 10 for three types of oil samples. The physico chemical properties for oils are in compliance with the requirements of the standard for the quality of sunflower oil, and the exceptions are only two samples of O1 oil where the acid value and saponification value are higher than the standard.

These data shown that sunflower oil may were mixed with oil with shorter fatty acid chain, such us palm oil. We recommend more frequent analysis by the national food authority for consume secure oil.

***Key words**: Sunflower oil, Market, Physico-chemical properties, Quality.*

DETERMINATION BY FAAS OF SOME OF THE HEAVY METALS AND TRACE ELEMENTS IN RAW COW'S MILK PRODUCED IN KOSOVO

Valon Durguti[1], Medin Zeqiri[1*], Fisnik Laha[1], Fidan Feka[1], Xhavit Bytyqi[1]

[1]Department of Food Sciences and Biotechnology, University for Business and Technology, Kalabria n.n., 10000 Pristina, Kosovo

[*]e-mail: medin.zeqiri@ubt-uni.net

Abstract

Heavy metals pose a great risk to human health due to the ability of bioaccumulation in human tissues. The purpose of this research has been to determine the concentration of some of the heavy metals and trace elements in raw cow's milk.

A total of 40 samples were analyzed from three different regions of Kosovo (Obiliq, Gjakova and Sharri), from imported milk have been analyzed. Milk sampling is done based on ISO 707:2008. In the samples were analyzed following heavy metals and trace elements: Cu, Zn, Ni, Co, Fe, Mn, and Cr by the flame atomic absorption spectroscopy (FAAS).

Even though the results shows that the values of many of the analyzed samples were below the permissible limits, in some of the samples the limits set by various organizations (EPA, EFSA, WHO) were exceeded for some of the elements (Co, Cu, Mn, and Fe). The obtained results are comparable to the results of other researchers who have investigated the level of heavy metals and trace elements in fresh cow's milk all over the world. However, it is worth mentioning that for a number of elements the allowed values in raw cow's milk are not yet clearly defined.

The region where most of the microelements were isolated it was the Obiliqi region which is characterized by the highest pollution in Kosovo and perhaps in the region as a consequence of the thermal power plant.

***Key words**: Milk, Heavy Metals, Trace Elements, Pollution, AA Spectroscopy.*

IMPACT OF HYGIENE LEVEL IN THE HONEY PRODUCTION PROCESS ON THE QUALITY AND SAFETY OF THE FINAL PRODUCT

Simona Kunová[1], Viktória Lovászová[1], Peter Haščík[1], Miroslava Kačániová[2,3*]

[1]Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture, Trieda A. Hlinku 2, 94976 Nitra, Slovakia
[2]Institute of Horticulture, Faculty of Horticulture and Landscape Engineering, Slovak University of Agriculture, Tr. A. Hlinku 2, 94976 Nitra, Slovakia
[3]Department of Bioenergy, Food Technology and Microbiology, Institute of Food Technology and Nutrition, University of Rzeszow, 4 Zelwerowicza St, 35601 Rzeszow, Poland

[*]e-mail: miroslava.kacaniova@gmail.com

Abstract

Microorganisms present from pollen, dust, air, soil and nectar may be present in the honey. However, microbial contamination can also occur from food handling, equipment and cross-contamination, which can be controlled by standard hygiene and good manufacturing practice. The aim of the present was to evaluate the impact of the hygiene level in the process of honey production on the quality and safety of the final product.

All samples were divided into 3 groups: samples of primary contamination (beehive environment), secondary contamination (tools on honey production) and samples of honey from Hurbanovo in Slovakia. Samples were taken in two different periods, in June and September. In these samples: number of total viable count (TVC), coliform bacteria (CB) and filamentous microscopic fungi (FMF) were analyzed. Plate count agar (PCA) was used to determine of TVC, violet red bile lactose agar (VRBL) was used to determine of CB, and malt extract agar (MEA) was used to determine of FMF. After counting, the species of microorganisms were identified using the MALDI-TOF MS Biotyper.

The average value of TVC was 4.29 log CFU x cm^{-2} in the samples of primary contamination taken in June, and 2.04 log CFU x cm^{-2} in the samples taken in September. Average value of TVC was 2.6 log CFU x cm^{-2} in the samples of secondary contamination taken in June, and 1.85 log CFU.cm^{-2} in the samples

taken in September. Average value of TVC ranged from 1.67 log CFU x g^{-1} to 2.7 log CFU x g^{-1} in honey samples. Coliform bacteria (CB) were present only in the samples taken in September. The average number of CB was 1.75 log CFU x cm^{-2} in the samples of primary contamination and 2.47 log CFU x cm^{-2} in the samples of secondary contamination. CB were not present in the honey samples. FMF were not present in the samples. The most commonly isolated bacteria were bacteria of genera: *Acinetobacter*, *Staphylococcus*, *Bacillus*, *Sphingomonas*, *Pseudomonas* and *Ralstonia*.

Although contaminating microorganisms are present in the environment during honey production, the number of microorganisms is minimal or non-existent in the final product.

***Key words**: Honey, Total viable counts, Coliform bacteria, Filamentous microscopic fungi, MALDI-TOF MS Biotyper.*

RESEARCH ADVANCES IN EFFECTIVE REMOVAL OF HEAVY METALS FROM AQUEOUS SOLUTIONS - A REVIEW

Elena Ungureanu[1,2], Gabriel Mustatea[1], Andreea Mocanu[1], Alexandru Soare[1*], Mona Elena Popa[2]

[1]National Research and Development Institute for Food Bioresources - IBA Bucharest, 5 Ancuta Baneasa nn, 020323 Bucharest, Romania
[2]Faculty of Biotechnology, University of Agronomic Science and Veterinary Medicine, Marasti Boulevard 59, 011464 Bucharest, Romania

[*]e-mail: alexsoare14@gmail.com

Abstract

With the development of industry, large amounts of heavy metals are eliminated into the environment, which leads to contamination of important water resources, such as ground waters, surface waters, and lake waters. They can also get into drinking water and by ingestion, pollutants can accumulate in the human body where it manifests toxic effects on various systems and organs. In order to minimize the contamination of water resources and wastewater, the removal of heavy metals is being studied more and more through the use of various processes, such as adsorption, membrane filtration, ion exchange or coagulation. The aim of this review paper is a state-of -the-art discussion about the effective applications of different removal processes and sorbent materials for heavy metals removal from water resources.

For conducting the study were consulted more than 50 literature sources from the most important electronic databases: Web of Science and SCOPUS. Several platforms such as Science Direct, Springer Link, CAB Abstracts and Taylor and Francis were also consulted. Processes we are talking about include the use of adsorbent materials, such as activated carbon, nanotubes, bio-sorbents and bio-chars, or various filtration processes, that include ultrafiltration, microfiltration, nanofiltration or reverse osmosis. However, of all the adsorbent materials, bio-sorbents have gained considerable attention for applications in water treatment, due to their cost-effectiveness, acceptable performance and high removal capacity. Their most important aspect is eco-friendly character, as most come from agricultural waste (peanuts, rice, lemon peel, cocoa shells, and coffee residues), soil and mineral deposits (bentonite, kaolin, and zeolite) or aquatic and terrestrial biomass (lignin, seaweed, algae). Bio-sorbents may be subjected to processes like electrostatic interaction, precipitation, chelation, complexation, to enhance their adsorption capacity. The research studies demonstrated that the removal rate is

influenced by some parameters, like the pH of the aqueous media, the adsorbent dose, concentration of the metal, time of contact, temperature, and mixing or agitation speed.

As a conclusion, the removal processes show good adsorption capacities for heavy metals, but further research are needed for successful applications of these methods for removal of chemical pollutants from drinking water.

***Key words**: Environmental contamination, Heavy metals, Removal, Water treatment*.

INVESTIGATION OF HEAVY METALS AND TRACE ELEMENTS CONTENT IN DIFFERENT TYPE OF BISCUITS

Andreea L. Mocanu[1*], Alexandru Soare[2], Elena L. Ungureanu[3], Gabriel Mustățea[3]

[1]National Research and Development Institute for Food Bioresources, Ancuța Băneasa 5, 020323 Bucharest, Romania
[2]Faculty of Chemical Engineering and Biotechnologies, University Politehnica of Bucharest, Gh. Polizu 1-7, 011061 Bucharest, Romania
[3]Faculty of Biotechnologies, University of Agronomic Sciences and Veterinary Medicine, Marasti Boulevard 59, 011464 Bucharest, Romania

[*]e-mail: andreea.mocanu1@yahoo.com

Abstract

Interest in bakery products is growing from day to day due to the nutritional quality of these products. Biscuits are the most versatile snack in the food industry, occupying a notable position due to their attractive characteristics. The aim of this paper is to review available literature for conducting a comparative study of the heavy metals and trace elements concentrations found in the composition of several types of biscuits, from different areas of the world.

Biscuits are preferred by children and can be given as expressions of love from friends or family. They are nutritious, cheap, and convenient products, having different forms and being produced by combining flour, sugars, oils or vegetable fats and proteins. By comparing the data from more than 50 papers available on WoS, Springer, SCOPUS and CAB Abstracts we found that potential environmental contaminants with effects on human health can occur in biscuits in the technological flow, but also from the raw materials used to obtain them. The main source of biscuits contamination is represented by the flour. Contamination may occur with metals such as cadmium, lead, zinc, chromium, copper, manganese, iron can be due to the fertilizers and pesticides used in wheat cultivation. In recent decades the effects that these contaminants have had on the quality of crops have threatened food security, which can disrupt metabolism once they reach inside the human body.

The metals and trace elements are present, in generally, at low concentration in biscuits sample, except for some metals in some type of biscuits, in different studies.

***Key words**: Biscuits, Contaminants, Heavy metals, Trace elements.*

HEAVY METALS AND TRACE ELEMENTS CONTENT IN DIFFERENT TYPES OF SEASONING AND AROMATIC PLANTS - A REVIEW

Alexandru Soare[1,2*], Gabriel Mustățea[1], Elena L. Ungureanu[1,2], Andreea M. Mocanu[1]

[1]National Research and Development Institute for Food Bioresources - IBA Bucharest, 5 Ancuta Baneasa, 020323 Bucharest, Romania
[2]Faculty of Biotechnology, University of Agronomic Science and Veterinary Medicine, Marasti Boulevard 59, 011464 Bucharest, Romania

[*]e-mail: alexandru.soare@bioresurse.ro

Abstract

The use of seasoning and aromatic plants plays an important role in the food industry due to bioactive compounds which improve the taste of food and can influence digestion and metabolism. Contamination of these plants with heavy metals, mycotoxins, polycyclic carbohydrate residues and pesticides, may occur during both cultivation and conditioning. The aim of this review was the investigation of the levels of heavy metals in some aromatic plants and seasonings from different countries.

The content of these heavy metals and trace elements was tested through different methods. By comparing the data from more than 50 papers available on WoS, Springer, SCOPUS, CAB Abstracts, the results showed that the content of heavy metals in some spices exceeds the permitted limit and poses a risk to human health. In case of trace metals, these contribute to the proper functioning of the body, but if exceeding the tolerable daily intake, they become toxic and pose a risk to human health. After ingestion, heavy metals can bioaccumulate into the body and produce adverse effects on human health, as neurotoxicity, disorders of cardiovascular, gastrointestinal, renal and reproductive system, hepatotoxicity, immunotoxicity, but also carcinogenesis through generation of free radicals.

Spices and aromatic plants may contain high amounts of heavy metals and trace elements, therefore their accumulation in the human body may pose a risk to human health.

***Key words**: Aromatic herbs, Heavy metals, Seasonings, Toxicity, Trace elements.*

INCIDENCE OF SPOILAGE MOLDS IN SOME BAKERY PRODUCTS ACCORDING TO THE TYPE AND TIME OF APPEARANCE

Alina A. Dobre[1*], Irina Smeu[1], Elena Mirela Cucu[1], Nastasia Belc[1]

[1]National Research and Development Institute for Food Bioresources - IBA, Ancuta Baneasa 5, 020323 Bucharest, Romania

[*]e-mail: alina.dobre@bioresurse.ro

Abstract

The objective of this research was to quantify and identify degradation of fungi isolated from spoiled bakery products (test samples used were bread, breakfast cereals, biscuits) based on the effect of water activity (aw) and storage time and temperature. Thus, the mold species isolated will be use to organize a fungal strain data base for "green" bakery products in order to use them in further research.

Mold from contaminated bakery products were selected according to the degree of contamination and the diversity of the colonies. The samples were stored at 24 ^{0}C during the study and were analyzed on the day of receipt, at the end of the shelf life and three to five days after the end of the shelf life. During the test period, microbiological analysis according to ISO 21527 was done. A semi-automated Biolog® microbial identification system was used for the identification of the fungal strains isolated from the contaminated samples.

The results indicated that *Penicillium* spp. and *Aspergillus* spp. were the prevalent fungi for the assessed bakery samples, these fungal species frequently contaminate cereal products and their source is soil and air. In the case of bread samples were identified two major spoilage microorganisms, *Aspergillus parasiticus* and *Penicillium ochrochloron*, and *Aspergillus brasiliensis* and *Aspergillus versicolor* for breakfast cereals and biscuits. The differences found for a_w are explained by the different food matrices from which the strains were isolated (bread - main a_w 0.97, breakfast cereals and biscuits - main a_w 0.54) but also by the storage period and spoilage degree.

These findings will help in developing a shelf life extension antimicrobial packaging model based on the most effective essential oils against isolated molds.

***Key words**: Bakery products, Mold spoilage, Shelf-life, Biolog® system.*

ATMOSPHERIC DEPOSITION STUDY OF SOME TRACE METALS USING MOSS BIOMONITORING IN THE TERRITORY OF ALBANIA

Shaniko Allajbeu[1*], Flora Qarri[2], Lirim Bekteshi[3], Trajce Stafilov[4], Pranvera Lazo[1]

[1]Department of Chemistry, Faculty of Natural Sciences, University of Tirana, Boulevard "Zog I", 1001 Tirana, Albania
[2]Department of Chemistry, Faculty, University of Vlora, Boilevard "Pavaresia", 9400 Vlora, Albania
[3]Department of Chemistry, Faculty of Natural Sciences, University of Elbasan St. "Ismail Zyma" nn, 3001 Elbasan, Albania
[4]Institute of Chemistry, Faculty of Science, Ss. Cyril and Methodius University, "Arhimedova 3", 1000 Skopje, Macedonia

[*]e-mail: shanikoallajbeu@gmail.com

Abstract

Since 2010, Albania had contributed to the data onto the European moss survey (EMS), which is repeated at five-yearly intervals. It was announced in 2020 that the planned moss survey for 2020/2021 was extended for 2022 because of the COVID-19 pandemic, and now the samples are in process of analysis. So this study was conducted in the framework of 2010 ICP Vegetation in order to determine anthropogenic pollution from trace metals (Cr, Co, Fe, and Ni) that pose risk to human health, also to provide an assessment of air quality throughout Albania.

The representative *Hypnum cupressiforme* (Hedv.) moss samples were collected from 47 sites in accordance with the long-range transboundary air pollution (LRTAP) Convention-ICP Vegetation protocol and sampling strategy of the European program on biomonitoring heavy metal atmospheric deposition during the relatively dry periods of October-November 2010 and June-July 2011. Metals concentrations were determined by induced coupled plasma-atomic emission spectroscopy (ICP-AES). The quality assurance was checked by moss reference materials, M2 and M3. We tried to identify and assess the most polluted areas and the pollution sources. The concentration data were statistically processed by using descriptive statistics, and spatial analysis to understand spatial and temporal variability, the relationship between the elements in moss was tested by Pearson correlation analysis and factor analysis (FA) to assess the most probable pollution sources.

Significant variations were detected in the concentration data of the elements. Factor analysis in combination with the inventory of emission sources, and chemical properties of the elements made possible the identification of the sources. The main pollution source was pointed from soil dust particles, and the anthropogenic inputs originated from mining, metal high-temperature processing, vehicle emissions, waste incineration, etc.

The sequence of the distribution of elements in moss samples was Fe > Cr > Ni > Co. Significant variations were detected in the concentration data of the elements (except Fe). Two dominant factors were identified representing elements Cr, Ni, and Co from chromium industry and wind-blown mineral dust particles (F1); and F2 is composed by high Fe loadings as a typical crustal element.

***Key words**: Air quality, Moss biomonitoring, Trace metals, Statistical analysis, ICP-AES, Albania.*

THE CHEMICAL COMPOSITION AND SAFETY OF WILD BOARS MEAT HARVESTED IN POLAND

Alicja Rutkowska-Mazur[1], Jerzy Niedziółka[2], Łukasz Migdał[3], Władysław Migdał[4*]

[1]Department of Animal Products Technology, Faculty of Food Technology, University of Agriculture in Krakow, Balicka 122, 31-149 Krakow, Poland
[2]Department of Zoology and Animal Welfare, Faculty of Animal Sciences, University of Agriculture in Krakow, Mickiewicza 24/28, 30-059 Krakow, Poland
[3]Department of Animal Genetics, Breeding and Ethology Faculty of Animal Sciences, University of Agriculture in Krakow, Mickiewicza 24/28, 30-059 Krakow, Poland
[4]Department of Animal Products Technology, Faculty of Food Technology, University of Agriculture in Krakow, ul. Balicka 122, 31-149 Krakow, Poland

[*]e-mail: wladyslaw.migdal@urk.edu.pl

Abstract

In Poland, wild boars constitute a large population and they cause more and more problems today. At the beginning of XX century wild boars was considered as crop pest. In the 1930s, the number of wild boars was estimated at around 16 thousands of animals, in the 1985/1986 at around 46 thousands, in the 2005/2006 - 173.5 thousands, in the 2019 their number was estimated at 225 thousands animals. The increase in the wild boar population has become a serious problem for pig breeding as wild boar is the main African swine fever (ASF) vector, which is deadly for both wild boars and domestic pigs and is therefore a serious threat to European pig breeding. Currently, the wild boar is the most hunted game animal in Poland. For quite a few years now, in each hunting season, the country has been shooting around 300,000 wild boars. This meat was considered as very healthy meat, for many years it reigned among meat dishes. Today, consumption of venison is very low in Poland - from 0.05 to 0.15 kg/person. The main purpose of the study was to compare the meat of wild boars hunted in various regions of Poland.

Loin from 30 wild boars were analyzed. The samples of meat were comminuted and subjected to physico-chemical analyses. The content of dry matter, ash, total proteins and fats were determined according to AOAC International (2019), colour of meat samples were obtained in CIELab system (Konica Minolta CM - 600d

spectrophotometer) and the shear force was performed with Warner-Bratzler triangle edge knife. The content of heavy metals (As, Cd, Pb, and Hg) was also determined. Analyses were conducted according to the Polish Standard PN-EN 15763:2010, with the inductively coupled plasma mass spectrometry (ICP-MS).

Obtained results confirm the very good quality of wild boar meat as a raw material for processing. However, it should be remembered that before the meat is processed, all legal regulations must be taken into account (especially testing the meat for the presence of trichinosis). Content of selected heavy metals in wild boar muscles differed depending on the region of the country, but the meat was fit for consumption.

The wild boar meat may act as a good indicator of the environmental contamination with heavy metals such as cadmium, lead mercury and radioactive metals. Obtained results confirm the very good quality of wild boar meat as a raw material for processing. However, it should be remembered that before the meat is processed, all legal regulations must be taken into account (especially testing the meat for the presence of trichinosis). The research on the content of toxic elements in meat of hunted wild boars indicates the need to regularly monitor the quality of the obtained raw material, as the varying conditions of wild boars habitat and factors associated with the hunt can contribute to increased contents of heavy metals in wild boars.

***Key words**: Wild boars, Meat, Quality, Safety.*

MYCOTOXINS - INFORMATION OR TABOO TOPIC FOR THE POPULATION OF THE PELAGONIJA REGION

Katerina Trifunovska[1*], Gorica Pavlovska[2], Vezirka Jankuloska[2]

**[1]Faculty of Technology and Technical Sciences,
University St. Kliment Ohridski, 1 Maj bb., 7000 Bitola, Macedonia**

[*]e-mail: katerina.trifunovska@uklo.edu.mk

Abstract

Mycotoxins are natural toxins that often occur as contaminants in food and feed. They have been shown to cause various diseases and food poisoning in humans and animals, known as mycotoxicoses. Depending on the type of mycotoxin, amount, and timing of exposure, mycotoxins can cause acute or chronic toxicity. The aim of this research was to determine the knowledge of the citizens of Bitola and the Pelagonia region about the presence of mycotoxins in food, as well as their harmful effects.

For this purpose survey was conducted on 100 respondents from Bitola and the Pelagonia region via questionnaire through Google Docs forms. The survey consists of 22 questions divided into 4 groups: basic information about the respondents, general knowledge about mycotoxins, the presence of mycotoxins in food, and their toxic effects on human health. Advanced statistical analysis of three key questions from the survey was performed using the Chi-square test of independence. In addition, the Cramer value was calculated.

The results showed that the respondents were mainly women (70%) with higher education (51%) who had relatively good general knowledge about mycotoxins with correct answers between 43% and 65%. The knowledge of the presence of mycotoxins in food was lower, and the correct answers ranged between 41% and 49%, except for one question where only 29% of respondents answered correctly. The respondents had the least knowledge about the toxicity of mycotoxins, in other words, only about 30% of the respondents had correct answers to half of the questions. Statistical analysis showed that there was a statistically significant difference between the answers to the questions, and the values of the Cramer coefficient showed that the correlation between the answers is generally moderately strong.

This research showed that a large population of respondents needs to be educated by schools, organizations, nutritionists, or health professionals about

these dangerous food contaminants.

***Key words**: Mycotoxins, Presence in food, Toxicity.*

EFFECT OF SEASONAL VARIATION ON COLOUR AND TEXTURE OF SMOKED BALTIC SPRATS PRODUCED FROM FISH AFTER FROZEN STORAGE

Santa Puke[1], Olga Dmitrijeva[2], Ruta Galoburda[1*]

**[1]Faculty of Food Technology,
Latvia University of Life Sciences and Technologies,
Liela 2, LV-3001 Jelgava, Latvia
[2]Research and Project Development Centre,
Latvia University of Life Sciences and Technologies,
Liela 2, LV-3001 Jelgava, Latvia**

[*]e-mail: ruta.galoburda@llu.lv

Abstract

Smoked Baltic sprats (*Sprattus sprattus balticus*) are consumed fresh or processed into canned produce. Along with safety, colour and texture are the most important attributes for quality product and should be the same year round. However, the chemical composition of sprats depends on the season, which lasts from October/November till March/April. Freezing of fish is used to prolong the season and spread production over the year. Therefore, the aim of this research was to evaluate colour and texture of smoked sprat depending on season and pre-treatment method applied prior to smoking.

We evaluated colour and texture of smoked Baltic sprats produced from fish after one year frozen storage depending on a catch season and type of pre-treatment. For evaluation of colour CIE L*a*b* system was used. Cutting strength and work of shear were used to characterize the texture of smoked sprats. For pH measurement fish was homogenized with distilled water. Correlation analysis and analysis of variance were used for data evaluation.

The study revealed that season did not have effect on pH, cutting strength and smoking loss. The pH of smoked sprats was between 5.50 and 7.12. It was not significantly influenced by season, but was influenced by the treatment method applied ($F(6,14) = 11.08$, $p < 0.001$). Whereas the colour and texture were significantly affected by season. Work of shear decreased from 1.70 N/mm*s in the beginning till 1.15 N/mm*s in the end of season. Statistically significant difference were determined between groups for colour component L* ($F(2,18) = 6.593$, $p = 0.007$), colour component a* ($F(2,18) = 4.933$, $p = 0.02$) and colour component b*

($F(2,18) = 4.344$, $p = 0.029$) and significant trend for differences in work of shear ($F(2,18) = 3.474$, $p = 0.053$).

In conclusion, a variable chemical composition of fish during season and a type of pre-treatment affect such quality parameters as colour and texture.

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***Key words**: Frozen sprats, Pre-treatment, Cutting strength, Work of shear.*

ASSESSMENT OF DRINKING WATER QUALITY FROM ARTISANAL WELLS IN THE PRIZREN REGION

Sami Gashi[1], Fadil Kryeziu[2,3*], Shkëlzim Ukaj[1], Sejran Abdushi[2], Vehebi Sofiu[1], Violeta Kryeziu[3]

[1]Faculty of Food Science and Biotechnology, University for Business and Technology, Calabria 65, postal code Pristina, Kosovo
[2]Faculty of Medical Technical Sciences, University for Business and Technology, Calabria 65, 20000 Pristina, Kosovo
[3]Regional Institute of Public health, Sh. Emini nn, 2000 Prizren, Kosovo

[*]e-mail: fadil.kryeziu@ubt-uni.net

Abstract

The drinking water supply in the Prizren Region still poses a challenge to local and central governments. Over 30% of the inhabitants of this region are not supplied with safe drinking water. They are bound by alternative supply solutions. Many households provide drinking water from artisanal wells to provide water for consumption. The water provided by these springs is often unsuitable and unsafe because it is not treated. In this research, we have studied the quality of drinking water in ten artisanal wells that constitute the main source of supply for more than 10 households, in different villages of the Prizren region.

Samples were subjected to laboratory analyses evaluating physic-chemical and bacteriological parameters. In assessing the quality of the samples, we used the prospective analytical epidemiological method. Physico-chemical and bacteriological samples were analyzed in the water laboratory of the Regional Institute of Public Health in Prizren. In the research physic-chemical parameters such as; temperature, turbidity, pH, ammonia, nitrates, nitrites, iron, and manganese were investigated with a turbid meter, tempo meter, pH meter, and photometer (Hanna Instruments), while in the microbiological analysis we used the membrane filter method. The results are compared with the standards for drinking water according to National Instruction 16/2012, harmonized with the European Directive on Drinking Water.

The results showed that 4 samples of 10, are characterized by increased values compared to the allowed standards for drinking water according to National Instruction 16/20212. Of these, 2 samples had increased turbidity values where

the nephelometric turbidity unit was 2.2, and iron 14 mg/L. In 4 samples we found the presence of bacterial contamination like coliform bacteria E. coli. Other samples are within permitted standards.

We concluded that the quality of drinking water from artisanal wells is not safe for human consumption, and/or it should be treated before use. Especially bacteriological findings speak of contamination and must necessarily be disinfected before use. Local institutions should increase care for the water supply of these residents, at best monitoring its quality.

***Key words**: Free Chlorine, Chlorides, Iron, Manganese, Pollution, Bacteria.*

STUDY OF TOTAL AFLATOXIN CONTAMINATION IN FLOUR SAMPLES FROM TIRANA, ALBANIA

Afërdita Shtëmbari[1*], Lorena Memushaj[2]

[1]Department of Industrial Chemistry, Faculty of Natural Sciences, University of Tirana, Boulevard Zogu 1, 1009 Tirana, Albania
[2]Department of Pharmacy, Faculty of Medical Sciences, Aldent University, Dibra street 235,1000 Tirana, Albania

[*]e-mail: aferdita.shtembari@fshn.edu.al

Abstract

Mycotoxins, especially aflatoxins are toxic compounds that are naturally produced by different types of fungi. They are commonly found in foods such as cereals, dried fruits, nuts and spices, because they enter the food chain as a result of crops infection before or after harvest. The aim of the study is to determine the level of total aflatoxin contamination in flour samples, due to the high toxicity of aflatoxin and its effects on public health.

To investigate the incidence of total aflatoxin in wheat and maize flour that were consumed in Tirana in period April - May 2021, 18 samples were randomly collected in Tirana markets and mill flour. Aflatoxin levels in all the samples (11 wheat flour and 7 maize flour) were determined by enzyme-linked immune sorbent assay (ELISA) method, measured in 450 nm. Moisture content was also, determined for all samples analyzed via a thermogravimetric method, i.e., by weight loss after drying.

Mean total aflatoxins (B1, B2, G1, G2, and M1) levels in the samples were 2.42 and 7.37 μg/kg in wheat and maize flour, respectively. Total aflatoxin incidence in maize flour was higher compared with wheat flour samples, 100%, and 63.6%, respectively. However, about 14.28 % of the maize flour and 27.27 % of wheat flour samples analyzed exceeded the European Union maximum residue level. Moisture content in all flour samples result less than 14%.

The results showed that the high incidence of positive samples, especially for the maize flour indicates the importance of routine monitoring of total aflatoxin contamination in flour consumed by human, should be performed regularly.

***Key words**: Total aflatoxin, ELISA, Wheat flour, Maize flour.*

THE IMPACT OF GLOBAL GAP IMPLEMENTATION AND RELATION TO KOSOVO FARMS

Lumta Dida[1*], Ben Dida[2]

[1]Agricultural Engineering and Environment, UBT - University of Business and Technology, Kalabria nn, 10000 Pristina, Kosovo
[2]Hybrid Agro, 1st October 32, 10000 Pristina, Kosovo

[*]e-mail: lumta.dida@ubt-uni.net

Abstract

Global GAP, is a standard related directly with food quality. It has very important linkage with environment protection, consumer protection and labor protection. Certified products with Global GAP, passes through different control and specially those related to pesticide use. Global GAP implementation in Kosovo has started 7 years ago, with very few numbers of certified farms. Today number of farmers/ processors certifying with GAP is increasing with high rate, due to the huge potential market for export. The aim of this research study was to assess the extent of changes in management system, workers welfare, production technologies and the potential of selling the products through commercial networks and to foreign markets.

This research regarding the impact of Global GAP implementation was conducted in 2020 - 2021 on 100 farms that are now implementing Global GAP. The years of implementation were different, starting with farms that have been implementing the standard for 5 years now and farms that were in the first year of implementation. These farms cultivated different crops such as: Pepper, Cherry, Cherry, Blueberry, Apple, Grape, Raspberry, Gherkins, and Potato. Farmers' associations and individual farmers were included in this study. The research data were collected from a questionnaire which was compiled with question-based assessments to assess what kind of: technological and infrastructural changes the surveyed farms had to use in order to ensure quality system management and how much the certificate products had an impact on sales. Gained results are analysed by arithmetical mean value.

The research results showed that for the implementation of the GLOBAL GAP in most farms the managerial change of quality has been made. Also in order to implement the standards it was necessary to change the infrastructure to improve the conditions of workers, and the way of storing pesticides and fertilizers. As for managing the production site, 89% of farmers created a decision-making

system based on risk analysis, and 70% created production data archiving system. Referring to the health, safety and well-being of workers, changes in quality control of water used for production were implemented by 100% of farmers conducted in this research, while 88.6% implemented changes in crop hygiene and reduction of processing, 77% expanded of the workers utilities (workers' rest areas, accommodation conditions), 58% introduced the employee training system, and 25% of farmers implemented changes in the waste management on the farm.

Implementation of GLOBAL GAP has increased the chances for all manufacturers to trade products in foreign markets, especially those in the EU, and improved product safety. The product safety was particularly realized by to quality control of water used for irrigation, pesticide use, as well as by washing the products. There are better conditions for employees due to better infrastructure. Implementation of GLOBAL GAP standard is more difficult for small farmers due to financial investment.

***Key words**: Standard, Global GAP, Fruits, Vegetables.*

ASSESSMENT OF PESTICIDE RESIDUES IN APPLE FRUITS AS AN INDICATOR OF FOOD SAFETY

Edlira Shahinasi[1*], Benada Maneshi[2], Ferdi Brahushi[3]

[1]Department of Chemistry, Faculty of Biotechnology and Food, Tirana Agricultural University, Pajsi Vodica nn, Koder-Kamez, 1029 Tirana, Albania
[2]Directorate of Environment and Sustainable Development, Municipality of Tirana, Sheshi Skenderbe nn, 1001 Tirana, Albania
[3]Department of Environment and Natural Resources, Faculty of Agriculture and Environment, Tirana Agricultural University, Pajsi Vodica nn, Koder-Kamez, 1029 Tirana, Albania

[*]e-mail: eshahinasi@ubt.edu.al

Abstract

Pesticides are widely used in agriculture sector to control pests and plant diseases, increasing the overall production of crops and their quality. As the other crops, apple trees are treated with pesticides in order to maintain healthy plant and to improve the quality of fruits. However, the excessive use of pesticides in apple trees leads to the presence of pesticide residues in fruit, which can have adverse effects for the consumers. Since the apples are preferred to be consumed fresh, the adverse effects of the pesticide residues are so obvious therefore. The main objective of current study was to assess the pesticide residues in apple fruits as indicator of food safety.

For this purpose, fruit samples of Starking and Fuji cultivars were collected and analyzed for pesticide residues. The analyses of the pesticide residues were performed using QuEChERS method and chromatography techniques (LC-MS/MS and GC-MS/MS). Furthermore, Dietary Risk Assessment (IESTI in % ARfDI) for children's category was estimated using EFSA PRIMo Model v3.1.

The obtained results, showed that pesticide residues were detected in both apple cultivars, but their levels were below MRLs. In the fruit samples of Starking cultivar were detected only 2 fungicides tebuconazole and trifoxystrobin in amounts of 0.030mg/kg and 0.018mg/kg, respectively. Whereas, in the fruit samples of Fuji cultivar were detected 2 insecticides phosmate and thiacloprid (0.087mg/kg and 0.058mg/kg, respectively) and 5 fungicides dodine, floupiram, pyrimethanin, tebuconazol and tebufenozid (respectively in amount of 0.021 mg/kg; 0.01 mg/kg; 0.032 mg/kg; 0.029 mg/kg, and 0.095 mg/kg). The fungicide tebuconazole was

detected in all fruit samples. MRL of insecticides expressed as %MRL was above 15%. The total %MRL of pesticides in Starking cultivar samples was 12.57%, while the total %MRL of Fuji cultivar samples was 60.11%. Furthermore, the acquired data based on Dietary Risk Assessment (IESTI in % ARfDI) for children's category showed that exposure to these pesticides had no potential health risk.

Based on found concentrations of pesticide residues and calculation of dietary risk for children's category can be concluded that the assessed apple fruits were safe for the consummators.

***Key words**: Apple fruit, Pesticide residue, Health risk, Short-term intake.*

EXAMINATION OF PHYSICO-CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF SPRING WATER "ZLATARICA" BUGOJNO

Enver Karahmet[1], Senita Isaković[2*], Ena Skopak[2], Almir Toroman[1], Saud Hamidović[1], Fahir Bečić[3], Ervina Bečić[3]

[1]Faculty of Agriculture and Food Sciences - University of Sarajevo, Zmaja od Bosne 8, 71000 Sarajevo Bosnia and Herzegovina
[2]Secondary School of Agriculture, Food, Veterinary and Service Activities, Hamdije Kreševljakovića 55, 71000 Sarajevo, Bosnia and Herzegovina
[3]Faculty of Pharmacy, University of Sarajevo, Zmaja od Bosne 8, 71000 Sarajevo, Bosnia and Herzegovina

[*]e-mail: senita.ciklas@hotmail.com

Abstract

Spring Zlatarica is located 6 km northeast of Bugojno. The spring is situated in a distinctly mountainous terrain, which includes the mountains Kalin (1,530 m) and Rudina (1,385 m). The spring is located at the bottom of the mountain Kalin, in the valley of the river Vitina at an altitude of 783 m. This study aimed to examine the physicochemical, microbiological and radiological properties of drinking water and production for the market in Bosnia and Herzegovina and beyond.

Physico-chemical and microbiological characteristics, presence of heavy metals and metalloids and measurement of total beta activity (radiological correctness) were examined thirteen years, in the period from 2008 to 2021. Quality and analyses were performed in accredited laboratories: The Federal Institute of Public Health in Sarajevo, laboratories for chemistry and microbiology of the Faculty of Agriculture and Food Sciences University of Sarajevo. The methods used were in accordance with current legislation and standards for testing researched water quality parameters.

Analyses of physical and chemical parameters of water samples taken from the Zlatarica spring showed that the water is: drinkable, low-mineralized, average temperatures at the spring 9.3 0C, with average mineralization 280 mg/L, colourless, odourless and tasteless, and with pH of 7.85. According to the ionic classification, water belongs to the hydro carbonate-calcium type. The sulphate content was very low and had a mean value of 4 mg/L. The chloride content is also low and was 1.77 - 2.48 mg/L. Of particular importance is the sodium (Na)

content is very low (2.13 - 6.9 mg/L). Water does not contain nitrites and ammonia, while the content of nitrates is very low, almost insignificant, which indicates the absence of organic pollution of water. Consumption of KMnO4 is very low and is 0.4 - 0.94 mg/L. According to the analysis of metals and metalloids, the content of iron (Fe), manganese (Mn), aluminium (Al), zinc (Zn), nickel (Ni), copper (Cu), lead (Pb), chromium (Cr), arsenic (Ar), mercury (Hg), and other heavy metals were very low and corresponds to the Bosnia and Herzegovina Rulebook on health safety of drinking water. The content of fluoride (0,27 mg/L) and selenium (Se) of 6.6 mg/L show the quality important for human health of the tested water. Bacteriological analyses confirmed there weren't coliform bacteria were present, the total number of aerobic mesophilic bacteria was 2, while coliform fecal bacteria, streptococci, Proteus spp., sulphite-reducing clostridia and Pseudomonas aeruginosa were not isolated. Radiological measurement of total beta activity on the beta counter LB5100 was < 1 Bq/L.

In accordance with the test results, it can be concluded that all physical and chemical parameters correspond to the values determined by the Rulebook on the health safety of drinking water.

Key words: *Spring water, Microbiological analysis, Physico-chemical characteristics, Metals and metalloids, Zlatarica.*

CHEMICAL HAZARDS AND RISK ANALYSIS

V

HEALTH RISK ASSESSMENT OF POTENTIALLY TOXIC METALS IN SHEEP MEAT AND SHEEP MEAT PRODUCTS

Radoslav Grujić[1*], Sebila Rekanović[2], Mira Obradović[1], Elvisa Hodžić[2], Nenad Stojanović[3]

[1]State College of Medicine Prijedor, Nikole Pašića 4A, 79000 Prijedor, Republic of Srpska, Bosnia and Herzegovina
[2]Biotechnical Faculty, University of Bihac, Luke Marjanović bb, 77220 Bihać, Bosnia and Herzegovina
[3]Faculty of Agriculture, University of Banja Luka, Petra Bojovića 1a, 78000 Banja Luka, Bosnia and Herzegovina

[*]e-mail: grujicr@blic.net

Abstract

Meat and meat products are an important source of nutrients in human nutrition. Under some unfavorable conditions for raising animals for meat production or conditions during the processing and storage of meat, contamination with toxic metals can occur. The aim of this paper is to assess the health risk of consumers from the intake of 9 metals through the consumption of sheep meat and meat products.

The research was performed on fresh sheep meat and sheep meat products obtained by boiling (temperature 70 - 75 ^{0}C, time 80 - 90 minutes), and drying (temperature 14 - 18 ^{0}C, air circulation 50 m^3/min., relative humidity 85 - 88%). Mineral content of samples of fresh meat and chicken products was determined using an Optima 8000 optical emission spectrophotometer (ICP OES), Perkin Elmer, USA. After determining the content of individual metals, the values of the following parameters were determined: estimated daily intake (EDI), target hazard quotient (THQ), relative risk (RR) and cancer risk (CR) for lead and nickel by US Environmental Protection Agency. The results were statistically processed using descriptive statistics. The significance of the difference between THQ calculated and THQ dangerous to health (THQ = 1) was assessed by t-test of paired samples.

Obtained values for EDI for: Fe, Mn, Zn, Cu, Se, Cd, Pb, Mo, and Ni from fresh sheep meat were: 0.000173388, 4.37296 x 10^{-06}, 2.38083 x 10^{-05}, 0.003206472, 0.049150604, 0.0000, 0.056642576, 0.009576052, and 0.0000, respectively. These results show EDI for tested metals is lower than RfD (reference doses recommended by the US Environmental Protection Agency - EPA). Also, eating

sheep meat and meat products three times a week in the amount of 0.2 kg will not have a negative impact on the population using meat in their diet. Cancer risk factors for Pb and Ni were estimated as follows: 1.92585×10^{-09} and 0.00000. These values are lower than the tolerance values for these metals set by the EPA. This indicates that consuming sheep meat does not pose a cancerogenic risk for Pb and Ni.

Based on these parameters, we can conclude that sheep meat and meat products do not pose a risk for consumer's health.

***Key words**: Sheep meat products, Health risk, Individual metals.*

FOOD BIOTECHNOLOGY, NOVEL BIO-PRODUCTS, FUNCTIONAL FOODS

VI

FOULING ANALYSIS ON ULTRAFILTRATION OF *FUCUS VESICULOSUS* EXTRACTS

Tiago Madeira[1], Catarina Marçal[2], Susana M. Cardoso[2], Licínio Gando-Ferreira[3], Rui Costa[1,4*]

[1]Polytechnic Institute of Coimbra, Coimbra Agriculture School, Bencanta, 3045-601 Coimbra, Portugal
[2]LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, 3810-193 Aveiro, Portugal
[3]University of Coimbra, CIEPQPF, Department of Chemical Engineering, Rua Silvio Lima - Pólo II, Pinhal de Marrocos, 3030-790, Coimbra, Portugal
[4]Research Centre for Natural Resources, Environment and Society (CERNAS), Coimbra Agriculture School, Bencanta, 3045-601 Coimbra, Portugal

[*]e-mail: ruicosta@esac.pt

Abstract

The interest in separating and concentrating bioactives and minerals from seaweeds extracts is growing due to large health benefits of these substances. The aim of this study was to investigate the separation of components of *Fucus vesiculosus* seaweed extracts by tangential ultrafiltration and apply Hermia's models adapted to crossflow ultrafiltration to understand the fouling mechanism.

The seaweed *F. vesiculosus* were cultivated at ALGAplus Lda, and dried at 20 ^{0}C and milled to particles with less than 250 µm diameter. Extractions were done at 120 ^{0}C for 2 h with additional 30 min. to heat the sample to 120 ^{0}C and 30 min. to lower the temperature to 100 ^{0}C. The filtration system used was a Sepa CF II membrane system (GE Osmonics, USA) at room temperature with concentrate recirculation until a 500 mL permeate volume was obtained and starting from a 2000 mL feed solution volume, which corresponds to volumetric concentration ratio (VCR) of 1.33. The influence of membrane cut-off varying from 5 to 150 kDa, crossflow velocity from 0.081 and 0.095 m/s and transmembrane pressure between 2 and 8 bar was studied. Iodine was determined by a 7700 inductively coupled plasma mass spectrometer (ICP-MS) equipped with nickel sampler and skimmer cones and a collision/reaction cell was used for iodine determination. A nonlinear optimization tool of the MaLlab software, version R2015a, was used to estimate the parameters of the fouling models applied to the different filtration tests.

The present study revealed that the ultrafiltration membranes process was successful in clarifying and still delivering permeates with a high content in

iodine. Clarification was almost completely achieved with 5 kDa polyethersulfone membrane, while the hydrophilic polyethersulfone membrane was not adequate to due to the high retention in iodine. Cake layer formation mathematical model was successfully used to predict the permeate flux over time.

There was evidence that cake layer is the fouling mechanism in the filtration of *Fucus vesiculosus* extracts, whatever the membrane crossflow velocity or transmembrane pressure, probably due to the high content of these extracts in alginates.

***Key words**: Fucus vesiculosus, Ultrafiltration, Iodine, Alginates, Fucoidans, Mathematical modeling.*

TECHNO-FUNCTIONALITY OF PROTEIN HYDROLYSATES FROM SWEET LUPINE AND HEMP

Diana Pasarin[1*], Andra Ghizdareanu[1], Catalin Matei[1]

[1]Bioresource Department, National Research and Development Institute for Chemistry and Petrochemistry, ICECHIM, Splaiul Independentei 202, 060021 Bucharest, Romania

[*]e-mail: diana.pasarin@gmail.com

Abstract

Foods are multicomponent colloidal systems, the properties of which depend on the strength of the interactions between the components. The technical and functional properties directly or indirectly affect the processing, quality and acceptance and use of these hydrolysates in food and food formulations. The aim of this paper was to determine the techno-functional properties (solubility, water absorption capacity, emulsification, emulsion stability, pH) of lupine and hemp protein hydrolysates, which can be used as food ingredients and have impact during food processing.

Lupine and hemp protein hydrolysates obtained after optimization of process parameters, NaCl, NaOH and sun flower seed oil were used. The solubility of the hydrolysates was determined as a function of pH in the range of 4 and 9. Water absorption capacity was conducted according to the AACC official method. Emulsifying capacity was determined at pH 7.

The both hydrolysates showed an increase in solubility under acidic conditions (79% and 82% respectively, at pH 4), due to the generation of smaller peptides, whose ionizable groups are accessible to the interaction with water molecules. The water absorption capacity of lupine and hemp hydrolysates was 1.01 and 1.46 g water/g sample, respectively. The number and type of polar hydrophilic groups in the peptides determine their interaction with the polar molecules of water. Lupine protein hydrolysate had an emulsifying activity of 80% and an emulsion stability of 100%, and hemp hydrolysate recorded 100% at both properties after 30 minutes. There is a direct relation between the emulsifier activity of proteins and their solubility. Proteins with high hydrophobicity also have a high emulsifying activity. The pH recorded in both samples was 6, higher than the isoelectric point of the proteins (4.5 - 5).

Both hydrolysates can be used in food and food processing. The combination of techno-functional properties with nutritional value and health-promoting

effects suggests potential application of these hydrolysates as multipurpose food ingredients.

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***Key words**: Lupine hydrolysate, Hemp hydrolysate, Techno-functional properties.*

BIOACTIVE PEPTIDES FROM OAT KERNEL PROTEINS RELEASED VIA INFOGEST METHOD

Małgorzata Darewicz[1*], Monika Pliszka[1], Justyna Borawska-Dziadkiewicz[1], Piotr Minkiewicz[1], Anna Iwaniak[1]

[1]Faculty of Food Science, University of Warmia and Mazury in Olsztyn, Pl. Cieszyński 1, 10-719 Olsztyn, Poland

[*]e-mail: darewicz@uwm.edu.pl

Abstract

Oat kernels are characterized by a high content of nutrients, such as proteins, fats, vitamins and minerals. The most abundant oat protein fraction is represented by globulins, and their content reaches ca. 80% of total oat proteins, thus they may be the source of bioactive peptides when delivered in diet. The aim of this study was to examine dipeptidyl peptidase-IV and angiotensin I-converting enzyme inhibitory activity as well as antioxidant activity of oat globulins digests.

In this study oat kernel proteins were examined via *in vitro* digestion. In silico, part of the study was carried out using computation tools available in UniProt, BIOPEP-UWM, and METLIN databases as well as Fragment Ion Calculator. According to INFOGEST method, the in vitro digestion procedure included the following steps: "oral" - 2 min., "gastric" - 2 hours, pH = 3, "intestinal"- 2 hours, pH = 7. Then, digests were analyzed for their DPP-IV and ACE inhibition and antioxidant activities. Next, they were used in a screening for peptides with above-mentioned bioactivities. Based on the in silico systematic screening for DPP-IV-, ACE-inhibitory, and antioxidant peptides, the amino acid sequences of bioactive peptides were identified in the digests using LC-Q-TOF-MS/MS method.

The intestine digest demonstrated the highest degree of DPP-IV inhibition (98.51%; IC50 = 0.51 mg/mL) and ACE inhibition (87.76%; IC50 = 0.82 mg/mL), and antioxidant activity (ABTS = 96.27%; DPPH = 35.70%; FRAP = 23.02 μM Trolox/mg of sample). The DPP-IV inhibitors (i.e. HF, HW), ACE inhibitors (i.e. GF, IF), and antioxidant fragments (i.e. PW, VW), selected based on the results of in silico studies, were identified in the digests.

According to our results, it can be concluded that oat kernels globulins are the source of peptides with DPP-IV- and ACE- inhibitory as well as antioxidant activity.

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***Key words**: Bioactive peptides, Digestion, Oat proteins.*

WASTES FROM THE MANUFACTURE OF BERRIES OIL - A RICH SOURCE OF NUTRIENTS FOR USE IN FOOD INDUSTRY

Livia Apostol[1*], Mirela Elena Cucu[1], Iulia Elena Susman[1], Cristina Luntraru[2], Mihaela Neagu[2], Liviu Gaceu[3]

[1]National Research and Development Institute for Food Bioresources - IBA, Dinu Vintila 6, 021102 Bucharest, Romania
[2]Hofigal Export - Import SA, 2 Intrarea Serelor 2, 042124 Bucharest, Romania
[3]Faculty of Food and Tourism, Transilvania University of Brasov, Eroilor Boulevard 29, 500036 Brasov, Romania

[*]e-mail: apostol_livia@yahoo.com

Abstract

Taking into consideration the circular economy context, from the processing of agro-industrial raw materials result by-products and residues which can be transformed into the functional food ingredients. Given the importance of nutritionally rich foods for healthy diet choices, the challenge for producers is to find suitable and convenient ingredients for the nutritional improvement of food. Currently wastes from the manufacture of berries (obtaining cold pressed oil and obtaining juice) are less used, which means that they are lost from the circular economy point of view. The aim of the study was to evaluate the nutritional composition of the waste resulting from obtaining cold-pressed sea buckthorn oil.

For this research as material we used the skin and seeds from sea-buckthorn oil obtained by cold pressing, dried at a temperature of 40 - 45 ^{0}C, up to a humidity of 10%. Mineral content was determined using an atomic absorption spectrophotometer (ContrAA 700; Analitykjena). Total fat was determined by petroleum ether extraction at 40 - 65 ^{0}C (Soxhlet Extraction System 2055). Crud fibers was measured using Fibretherm equipment. Total nitrogen and total protein were estimated by the Macro Kjeldahl method. For the amino acid content, we used an ICS300 detector (Dionex-USA).

The obtained results revealed that are a good source of protein (15.09 %), lipids (11.24 %) and crude fiber (9.98%). This by-product presents a high mineral content (mg/100 g): potassium (600), calcium (95), magnesium (81), iron (6.84), zinc (1.47),

and copper (0.95). The total oil content of sea buckthorn waste was 11.24%. The results of the fatty acid profile showed that sea buckthorn waste has a content of 18.59% monounsaturated fatty acids (MUFA), compared to an average content of 20.7% in cold-pressed sea buckthorn oil, and the content of polyunsaturated fatty acids (PUFA) was 59.45 %, compared to an average content of 68.6% in cold-pressed sea buckthorn oil. The protein content of essential amino acids such as: leucine (5.5%), lysine (4.04%), valine (3.98), phenylalanine (3.45%), and threonine (3.25%).

The chemical characterization performed in this study is evidence that the waste resulting from obtaining cold-pressed sea buckthorn oil can serve as a valuable source of nutritional components for the food industry.

***Key words**: Waste, Sea-buckthorn, Nutritional properties, Fatty acid, Minerals content.*

METABIOTICS: NOVEL INSIGHTS FOR TAILORING THE FUTURES OF FUNCTIONAL FOODS

Nicoleta Stănciuc[1*], Gabriela Elena Bahrim[1], Gabriela Râpeanu[1]

**[1]Faculty of Food Science and Engineering,
Dunarea de Jos University of Galati,
Domneasca 111, 800201 Galati, Romania**

[*]e-mail: nsava@ugal.ro

Abstract

The concept of probiotics indicate that the viability of bacterial cells represent an essential condition to ensure the beneficial effects to the host's health. However, a new concept have broken the paradigm, recognizing that some mechanisms and clinical benefits were not directly related to the live microorganisms. Therefore, new concepts in probiotics development were introduced in order to increase their *in vitro* and *in vivo* relevance, newly defined as metabiotics. The metabiotics include chemicals and cells (viable and death cells) derived from probiotic metabolic activity, as postbiotics and paraprobiotics. Generally, metabiotics, such as postbiotics, are obtained by optimized fermentation processes using selected probiotics strains and conventional and unconventional fermentation media to obtain metabolites or signaling molecules with a known chemical structure, with significant physiological-function impact on host whole metabolism, also in connection with the functionality of indigenous gut microbiome. These bioactive ingredients have advantages when comparing with classical probiotics due to of their chemical structure, well-dosed, safe and long shelf-life, for similar in vivo effects. Selected processes, such as high pressure, ohmic, ultrasonic and thermal treatments have efficiency in paraprobiotic (inactivated microbial cells; non-viable) production. In this context, the Biotics+ project aims to enable the development of tailored functional foods based on metabiotics.

The project is financed by the Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI) through the National Research, Development and Innovation Plan 2015 - 2020, Program 4 - Fundamental and frontier research, Exploratory Research Projects and is coordinated by the Faculty of Food Science and Engineering from Dunarea de Jos University of Galati. Our ongoing project results (Biotics+, www.biotics.ugal.ro) will contribute to food functionalization, by developing emerging concepts, based on probiotic strains selection, fermentation and optimization of unconventional substrates (bovine colostrum, gluten free and leguminous flour extracts) to obtain high yield of

postbiotics, whereas selected combined treatments will be used to produce paraprobiotics.

The Biotics+ project ambition is to extend the metabiotics application in foods as functional ingredients, providing several advantages during the industrial handling and commercialization, including the possibility of being added to certain foods considered stressful to probiotics survival, thus, contributing to the development of the tailored functional foods market.

***Key words**: Probiotic strains, Fermentations, Unconventional substrates, Metabiotics.*

SUSTAINABLE USE OF KIWI POMACE FOR THE DEVELOPMENT OF INNOVATIVE FOOD INGREDIENTS

Gheorghe - Ionuț Ilie[1], Ștefania-Adelina Milea[1], Gabriela Râpeanu[1*], Nicoleta Stănciuc[1]

[1]Faculty of Food Science and Engineering, Dunarea de Jos University of Galati, Domneasca 111, 8002021 Galati, Romania

[*]e-mail: Gabriela.Rapeanu@ugal.ro

Abstract

The kiwi fruit processing industry generates large amount of waste, estimated at around one million tons per year. Kiwi fruit pomace is an important source of bioactive compounds, which can be valorized as ingredients, thus reducing economic and environmental problems. The aim of our study was to develop an appropriate technological variant for the transformation of kiwi pomace in added-value ingredients, with probiotic potential.

In this study, kiwi fruits pomace was mixed with different types of flour (black rice and buckwheat flours in a ratio of 20 : 80, w/w), inoculated with *Lactobacillus casei* and freeze-dried. The powders were coded as KBR (kiwi pomace with addition of black rice flour) and KBW (kiwi pomace with addition of buckwheat flour). Different spectrophotometric methods were used to evaluate the phytochemical content, such as for polyphenols and carotenoids. Therefore, the total polyphenolic content and total flavonoids content were evaluated using the Folin-Ciocâlteu and aluminum chloride methods, respectively. The cells viability were measured by a 10-fold serial dilutions of the samples using a sterile physiological serum (0.9 g NaCl%, w/v), by using the pour plate technique. The viable cell number was determined by estimating the number of colony-forming units (CFU) by cultivation on the Man Rogosa and Sharpe (MRS) agar plates (medium at pH 5.7) after 48 h of incubation at 37 ^{0}C. The counts were expressed as CFU/g dry weight (DW). Scanning electron microscopy was used to evaluate the structure and morphology of the freeze-dried powders, whereas the color was measured by using the three coordinates of CIELAB method.

The powders showed a total polyphenols content values of 11.10 ± 0.32 (KBR) and 13.83 ± 0.35 mg gallic acid/g dry weight (KBW) and total carotenoids content up to 34.32 ± 1.35 mg total carotenoids/g dry weight. Both powders showed remarkable cells viability after freeze-drying, with 9.27 log CFU/g DW the kiwi pomace powder

with buckwheat addition and 8.88 log CFU/g DW in the kiwi pomace powder with black rice flour addition. The SEM and droplet size measurement results revealed both vesicular and polyhedral formations distributed on curved surfaces connected by ridge areas. Data obtained from the color CIEL*a*b* were highly correlated with the specific pigment in kiwi pulp, but also with the color of the added flour.

Obtained results are useful in the valorization of bioactive compounds combined with lactic acid bacteria in order to develop a food bio-ingredient.

***Key words**: Kiwi pomace, Lactic acid bacteria, Black rice flour, Buckwheat flour functional ingredient.*

WILD ROSE AS RAW MATERIAL FOR MARMALADE AND JUICES WITH ENHANCED ANTIOXIDANT ACTIVITY

Adina Teodorescu[1], Nina Nicoleta Condurache Lazar[1], Gabriela Râpeanu[1*], Nicoleta Stănciuc[1]

[1]Faculty of Food Science and Engineering, Dunarea de Jos University of Galati, Domneasca 111, 800201 Galati, Romania

[*]e-mail: Gabriela.Rapeanu@ugal.ro

Abstract

Wild rose (*Rosa canina* L.) is a well-known plant, due to its rich content in polyphenolic compounds, phenolic acids, kaempferol, apigenin, and resveratrol. The use of berries is based also on the significant content in vitamin C, carotenoids (lycopene, β-carotene, zeaxanthin), tocopherols, minerals, such as calcium, potassium and phosphorous. The whole plant, including berries are used in different applications for their health-related benefits, such as antioxidant, anti-inflammatory, antibacterial, antimutagenic, anticancerogenic, regulation of the level of lipids and glucose in blood, antiulcerogenic, modulatory effects on urine composition and excretion, osteoarthritis and arthralgia treatment. The aim of this research was to use different approaches in order to enhance the potential applications of wild rose berries.

The berries were initially blanched using hot water at 70 ^{0}C. The fruits were homogenized and divided into two equal quantities. One half of the quantity was enzymatically treated with Pectinex® Ultra Color (Novozyme) to promote the extraction of biologically active compounds and used to obtained juice, whereas the other half was used to obtain marmalades. In order to obtain marmalade, the pulp was mixed with sugar cane and heated in a non-stick electric pot at 102 ^{0}C for half an hour. For juice, the pulp was mixed with apple juice in different ratio (1 : 1 - J1 and 1 : 3 - J2) and pasteurized at 95 ^{0}C for 15 min. The pulps were extracted with different solvents (such as methanol, ethyl acetate and ethanol) and characterized for anthocyanins and carotenoids contents, by using spectrophotometric methods.

The extracts showed an anthocyanins content of 13.56 ± 1.45 mg cyanidin-3-O-glucoside/100 g dry weight (DW) and 133.47 ± 2.67 mg carotenoids/100 g DW. The marmalade showed carotenoids content of 28.90 ± 0.08 mg/100 g DW, whereas the juices showed a content of 32.24 ± 1.03 mg/100 mL for J1 and 18.06 ± 1.11

mg/100 mL for J2, respectively. The products showed an ABTS radical scavenging potential of 12.48 ± 0.02 µMol Trolox/g DW for marmalade and 20.92 ± 0.52 µMol Trolox/mL for J1 and 12.85 ± 0.08 µMol Trolox/mL for J2, respectively.

The obtained results bring new insight of using wild rose berries as raw materials for foods.

***Key words**: Wild rose, Marmalade, Juices, Antioxidant activity.*

DEVELOPMENT OF METHODOLOGY FOR CREATION OF NOVEL FOODS USING NUTRITIONALLY RICH UNDERUTILIZED SPECIES AS MEANS TO INCREASE SUSTAINABILITY, IMPROVE BIODIVERSITY, AND REDUCE MALNUTRITION

Jelena Milesevic[1,2*], Marija Knez[1,2], Marija Ranic[1,2], Milica Zekovic[1,2], Mirjana Gurinovic[1,2], Maria Glibetic[1,2]

[1]Center of research excellence in nutrition and metabolism, Institute of medical research, University of Belgrade, National institute of Republic of Serbia, Tadeusa Koscuska 1, 11000 Belgrade, Serbia
[2]Capacity Development Network in Nutrition in Central and Eastern Europe, CAPNUTRA, Cara Dusana 6, 11000 Belgrade, Serbia

[*]e-mail: jelena.milesevic@gmail.com

Abstract

The double burden of malnutrition, the coexistence of both over- and under-nutrition, affects both developed and middle and low-income countries. Novel food approaches, with the capacity to simultaneously address food insecurity and malnutrition and prevent further increase of overweight and obesity in humans, are required. The current work aims at developing a methodology for recipe design of novel dishes and food products based on acquired knowledge on cultural and traditional practices in various countries across Europe combined with study on consumer acceptance and preferences and food producers' interest in using nutritionally rich but neglected cultivars of different endemic plants and vegetables.

Methodology that is being developed include: comprehensive grey literature (collection of the traditional recipes and existing food products containing cultivars of different endemic plants and vegetables across Europe to gain insight into available options that can be further adjusted to enhance nutritional value of novel foods and offer dietary diversity), qualitative questionnaire for consumer acceptance (paper format, focus groups), online survey (international consumer preferences of dishes and food products containing studied plants), and tailor-made interview (food producers to examine readiness for enhancing food processing and marketing practices). Recipe and food products collection include overview of online recipe databases, cook books, and commercial food

databases across Europe. Consumers focus groups are organized in four countries (2 focus groups per country) - in Serbia, France, Greece, Hungary. A quantitative survey is run in eleven BIOVALUE partner countries through an online consumer survey regarding consumer preferences within a wide range of cultural and social contexts. Interviews with food producers are performed in Germany, Greece, Hungary, Turkey, Spain, and Serbia (15 companies per country).

Novel foods and food dishes, based on promising neglected and underutilized species, are designed with an idea to offer a solution to overcoming deficiencies of various minerals vitamins. Locally available, nutrient-dense, climate adjusted, and affordable plant species are perceived as suitable vehicles to address these issues and provide economic, cultural benefits and, at the same time, address sustainability and food security concerns.

Novel foods and new food technologies bear extensive potential in addressing all forms of malnutrition and include concept of biodiversity from farm to fork. The creation, application, testing, and improved availability of these foods require involvement of all actors in food chain. This multidisciplinary study exhibits complexity that is required to intertwine nutritional and environmental aspects of food production with food industry willingness and consumer awareness and acceptance of novel foods.

***Key words**: Novel foods, Biodiversity, Underutilized nutritionally rich foods, Europe, New food technology.*

DEVELOPMENT AND QUALITY EVALUATION OF CEREAL BASED PROTEIN ENRICHED FOOD PROTOTYPES

Gabriela Daniela Stamatie[1,2*], Ervin Cosma[1,2], Sabina Andreea Bobea[1,2], Denisa Eglantina Duță[2]

[1]Faculty of Biotechnology, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Boulevard Mărăști 59, Bucharest 011464, Romania
[2]National Institute of R&D for Food Bioresources - IBA Bucharest, Ancuța Băneasa 5, 020323 Bucharest, Romania

[*]e-mail: gabriela.stamatie@bioresurse.ro

Abstract

Cereal based protein enriched food prototypes represent a healthier alternative product when consumers showed more interest in health and diets. There is a general nowadays trend to replace the animal original protein with plant protein and to use plant proteins to increase the nutritional value of food products. The aim of this study was to develop and analyze new food products: protein bars, pretzel, grissini, cookies, pasta using wheat flour and various protein ingredients.

The materials used for enriching the protein content of food products were: almond flour, flaxseeds flour, pumpkin flour, pea protein, chia protein, rice protein, spirulina protein, seeds mixtures, dried fruits, nuts flour. The physicochemical analyzes were performed to determine the energy value (kcal/100g) of the obtained products: moisture (%, thermobalance), total ash (%, dry ashing), protein (%, Kjeldahl method), fat (%, Soxhlet method), brute fiber (%, chemical method using FiberBag equipment). The pasta boiling behavior was analysed measuring the increase of the water volume for boiled pasta in comparison with uncooked pasta. Sensory qualities and consumer acceptability for product prototypes was assessed through sensory acceptability and preference tests. Determination of total number of bacteria and number of yeast and molds was performed according to SR EN ISO 4833-1/2014 and SR ISO 21527-2: 2009 respectively.

The bars had a protein content from 13.2 to 18.45%, fat from 5.96 to 10.45%, fibers around 0.34%, and energetic value from 315.92 to 379.59 kcal/100 g. Cookies had the following properties: 21.11% humidity, 9.62% protein content, 24.28% fat content, 0.28% fibers, 436 kcal/100g energetic value. Pretzel and grissini had: 29.48% humidity, 12.57% protein content, 7.33% fat, 0.29% fibers, and 318.15 kcal/100 g energetic value. Pasta products had: a protein content in the range 13 - 22%, and 1.2 to 3.4 degrees of acidity (measured through titration with NaOH 0.1

N). Microbial contamination was not detected in the products. All the products have been appreciated by the evaluators and by the consumers and represent optimal variants for the large-scale realization of protein-enriched flour products.

This research revealed the potential of the new prototypes as a protein dense nutrient rich wholesome food for different age groups.

***Key words**: Cereal-based products, Protein, Bars, Cookies, Pasta, Pretzel, Grissini.*

CONSUMERS VII

ANALYSIS OF CONSUMERS' PREFERENCES FOR LOCAL CHEESE IN KOSOVO APPLYING CONJOINT CHOICE ANALYSIS

Njazi Bytyqi[1], Attila Bai[2], Balogh Péter[2], Eroida Mehaj[3*], Ardit Sertolli[2]

[1]Department of Agroeconomy, Faculty of Agriculture and Veterinary, University of Pristina, Boulevard "Bill Clinton" nn, 10000 Prishtina, Kosovo
[2]Department of Business Economics, Institute of Applied Economics, Faculty of Economics and Business, University of Debrecen, Böszörményi 138, 4032 Debrecen, Hungary
[3]Faculty of Tourism & Hospitality - Ohrid, St. Clement of Ohrid University, Kej Makedonija 95, 6000 Ohrid, Macedonia

[*]e-mail: mehajeroida@gmail.com

Abstract

Analyzing consumer preferences for cheese consumption in the market of Kosovo is very important, very complex and also very interesting process to study, as cheese is part of every meal in all Kosovar families. Our goal in this research was to identify the impact of attributes and attribute levels on consumers' preferences when buying and consuming cheese.

The research was conducted in five cities in Kosovo (Pristina, Prizren, Peja, Gjilani, and Mitrovica) with a total of 225 cheese consumers' and we have used the type of questionnaires adapted to face-to-face contact with consumers'. These preferences were analyzed by applying conjoint choice analysis (CCA) and latent class analysis (LCA) methods. These methods (CCA and LCA) enabled us to classify consumers into five groups (classes), depending on the category of cheese they preferred: Origin ("Sharri" cheese, "Rugova" cheese, home-made cheese), price (3 €/kg, 4 €/kg, 5 €/kg, 6 €/kg), type of milk (cow milk, sheep milk, goat milk), type of cheese (soft cheese, medium-soft cheese, hard cheese), taste (white cheese, yellow cheese, cheese with added spices), and the attributes of cheese that have most preferences are shown with the highest level of significance ($P \leq 005$).

Research results have shown that attributes such as type of milk for producing cheese and taste of cheese are very important attributes with a final impact on consumer preferences, although the level of importance of the type of cheese varies according to classes (groups) of consumers depending on the type of milk and taste which have been shown to be important attributes to all consumers classes.

Cheese producers in Kosovo should be oriented in the production of their cheeses according to consumer preferences, adapting to their preferences according to the type of cheese, type of milk for producing cheese, taste and origin of cheese. The research analysis provided us useful information for producers and policymakers on the potential for further development of the cheese industry, for the creation of labels and brands for the type of milk and cheese, with regional indicators on milk content for production and protect the origin of the cheese.

***Key words**: Cheese, Consumers' preferences, Conjoint choice analysis, Latent class analysis.*

HOUSEHOLDS FOOD CONSUMPTION PRIORITIES RESEARCH IN THE COVID-19 CONDITIONS

Elena Kravchenko[1*], Oksana Karashchuk[1]

**[1]Basic Department of Trade Policy,
Plekhanov Russian University of Economics,
Stremyanny lane 36, 117997 Moscow, Russia**

[*]e-mail: krav.elen07@gmail.com

Abstract

Population's safety and health is the food trade's key issue. Consumer behavior model and the consumer's food products value perception that determine his choice is transformed. COVID-19 pandemic has affected the change in households' food consumption priorities. The restrictions imposed and the reduction in real incomes of the population led to a change in the diet in households, the impulsive purchases rejection and the strengthening of the trend for savings, which manifested itself in the transition to cheaper food. Irrational eating behavior model of the population leads to a micronutrients shortage. This worsens the health and quality of the population's life. The economic, social and medical consequences of malnutrition are significant and have a negative impact on food security and sustainable State development. According to stated, the study purpose is to research the dynamics and assess the compliance of actual food consumption in Russian households with the recommended standards by the Ministry of Health of Russia and WHO.

The study used materials from the Russian Federal State Statistics Service for the 2005 - 2020 period (data on the basic foodstuffs consumption volume and structure, food's cost, share of food purchase costs in consumer spending, and the nutritional and energy food value consumed), as well as materials from the Ministry of Health of Russia and the World Health Organization (recommended food consumption norms in households). In the course of the study, the following methods were used: regression analysis method - to assess the relationship between food costs and basic foodstuffs in households consumption; stratification method - to study consumption trends in households (by place of residence, by composition, by socio-demographic type and income level); normative method - to assess the actual food consumption compliance in Russians households with the Ministry of Health of Russia and WHO recommended standards; graphical method - for visual representation by the population basic foodstuffs consumption dynamics in accordance with rational norms; binary choice models - for determining the

determinants of irrational nutrition structure; abstract-logical method - for the implementation of trends' study results theoretical generalizations in the basic foodstuffs consumption.

The study of various socio-economic groups' household consumption volume and structure dynamics revealed food expenses amount increase in the total amount of Russians consumption expenses and a change the diet structure in households during the COVID-19 pandemic. When studying the Russian population's consumption over the past 15 years, significant differences in the consumption of urban and rural populations have been revealed. It was found that in rural areas the volume of certain type's products consumption is lower by 1.5 - 11%. It is also determined that the proteins and fats content in the population's diet increases and the carbohydrates consumption decreases. This trend poses weight gains and obesity threat in humans. The dependence of the diet structure on the family economic situation has been established, which is expressed in the insufficient important food products consumption, primarily with a high vitamins and minerals content in households with low incomes. It is determined that the population's nutrition structure does not comply with the recommended rational nutrition norms established by the Ministry of Health of Russia and the World Health Organization. The population's irrational eating behavior model worsens the quality of households' life in the country, increases the cardiovascular and oncological diseases risk. During the COVID-19 pandemic, was improved the consumer behavior model, which was reflected in a change in the diet structure in favor of a healthy diet: foods with a high nutrients content. In this regard, in the future, we can expect an improvement in the household consumption structure in Russia and the priorities consolidation for healthy consumption.

The study results have a practical importance for the innovative guidelines development on population's healthy diets, the balanced nutrition standards formation, and the food resource balances compilation. The formulated conclusions are the basis for determining the problems that hinder the achievement of sustainable development goals in the Russian Federation.

***Key words**: Food products, Consumption, Households, Food expenses, Healthy eating indicators, Rational nutrition, diet, Consumption norms.*

FACTORS DETERMINING THE CHOICE OF FOOD PRODUCTS

Petya Hristova[1*], Magdalena Platikanova[1]

[1]Department of Hygiene, Epidemiology, Microbiology, Parasitology, and Infectious Diseases, Medical Faculty, Trakia University, Armeyska 11, 6000 Stara Zagora, Bulgaria

[*]e-mail: petia_14_1995@abv.bg

Abstract

Nowadays, nutrition, in particular the choice of food, is important, extending far beyond the ordinary physiological process. The aim of the present study is to investigate the factors that influence food choice.

The survey was conducted as a questionnaire among 550 participants (324 women and 226 men) aged from 18 to 65. The participants in the study are residents of Stara Zagora District. An analysis of the results from the survey with data coding and application in the processing as ordinal and nominal values was performed.

The results show that the most frequently consumed food groups are fresh vegetables (54.44%), followed by fresh fruits (43.47%), meat and meat products (43.33%), confectionery (30.20%), milk (30.04%), cheese and cottage cheese (29.49%), pasta (28.72%). The choice of food is determined by a number of factors such as sex, age, education, and employment, as well as socio-economic status. There are differences in the results among the different target groups. The sex distribution shows that 12.79% of women and 6.98% of men eat a healthy diet on a regular basis. According to age, 6.98% of people in the age group 41 - 50 eat healthy, followed by those aged 21 - 30 (6.60%). Respondents with secondary and higher education show the highest results in terms of healthy eating - 9.02% and 8.64%, respectively. More future in-depth research is needed to focus on food choices and diets.

Informing people about healthy eating can lead to greater success in establishing it as a regular practice. With the help of self-assessment, self-control, and nutrition information obtained from general practitioners, healthy eating can become an effective method of disease control and prevention.

***Key words**: Food choice, Food products, General practitioners (GPs), Nutrition assessment, Healthy eating.*

FOOD CHAIN MANAGEMENT, MARKETING, ECONOMICS

VIII

DESIGN AND DEVELOPMENT OF CONSUMER-ORIENTED PRODUCTS THROUGH THE METHOD OF QUALITY FUNCTION DEPLOYMENT

Maryna Mardar[1*]

**[1]Department of Marketing, Business and Trade,
Odessa National Academy of Food Technologies,
Kanatna str., 112, 65039 Odesa, Ukraine**

[*]e-mail: marinamardar2003@gmail.com

Abstract

One of the promising areas for new product development is the use of modern quality management tools and methods, such as the QFD (Quality Function Deployment) methodology. QFD methodology includes application of such instruments and methods of quality management as the: Diagram of Affinity, Tree Diagram, Method of Benchmarking, Method of "Kano model" and so on. The aim of this study was to apply the methodology of QFD to develop a new product of improved quality (granola), taking into account the wishes of the consumers.

In accordance with the set task, the object of the research is the development of a new type of granola. Based on the marketing research and the Kano method, the consumer preferences were identified and the relationship between the consumer satisfaction and the product characteristics was established. The obtained results were used in the construction of the "House of Quality". Benchmarking method was used to compare the quality indicators of the new products with the indicators of competing products.

As a result, it has been determined how much the product we are developing will compete with the best analogues in the market. Based on the analysis of the study of regulatory documents, the list of the most important technical characteristics of granola, which are included in the ceiling of the "House of Quality". For determining strength of the connections between the consumers' demands and technical characteristics, the matrix of the connections was made. Based on the calculations, the total assessment and the priority of the quantifiable indicators were determined, taking into account their rating of importance and the strength of the relationship between the consumer requirements and the quantifiable indicators.

As a result of the research, the following characteristics have been highlighted as the priority - oriented in the development of the new granola: the type of the main raw materials and additives, the content of the biologically active substances, the natural composition, and the preventive properties. These technical characteristics should be paid attention to first of all as it will allow to create a product with improved consumer properties and good organoleptic indicators.

***Key words**: QFD methodology, Grain product, Quality, Marketing researches.*

VIEWPOINT OF MANAGEMENT ABOUT THE APPLICATION OF INTEGRATED MANAGEMENT SYSTEMS IN FOOD COMPANIES

Igor Grujić[1*], Branko Latinović[1], Radoslav Grujić[2]

[1]Faculty of Information Technology, Paneuropean University Apeiron, Vojvode Pere Krece 13, 78102 Banja Luka, Bosnia and Herzegovina
[2]State College School of Medicine - Prijedor, Nikole Pašića 4A, 79000 Prijedor, Republic of Srpska, Bosnia and Herzegovina

[*]e-mail: igor.r.grujic@apeiron-edu.eu

Abstract

The authors present the attitudes of management and business owners in the food sector regarding the implementation of management systems (MS) through the implementation of Quality Management Standards - QMS (ISO 9001: 2015), Environmental Management Standards - EMS (ISO 14001), Occupational Health and Safety Management Standards - OHSMS (OHSAS 18000) and Food Safety Management Standards - FSMS (ISO 22000, HACCP, IFS) in food companies in four Balkan countries. The aim of the research was to determine the current situation and plans for the application and integration of management standards in the next five years. Particular emphasis is placed on the organizational and technical capabilities of enterprises to integrate multiple management systems (QMS, FSMS, EMS, OHSMS) into an integrated management system (IMS).

The views of company representatives were collected through a survey conducted in four Balkan countries (Bosnia and Herzegovina, Serbia, Macedonia, and Montenegro). For the needs of the research, a specific e-questionnaire was designed. The distribution of e-questionnaires and the collection of answers from companies covered by the survey was conducted via Microsoft Forms. The survey covered 92 companies. Based on the Cronbach's alpha coefficient, the reliability and internal compliance for this sample were tested. Data processing was performed using IBM SPSS Statistics 26.

According to the survey results, most companies have certificates for the following standards: QMS (ISO 9001 - 81 companies), FSMS (HACCP - 82, and ISO 22000 - 50), and EMS (ISO 14001 - 59). 43 companies have a certificate for the OHSMS standard (OHSAS 18000 - 30 or ISO 45000 - 13). IFS (32), BRC food safety (11), Halal (51), organic (21), Kosher (8) and other standards are also used. Most companies apply the standards separately, i.e. they have certificates for each standard individually.

Less than 20 companies stated that they apply some of the combinations of several standards in an integrated way. Only three (3) companies apply all four observed standards (ISO 9001 + ISO 14001 + OHSAS 18001 + ISO 22000). According to the companies, 35 of them apply QMS and some of the FSMS in an integrated way. Representatives of the companies stated that in the next 5 years, activities will focus on the integration of different MS, including the simultaneous integration of all four observed MS (65 companies). To facilitate the implementation of MS, companies will employ experts in this field (51), develop and implement a support information system (60) or hire a consulting agency (65).

The results showed that companies in the food sector in the 4 Balkan countries apply more MS. The most commonly used are FSMS (82), QMS (81), and EMS (59). The success of the application of MS companies is also proven through certificates for appropriate standards. It was noticed that companies use little of the benefits of integrating more MS into a single system, but plan to do so in the next 5 years.

***Key words**: QMS, FSMS, EMS, OHSMS, Integrated management systems, Food sector, Balkan countries.*

ECONOMIC EFFECT OF LAND FRAGMENTATION ON FARM PRODUCTIVITY

Emine Daci Zejnullahi[1*], Mufail Salihaj[1], Medin Zeqiri[1]

[1]Department of Food Sciences and Biotechnology, UBT- Higher Education Institution, Kalabria nn, 10000 Pristina, Kosovo

[*]e-mail: emine.daci@ubt-uni.net

Abstract

There are not many studies conducted related to the land fragmentation in the entire country and in particular at different farm levels. Most of the studies in Kosovo are focused on Agriculture and other related issues, which ignores the land fragmentation issues and structure even if it is crucial for the productivity. This paper is focused on the study of the relationship between land fragmentations, structure and impact on the farm productivity in Kosovo.

The study was based on data collected through a paper questionnaire, which was conducted face-to-face discussion with representatives of 444 households, which were randomly selected from the Dukagjini region covering the municipalities of Peja, Gjakova and Prizren. Regarding the theoretical review, we have analyzed studies related to the: influence of various factors such as biophysical factors (climate, soil fertility etc.) and socio-economic (preferences, prices, production objectives, etc.) related to the treatment of farm and labor investments, structure, fragmentation, infrastructure and markets, and management practices. The collected data were processed using the software program SPSS 17. To calculate the productivity of farms we have used the clustering model.

As in the researchers studied, also in our research results show strong correlations between fragmentation and productivity. Land fragmentation seems to be correlated to farm productivity. In order to measure the correlation between the two variables researched at the beginning we have that farms as we have grouped farms into 6 different clusters such as: field crops, permanent crops, grazing livestock, mixed crops, mixed livestock and mixed crops-livestock. Analysis into six different clusters has shown that farm fragmentation and other factors have affected their productivity. Other key factors that were found to significantly affect the farm productivity in combination with the farm fragmentation are the agricultural education of the farmers, management and the farm structure.

Policy makers should issue administrative instructions for the protection of land areas from further fragmentation as in many countries around the world, reducing the level of fragmentation of agricultural farms, developing and implementing policies for land consolidation, land consolidation and protection against change of destination is an immediate need. Increasing cooperation between farmers would affect several aspects: increasing net income per unit of employment, reducing costs per unit of production (the effect of economies of scale) and also investing in the profiling of agricultural farms.

***Key words**: Land fragmentation, Farm structure, cluster method, Dukagjini region and farm productivity.*

CROSS-COUNTRY ANALYSIS OF ONION TRADE IN EU AND BALKAN COUNTRIES

Gábor Gyarmati[1*]

[1]Keleti Faculty of Business and Management, Óbuda University, Tavaszmező 15-17, H-1086 Budapest, Hungary

[*]e-mail: gyarmati.gabor@uni-obuda.hu

Abstract

Onions are a staple food in most kitchens. For this reason, the aim of my study is to examine how trade in this product has developed on the European continent, who are the most important producers, exporters and receiving countries.

The source of the trade data used to calculate the Balassa Index was the World Bank's WITS (World Integrated Trade Solution) database (World Bank (2022) and Altabig database (2022). The data were downloaded at HS-2 (Harmonized Commodity Description and Coding System) level for agricultural products (chapters 1-24) for the period 2010-2020. The methodological basis of the study is the index of manifest comparative advantage defined by Balassa in 1967. The index is based on the theory of trade based on Ricardo's theory of comparative advantage. The weight and role of agriculture and agricultural trade is presented using the FAO (Food and Agriculture Organization of the United Nations), and the WTO (World Trade Organization) databases (FAO (2022), WTO (2017)). The Balassa index is calculated for EU27 member states including Hungary and Western Balkan countries such as Albania, Bosnia and Herzegovina, Montenegro, Macedonia, Kosovo, and Serbia. Although it should be noted that data for Kosovo was so unavailable that it had to be excluded from the analysis. Where only some data were missing, they were filled in by linear extrapolation.

In recent years, weather and logistical problems have become commonplace in the global onion market, affecting quality and prices in many countries. The Netherlands could export larger quantities, but does not have the transport capacity to do so. British producers face higher fertilizer, energy, transport and labor costs. Demand for white onions is high as production has fallen slightly in several European areas. Italian onions are also in demand abroad, as weather conditions have allowed for good quality this year. Exports are slow and prices are low, similar to the same period last year, but not yet at pre-plague levels. The pressure of low prices for Dutch onions is having a big impact, as is the year-on-year increase in German and UK production. According to the Hungary national

report, the area sown to onions this year is 1,360 hectares, with an estimated harvestable yield of 29,776 kg/ha, resulting in a total production of 40.5 thousand tons this year. The area under onions in Hungary has been decreasing for years, while demand for the vegetable has increased. Problems are posed by cheap foreign competition and low purchase prices, but input prices and production costs have increased. Pesticide withdrawals are also making things more difficult for farmers, especially in the area of weed control. The unpredictable weather caused by climate change is also posing increasing challenges for producers in central Europe. The general assumption is that countries trade in a given product because they derive a comparative advantage from it. This is only partly true. Most European countries have a comparative disadvantage from onions. It is assumed that they need imports, which are replaced by Chinese, Indian and American products. At the same time, Spain and the Netherlands have an absolute advantage and are exploiting it. There are countries that are major producers but at a comparative disadvantage. Our case falls into this group. Italy and France. Some countries are large producers and have a comparative advantage. For example, the Netherlands and Spain. Small producers but with an advantage Group 3, Macedonia and Spain. The other countries studied are small producers and have a disadvantage, i.e. they need to import or should import.

If we compare 2010 and 2018 data, we can see that both value and Balassa indexes decreased in the countries analysed. It means that comparative disadvantage increased in Europe.

***Key words**: Balassa index, Onion, Export, Import.*

INTELLIGENT DECISION SUPPORT SYSTEM FOR CHOICE THE BEST FOOD STORAGE TECHNOLOGY

Rolandas Drejeris[1], Mindaugas Samuolaitis[1*]

[1]Academy of Agriculture, Vytautas Magnus University, Studentu 11, LT-53361 Akademija, Kaunas district, Lithuania

[*]e-mail: mindaugas.samuolaitis@vdu.lt

Abstract

Storage processes are constantly being improved: new innovative handling and packaging equipment is being developed and applied; new product storage technologies, accounting, management, and telecommunication as well information technology innovations are being implemented. This change in opportunities has not escaped food storage processes either. The storage of food products is subject to higher requirements than other goods, therefore, considering the current trends in food storage, the choice of the appropriate food storage technology can be identified as a problem for the food companies. The choice of any technology is a sufficiently responsible decision for a business that requires objectivity, it depends on many conditions and situations. Therefore, the choice of food storage technology can be considered as a multi-criteria task, the solution of which would be clearly facilitated by the development of an intelligent decision support system. The aim of this paper is to propose a decision support system for food storage selection based on the application of the multi-criteria evaluation method - COmplex PRoportional ASsessment (COPRAS).

Summarizing scientific and professional literature for choosing the best food storage technology, we see it meaningful to choose the best food technology as a process. This is the precondition for the most appropriate disclosure of both the content of the selection and the chain of this multi-step process. So, we found that choosing the best food storage technology is the multicriteria task, therefore the use of the COPRAS multi-criteria evaluation method was the most suitable for achieving it. After systematizing the basic information about the process for choosing the best food storage technology developing an evaluation tool, an example of the choice of food storage technology based on real situations was provided in the 2 international food companies established in Kaunas (Lithuania).

The most important task solved was the selection of appropriate criteria for assessment. The COPRAS method for multicriteria evaluation for choosing technologies was recognized as the best. After performing an expert evaluation

according to the criteria's and after multi-criteria evaluation calculations, the best food storage technologies were selected, which best meets the requirements for food companies according to the developed tool.

The multi-criteria method presented in the article and the identified evaluation criteria really could allow for the food companies to select the most appropriate technology for food storage. The proposed methodology can be applied to all food businesses, even for different forms of ownership and different activities.

***Key words**: Products storage processes, Multi-criteria evaluation, Copras.*

PROFITABILITY AND ECONOMIC VALUES OF PRODUCTIVE AND FUNCTIONAL TRAITS IN SHEEP OF BULGARIAN DAIRY SYNTHETIC POPULATION

Stanimira Slavova[1*], Nevyana Stancheva[2]

[1]Agricultural Institute, Radnevo road nn, 6000 Stara Zagora, Bulgaria
[2]Agricultural Institute, Simeon Veliki Boulevard 3, 9700 Shumen, Bulgaria

[*]e-mail: mirka_sl@abv.bg

Abstract

The subject of the current research was to estimate profitability and economic values of production and functional traits in sheep of Bulgarian dairy synthetic population, raised at the experimental farm of the Agricultural Institute - Shumen. The aim of this research was to answer the question whether production was profitable and which were the traits of the highest economic priority for the breeding goal.

Data was presented and processed for a period of 5 years (2016 - 2020). Semi-intensive production system including winter indoor lambing and summer grazing on pasture has been practiced within the study period. Results were obtained using a program ECOWEIGHT for sheep (for calculating economic weights for sheep).

Profit and profitability per ewe showed negative values 50.85 euros, and - 21.67%, respectively, taking in account the subsidies in the calculation. Marginal economic values of the most important traits in dairy sheep was estimated to 0.4 euros per liter of milk and 48.26 euros per lamb. Negative values were established for the mature weight of ewes, wool yield and daily gain of breeding lambs in rearing. The highest relative economic value was calculated for the litter size per lambing ewe - 30.31%, followed by the milk yield - 13.54% and productive lifetime of ewes - 11.1%.

Milk production in the studied flock need further studies to be carried out to reveal the factors affecting its low relative economic value. However, production on the farm should be optimized in terms of nutrition and animal health status, breeding technology, management and marketing strategy.

***Key words**: Bulgarian dairy synthetic population, Profit, Profitability, Marginal economic values, Relative economic values.*

EDUCATION, INNOVATION AND KNOWLEDGE TRANSFER

IX

INNOVATION, EDUCATION AND KNOWLEDGE TRANSFER, THROUGH LANGUAGE COMPONENTS ON EXTRACURRICULAR PROJECTS, IN PRESCHOOL EDUCATION, FOR MAINTAINING PUBLIC HEALTH AND NUTRITION

Albana Tahiri[1*], Gilberta Hadaj[1]

[1]Department of Education, Faculty of Social Sciences, Albanian University, Zogu I Boulevard, 1001 Tirana, Albania

[*]e-mail: albanatahiri@gmail.com

Abstract

During the last decades, the curricular changes in the Albanian education, have made that the preschool education went through different reforms. The curriculums are designed in function of the competency-based curricular approach. At the core of our thesis lies the importance of the role of curricular projects and the creative didactic work of educators in educational institutions, for merging the areas of standards with the approach based on the competencies of the subject. Our paper aims, through the model of a curriculum project in preschool education, (including the age group of 4 - 6 years old) to address key curriculum competencies by integrating them with the subject area, such as health, physical well-being and nutrition. The connection between them ensures their mutual development and enables subject integration, where priority is given to linguistic and health articulation.

Our research is extended to 10 public kindergartens, and 5 public schools in the city of Tirana through surveys and questionnaires, based on the literature of the Ministry of Education as a curriculum and education strategy and 20 years of work experience in the field of education. We collected data from 900 students and 30 teachers participating in the study. Gained data were analyzed by arithmetical mean value.

The results showed that 70% of educators combined language components in the implementation of the interdisciplinary project, such as the field of health, physical well-being and nutrition. 65% of educators have difficulties in using technology in teaching, and 45% of them do not merge key curriculum competencies with the subject area, but implement them separately, while 80% confirm the problems and challenges in pandemic conditions.

University auditors have a duty to train teachers who are able to implement a new curriculum, which is based on competencies and teaching takes on a comprehensive character. Teacher qualification should be the focus. The study confirms giving importance to interdisciplinary projects, where the fusion of key curricular competencies, interacts extensively with the subject area, such as the field of health without neglecting the professional development of teaching.

***Key words**: Curricular framework, Education, Language competencies, Health competencies, Play.*

ACTIVE TEACHING TECHNIQUES AND ASSESSMENT METHODS TO PROMOTE STUDENTS' UNDERSTANDING OF CHEMISTRY

Flora Qarri[1], Edvina Cipi[1*]

[1]Department of Chemistry,
Faculty of Technical and Natural Sciences, University "Ismail Qemali" - Vlore,
Boulevard Vlore-Skele nn, 9401 Vlore, Albania

[*]e-mail: edvinaelite@gmail.com

Abstract

In the Albanian educational system, chemistry is a subject of major interest as it is one of the main requirements for the university admission in many fields as engineering, medicine and other scientific subjects. The right approach towards its teaching becomes crucial as faulty tutoring can hinder or create a discomfort among secondary students trying to learn. This study aims to investigate the effectiveness between three (3) teaching approaches and learning methods of chemistry in secondary schools in the area of Vlore, Albania, and propose the optimal solution respecting the national educational curricula.

The population of the study consisted of all the sophomore secondary students, in two (2) schools, twelve (12) classes, or a total of three hundred and seventy-three (373) students in the area of Vlore City, Albania. One of the schools was public and the other private but both the biggest secondary educational institution in the area. The main topics used for the purpose of this research were atomic structure and molecular bonding, in accordance to the national curriculum program timeframe imposed by the Ministry of Education, Sports and Youth in Albania. In eight (8) weeks study period, three (3) teaching techniques were posed to study students learning performance: direct learning method, guided inquiry method and an experimental hybrid of both the methodologies. The evaluation was done on double bases. First all the students were subjected to the same evaluation tests at the end of each topic. Also a survey research design was structured as an instrument to collect data as a questionnaire. The elaboration of all the information obtained was analyzed using simple percentage statistical method.

The result of the findings revealed that guided inquiry method focused on the doing (demonstrational) of teaching chemistry brought higher score (grades) among the students of different average grade classified groups. But from the target group of students with grades from 8 to 10 (in an evaluation scale of

10\10), 32.2% private and 25.9% public achieved upper grades with a half or full grade than their average testing individual results after the combined teaching technique of both "doing" and direct learning were applied. The direct learning on its own showed no significant improvement and 39.1% of the total study population evaluated it in the questioners as "hard to keep focus". The study disclosed a new path of alternated guided-inquiry methods and direct learning method of teaching chemistry when adapted adequately by the teachers can have a great positive influence in the learning process in secondary schools in the area.

So, in conclusion, due to the study results it is suggested among others that teachers should use students' centered methods of teaching intersecting the other methodologies in the teaching and learning of Chemistry as this will increase students' interest towards the learning of Chemistry and simultaneously produce noticeable results.

***Key words**: Chemistry, Didactics, Methodology, Interactive, Active learning.*

STUDENT INFORMATION SYSTEM IN THE PRE-UNIVERSITY SCHOOL IN KOSOVO

Elmedina Bajgora[1], Denis Celcima[2*]

[1]Faculty of Business, Haxhi Zeka University, UÇK nn, 30000 Peja, Kosovo
[2]Faculty of Psychology, UBT-University of Business and Technology, Kalabria nn, 10000 Pristina, Kosovo

[*]e-mail: deniz.celcima@ubt-uni.net

Abstract

Student information systems (SIS) worldwide provides: registering students, track student attendance, document grading and the results of student assessment scores, form student schedules, generate reports and manage other student-related, parents, teachers' data needs in an educational institution. This allows a teacher to keep that parent updated with their child's social and academic progress in the classroom and prevents absences of children from school of whom parents are uninformed. The application of SIS in primary and secondary schools in Kosovo adjusts the quality of education. This research aims to investigate the application of SIS in primary and secondary schools' education in Kosovo.

To conduct this research was used an online questionnaire. It was sent to seven regions of Kosovo, or 38 municipalities, at primary and secondary schools in different cities. The target groups were students, teachers, and parents. There were 15690 respondents in 1,046 primary and secondary schools. The questions were structured to measure the SIS necessities in schools. To achieve the aims of this research, we used SPSS to process and analyze survey data.

The results show a strong correlation between the SIS and teachers, students, and parents. The impact of the SIS eliminates problems caused due to the lack of information such as the schedule, the child's assessment and the child's performance at school. If parents are informed in time, they will have greater chances for the child's improvement. Communication between academic staff, parents, and students through SIS is transparent. Therefore, the teachers are the ones who agree that SIS enables them to provide a good education.

The conclusion of this research is to that SIS in pre-university school education in Kosovo should be applied, and policymakers should develop a concrete plan or

administrative instruction to implement the student information system (SIS) in preschool education.

***Key words**: Student information system, Education, Pre-university school education.*

HYGIENIC ENGINEERING AND DESIGN

X

HYGIENIC DESIGN OF GASKETS AND SEALS

Ferdinand Schwabe[1*]

[1]Hygienic Design Consultant,
Schulstraße 62, 32547 Bad Oeynhausen, Germany

[*]e-mail: fs@hygienicdesign.biz

Abstract

In food processing- and filling equipment, quite often a lot of individual parts have to be connected e.g. to assemble piping systems, heat exchangers, pumps or valves. All connections with contact to food products or processing fluids have to be sealed hygienically against leakage from the inside to the environment and also to form a barrier against the environment and potential contaminants. This research is intended to create awareness about the key design principles that should be followed when designing or selecting sealing solutions made of polymeric materials.

Did you ever hear about "plastic and rubber particles detected in food products"? Such announcements of foreign particle contamination point to a physical hazard that often is the result of a faulty seal design. But it may also be the result of wrong material selection. Or did you hear about "food contamination by pathogenic microorganisms"? Here also, the reason for such a biological hazard is more often to find in a non-hygienic, non-cleanable gasketed joint between components rather that due to a rough stainless steel surface. The design engineer needs to have a good knowledge about materials and their chemical and physical properties and also design experience. Such experience and knowledge may be usefully amended by using Finite Element Analysis as a design tool. It can substantially reduce the number of iterations by trial and error, because questions like e.g. "is the groove volume large enough to cover for a certain amount of product swell and thermal expansion under conditions of cleaning and/or sterilization can be verified before going into production of physical samples.

Apart from requirements for static gaskets, a few essentials on polymeric dynamic seals like piston seals or rotary shaft seals are provided. Requirements for rotary mechanical seals made of ceramic materials or cemented carbides are not included, since those are a completely different group of seals.

***Key words**: Hygienic design principles, Seal, Gasket, Sealing solution.*

DETERMINING THE SAFETY AND QUALITY OF PACKAGING IN SOFT DRINKS BASED ON MICROBIOLOGICAL INDICATORS AND THE IMPACT ON THE ECONOMIC COST

Arianeta Nura[1*], Emine Daci Zejnullahi[1], Luljeta Ajdini[1], Suzana Aliu[1]

[1]Faculty of Food Science and Biotechnology,
UBT- Higher Education Institution, Kalabria nn, 10000 Pristina, Kosovo

[*]e-mail: arianeta.nura@ubt-uni.net

Abstract

The importance of research is to investigate and present the significance of safe packaging of fruit juices, based on microbiological indicators and determination of their impact on economic cost. The purpose of this research is to study some microbiological indicators and determine their impact on economic cost in the packaging of soft drinks.

Samples for microbiological analysis were taken from non-alcoholic beverage packaging produced in the Royal Beverage L. L. C processing industry, before and after disinfection with ClO_2 and rinsing in bottle filling lines, before and during the production process. The microbiological indicators that have been studied are the total coliform bacteria, faecal coliforms *E. coli*, aerobic mesophilic bacterial and fungal microflora (*yeasts and molds*). For determination of microbiological parameters was used membrane filtration method using filters 0.45 μm pore size for bacteria and 0.65 μm for yeast and molds. Enumeration of bacteria is made by counting colonies on plates with Endo agar, PCA, Mac Conkey agar, and RBA agar. During the research, we mainly used chlorine dioxide (ClO_2) with a concentration of 0.2 - 0.5 mg/L. Disinfection is performed through automatic pumps for dosing ClO_2 dosed in water. The determination of the amount of disinfectant was done with the photometer MD 600, the amount of which should be 0 mg/L. During the process of studying the microbiological parameters, has been studied economic cost of disinfection in a period of six months and it has been calculated how this cost affects the price of beverage production. The variables which has been studied are variable costs like ClO_2, water costs, the work of technicians, technologist, microbiologist and fixed costs, utility costs and equipment depreciation.

The results showed that the disinfection process that was used during the research was effective in packaging. Out of 2,376 samples taken, only 5% of them resulted in the presence of aerobic mesophilic bacteria, which is within the allowed norms 10 CFU/10 mL sample, in accordance with the standard ISO 22000 - HACCP. The

treatment has an affordable economic cost considering the importance it has in hygiene and the quality of the products.

By using these methods we have achieved satisfactory results with a small percentage of microorganisms within the allowed norms, with small side effects and at an affordable economic cost. Microbiological quality should be monitored since the high microbial load makes them a health risk.

***Key words**: Safety, packaging quality, Microbiological indicators, Economic cost, Disinfectant.*

NUTRITIONAL BIOCHEMISTRY XI

BIOAVAILABILITY OF CALCIUM FROM ORGANIC MILK YOGHURT

Inga Ciprovica[1*], Lolita Neimane[2], Inese Siksna[2], Mara Grundmane[2], Olga Lubina[2], Jelena Zagorska[1]

[1]Faculty of Food Technology, Latvia University of Life Sciences and Technologies, Liela 2, LV3001 Jelgava, Latvia
[2]Faculty of Public Health and Social Welfare, Rīga Stradiņš University, Dzirciema 16, LV1007 Riga, Latvia

[*]e-mail: inga.ciprovica@llu.lv

Abstract

The study focuses on the bioavailability of dietary calcium from organic milk yoghurt for humans. Several studies suggest that the consumption of yoghurt increases the absorption of phosphorus, calcium, magnesium and zinc. Lactic acid bacteria, lactose and low pH of yoghurt enhance the bioavailability of these nutrients. This research aimed to investigate the effect of organic milk yogurt consumption on calcium absorption, and blood calcium was evaluated and compared between 2 groups of menopausal women.

Plain organic milk yoghurt (fat 3.5 - 4.5%, protein 4.8%, lactose 4.5%, lactic acid bacteria 1.4 x 10^9 CFU g^{-1}, vitamin D < 0.1 µg x 100 g^{-1}, calcium 132 mg x 100 g^{-1}) was used for the study. Milk composition was analyzed by infrared spectroscopy; calcium concentration in yogurt was determined by inductively coupled plasma mass spectrometry (ICP-MS), vitamin D by ISO 12821-2009, while lactic acid bacteria by ISO 7889-2003. Sixty menopausal women participated in the study. 30 women (aged 56.43 ± 3.61 years) habituated to 175 g of yogurt (230 mg Ca per serving) daily for 60 days, and 30 women (aged 57.51 ± 4.41 years) were in a control group and did not consume yogurt during the study. A 72-hour food diary was completed before and after the study to evaluate nutritional habits and calculate the total dietary calcium intake daily. The participants have no dietary restrictions. The Fineli Food Composition Database was used to calculate nutrient intakes among participants. Calcium and vitamin D concentration was measured in blood before and after the study. Calcium was measured by colorimetric analysis, 25-OH vitamin D by immunoassay analysis. IBM SPSS Statistics 23 was used for data statistical analysis.

Comparing both groups' results, calcium and vitamin D concentration has changed significantly during the study in the blood samples of women who

have consumed organic milk yogurt. Overall, yogurt consumption has shown a significant influence on the bioavailability of calcium.

The results indicate that there are significant differences in calcium and vitamin D data in the blood samples of women who have consumed organic milk yogurt.

Acknowledgement: The study has been financially supported by project No. 19-00-A01612-000009 "Scientifically substantiated fermented milk products development and their clinical studies" supported by the European Agricultural Fund for Rural Development. The approval from Riga Stradiņš' University Ethics Committee was received in the year 2021 (No. 22-2/278/2021).

***Key words**: Calcium bioavailability, In vivo digestion, Organic milk, Yoghurt.*

CLINICAL HEALTH AND NUTRITION

XII

NUTRITIONAL STATUS AND LIFESTYLE AS FACTORS FOR OBESITY AND MALNUTRITION IN ADOLESCENTS IN MACEDONIA

Tatjana Pavlova[1*], Zlatin Zlatev[2], Marija Menkinoska[3], Tatjana Blazevska[3], Zora Uzunoska[3]

[1]Unimerkant ketreing DOOEL, Skupi 6 br. 9, 1000 Skopje, Macedonia
[2]Faculty of Technics and technologies, Trakia University, Graf Ignatiev str. 38, 8602 Yambol, Bulgaria
[3]Faculty of Technology and Technical Sciences, University St. Climent Ohridski - Bitola, Dimitar Vlahov bb., 1400 Veles, Macedonia

[*]e-mail: tatjanapavlova15@yahoo.com

Abstract

The adolescence is a period in which improper eating habits occur and as a consequence there are eating problems. Improper food choices and lack of physical activity are the main factors in the occurrence of basic problems such as obesity and malnutrition which are a prerequisite for the occurrence of diseases in later life stages. In Macedonia there are no detailed data on the way and habits in the diet as well as its impact in combination with the lifestyle on the occurrence of obesity and malnutrition, other non-communicable diseases and comorbidities specific to the adolescent period. Therefore, this research is an initial scientific and analytical contribution, especially to the study of this complex interrelationship, which is main purpose of this work.

For the purpose of this research, 409 high school students from several high schools in the territory of the city of Skopje took part. The respondents are of Macedonian and Albanian ethnicity. The age limit ranges from 14 - 18 years. The research was conducted by interviewing adolescents using a combined questionnaire consisting of 51 questions (Q1 - Q51), in October 2019. A pilot research was conducted, and 10% of the respondents' answers were taken as a sample. For data processing were used: software product Statistica 8. All data were processed at a level of significance $\alpha = 0.05$.

From the analyzed results from the pilot test it was established that the main influence on the characteristic "change in body weight" of adolescents is exerted by: the level of education of the parents; the type of food consumed; physical

activity. In addition, analyzes were performed on the effect on this characteristic of smoking, and on girls the influence of their menstrual cycle.

All factors that turned out to be significant according to the pilot test, showed a significant influence on body weight among the surveyed adolescents of Macedonian and Albanian ethnicity.

***Key words**: Obesity, Overweight, Malnutrition, Nutrition examination survey, Adolescent, Food-intake.*

ENERGY DRINK CONSUMPTION: NUTRITION KNOWLEDGE, ATTITUDES TOWARDS NUTRITION AND SOCIOECONOMIC CORRELATES IN ADIPOSITY CONTEXT. REPORT FROM THE ABC OF HEALTHY EATING STUDY OF POLISH TEENAGERS

Lidia Wadolowska[1*], Jadwiga Hamulka[2], Joanna Kowalkowska[1], Marta Jeruszka-Bielak[2], Magdalena Górnicka[2]

[1]Department of Human Nutrition, Faculty of Food Science, University of Warmia and Mazury in Olsztyn, Sloneczna 45F, 10-718 Olsztyn, Poland
[2]Department of Human Nutrition, Institute of Human Nutrition Sciences, Warsaw University of Life Sciences (WULS-SGGW), Nowoursynowska 159 C, 02-776 Warsaw, Poland

[*]e-mail: lidia.wadolowska@uwm.edu.pl

Abstract

Consumption of energy drinks (ED) is becoming a new dietary habit for increasingly younger children. This study identified attitudes towards nutrition as well as nutrition knowledge-related and socioeconomic correlates of the frequent consumption of ED in relation to adiposity markers in Polish teenagers.

The sample consisted of 1,569 pupils aged 11 - 13 years from Polish primary schools located throughout the whole country. Data related to the consumption of selected food items, nutrition knowledge and sociodemographic and economic factors were collected with the SF-FFQ4PolishChildren questionnaire. The usual consumption of ED reported by teenagers was converted into two categories: ≤ 1x/week, and 2 - 7x/week. Attitudes towards nutrition were determined with a three-factor eating questionnaire TFEQ10. Three subscales of attitudes were developed: emotional eating (range 0 - 6 points), uncontrolled eating (0 - 15) and cognitive restraint of eating (0 - 9). The nutrition knowledge level was determined based on 18 questions. The measurements of body weight, height, and waist circumference were taken. A multivariate logistic regression was applied to verify the association between variables.

6.8% of teenagers consumed ED 2 - 7 times/week. Central obesity (waist-to-height ratio ≥ 0.5) was found in 12.2%, and overweight/obesity (BMI-for-age ≥ 25 kg/m^2 according to IOTF 2012) in 24.7% of those tested. Predictors of 2 - 7

times/week consumption of ED were male sex, age 12 or 13 years (reference: 11 y), low or moderate family affluence (reference: high), lower nutrition knowledge and emotional eating (adjusted odds ratio 1.21 per 1 point, 95% confidence interval 1.03 - 1.42). Residence (urban vs rural) was not a predictor of the frequent consumption of ED, as well as uncontrolled eating and cognitive restraint of eating. No association was found between frequent consumption of ED and central obesity or overweight/obesity.

It was estimated that about 7% of teenagers aged 11 - 13-years-old consumed ED several times a week. Special attention should be paid to reducing emotional attitudes to eating in teenagers above 11 years of age to reduce the frequent consumption of ED. Since the current study does not support previous evidence, more investigation is needed to explain why no association was found between frequent ED consumption and obesity markers in Polish teens.

Acknowledgement: The study was financially supported by the Carrefour Foundation (Agreement ABC No.1/2014; Agreement ABC No. 2/2016) and each scientific centre from sources of the Polish Ministry of Sciences and Higher Education. Project financially supported by the Minister of Education and Science under the program entitled "Regional Initiative of Excellence" for the years 2019-2022, Project No. 010/RID/2018/19, amount of funding 12,000,000 PLN (2,636,280 euros).

***Key words**: Energy drinks, Attitudes towards nutrition, Nutrition knowledge, Family affluence, Central adiposity, Obesity, Adolescents, Teenagers.*

IDENTIFICATION OF DIABETES PERSONS IN THE MUNICIPALITY OF RAHOVEC THROUGH THE HbA1c TEST METHOD

Shkëlzim Ukaj[1], Arta Fetoshi[1], Duresa Ukaj[1], Hyzer Rizani[1*]

**[1]Faculty Food Science and Biotechnology,
University for Business and Technology, Kalabria nn, 10000 Pristina, Kosovo**

[*]e-mail: hyzer.rizani@ubt-uni.net

Abstract

Diabetes, which is a chronic disease, occurs when the pancreas produces little or no insulin, or when the body cannot use the insulin produced by the pancreas. The hormone insulin regulates blood sugar. High blood sugar is known as hyperglycemia, which has a very harmful effect if not controlled in time because it causes damage to human organ systems especially the cardiovascular system and nervous system. HbA1C testing is a test that measures long-term control of glycosylated hemoglobin. The purpose of this paper is to determine how many people are using the HbA1c test and what the distribution of its application by age is.

To accomplish this work we initially set two research objectives, a) Identify the total number of HbA1c tests and, b) Identify the age groups that perform this HbA1c test. Through these research objectives, we identify the number of patients who were 234, who underwent HbA1c testing during the period January - December 2020 at the Hospital "Fahredin Hoti" - Rahovec. We used the statistical research method because data were obtained from patient portfolios for the period January - December 2020, and data and demographic variables were obtained.

According to the results we have obtained, the females are more affected by diabetes and has performed HbA1c testing to diagnose diabetes or pre-diabetes (58% are females and 42% are males). The highest blood glucose values are given by women up to the age of 60 because the men of this area have the most active life because they are mainly engaged in agriculture.

In the research conducted based on the results, we found that the age affected by diabetes mellitus is any age so we recommend that each person take the HbA1c test, to identify diabetes in time.

***Key words**: Indicators, Hiperglikemi, HbA1c, Rahovec, Diabetes mellitus.*

INTESTINAL MICROBIOTA AND ITS ROLE IN DIABETES MELLITUS

Dzengis Jasar[1,2*], Katerina-Kubelka - Sabit[1,2*], Vanja Filipovski[1,2*]

[1]Department of Histopathology and Cytology, Clinical Hospital Acibadem-Sistina, Skupi 5a, 1000 Skopje, Macedonia
[2]Faculty of Medical Sciences, University "Goce Delchev" - Shtip, Ljuben Ivanov 25, 2000 Shtip, Macedonia

[*]e-mail: dzjasar@acibademsistina.mk

Abstract

Diabetes is a complex metabolic disease caused by interaction between an individual's metabolism, genetic factors and environment as well as intestinal microbiota that interact between the host and environment. The main objective of this review is to address the pathogenic association between intestinal microbiota and the development of diabetes mellitus.

Different electronic databases such as PubMed, Google Scholar, and Web of Science were searched for relevant literature which has been reviewed in this article. The intestinal microbiota affects host metabolism and obesity through several pathways involving gut barrier integrity, production of metabolites affecting satiety and insulin resistance, epigenetic factors, and metabolism of bile acids and subsequent changes in metabolic signaling. In addition, gut bacteria play a crucial role in the host immune system, modulation of inflammatory processes, extraction of energy from the host diet and alterations of human gene expression. Several bacteria has been targeted as important in the pathways of diabetes mellitus development like *Prevotella*, *Ruminococcus*, and *Bacteroides* spp. It is important to note that intestinal microbiota differs in various parts of the world as well as in newborns delivered by vaginal and Caesarean section.

New insights into the role of the intestinal microbiota in diabetes could lead to the development of integrated strategies using probiotics to prevent and treat these metabolic disorders. The field of intestinal microbiome and its role in diabetes in its early stage of development holds a promising future in providing us with novel therapeutic targets that may restore the gut microbiome to a healthy state and help in the prevention and treatment of this disease.

***Key words**: Intestinal microbiota, Diabetes mellitus, Metabolic disease, Therapeutic targets.*

SWEETENED BEVERAGE CONSUMPTION: NUTRITION KNOWLEDGE, ATTITUDES TOWARDS NUTRITION AND SOCIOECONOMIC CORRELATES IN ADIPOSITY CONTEXT AMONG POLISH TEENAGERS. A CROSS-SECTIONAL STUDY - REPORT FROM THE ABC OF HEALTHY EATING PROJECT

Jadwiga Hamulka[1*], Krystyna Gutkowska[1], Lidia Wadolowska[2], Ewa Czarniecka-Skubina[1], Joanna Kowalkowska[2], Monika Hoffmann[1]

[1]Institute of Human Nutrition Sciences, Warsaw University of Life Sciences (WULS-SGGW), Nowoursynowska 159 C, 02-776 Warsaw, Poland
[2]Department of Human Nutrition, Faculty of Food Science, University of Warmia and Mazury in Olsztyn, Sloneczna 45F, 10-718 Olsztyn, Poland

[*]e-mail: jadwiga_hamulka@sggw.edu.pl

Abstract

Consumption of sweetened beverages (SB) has been increasing for decades and is increasingly becoming a dietary habit among younger children. This study identified attitudes towards nutrition as well as nutrition knowledge-related and socioeconomic correlates of the frequent consumption of SB in relation to adiposity markers in Polish teenagers.

The sample consisted of 1,568 pupils aged 11 - 13 years from Polish primary schools located throughout the whole country. Self-reported data related to the consumption of selected food items, nutrition knowledge, sociodemographic and economic factors were collected with the SF-FFQ4PolishChildren questionnaire. The usual consumption of SB reported by teenagers was converted into three categories: ≤ 1x/week, 2 - 6x/week and every day. Attitudes towards nutrition were determined with a three-factor eating questionnaire TFEQ10 and divided into three subscales. The nutrition knowledge level was determined based on eighteen questions. The measurements of body weight, height and waist circumference were taken. A multivariate logistic regression was applied to verify the association between variables. Adjusted odds ratios (ORs) and % Confidence Intervals (95%CIs) were then calculated.

The study found that 14.1% of teenagers consumed SB every day, and 37.4% of them consumed SB 2 - 6 times/week. Central obesity (waist-to-height ratio ≥ 0.5) was found in 12.1% and overweight/obesity (BMI-for-age ≥ 25 kg/m^2 according

to IOTF 2012) in 24.6% of those tested. Predictors of everyday consumption of SB were: male sex, age 13 years (OR 2.50, 95% CI 1.34-4.64; reference: 11 y), lower nutrition knowledge and attitudes towards nutrition. The OR for emotional eating was 1.20 per 1 point (95% CI 1.06 - 1.36), uncontrolled eating was 1.15 per 1 point (95% CI 1.09 - 1.22), and cognitive restraint of eating was 0.87 per 1 point (95% CI 0.80 - 0.94). Residence (urban vs rural) and family affluence were not predictors of 2 - 6x/week or every day consumption of SB. No association was found between 2 - 6x/week and everyday consumption of SB and central obesity or overweight/obesity.

It was estimated that over half of Polish teenagers aged 11 - 13 years (approx. 52%) usually consume SB several times a week. To reduce the frequent consumption of SB, it is worth boosting the restraint attitudes to eating and reducing emotional attitudes to eating in older teenagers. Since the current study does not support previous evidence, more investigation is needed.

***Key words**: Sweetened beverages, Attitudes towards nutrition, Nutrition knowledge, Family affluence, Central adiposity, Obesity, Teenagers.*

HEALTH AND NUTRITIONAL EPIDEMIOLOGY

XIII

INFORMATION OF THE GENERAL POPULATION ABOUT BLOOD TYPE DIET IN THE FIELD REPUBLIC OF CROATIA

Monika Cuković[1], Natalija Uršulin-Trstenjak[2,3*], Valentina Novak[2], Ivana Herak[2], Dean Šalamon[4]

[1]Special hospital for pulmology and TBC, Klenovnik 1, 42244 Klenovnik, Croatia
[2]University North, 104 brigade 3, 42000 Varaždin, Croatia
[3]University North, Trg dr. Žarka Dolinara 1, 48000 Koprivnica, Croatia
[4]Varaždin General Hospital, Ivana Meštrovića 1, 42000, Varaždin, Croatia

[*]e-mail: natalija.ursulin-trstenjak@unin.hr

Abstract

Blood type diet is the key which opens the door to health secrets, diseases, long life, physical vitality and emotional strength. Determines to which diseases is a person disposed, which physical activity suits him the best and which food should they eat. Blood type diet (AB0) began promoting over the last ten years. It claims to improve health and reduces the risk of disease. The aim of this research was to get insight into population awareness and knowledge about link between diet and blood types and their knowledge in general about proper nutrition. At the same time, the aim was also to encourage the respondents on thinking and testing this kind of diet.

The research was anonymously, conducted through social media trough the period of 26 April to 06 may 2021 and it is provided opportunity to the population of all age structures and qualifications to solve the survey. There were 964 respondents participating in research from the Republic of Croatia. All collected data were analyzed in the SPSS 23 statistical program from IBM. The data are presented in descriptive and graphical terms.

Big number of respondents were in all age groups which proves that this topic is unexplored, but very interesting and it encourages thinking. Results of this research also brought to the knowledge about types of diets which people usually consume, about desire and interest of the general population about testing the new ways nutrition. It is interesting that more than half respondents (53.3%) had never heard about "Blood type diet".

Research conclusion leads to connection between blood type and certain disease, and 34.1% of respondents thinks that they can improve their physical

and mental health by feeding according to their blood type. Indigestion after consuming certain groceries which doesn't match their blood type recognized 80% of respondents. Also, researches showed changes that happened to people who tried feeding only by their blood type and their reactions were positive.

***Key words**: Blood type, Nutrition, Diet, Physical activity.*

CONSUMPTION OF FAST-ACTING CARBOHYDRATES AND THEIR IMPACT ON THE DIET OF DIFFERENT AGE GROUPS IN THE PEJA REGION

Indrit Loshi[1], Valon Shala[1*], Astrit Bilalli[1], Burel Cenaj[2]

[1]Faculty of Agribusiness, University of Peja "Haxhi Zeka", "UÇK" nn, 30000 Pejë, Republic of Kosovo
[2]Food and Veterinary Agency, Nënë Terza M9, 10000 Pristina, Republic of Kosovo

[*]e-mail: valon.shala@unhz.eu

Abstract

The definition of what constitutes a healthy diet is continuously shifting to reflect the evolving understanding of the roles that different foods, essential nutrients, and other food components play in health and disease. The purpose of this research was to identify the amount of fast-acting sugars consumed by sugary drinks, carbonated drinks, chocolates, candies, sweets, etc., and their impact on the daily diet for different age groups.

The targets of the research were adolescents (11 - 18 years old), young age groups (19 - 29 years old) and middle age group (30 - 50 years old) in both genders with different jobs and professions. In total, n = 340 diets were taken and analyzed during 2021, from which: 130 diets for adolescents, 100 diets for young people and 110 diets for middle-aged people. The method used in the research is dietary recall (24HR).

From this research we concluded that the age group of adolescents (11 - 18 years old) women receive on average 19.95%, while men get 19.43% of total kcal from fast-acting sugars; in young age groups (19 - 29 years old) women get on average 20.05%, while men get 21.63% kcal from fast-acting sugars, while the middle age group (30 - 50 years old) males receive on average 12.32%, and women receive 16.25% of total kcal from fast-acting sugars. In all age groups we have a high consumption of fast-acting sugars compared to the recommendations for the consumption of fast sugars, where the maximum consumption is preferably 10% of the total diet. Younger age groups (19 - 29 years old) men consume the highest amount of kcal from fast-acting sugars compared to all other age groups.

A national strategy for healthy food consumption, educating young age groups about the negative effects of consuming sugars and fast foods, awareness

campaigns on social networks and television about possible diseases from sugar consumption, cooking and consuming healthy foods at home, etc., are just some of the measures that need to be taken to reduce the high amount of kcal taken from fast sugars.

***Key words**: Diet, Dietary recall, Fast sugars, Calories.*

EATING DISORDERS AND NONALCOHOLIC FATTY LIVER DISEASE - A SOCIALLY SIGNIFICANT PROBLEM IN THE MODERN WORLD

Radin Tzonev[1*], Radka Goranova-Spasova[2]

[1]Acibadem City Clinic Tokuda Hospital, Medical Faculty, Sofia University "St. Kliment Ohridski", Tsar Osvoboditel Boulevard 15, 1504 Sofia, Bulgaria
[2]Faculty of Public Health "Prof. Tz. Vodenicharov", Medical University - Sofia, Byalo more 8, 1527 Sofia, Bulgaria

[*]e-mail: radintzonev@abv.bg

Abstract

Modern society, unlike its ancestors, has its own new norms of nutrition and behavior. These are determined by urbanization, introduction of new eating habits and the wide use of convenience food. Obesity, nonalcoholic fatty liver disease (NAFLD), including fatty liver disease and non-alcoholic steatohepatitis (NASH) lead to the development of fibrosis, which progresses and becomes a leading cause of cirrhosis or hepatocellular carcinoma (HCC). The present study aims to examine and discuss the behavior in the joint manifestation of these two diseases. Apart from the health consequences for the individual and society, the economic burden of these previously neglected conditions is also significant.

We searched official data from the WHO, EUROSAT, National Statistical Institute of Bulgaria and National Center for Public Health and Analysis regarding morbidity and economic burden of obesity and NAFLD, and official recommendations from AASLD, EASL of treatment for cirrhosis and HCC. Data show that about 20 - 30% of adults living in high-standard countries consuming Western diets have too much liver fat, i.e., NAFLD. Between 2 - 5% have significant liver damage (NASH) and 1 - 2% of all adults may be at risk of progression to cirrhosis and hepatocellular carcinoma due to NASH. Current treatment should include a diet low in carbohydrates, physical activity and GLP-agonists.

Changes in lifestyle, especially diet, lead to a significant reduction in the risk of developing insulin resistance, NAFLD, NASH, cirrhosis and primary hepatocellular carcinoma.

***Key words**: Obesity, NAFLD, NASH, Economic burden, Lifestyle.*

GENOTYPE-PHENOTYPE CORRELATIONS IN THE BEHAVIOR OF PATIENTS WITH METABOLIC DYSFUNCTION

Robert Mihail Sionel[1,2*], Lavinia Berca[2], Iuliana Iordache[1], Dănuț Cimponeriu[3], Ortansa Csutak[3]

[1]Faculty of Biology, University of Bucharest, Splaiul Independenței 91-95, 050095 Bucharest, Romania
[2]National Institute of Research and Development for Food Bioresurces, Ancuța Băneasa 5, 020323 Bucharest, Romania
[3]Genetics Department, Faculty of Biology, University of Bucharest, Intrarea Portocalelor 3, 060101 Bucharest, Romania

[*]e-mail: robert.sionel.95@gmail.com

Abstract

Genetic predisposition and lifestyle are involved in the onset and evolution of type 2 diabetes (T2DM) or metabolic syndrome (MS). This study tested the association between these diseases, mutations in four genes (ALDH2, ADH1B VDR, and OXTR), and lifestyle peculiarities.

A number of 225 patients from Bucharest who were evenly distributed in the T2DM, MS and healthy control (HC) groups were investigated. Genetic polymorphisms have been identified by methods based on polymerase chain reaction (PCR) and restriction fragment length polymorphism (RFLP). The genotypes investigated were distributed according to the Hardy Weinberg equilibrium condition. The data were compared with the chi2, Fisher or Mann Whitney U tests.

It was observed that the rs53576 genotype/allele is a protective factor for T2DM (OR = 0.37811; $p < 0.05$). Patients with T2DM ($p < 0.001$) or MS ($p < 0.05$) carrying rs53576 AA more frequently followed a weight management program for 3 or more months. Carriers of the rs53576 A allele in the T2DM group were more frequent consumers of alcohol ($p < 0.05$) and those in the SM group more frequently consumed weight loss products without being recommended by a doctor ($p < 0.01$).

In conclusion, the rs53576 polymorphism in the OXTR gene is associated with the appearance of DZ2 and some behavioral features of patients with T2DM or MS.

***Key words**: OXTR, VDR, ADH1B, ALDH2, Type 2 diabetes, Metabolic syndrome, Alcohol.*

THE RELATIONSHIP BETWEEN LIFESTYLE FACTORS AND DIETARY HABITS OF PRIMARY SCHOOL CHILDREN

Ana Ilić[1*], Ivana Rumbak[1], Martina Bituh[1], Tea Karlović[1], Lucija Marić[1], Ružica Brečić[2], Irena Colić Barić[1]

[1]Department of Food Quality Control, Faculty of Food Technology and Biotechnology, University of Zagreb, Pierottijeva 6, 10000 Zagreb, Croatia
[2]Marketing Department, Faculty of Economics and Business, University of Zagreb, Trg J.F. Kennedy 6, 10000 Zagreb, Croatia

[*]e-mail: ailic@pbf.hr

Abstract

Recently, studies show the impact of different individual lifestyle factors on children's dietary habits. The aim of this study was to determine the differences in the dietary habits of primary school children in relation to the combination of lifestyle factors.

Dietary records for three non-consecutive days were used to estimate the intake of energy, macronutrients, micronutrients and food groups of 106 children (55.7% boys) aged 8 - 9 years from schools in the city of Zagreb. Sleep and sedentary data were obtained from the general questionnaire and physical activity from the physical activity questionnaire for older children. Anthropometric measurements were performed according to standard protocols, while z-scores were obtained using AnthroPlus software. Children were divided into three clusters using K-Means cluster analysis toward sleep duration, sedentary behaviour, and physical activity.

Children in all three clusters have similar sleep duration (9 - 10 hours on average), but activity level decreases from the first to the third cluster (activity level 3.1, 2.9, and 2.6, respectively) and sedentary time increases (84.9 min, 193.1 min, and 372.0 min, respectively). There is no difference in children's anthropometric characteristics between clusters. Children in cluster 1 and 2 had significantly higher daily energy intake (1,802 kcal and 1,779 kcal, receptive) than children in cluster 3 (1,430 kcal). Children in cluster 1 had greater intake of total fat, monounsaturated fatty acids, and added sugars than children in cluster 3. According to Kendall's τb coefficient, cluster 3 is associated with higher energy intake from milk and dairy products ($r = 0.222$; $p = 0.02$) and lower from sweetened milk and dairy products ($r = -0.240$; $p = 0.01$).

The dietary habits of the children in this study are similar across clusters. The only differences are in the intake of energy, total fat, monounsaturated fatty acids, added sugar, and milk and dairy products.

***Key words**: Childhood, Dietary habits, Dietary intake, Physical activity, Sedentary behaviour, Sleep duration.*

CHANGES IN SELECTED HEALTH AND NUTRITIONAL PARAMETERS OF PRESCHOOL AGED CHILDREN INFLUENCED BY THE COVID-19 PANDEMIC

Katarína Fatrcová-Šramková[1], Tünde Juríková[2*], Marianna Schwarzová[1]

[1]Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic
[2]Institute for Teacher Training, Faculty of Central European Studies, Constantine the Philosopher University in Nitra, Dražovská 4, 94974 Nitra, Slovak Republic

[*]e-mail: tjurikova@ukf.sk

Abstract

The last period of Covid-19 has markedly changed the life of preschool aged children with impact on health and nutrition in the period of growth and development. The aim of the research was to evaluate the selected health and nutritional parameters influenced by pandemic Covid-19.

The set concluded children (n = 130) from 4 up to 6 years old (55.4% girls, 44.6% boys). The majority of set ratio was presented by children 5 - 5.99 years (64.6%). Anthropometric data were evaluated by percentile method and growth charts. The nutrition status was estimated by on-line questionnaire. Software Statistica 10.0 (StatSoft Inc., USA) was used.

During the 3rd wave of pandemic (from September 2021 up to now) it has been noticed the rise of weight by 0.9 ± 0.1 kg. In term of weight the set was presented by 58.5% of children belonged to percentile range of low and medium values (group A) and 41.5% of children (group B) had high values (19.2% high, 6.9% very high, 15.4% extremely high weight). More children in group B (7.4 vs. 34.2%) had low body height values ($p < 0.01$) and high values prevailed in group A. The medium values of body mass index was typical for the group B ($p < 0.001$) (22.2 vs. 60.5%; proportional children) and high values in group A (64.8 vs. 7.9%; obese or overweighed children). The children of group A consumed during pandemic vs. before pandemic lower amount of fresh/frozen fruit and vegetables. In the group A more than 2 portion of vegetable daily consumed less children during pandemic than before pandemic (27.8% vs. 31.5%) on contrary with fruit (50% vs.

42.6%). Physical activity more than 2 hours daily/outdoor sport activities had less children in group A during pandemic vs. before pandemic. Significant inadequate sleep (less than 8 hours) had the children belonged to group A before and during pandemic (11.1% and 16.7%) with predominance of children with irregular sleeping regime.

During the Covid-19 pandemic, selected eating habits and lifestyle aspects of preschool children were affected. Further investigation of the long-term effects on children's weight and health is needed.

Acknowledgment: This research was supported by projects KEGA 011UKF-4/2022 and VEGA 1/0159/21.

***Key words**: COVID-19 pandemic, Preschool aged children, Slovakia, Anthropometric data, Nutrition, Life style.*

ASSOCIATIONS BETWEEN DIET AND RISK-OF-POVERTY IN SERBIA AND MACEDONIA

Anita Manasijev[1*], Pieter van't Veer[1], Carel Peeters[1], Mirjana Gurinovic[2], Igor Spiroski[3], Maria Glibetic[2], Jelena Milesevic[2]

[1]Division of Human Nutrition and Health, Wageningen University, Droevendaalsesteeg 4, 6708 PB Wageningen, The Netherlands
[2]Center of research excellence in nutrition and metabolism, Institute of medical research, University of Belgrade, National institute of Republic of Serbia, Tadeusa Koscuska 1, 11000 Belgrade, Serbia
[3]Institute of Public Health of the Republic of Macedonia, 50-ta Divizija 6, Skopje 1000, Macedonia

[*]e-mail: anita.manasijev@wur.nl

Abstract

Previous research identified the nutritional problems present in low-income groups in Europe, including Serbia. However, multivariate relationships between dietary factors and risk-of-poverty levels in the Balkans have not been well established. This study aimed to investigate associations between diet and risk-of-poverty in Serbia and Macedonia. The secondary objective was to explore the added value of Gaussian graphical modelling relative to a multiple regression analysis.

Existing 24-hour recalls from 804 Serbian and Macedonian participants were used. Gained data were analyzed by logistic regression models and Gaussian graphical models. Logistic regression models were used to describe risk-of-poverty by dietary variables that were known to be associated with risk-of-poverty. Adjustment was made for energy intake, age, gender and country. Subsequently, graphical models were estimated for both countries jointly and separately, including 67 dietary variables. Monthly household income was used as representative node of interest for risk-of-poverty. Extracted networks were subjected to analyses aimed at detecting core components and shared and differential connections between the countries.

The full logistic regression model showed associations between high risk-of-poverty and high sodium and low calcium intake amongst the Serbian population ($p < 0.05$). In the Macedonian population, high risk-of-poverty was associated with high intake of starchy staple foods ($p < 0.05$). The graphical network model

showed that foods and nutrients were strongly correlated, as well as a positive connection between income and selenium in Macedonia and zinc in Serbia. In the shared network, income was not directly linked to any dietary node.

The logistic regression findings confirm the previously observed associations amongst the Serbian population; different associations were observed in Macedonia. Gaussian graphical network modelling highlight that foods and nutrients were highly interrelated. Prediction of risk-of-poverty by dietary factors largely depends on complex country-specific patterns. Incorporation of a priori knowledge on causal relations between poverty, diet, nutrients and body size measures might help to improve the intercountry generalisability in risk-of-poverty prediction.

***Key words**: Critical nutrient intake, Diet, Gaussian graphical network modelling, Macedonia, Risk-of-poverty, Serbia.*

MAGNESIUM SUPPLEMENTATION IN PREGNANCY

Biljana Ilic[1*], Dragan Radosavljevic[1], Ivan Milojevic[1], Tijana Joncic[1], Marija Mikic Mladenovic[1], Zorica Kaludjerovic[1]

[1]Academy of Applied Preschool Teaching and Health Studies, Balkanska 18, 3400 Krusevac, Serbia

[*]e-mail: ilicbiljana.vms@gmail.com

Abstract

Magnesium deficiency is prevalent in women of reproductive age in both developing and developed countries. The need for magnesium increases during pregnancy, and most pregnant women usually do not meet this increased need only through diet. Magnesium deficiency or insufficiency during pregnancy can pose a health risk to both mother and newborn, with implications that can extend to adulthood. The aim of this study was to consider the importance of magnesium intake in pregnancy and the results of studies that examined it.

Many studies have shown links between the amount of magnesium in a pregnant woman and certain conditions in pregnancy associated with high mortality and morbidity, such as gestational diabetes, premature birth, preeclampsia and low gestational age or intrauterine fetal growth restriction. In special circumstances, in pregnant women who have diabetes mellitus, type one, the fetus is endangered due to hypocalcemia and hapomagnesaemia, as a consequence of magnesium deficiency in the mother. Due to the lack of this mineral in the body, there is an increase in the irritability of the smooth muscle of the uterus and the appearance of premature contractions, as well as frequent constipation, which in turn affects the quality of life of the pregnant woman. The biggest natural sources of magnesium are dairy products, bananas, kefir, beans, peanuts, wheat bran, green leafy vegetables, pumpkins, dark chocolate, etc.

Pregnant women should be advised to increase their intake of magnesium-rich foods such as nuts, seeds, beans and leafy vegetables and / or to add magnesium through supplements.

***Key words**: Magnesium, Preeclampsia, Pregnancy, Preterm labor, Food.*

PUBLIC HEALTH, NUTRITION, CHRONIC DISEASES

XIV

THE ROLE OF THE SCHOOL PSYCHOLOGIST DURING THE PANDEMIC PERIOD

Rita Loloci[1*], Orneda Gega[1], Menada Petro[1]

**[1]Faculty of Education, "Aleksandër Moisiu" University,
New University Campus,
Friendship Hospital nn, 2001 Durrës, Albania**

[*]e-mail: ritaloloci@gmail.com

Abstract

School psychological service is one of the most important changes that has taken place in Albania in the last 10 years. During the pandemic period their psychological service took on another dimension and their workflow increased a lot. Closing schools due to the pandemic would change their lifestyles. Most countries around the world turned their attention to physical health care. Many studies have been conducted to measure the economic consequences, but very few studies have been conducted to measure the psychological consequences of the pandemic and especially the consequences that this period caused on the mental health of children. The study addressed the quality of evaluation and improvement of the psychological service in the school during the pandemic. The purpose of the study is to identify the work done by school psychologists, and their forms of intervention in mitigating the psychological effects of the pandemic.

We used a mixed-method approach for the study. About 73 school psychologists from different schools in Albania were asked about the typology of work they performed during the pandemic period and the number of cases treated by them. An online questionnaire for school psychologists and interviews with school principals were used as an instrument to collect data on the role of psychologists in the pandemic. To analyze the data collected from the questionnaire we used SPSS statistics.

The service that school psychologists have performed the most in the period of the pandemic is the assessment of the psychological state of the students (62.9%). Psychologists responded that the most common symptoms caused by the pandemic in students were anxiety and stress (66.1%) and that students who received psychological services during and after the pandemic were calmer, allowing them to integrate into normal life and perceive the pandemic as a situation they would coexist with.

In conclusion, this study identified the need to provide psychological service at a higher frequency, the use of new methods, different types of meditations, reiki sound therapy, and all methods that strengthen and encourage a higher self-confidence, the promotion of positive energy in all target groups mentioned. Building collaboration with parent-teacher-psychologist.

***Key words**: Psychologist, Mental health, Children, School, Parents, Intervention.*

ANALYSIS AND PREDICTION OF COVID-19 USING SIR AND SEIR MODELS IN ALBANIA

Frederik Dara[1*], Elfrida Dishmema[2], Arbër Qoshja[1], Silvana Mustafaj[2]

[1]Department of Applied Mathematics, Faculty of Natural Sciences, University of Tirana, Boulevard Zogu I nn, 1001 Tirana, Albania
[2]Department of Mathematics and Informatics, Faculty of Economy and Agribusiness, Agriculture University of Tirana, Kodër-Kamëz nn, 1000 Tirana, Albania

[*]e-mail: frederik.dara@fshn.edu.al

Abstract

The SARS-CoV-2 (COVID-19), has drastically changed our human lifestyle, affecting it badly. This virus has spread quickly to 223 countries and territories worldwide, leading to more than 279 million confirmed cases and about 5.4 million victims as of December 2021. Having a tool for analyzing and predicting the future of this disease it is very important for governments, medical systems, and economic sectors. Thus, the modeling of the spread and the prediction of the total number of cases has been analyzed extensively in many countries by several researchers. Some papers are published on mathematical modeling on the spread of COVID-19 in Albania. The aim of this paper is to study the spreading of COVID-19 in Albania.

This research was based on official data available since October 31, 2021. We use the Susceptible-Infected-Removed model (SIR) model and the Susceptible-Expected-Infected-Removed (SEIR) model to analyze and predict COVID-19 spread in Albania. Both models are mathematical models used in epidemic outbreaks. The analysis includes confirmed and recovered cases, deaths and the growth rate in Albania. The authors have attempted to analyze and predict the disease along with its related issues to determine the maximum number of infected people, the speed of spread, and most importantly, its evaluation using a model-based parameter estimation method. Calculations are done using adaptive SIR and SEIR models featuring dynamical recuperation and propagation rates. The official data of COVID-19 spread in Albania, reported by the Ministry of public health, has been used to verify the current model results.

Initially was shown that the two models, the SIR and SEIR models, had a good fit with the daily reported data. Overall, the SEIR model was able to predict disease trends better, but both models fail to fully capture the impact of other factors, such as social distance and vaccination. The two most important parameters of

the SIR model, β varies between 0.024 and 0.283 and γ varies between 0.007 and 0.247. The basic reproduction number (R_0) and reproduction number (R) fluctuates in interval [1.26, 3.826] and [0.536, 3.064], respectively. The reproduction rate fluctuates between 0.61 and 1.87 and has a very small coefficient R2 (in linear regression). SEIR model produced the average basic reproduction number β_0 = 1.183, the average rate of infection β= 0.121 and the average rate of recovery β = 0.105.

Both models fit well with the data, but their predictions are not so well, which means that other factors must be taken into account for more accurate predictions.

***Key words**: COVID-19, Prediction, Mathematical model, SIR/SEIR model, Epidemic outbreak.*

EATING HABITS OF ADULTS IN SLOVAKIA DURING THE COVID-19 PANDEMIC

Petra Vadovičová[1], Katarína Fatrcová-Šramková[2*], Marianna Schwarzová[2]

[1]Union of Nutrition Professionals and Promoters of Healthy Lifestyle c.a., Legionárska 19, 83104 Bratislava, Slovak Republic
[2]Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic

[*]e-mail: katarina.sramkova@uniag.sk

Abstract

The COVID-19 pandemic, domestic isolation and lockdown have resulted a change in people's lifestyles habits and behaviours, including nutritional behaviour worldwide. The aim of the research was to evaluate selected nutritional and health indicators and changes in eating habits of adults in Slovakia affected by the COVID-19 pandemic.

The group (n = 860; 50.1% women) consisted of adults who did not have COVID-19, with a mean age of 41.3 ± 10.1 years. The comparison of eating habits from the online questionnaire was focused on the period before the pandemic vs. during the pandemic. The values of anthropometric parameters were obtained by the self-reported method. We used the software Statistica 10.0 (StatSoft Inc., USA) for statistical evaluation.

Body weight increased during the pandemic in 39.2% of those surveyed. Significant ($p < 0.05$) weight loss was observed in men. During the pandemic, there was an increase in the consumption of milk and dairy products in 13.7% of respondents, but significantly ($p < 0.001$) more women (17.2% vs. 10%) limited the intake of milk and dairy products during the pandemic. The consumption of meat and meat products during the pandemic was significantly less in 22% of the group (with a predominance of women 26% vs. men 18%) ($p < 0.01$). A significant increase occurred in egg consumption in 14.9% of those surveyed (with a 6.4% predominance in males) ($p < 0.05$). Spirits were consumed by 67% of the group during the pandemic, significantly more men drank alcohol than women (74.8% vs. 59.2%) ($p < 0.001$). A favourable finding was the increased consumption of fresh vegetables and fruits during the pandemic period, while an increase in salt

consumption was an unfavorable observation. During the pandemic the largest increase in the use of nutritional supplements was in the use of vitamin D (57.9%) and vitamin C (47.9%). However, the majority of respondents chose not to take probiotics (65%).

Home isolation and lockdown resulted in a significant change in the nutritional behaviour of adults.

Acknowledgment: This research was supported by projects VEGA 1/0144/19, and Drive4SIFood 313011V336.

***Key words**: COVID-19 pandemic, Slovakia, Nutrition, Eating habits, Anthropometric parameters.*

CONSEQUENCES OF THE COVID-19 PANDEMIC ON THE EATING HABITS OF SCHOOL-AGED CHILDREN IN SLOVAKIA

Marianna Schwarzová[1], Katarína Fatrcová-Šramková[1*], Tùnde Juríková[2]

[1]Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic
[2]Institute for Teacher Training, Faculty of Central European Studies, Constantine the Philosopher University in Nitra, Dražovská 4, 94974 Nitra, Slovak Republic

[*]e-mail: katarina.sramkova@gmail.com

Abstract

The COVID-19 pandemic and strict rules to prevent the spread of the SARS-CoV-2 virus have caused significant changes in the lifestyle habits of the population. The aim of the research was to evaluate changes in the eating habits and selected aspects, including changes in body weight within the group of school-aged children in Slovakia caused by the COVID-19 pandemic.

The average age of the randomized group of children (n = 252) represented 8.6 ± 2.2 years. For the characteristic of 6 - 14 years old children the questionnaire method was used. The group consisted mainly of children aged 6 - 10 years (84.5%). Body weight and body height were calculated to the body mass index. The comparative assessment was focused on the pre-pandemic period vs. during a pandemic (in the 1st and 2nd wave of the pandemic). For statistical evaluation software Statistica 10.0 (StatSoft Inc., USA) was used.

Body weight increased during the pandemic in 44.44% representatives of the research sample that can be evaluated as an unfavorable trait. The recommended 5 - 6 meals daily had significantly ($p < 0.05$) more children during the pandemic (54.37% vs. 43.65%). Snacks (evening/night meals) were consumed with the higher frequency of 1.3 ± 0.7 ($p < 0.001$). During the pandemic, children consumed significantly more bread and pastries, milk, fresh vegetables ($p < 0.05$), pasta and cereals, meat products, yoghurts, eggs, fresh fruit, but also sweets, fast food, salty delicacies) ($p < 0.001$). In the pandemic period, the number of portions fish consumed increased to 1.32 ± 1.08 ($p < 0.001$), eggs to 3.48 ± 2.30 ($p < 0.001$), honey to 3.37 ± 3.67 ($p < 0.01$) per week. During the pandemic, the children

took several nutritional supplements of the following types: vitamin C ($p < 0.05$), vitamin D (p 0.001), zinc and ginger ($p < 0.05$).

We have confirmed several negative changes in the consequences of the pandemic in school-aged children, which have pointed to the strategically necessary need for educational activity in terms of disease prevention in the post-covid period.

Acknowledgment: VEGA 1/0144/19, Drive4SIFood 313011V336.

***Key words**: School-aged children, COVID-19 pandemic, Slovakia, Nutrition, Body weight.*

THE ROLE OF THE FOOD SECTOR IN THE STRATEGIES FOR IMPROVING THE NUTRITION AND HEALTH OF THE POPULATION

Vlora Hyseni[1*], Daniela Nikolovska Nedelkoska[1]

[1]Faculty of Technology and Technical Sciences, University "St. Kliment Ohridski", Dimitar Vlahov bb, 1400 Veles, Macedonia

[*]e-mail: vlora.huseni@uklo.edu.mk

Abstract

Nutrition is a basic human need and thus plays an important role in health promotion and disease prevention. Unhealthy diets and resulting malnutrition are associated with metabolic changes and risk of non-communicable diseases (NCDs). The nature of the problem related with NCDs, overweight status and obesity requires comprehensive approach wherein governments and other stakeholders work in genuine partnership. The aim of our research was to provide an overall picture of the impact of the food sector/industry in the strategies for improving the nutrition and health of the population.

In order to this, we searched the following electronic databases: PubMed, SCOPUS, EBSCO and Google Scholar. We reviewed a total of 115 full-text documents. From these, we identified 45 manuscripts and several national action plans and initiatives that met the inclusion criteria. Our findings confirm that in some countries national programs have been implemented to motivate food producers to offer healthier food options to the consumers. The food industry is reformulating existing products and creating new healthier food choices (food products with reduced salt, sugar and saturated fat). Also, a trend in the food industry is the production of functional food, which contains natural bioactive components that give additional value to the product in terms of health benefits. On the other hand, the food companies are often criticized for their focus on profit from less healthy food products (e.g. ultra-processed food) and, especially multinational food companies, for inappropriate marketing strategy and impact on consumers.

Strong government leadership and funding are crucial for establishing sustainable programs that will enable the food industry to formulate and market healthier products.

***Key words**: Food sector, Food industry, Food reformulation, Obesity, Government.*

HARMONIZATION OF FOOD CONSUMPTION DATA COLLECTION IN THE BALKAN REGION ACCORDING TO THE EFSA EU MENU METHODOLOGY STANDARDS

Jelena Milešević[1,2*], Mirjana Gurinović[1,2], Milica Zeković[1,2], Agnes Kadvan[2], Marija Ranić[1,2], Maria Glibetić[1,2]

[1]Center of research excellence in nutrition and metabolism, Institute of medical research, University of Belgrade, National institute of Republic of Serbia, Tadeusa Koscuska 1, 11000 Belgrade, Serbia
[2]Capacity Development Network in Nutrition in Central and Eastern Europe, CAPNUTRA, Cara Dusana 6, 11000 Belgrade, Serbia

[*]e-mail: jelena.milesevic@gmail.com

Abstract

Initiatives in the Capacity Development in Nutrition Research in the Balkan region in the last decade have been toward the creation of contemporary, harmonized Research Infrastructure (RI) compliant with European standards. This study gives overview of the process of implementation of the European Food Safety Authority (EFSA) EU Menu methodology during the EFSA support projects for Food consumption data collection in four countries (Serbia, Montenegro, Bosnia and Herzegovina, and Macedonia).

Implementation of EU Menu methodology in Balkan countries was carried out through application of an innovative tool for standardized food consumption data collection and dietary intake assessment, the Diet Assess and Plan (DAP). DAP includes computerized food consumption, anthropometric measurements and physical activity questionnaires, validated food picture book and FoodEx2 exposure hierarchy with sets of facet descriptors of the interest. It operates with Balkan food platform (Serbian food composition database (FCDB) and Regional FCDB), compliant with European Food Information Resource (EuroFIRTM) standards. Application of the methodology required the development of study protocol, extensive education and training of study personnel, and process surveillance by internal and external coordinators. In total, 8720 participants (B&H - 2,372 adults, Montenegro - 572 children and 1,100 adults, Macedonia - 1,080 children, Serbia - 3,020 adults and 576 children) were included in the national surveys, which employed and upgraded DAP platform. Data on food and recipes composition were exchanged across countries, contributing to development of

Regional FCDB which nowadays operates with more than 5500 foods, recipes and dietary supplements.

The implementation of the DAP platform in national dietary surveys conducted with the support of the EFSA EU Menu project in Balkan countries enabled harmonized food consumption data collection. Collected food consumption data is internationally comparable with other European countries within the framework of EU Menu program. Existence of this data in the Balkan region will inform identification of dietary patterns, the establishment of national nutrient reference values and food based dietary guidelines, dietary exposure assessments, the endorsement and evaluation of new food legislations.

The implemented methodology and collected data provide evidence and infrastructure for policy-making lacking in the field of public health nutrition in the region, and have long-term effect on development of sustainable food system.

***Key words**: Dietary exposure assessment, Food consumption, EU Menu, Dietary software, Research Infrastructure, Balkan region, Harmonized methodology, Sustainable food systems.*

APPLICATION OF NRS 2002 METHOD IN NUTRITIONAL RISK ASSESSMENT OF ELDERLY PATIENTS HOSPITALIZED IN VARAŽDIN GENERAL HOSPITAL

David Vitez[1], Natalija Uršulin-Trstenjak[2,3*], Melita Sajko[2], Damir Poljak[4], Ivana Doldek Šarkanj[3]

[1]County Hospital Čakovec, I. G. Kovačića 1 e, 40000 Čakovec, Croatia
[2]University North, 104 brigade 3, 42000 Varaždin, Croatia
[3]University North, Trg dr. Žarka Dolinara 1, 48000 Koprivnica, Croatia
[4]Varaždin General Hospital,
Str. Ivana Meštrovića 1, 42000, Varaždin, Croatia

[*]e-mail: natalija.ursulin-trstenjak@unin.hr

Abstract

Increasing incidences of nosocomial infections, prolonged hospitalizations, higher treatment costs are sufficient reasons for the need for early and effective interventions aimed at prevention, and then treatment of the causes of malnutrition among the elderly. Research conducted on the Croatian population proves that nutritional risk increases with age and that age is an independent predictor of length of hospital stay. Prevention of malnutrition in hospital patients must be a priority for all health professionals and requires multidisciplinary collaboration. The aim of the study was to detect how many hospitalized patients are at nutritional risk.

We examined 66 patients with a lower age limit of 65 years hospitalized in the General Hospital Varaždin in Republic of Croatia for a period of 3 months. The standard Nutritional Risk Screening method from 2002 (NRS 2002) recommended by the European Society of Clinical Nutrition and Metabolism (ESPEN) was used to assess both nutritional status and risk of elderly patients. The obtained data were analyzed by the statistical program SPSS 23 from IBM with a descriptive and graphical representation.

Of the total number of subjects, 70% of them were exposed to nutritional risk and required nutritional support, while it was needed for 30% of subjects to repeat nutritional screening once a week. In the group of patients with malignant disease, as many as 89% of patients were at nutritional risk (NRS $\geq$ 3), which is a difference compared to the group of non-malignant patients. The nutritional status of patients generally deteriorates if they suffer from a malignant disease that progresses intensively.

Numerous studies show that malnutrition is a common problem among the elderly, and the simplest way to solve this problem is to introduce a routine method of assessing nutritional status for all elderly who are at increased nutritional risk from the very admission to the hospital.

***Key words**: Elderly population, Oncology patients, Nutritional risk assessment, NRS 2002.*

ANTIOXIDANT ACTIVITY OF FUNCTIONAL READY-TO-EAT PRODUCTS FOR CANCER PATIENTS

Marietta A. Aslanova[1], Olga K. Derevitskaya[1], Anna L. Bero[1*], Natalya E. Soldatova[1]

[1]V. M. Gorbatov Federal Research Center for Food Systems of Russian Academy of Sciences, Talalikhina 26 109316 Moscow, Russia

[*]e-mail: a.bero@fncps.ru

Abstract

Main requirements for the nutrition of cancer patients include the presence of antioxidants in the diet. Animal products are a source of complete proteins and fat, vitamins and minerals and should be present in a balanced diet. The aim of the work was to determine the antioxidant activity of ready-to-eat turkey products enriched with the vitamin complex and intended for inclusion into the diet of cancer patients.

The research objects were the vitamin complex consisted of antioxidant vitamins C, B_9, B_{12}, D_3, which quantitative and qualitative composition was developed by the authors, finished minced products from turkey fillet without the vitamin complex (control) and finished minced products from turkey fillet enriched with the antioxidant vitamin complex. The products were prepared by different ways: 1 - in a microwave oven (Panasonic) at a power of 1000 W during 8 min.; 2 - in an electric oven (Panasonic) at a temperature of 180 ^{0}C during 30 min. with preliminary searing; 3 - in a steam convection oven (Unox) at a temperature of 170 ^{0}C and air humidity of 60% during 30 min. The total antioxidant capacity was determined by the ferric reducing/antioxidant power (FRAP). Catalase activity and the content of 2-thiobarbituric acid reactive substances (TBARS) were determined using SF-2000 spectrophotometer (OKB Spectr, Russia). Superoxide dismutase activity was determined using SF-2000 spectrophotometer in accordance with the method of Marklund and Marklund with modifications by Getellier, Mercier, and Renerre.

It was found that the vitamin complex developed by the authors had the antioxidant activity, which was 374.15 μmol-equivalent of dihydroquercetin/g. The maximum preservation of vitamins in the enriched products after heat treatment was revealed in the third method and amounted to: 19.6%, 72%, 34.5% and 51% for vitamins C, B_9, B_{12}, and D_3, respectively. Introduction of the vitamin complex into turkey products helps to increase the antioxidant activity. For example, a significant increase in the superoxide dismutase activity by 1.4, 1.6

and 1.43 times was observed in the enriched products compared to the control in the first, second and third treatment methods, respectively. The catalase activity increased by 2.2, 2.3 and 2.1 times, while the products of free-radical and peroxide oxidation of endogenic substances (TBA-AP) decreased by 3.8, 3.9 and 4 times, respectively.

Thus, the turkey culinary products enriched with the vitamin complex have the high antioxidant activity irrespective of the heat treatment method and, therefore, can be included into the diet of cancer patients.

***Key words**: Nutrition in cancer, Ready-to-eat turkey meat products, Antioxidant effect, Vitamins, Selenium, Anticarcinogenic activity, Methods of heat treatment.*

INVESTIGATION OF PREDISPOSITION FOR SPORADIC FORMS OF COLON CANCER IN ROMANIAN PATIENTS

Pompilia Apostol[1*], Madalina Cristea[1,2], Danut Cimponeriu[2]

[1]Clinica Sante, Genetics Department,
Agricultori 35, 021482 Bucharest, Romania
[2]Faculty of Biology, University of Bucharest,
Portocalilor 1-3, 060101 Bucharest, Romania

[*]e-mail: pompilia.apostol@clinica-sante.ro

Abstract

The predisposition for colon cancer is multifactorial. In patients with sporadic forms of colon cancer (CC) without adenomatous polyposis coli (APC) gene mutations the risk for disease has been less investigated. However, an important role is attributed to the interactions between genetic factors and lifestyle. The aim of this research was testing the association between colon cancer, life style and mutations in methylenetetrahydrofolate reductase (MTHFR), and 5-methyltetrahydrofolate-Homocysteine Methyltransferase Reductase (MTRR) genes.

This case-control study included subjects diagnosed with sporadic forms of (CC) and healthy subjects. In each lot 57 men and 43 women were included. Tumors were located in the descending (n = 37), sigmoid (n = 28), transvers (n = 25) or ascending colon (n = 12). The most frequently symptoms reported by patients were: intestinal transit problems (n = 30), abnormal stool color (n = 22) and Fe deficiency anemia (n = 19). None of the selected subjects knows to have APC gene mutations or positive family history of malignant diseases. Data regarding risk factors for CC were collected for each subject. The MTHFR C677T and MTRR A66G polymorphisms were genotyped by PCR-RFLP. The qualitative variables were compared between lots with chi2 or Fisher test whereas quantitative variables were compared with Mann-Whitney U test.

The distribution of the studied polymorphisms respects the Hardy-Weinberg equilibrium. Polymorphism's variants were not significantly associated with CC. However, an association between MTHFR 677C polymorphism and colon cancer was observed in the male sublot ($p < 0.05$). The risk for disease was associated with active smoking (OR = 1.4, $p < 0.05$), increased BMI (OR = 1.6, $p < 0.05$) and processed meat consumption (sausages, pressed meat) at least 2 times/week, for at least two years (OR = 1.7, $p < 0.05$). The consumption of smoked meat, poor

diet in vegetables and sedentary lifestyle were not significantly associated with disease risk. A strong association with disease was calculated for MTHFR 677CC carriers who had a high BMI (OR = 2.3, $p < 0.05$).

In conclusion, MTHFT 677CC was associated with colon cancer only in the men sublot. Lifestyle and interactions between genetic and non-genetic factors may improve the understanding the predisposition for colon cancer.

***Key words**: MTHFR, MTRR, C677T polymorphism, BMI, PCR-RFLP, Colon cancer, Processed meet.*

DEVELOPMENT OF FERRITIN ELECTROCHEMICAL IMUNOSENSOR BASED ON CPE MODIFICATION

Majlinda Vasjari[1,3*], Nevila Broli[1,3], Sadik Cenolli[1,3], Valbona Aliko[2,3], Ledia Vasjari[2,3], Gerta Hajdaraj[4], Caterina Faggio[5]

[1]Department of Chemistry, Faculty of Natural Science, University of Tirana, Boulevard Zogu I nn, 1001 Tirana, Albania
[2]Department of Biology, Faculty of Natural Sciences, University of Tirana, Boulevard Zogu I nn, 1001 Tirana, Albania
[3]Nano-Alb, Academy of Sciences of Albania, Fan Noli 7, 1001 Tirana, Albania
[4]Clinic-Biochemical Laboratory-Ajel Diagnostic, Teodor Keko nn, 1001 Tirana, Albania
[5]Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, Piazza Pugliatti 1, 98122 Messina, Italy

[*]e-mail: majlinda.vasjari@fshn.edu.al

Abstract

Ferritin is a major intracellular iron storage protein present in all cells, tissues and tissue fluids of the organism. Low ferritin levels result in lower iron concentrations which is directly involved with anemia. Elevated levels of ferritin, or hyperferritinemia, indicate the presence of viruses and bacteria into the body. Clinical observations on COVID-19 patients have reported cases accompanied by elevated levels of ferritin in blood. The aim of this research was to develop a new voltametric immunosensor for determination of ferritin based on the principles of biological recognition, antibody-antigen reaction combined with nanotechnology and the advantages of electrochemical detection strategies.

Carbon paste electrode (CPE) modified with grain natural material, characterized as titanium magnetite is used as substrate for immunosensor. The immobilization of ferritine antibody (FeAb) can be effectively improved by using a thin film of surfactant, trimethyl-tetradecylammonium chloride (TTDC), onto the CPE substrate. The modification procedure of the immunosensor is characterized by cyclic voltammetry (CV) and differential pulse voltammetry (DPV). The effect of FeAb incubation time and the FeAb-ferritine reaction kinetic are explored to provide optimum analytical performance. The quantitative determination of ferritine is based on the change in DPV response before and after antibody-antigen reaction. All measurements are done in pH = 7 phosphate buffer saline

(PBS) at room temperature. Calibration method was based on the reduction of the DPV peak (%) in relation to the ferritin concentration.

The time required for the immobilization of FeAb was studied, which resulted in 60 minutes, as well as the equilibrium time of the FeAb-ferritin reaction, which resulted in 30 minutes. The linear range resulted within the interval 0.05 - 0.5 mg/L ferritin (R2 = 0.9947). The recovery of ferritin addition in real sample matrix resulted from 87% to 125%. The specificity of FeAb-ferritin reaction evaluated in terms of binding constant, resulted in the order of 10 - 9 L/mol indicating a specific antibody-antigen reaction.

Based on the values of affinity constants calculated in each case the quantification of ferritin with the studied sensors is based on the specific antiferritin-ferritin bond. The use of surfactant layer (TTDC), improves the process of antiferritin immobilization, which affects the increase of sensitivity and improve the analytical performance of the imunosensor.

***Key words**: Ferritin, Imunosensor, Carbon paste, Surfactant, Modification.*

DIET AND MYCOTOXIN EXPOSURE AND DIETARY HABITS IN COLORECTAL CANCER DEVELOPMENT AMONG A POLISH POPULATION: A STUDY PROTOCOL

Katarzyna Eufemia Przybyłowicz[1*], Tomasz Arłukowicz[2], Anna Danielewicz[1], Jakub Morze[1], Magdalena Gajęcka[3], Łukasz Zielonka[3], Bartosz Fotschki[4], Tomasz Sawicki[1]

[1]Department of Human Nutrition, Faculty of Food Sciences, University of Warmia and Mazury in Olsztyn, Słoneczna 45F, 10-719 Olsztyn, Poland
[2]Department of Internal Medicine, School of Medicine, Collegium Medicum, University of Warmia and Mazury, Warszawska 30, 10-900 Olsztyn, Poland
[3]Department of Veterinary Prevention and Feed Hygiene, Faculty of Veterinary Medicine, University of Warmia and Mazury in Olsztyn, Oczapowskiego 13/29, 10-718 Olsztyn, Poland
[4]Institute of Animal Reproduction and Food Research, Polish Academy of Science, Tuwima 10, 10-748 Olsztyn, Poland

[*]e-mail: kprzybylowicz@uwm.edu.pl

Abstract

Colorectal cancer (CRC) is one of the most common and lethal types of cancer worldwide. The developing of this disease includes many factors such as genetic, socioeconomic, environmental, and lifestyle factors, and nutrition habits. The aim of the study is the determination of zearalenone and its metabolite level in the biological samples of participants at risk of CRC, in relation to the nutrition data and information on the quality of life dependent on health.

In the cohort clinical trial, 150 participants aged between 50 and 65 will be studied. The participants will be assigned into two groups depending on the colonoscopy result. Participants will be tested at dietary intake, quality of life, sleep time and quality, stress level as well as biochemical parameters of the blood (blood biochemical parameters of: erythrocyte sedimentation rate (OB), amount of red blood cells (RBC), amount of white blood cells (WBC), hematocrit (HCT), mean corpuscular volume (MCV), lipid profile (total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL)), creatinine, albumin, and level of glucose, adrenocorticotropic hormone (ACTH) and cortisol. Moreover, in the biological samples, concentration of zearalenone and its metabolites

(α-zearalenol and β-zearalenol) as well as the characteristics of gastrointestinal bacterial will be determined, and the end of the trial for both groups and their results will be compared. The concentration of zearalenone and its metabolites (α and β) in blood plasma samples will be assayed using the high-performance liquid chromatography coupled with mass spectrometry (HPLC-MS). The presence of bacterial DNA in the samples will be confirmed using Real-Time PCR on a thermocycler with SYBR Green as fluorochrome.

Taking into account the possible effect of mycotoxins and nutrition habits on the development of cancer, the results obtained may allow the formulation of new nutritional recommendations and reduce the development and occurrence of CRC.

The results of this study may provide new information over the development of CRC and also have important nutrition implications for adults aged between 50 and 65 years old. The conducted research will allow broadening the knowledge about the correlation between the consumption of selected food groups and the risk of CRC in the aspect of mycotoxin consumption. Therefore, the results obtained will form the basis of a methodology that can be used and adapted to study other types of cancer.

***Key words**: Colorectal cancer, Zearalenone, Mycotoxin, Dietary habits, Study protocol.*

TREATMENT WITH NATURAL SUBSTANCES AND THEIR IMPACT IN BIOENERGETIC METABOLISM OF LEUKEMIC LYMPHOCYTES AS A POTENTIAL APPROACH FOR CANCER IMMUNOTHERAPY

Donika Ivanova[1*], Severina Semkova[2], Zvezdelina Yaneva[1], Radmila Panovska[3], Zhivko Zhelev[3], Rumiana Bakalova[4,5]

[1]Faculty of Veterinary Medicine, Trakia University Student campus nn, 6000 Stara Zagora, Bulgaria
[2]Institute of Biophysics and Biomedical Engineering, Bulgarian Academy of Sciences, Acad. Georgi Bonchev Str., Block 21, 1113 Sofia, Bulgaria
[3]Medical Faculty, Trakia University, Armeiska 11, 6000 Stara Zagora, Bulgaria
[4]Faculty of Medicine, Sofia University "St. Kliment Ohridski", Koziak 1, 1407 Sofia, Bulgaria
[5]National Institutes for Quantum Science and Technology (QST), Anagawa4-9-1, Inage-ku, 263-8555 Chiba-shi, Japan

[*]e-mail: donika.ivanova@trakia-uni.bg

Abstract

In recent years, the explorations focused on the metabolic status distinctions between cancer cells and immune cells are included as a part of immuno-oncology, which is a modern and rapidly developing attractive scientific field of biomedicine. It is widely accepted that natural substances as vitamins and omega-3 fatty acids have beneficial effects on human immune system, but evidences for their anticancer activity also have been displayed. The aim of our investigation is to evaluate the impact on proliferative activity as well as on mitochondrial ATP production of leukemia lymphocytes after the combined treatment with vitamin C, vitamin K3 and docosahexaenoic acid.

The experiments were performed on leukemia lymphocytes (Jurkat cancer cell line). The used natural substance docosahexaenoic acid, applied at concentration 50 μM, was combined with vitamin C (L-ascorbic acid) and vitamin K3 (menadion) in different concentrations constant ratio 100 : 1 (mol : mol). The cell viability and proliferative activity were analyzed by trypan blue staining method and automatically counting. The amount of mitochondrial ATP, synthesized in live cells, was analyzed using generation of luminescent signal from luciferin/luciferase reaction.

The results indicated reduction of ATP production, accompanied by decrease of proliferative activity of leukemia lymphocytes, exposed to the cooperative effect of the used natural substances. Since immunotherapy has been an important part of the treatment of blood cancer, the studies relevantly reveal the mechanisms, responsible for activation of naive immune responses gain growing scientific interest. It has been considered that targeting at the bioenergetics mitochondrial metabolism of cancer cells by natural products could provide an adequate mechanism(s) for immune cells to control cancer progression.

Natural substances possessing redox-modulating and immuno-stimulating activity could be a part of cancer immunotherapy, because they could affect directly energy metabolic processes of cancer and immune cells in different ways.

***Key words**: Bioenergetics, Cancer therapy, Natural substances, Leukemia.*

PULMONARY CACHEXIA - A REVIEW OF MALNUTRITION IN PATIENTS WITH ADVANCED LUNG DISEASES AND STRATEGIES FOR DIET THERAPY

Vladimir Andreevski[1*], Petar Damceski[1], Stefan Pejkovski[1]

[1]University Clinic of Gastroenterohepatology, Medical Faculty, Ss. Cyril and Methodius University, Boulevard Mother Teresa 17, 1000 Skopje, Macedonia

[*]e-mail: banebumbar_med@hotmail.com

Abstract

Patients with advanced lung diseases often suffer from changes in body structure that manifest with progressive weight loss. Malnutrition associated with these morbidities is known as pulmonary cachexia syndrome that can occur in any type of chronic lung disease. This review will look at contributing factors for the appearance of pulmonary cachexia and strategies for diet therapy.

Since it was first mentioned and introduced as a new term in 2002, initially in patients with chronic obstructive pulmonary disease, pulmonary cachexia syndrome as distinct type of malnutrition has been subject of evaluation by dozen of observational studies, randomized trials and only few meta-analysis, listed in databases like PubMed/Medline, ProQuest, Scopus and others. Malnutrition is associated with accelerated decline in functional status and is independent predictor of mortality in advanced lung diseases. Patients have progressive reduction in lean body mass due to several contributing factors, like changes in metabolism and caloric intake, effects of lung dysfunction, aging process, loss of muscle mass, decreased physical activity, tissue hypoxia, chronic inflammation, and use of different drugs. The interaction of all aforementioned phenomena results in development of pulmonary cachexia. Focused nutritional assessment can aid in timely detection of first signs of malnutrition. The widely accepted goals of diet therapy are: adequate caloric intake to meet basal energy expenditure; small, frequent meals with nutrient-dense foods; meals requiring little preparation; rest before meals and daily multivitamins. However, nutrition alone is not enough to prevent muscle loss and improve respiratory function, so it's important to apply the following measures simultaneously: optimization of lung function, regular exercise to enhance the effect of diet and stimulate appetite, oxygen therapy, correction of any anaemia and cardiac dysfunction, inflammation control, use of anabolic preparations, and additional measures such as application of artificial dietary supplements using nasogastric tube or percutaneous gastrostomy.

The association of malnutrition with morbidity and mortality in pulmonary cachexia is a logical basis for the application of nutritional support. Monitoring and treatment of each of contributing variables should be performed regularly and consistently. Once identified, malnutrition can be mitigated via proper diet therapy which aims to improve prognosis in advanced lung diseases.

***Key words**: Nutrition, Pulmonary Cachexia, Advanced lung disease, Diet therapy.*

ORAL/DENTAL HEALTH AND NUTRITION

XV

GUIDE BONE REGENERATION WITH PLATELET RICH FIBRIN FOR OPTIMAL IMPLANT PLACEMENT: AN OVERVIEW AND A CASE REPORT

Biljana Evrosimovska[1*], Daniela Veleska Stevkovska[1], Vesna Jurukova Šotarovska[2]

[1]Department of Oral Surgery and Implantology, University Dental Clinical Centre "Ss Pantelejmon", Faculty of Dental Medicine, "Ss Cyril and Methodius University", Mother Tereza No. 17, 1000 Skopje, Macedonia
[2]Department of Fixed prosthetics University Dental Clinical Centre "Ss Pantelejmon", Faculty of Dental Medicine, "Ss Cyril and Methodius University", Mother Tereza No. 17, 1000 Skopje, Macedonia

[*]e-mail: bevrosimovska@gmail.com

Abstract

Guided bone regeneration is used most often when a tooth is extracted and a defect in the bone remains, leaving inadequate bone for implant placement. To regenerate enough bone for successful implant placement, a ridge augmentation technique is often required. Platelet Rich Fibrin (PRF) is used in guided bone and tissue regeneration. Outside of PRF, no other grafting material can govern and stimulate all 3 of the key processes involved in tissue and bone regeneration including angiogenesis, chemotaxis, and cell proliferation. The aim of this research was to evaluate the efficiency of PRF membrane and PRF/graft combination on bone healing in the male patient after tooth removal.

Case study: A 51-year-old male presented following atraumatic extraction of the gangrenous maxillary second premolar. The operative site was treated with guided bone regeneration (GBR), using sticky bone for space maintenance (made from bovine-derived xenograft (Bio-Oss) as a bone substitute mixed with advanced-platelet rich fibrin (A-PRF pieces and drained supernatant). A-PRF membrane was applied to isolate the defect site for GBR and as an interposition barrier to promote soft tissue healing. After 6 mounts of GBR the implant was placed and a natural-appearing esthetic outcome was eventually achieved with the final restorations.

Alveolar bone deficiency in most cases is no longer a contraindication to placement implants. The purpose of using PRF was to activate and facilitate the healing and

regenerative capacity of the host tissue, by providing a strong fibrin scaffold, major growth factors, and allowing space for tissue regeneration. We used PRF as a protective barrier on the bone graft site and helped avoid perforations of the weakened gingival tissues and prevent associated contamination of the bone graft below.

PRF seems to be an accepted minimally invasive approach with good clinical results. Applying PRF to the bone defects may accelerate the bone graft healing and shorten the period for rehabilitation.

***Key words**: Guided bone regeneration, Implant placement, Platelet rich fibrin.*

SURGICAL EXTRACTION OF THIRD MOLARS AND GUSTATORY FUNCTION

Igor Kirovski[1*], Tatjana Kirovska[2]

[1]PHO "Dr. Igor Kirovski", Pariska b.b. 1000 Skopje, Macedonia
[2]PHO "Dr. Tatjana Kirovska", Vic 24, 1000 Skopje, Macedonia

[*]e-mail: igor.kirovski@hotmail.com

Abstract

Extraction of a third molar in general is a common intervention in today's dentistry. With the raising frequency of the intervention of third molar extraction and the potential of affecting oral sensitivity and taste, the aim of this research is to turn the attention at certain risks and how to prevent it, but as well to benefit from possible positive effects.

There is a wide range of indications to remove third molars, these so called "wisdom" teeth. Some indications originate from the evolutionary anthropological development, others from medical pathology. The very procedure of the tooth extraction depends on various circumstances, and it is surgical in most cases. As the third molars are considered as not obligatory present for a full dental arch in the modern dental practice, the decision for removing them is easily made, even as preventive procedure. There is evidence that there are positive long-term effects on taste function, after the third molars extraction (TME). The very basis of this phenomenon is still unknown, with propositions yet to be confirmed. However, there are also possible negative effects from the extraction procedures, including affection of neurosensory and gustatory changes. The incidence, severity, duration, possible treatment and outcome of these situations are explained. This is due to the anatomical location of the nerves and their proximity with the site of third molars extractions.

The effects, both positive and negative, following third molars extractions, should be involved in the decision-making process, looking for the positive ones and executing strategies to avoid the negative consequences.

***Key words**: Third molar extraction, Gustatory affection, Neurosensory affection.*

FOOD LABELLING AND NUTRITION AND HEALTH CLAIMS

XVI

ACCURACY OF FOOD LABEL - CONSUMER ASPECTS

Natalija Atanasova-Pancevska[1], Aleksandra Markovska[2*]

[1]Department of Microbiology and Microbial Biotechnology, Institute of Biology, Faculty of Natural Sciences and Mathematics, "Ss. Cyril and Methodius" University, Arhimedova 3, 1000 Skopje, Republic of Macedonia
[2]Quality Consulting, Februarski pohod 26 1/2, 1000 Skopje, Republic of Macedonia

[*]e-mail: levelup-me@outlook.com

Abstract

In the last 50 years, consumer awareness of food quality and safety has been growing. Consumers receive information from the food labels. Most of the information on the declaration are clearly defined in the regulations, but there are information such as the shelf life and nutritional values that are left to the producer to determine and declare. The purpose of the research is to determine the reliability of the information that consumers receive through the food labels.

The study is based on two sets of questionnaires, one for industry and second one for the consumers. Questionnaire was submitted to a selected 20 food production companies in Macedonia. Questionnaire for the consumers, was made up from three sets of questions about: shelf life, nutritional values and problems related to purchased products. The questionnaire was submitted to a group 100 citizens (25 citizens aged 15 - 20; 25 citizens were in the age group of 20 - 30; 25 citizens were in the age group of 30 - 50 years, and 25 citizens were in the age group of 50 - 60 years). Gained data were processed by arithmetical mean value and a process of comparison.

After the analysis of the obtained data, it is concluded that the citizens when choosing food products mostly refer to the shelf life and nutritional values. On the other hand the industry uses established templates/formulas for this information without accurate measure the shelf life and nutritional values.

Public pressure will increase and thus the food industry itself will be forced to introduce internal methods to declare accurate information.

***Key words**: Consumer, Food label, Shelf life.*

THE IMPACT OF FOOD SAFETY MESSAGES TO CONSUMERS

Milenko Košutić[1*], Jelena Filipović[1]

[1]Institute of food technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

[*]e-mail: milenko.kosutic@fins.uns.ac.rs

Abstract

Consumer has a right to know all the facts necessary for proper decision making including regular and protected labelling. There has recently appeared a new concept called "a right-to-know" which enables consumers to make food choice on the base of information. The aim of this research was to identify key factors that influence on how consumers perceive food risks, in order to provide information directly relevant to the development of effective risk communication and consumer protection policies. Using a conjoint measurement, we assessed consumer interest in and perceived safety of food characteristics that consumers think to be important when they make a purchase decision.

The research was conducted through randomly distributed survey on the territory of Vojvodina. The consumers' attitude has been tested on a sample with 700 respondents divided to subsamples based on: age, education and gender. For the analysis of consumers' attitude a multivariate methods MANOVA and discriminant analysis were used. Roy's-test, Pearson coefficient of contingency (χ), multiple correlation coefficient (R) were also applied. By this procedure, each class has been joined a real number. Coefficients of discrimination were calculated which enabled the selection of properties defining the specificity of subsamples and those to exclude from analyses and thus reduce the observed space. On the basis of data on the impact of consumers' age and educational level on their perception of health safety information, it is possible to anticipate the demands and model consumer behavior.

The contribution of total to characteristics of subsamples (%) showed that the highest difference between respondents was in their statements regarding health information in relation to their education level and age. When the results in relation to the education level of respondents are observed, it was found that highest difference among respondents was in their attitude regarding health status information whereas the least difference was in their attitude regarding the way of presenting information about products with food safety messages. With increasing consumers age also increased the interest of consumers to read

the content on the food safety messages. Older consumers better understand information presented on food safety messages.

Older consumers better understand information presented on food safety messages. Age of consumer significantly affected their attitude as regard to which information on the food safety message is the most important. More educated consumers consider information presented in food safety messages important for proper choice of product and perceive it as an inherent part of a quality product.

***Key words**: Consumers, Food safety, Messages.*

Book of Abstracts

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MANAGEMENT I

RELATIONSHIPS BETWEEN CORPORATE FINANCIAL PERFORMANCE AND CORPORATE SOCIAL RESPONSIBILITY WHEN CONTROLLING FOR SOCIALLY AND ENVIRONMENTALLY CONSCIOUS INVESTMENTS

Diego Arturo Hernandez[1*]

[1]Quantitative Department, School of Business,
Tiffin University, 155 Miami Street, 44883 Tiffin, Ohio, USA

[*]e-mail: hernandezda@tiffin.edu

Abstract

The relationship between corporate financial performance (CFP) and corporate social responsibility (CSR) has been studied for many years, but this relationship appears to be mixed and inconsistent. The study plays a fundamental part in the relationship between CFP and CSR literature identifying a significant component in a company's primary purpose to maximize shareholders' interest while satisfying maximum ethical requirements. The problem addressed in this study was that the maximization of CFP as the primary responsibility for any business entity overshadows CSR. As a result, the purpose of this non-experimental quantitative correlational study was to determine if there is a relationship between CFP and CSR in order to determine if profits trump social responsibilities for corporations.

Based on the research problem, this study's purpose, and the research questions, the most appropriate research method and design was a quantitative correlational analysis. This investigation utilized Spearman's non-parametric correlational analysis to establish the relationships between profits and CSR investments. A total sample size of 138 companies in the U.S. was needed to analyze Research Question 1 (RQ1) To what extent, if any, is there a statistical relationship between CFP and CSR? Research Question 1a (RQ1a) To what extent, if any, is there a statistical relationship between CFP and CSR when controlling for socially conscious investments? Research Question 1b (RQ1b) To what extent, if any, is there a statistical relationship between CFP and CSR when controlling for environmentally conscious investments?

The correlational tests displayed steady statistically significant but very weak relationships between the variables. The full results of the collective research questions indicate support for higher CFP profits associated with higher CSR ratings. Findings displayed steady degrees of significance and the size of the

effect. In correlational analysis, test outcomes specified very significant ($p = .000$) relationships for the independent variable companies' profits and the CSR overall, CSR social and environmental ratings.

The analysis-determined support for all three hypotheses as statistically significant relationships was exposed for each research question. The evidence from this study supports research that found CFP related positively to CSR investments. In addition, the results of this investigation will assist in expanding the literature on stakeholder theory and the theoretical framework of this study. The inference is that firms in the United States consider CSR activities as an integral component of CFP. This information could be helpful to organizations that specify rules, recommendations, strategies, and procedures for CFP and CSR activities.

Key words: *Corporate financial performance, Corporate social responsibility, Social conscious investments, Environmental conscious investments.*

CHOICE OF WAREHOUSING TECHNOLOGY IN THE LOGISTICS COMPANIES

Rolandas Drejeris[1], Mindaugas Samuolaitis[1*]

[1]Academy of Agriculture, Vytautas Magnus University, Studentu 11, LT-53361 Akademija, Kaunas district, Lithuania

[*]e-mail: mindaugas.samuolaitis@vdu.lt

Abstract

Increasing the efficiency of warehousing is one of the priority issues for improving competitiveness of logistic companies. One of the priority issues in optimizing warehouse management is the selection of appropriate technologies based on the specifics of the company's operations. How to choose technology, which technology is the best in the current logistics companies' situation, which assessment is the most objective according to capability of warehouses and others criteria? Science and practice are yet to find answers to these questions. Thus, managers of any logistic company face a rather serious problem- what method to use to select the most appropriate technologies for goods warehousing? The constant challenges in the business sector to increase the competitiveness of logistics companies have led to more intensive research of this problem. The aim of the research is to develop and practically test a methodological tool as an intelligent decision support system for increasing the efficiency of warehousing technology selection in logistics companies using the method of multicriteria assessment.

An international logistics company with a branch in Lithuania and managing more than 5,000 square meters of warehouses in Lithuania and more than 1,000,000 square meters of storage space globally was selected for the case study. 6 international experts, who is working in Lithuania, were selected from the middle managers in the fields of warehousing, transport, and finance to conduct peer review and to perform evaluation of 5 the most contemporary technologies considering: the level of automation, intelligence and adaptability, and company's capabilities for continuous improvement of the company's operations. After reviewing databases as: Scopus, Clarivate Analytics, Ebsco and Emerald we found that warehousing technology selection is multicriteria task, therefore the use the Simple Additive Weight (SAW) multi-criteria evaluation method was the most suitable in this case, because its reveals more accurate results in determining various combinations of characteristics of warehouse, logistics companies' activities, clients and priorities of decision-makers.

The following criteria were identified for the evaluation of warehousing technologies: efficiency of warehouse operations, sustainability, degree of automation, possibility of practical application, expenditure of technology management, appropriate design, warehouse safety and security, possibility to weigh, reload, pack goods, apply labeling as well, ability to handle big data, possibility expand existing activity with use of technology. After performing an expert evaluation according to the criteria's and after multi-criteria evaluation calculations, the most suitable technologies were selected. Most suitable technology for the company were selected - digital twins for warehousing, which best meets the requirements for company needs of optimization for warehousing according to the developed tool.

The multi-criteria method presented in the article is justified and as well are identified and described evaluation criteria enabled the development of an intelligent decision support system, and its application allow to create preconditions for increasing the efficiency of goods warehousing technology selection in the logistics sector. The proposed technology selection tool has been tested in real business conditions, and its suitability is fully justified.

***Key words**: Selection of goods warehousing technologies, Intelligent decision support system, Multi-criteria approach, SAW.*

MOTIVATION OF EMPLOYEES IN THE TOURISM SECTOR DURING THE COVID-19 PANDEMIC

Nada Vidanović [1*]

[1]Department of Postgraduate Studies - Management in Tourism, Faculty of Tourism and Hospitality Management, University Singidunum, Danijelova 32, 11000 Beograd, Serbia

[*]e-mail: nada.vidanovic.15@singimail.rs

Abstract

Performance of employees in tourism, as in other sectors, depend on their will and motivation for work. During Covid 19 crisis, tourist sector received hard blow and tourism sector barely survived, and many employees were scared for their jobs and future. The aim of this paper is to explore the motivation of employees in the tourism sector during the Covid-19 pandemic, how it affected the performance of employees and whether the organizations in some way tried to raise morale and motivate them.

The tourism sector suffered the greatest burden with outbreak of Covid-19 pandemic, as countries around the world were completely closed, travel between countries was not allowed and in some countries movement within it was not allowed. Material was obtained through research in various books dealing with human resources, articles in scientific journals and from official statistical analyzes of the Statistical Office of Serbia, also we conducted our own research, an electronic questionnaire, with yes / no answers and filling in the Likert scale, conducted on 72 working in fields of tourism from different regions of Serbia. Gained data were analyzed by mean arithmetical value

The results of the research show that most of the respondents had the desire and the will to work, even though their employers did not try to motivate them enough, only 11.1% believe that motivation was at good level. Also secure and stable earnings, is the best way to motivate, organizations that were able to promise their employees secure incomes and stable jobs, were much more successful.

As we could see from the research we conducted, the human factor in one organization is the most important and influential, as the success of a company depends on it. The happier and happier the employees are, the greater the

possibility for the progress and success of one company. Improving employees is one of the important factors

***Key words**: Covid - 19 pandemic, Motivation, Quality, Employees.*

STRATEGIC ANALYSIS OF THE ENVIRONMENT OF THE ORGANIZATIONS

Ena Petreska Tomeska[1*]

[1]Department of Business Management, Faculty of Economics - Prilep, University of St. Kliment Ohridski Bitola, Marksova 133, 7500 Prilep, Republic of Macedonia

[*]e-mail: ena.petreska@yahoo.com

Abstract

Strategy is important for any company, because it defines the foundation on which managers are leading the companies and helps them to achieve positive results. The problem of choosing research methods in the field of strategic management is always relevant in strength, which can be provided by a choosing profitable and competitive method depending on the managerial or economic situation, a high level of dynamic processes in strategic management requires constant development of research methodology and tools. The purpose of this paper is to know the importance of future forecasting, respectively the process of strategic management and formulation (evaluation and choice of strategic alternatives), and the influence that this dimension may have in business.

Nowadays, the continuous sustainable improvement of business faces various challenges in the global economic competition. But all challenges can be overcome with special business strategies. Of particular importance in this research is the attempt to answer how to determine the position of cannot be found in the chosen environment, in order to find a rational strategy based on the method used by that evaluation of the strategic position and the action of the operation. For this research were consulted Scopus, Research Gate, Academia. edu, PubMed and Harvard Business Review. According to some authors, when applying strategic planning processes it is necessary to apply several models: Boston Consulting Group (BCG) matrix, Internal-External (IE) matrix, Strengths, Weaknesses, Opportunities, and Threats (SWOT) matrix, as well as Strategic Position and Action Evaluation (SPACE) matrix, while others are recommending application of: Porter 5 Forces model, McKinsey 7S model, and Political, Economic, Social, Technological, Legal and Environmental (PESTLE) analysis. The relative position of the market share is defined by the ratio of the market share of industry (sales) to relative market growth. My opinion is that BCG matrix, SWOT analysis, SPACE matrix, Porter 5 Forces model, McKinsey 7S model, and (PESTLE) analysis as part of the strategic analysis of the environment provides a roadmap for the

company to move its activities because it identifies where the company is in the market or industry.

It is especially important to emphasize that there is no strategy that is applied according to a certain so-called "recipe", but it is a set of research, data analysis and information and implementation of actions and processes during the operation. Therefore, it is important to set the goals of the company to be achieved that should be related to the different levels of the strategy in a cause-and-effect manner.

***Key words**: Strategic management, Planning, Company, SPACE matrix, Market.*

MARKETING II

BRAND SYMBOLISM IN CHILDREN AGED 3-5 YEARS IN MACEDONIA

Konstantin Kakurinov[1*]

[1]Department of Marketing, Faculty of Economics, Ss. Cyril and Methodius University, Boulevard Goce Delchev 9B, 1000 Skopje, Republic of Macedonia

[*]e-mail: konstantin.kakurinov@key.com.mk

Abstract

Young children represent one of the most frequent targets of brand influences when it comes to advertising. Due to their ongoing development of cognitive abilities for recognizing, representing and understanding brand symbols, as well as their lack of cognitive defenses against most forms of advertising, they are one of the most vulnerable groups when it comes to being influenced by advertising messages. For that reason, this research aims to asses the development of brand symbolism in children aged 3 - 5 years in Macedonia, as opposed to previous research in this field of children brand symbolism.

As this research was conducted during the peak of the Covid-19 pandemic in Macedonia, planned experiments to be conducted in kindergartens, in a physical capacity, with children aged 3-5 years, was not a feasible possibility. As an alternative approach, research for this paper was conducted via an internet questionnaire, aimed at the parents of children aged 3 - 5 years in Macedonia, the subject of analysis being the data collected from the same questionnaire. The questionnaire was answered by 171 respondents, structured with open and closed questions, based on a nominal and ordinal scale. Specific methods used were: a Likert scale, an ANOVA test and descriptive statistics.

Results from this research show that the respondents generally follow past research on the formation, development and progression of brand symbolism among young children, while they differ on the scope of influence that brands and media have on their own children. In effect, this research shows the difference between the actual development of brand symbolism in young children in Macedonia, and the difference in perception that their parents have on the development of brand symbolism in these children.

In conclusion, while this research has confirmed that brand symbolism in children aged 3-5 years in Macedonia is in line with past research, it shines a light on the

bias that parents have when it comes to the influence that brands, advertising messages and social and digital media have on their own children when it comes to the development of brand symbolism.

***Key words**: Brand influence on children, Digital media, Advertising, Cognitive development, Social brand symbolism.*

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