BIOLOGICALLY ACTIVE COMPOUNDS IN FOOD

2ND International Conference

BOOK OF ABSTRACTS

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Dear Colleagues,

After successful first edition of BACIF conference two years ago, we decided to organize second one now, in November 2017. Biologically active compounds, although known and appreciated for many years, still reach great attention. At the same time, the diversity of bioactive compounds and the aspects of their action in biological systems, leave a vast field for new and new research. We believe that a meeting like BACIF gives great opportunity to share the new knowledge and could be a field to exchange our views and experiences.
On behalf of Łódź Branch of Polish Society of Food Technologists and Faculty of Biotechnology and Food Sciences of Lodz University of Technology we would like to warmly welcome all participants. We are grateful to have you here, in Łódź, the town once called "The Promised Land". We hope that BACIF conference will be a place of fruitful discussion between the specialists of many issues, united on the field of biologically active compounds.
We believe that your stay in Lodz will be a great moment in your life.

For Organizing Committee
Krzysztof Kołodziejczyk

For Scientific Committee
Joanna Leszczyńska

Conference organizers are not responsible for the content of the published abstracts.

DAY – 1 (Thursday, 9.11.2017)

8:00 – 10:00 **Participants registration**

10:00 – 10:15 **Welcome**

SESSION 1 – Chair: **Christiane Faeste, Krzysztof Kołodziejczyk**

10:15 – 10:45 **Plenary lecture** – How does food processing influence the functional properties of secondary metabolites in fruit-derived foodstuffs? The example of polyphenol oxidation in apple juices and ciders – **Sylvian Guyot**

10:45 – 11:05 Authenticity and health value of fruit juices – **Jarosław Markowski**

11:05 – 11:25 ACI as a practical tool for comparison of antioxidant activity in fresh vs commercial juices – **Vanja Todorovic**

11:25 – 11:45 Content of chosen elements in broccoli stored in controlled atmosphere – **Kalina Sikorska-Zimny**

11:45 – 12:15 **Coffee break**

SESSION 2 – Chair: **Catherine Renard, Dorota Piasecka-Kwiatkowska**

12:15 – 12:45 **Plenary lecture –** Important mycotoxins in grain in Northern Europe: toxicodynamics, toxicokinetics and assessment of human risk - **Christiane Faeste**

12:45 – 13:05 Characterization and quality evaluation of mistletoe spirits – **Maja Rupert**

13:05 – 13:25 Popular methods of grilling and meat products contamination by polycyclic aromatic hydrocarbons – **Marta Ciecierska**

13:25 – 13:45 An intestinal inflammation cell tri-culture model: study of the interaction with a citrus carotenoid (β-cryptoxanthin) – **María del Carmen Ponce De Leon Rodriguez**

13:45 – 14:45 **Lunch**

14:45 – 15:30 **Poster session I**

SESSION 3 – Chair: **Georgios Seiragakis, Beata Smolińska**

15:30 – 16:00 **Plenary lecture** - Bioactive compounds in peach fruit under cold storage - **Vassilis Fotopoulous**

16:00 – 16:20 The seeds of hemp as a functional additive in yoghurts – Dorota Derewiaka

16:20 – 16:40 Physicochemical characteristic of industrial aromas in a powder form – **Aleksandra Jedlińska**

16:40 – 17:00 Corona CAD detector in food analysis - **Karol Bujak**

19.00 – 22.00 **Banquet**

DAY – 2 (Friday, 10.11.2017)

SESSION 4 – Chair: **Sylvain Guyot, Michał Sójka**

9:00 – 9:30 **Plenary lecture** – Multi-analyte allergen analysis by LC/MS/MS – **Georgios Seiragakis**

9:30 – 9:50 Analytical methods for exhaustive characterization of Brassica plants and dietary products based on them – **Agnieszka Bartoszek**

9:50 – 10:10 Antioxidant activity of chosen spices' constituents – **Rafał Wołosiak**

10:10 – 10:30 Supercritical carbon dioxide extraction of furocoumarins from food and herbal matrices – **Łukasz Woźniak**

10:30 – 11:00 **Coffee break**

SESSION 5 – Chair: **Vassilis Fotopoulous, Grażyna Budryn**

11:00 – 11:30 **Plenary lecture -** Enzymes, diffusion and chemical degradation, three factors that impact vitamin C and vitamin B9 when processing fruit and vegetables – **Catherine Renard**

11:30 – 11:50 Acidic, electrokinetic and structural properties of zinc ions/pectin systems – **Diana Gawkowska**

11:50 – 12:10 Design of a new functional fermented maize yogurt-like product containing phytosterols and papaya/melon extracts – **Magali Gies**

12:10 – 12.30 Ripened cheese as a source of bioactive peptides – **Agnieszka Skwarek**

12.30 – 12:50 Comparative analysis of coumarin content in various species of sweet clover (Melilotus) – **Patrycja Sowa**

12:50 – 13:40 **Poster session II**

13.40 – 14:00 **Summary and Closing of the Conference**

14:00 – 15:00 **Lunch**

17:00 – 18:00 **Social event – ms^2 Museum of Art**

PLENARY LECTURES

How does food processing influence the functional properties of secondary metabolites in fruit-derived foodstuffs? The example of polyphenol oxidation in apple juices and ciders

Sylvain Guyot

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For a very long time, edible fruits and vegetables have been processed in order to elaborate fruit-derived products that are more convenient for transportation, storage and for a use all along the year even when the fruit season is over. Processes may correspond to very basic operations such as a simple cold storage in controlled atmosphere or may be much more sophisticated as it is the case for wine, beer or cider making. In the latter case and in particular for French cider making, the raw material corresponds to rustic cider apple varieties the particularity of which being their high content in phenolic compounds[1]. Those secondary metabolites are essential for the sensory properties of the ciders such as color[2], bitterness[3], astringency[3] and colloidal stability. In addition, it is now well admitted that polyphenols are also essential contributors to the health benefit related to fruit and vegetable consumption. Information related to organoleptic and nutritional properties of native polyphenols is well documented. In contrast, only few is still known concerning those neoformed phenolic molecules that are formed during fruit processing in particular as a result of enzymatic oxidation[4]. In the present lecture, taking example of our work on polyphenols in apple juice and cider making, we will show how native phenolic molecules can be converted into original new structures[5] that acquire specific and sometimes surprising properties[6]. In the future, this will open the door to the production of innovative apple-derived products that would contain larger amount of bioactive and nutritional compounds while still displaying very good sensory qualities.

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Important mycotoxins in grain in Northern Europe: toxicodynamics, toxicokinetics and assessment of human risk

Christiane K. Fæste

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Mycotoxins are secondary metabolites produced by fungi such as *Fusarium*, *Penicillium*, *Aspergillus* and *Alternaria* species as part of their defence mechanisms. They include a diverse multitude of compounds responsible for a large range of biological and toxic effects. Depending on the fungi's preferred growth conditions, they can infect food and feed both in the field and during storage, and in consequence animals and humans get exposed to mycotoxins through the diet. Both, extrinsic climate factors and intrinsic factors connected to fungal strain characteristics are influencing the occurrence of specific mycotoxins. Their presence in practically all food- and feedstuffs worldwide, although with very different compositions and levels, is critical for nutritional security and safety, and important for human and animal health and welfare.

Mycotoxins responsible for food and feed contamination in Nordic countries are mainly produced by field-growing *Fusarium* species, which produces three major mycotoxin classes: trichothecenes, zearalenones and fumonisins. The most important trichothecenes regarding prevalence and potency are HT-2 toxin, T-2 toxin, deoxynivalenol and nivalenol. Furthermore, zearalenone and the fumonisins B1 and B2 are relevant. Additionally, the *Fusarium*-toxins enniatins B, B1, A, A1, beauvericin and moniliformin (MON) show considerable occurrence and toxicity.

Mycotoxin toxicokinetics are determining if and to which extent the site of toxic action is reached. A compound's toxicokinetic characteristics, including absorption rate from the gastrointestinal tract into the circulatory system, distribution in blood and to different body tissues, metabolism by degrading enzymes, and excretion from the organism (ADME), are decisive for its specific *in vivo* concentration-time profiles after oral uptake.

Risk assessments for important mycotoxins in the diet have been performed by national food safety committees and international bodies such as the Joint Expert Committee on Food Additives of the World Health Organization and Food and Agriculture Organization (JECFA/WHO) or the European Food Safety Authority (EFSA). As a result, acute reference doses (ARfD) were defined for some mycotoxins with the aim to prevent cases of acute toxicosis and sub-acute adverse effects in humans. Considering the continuous low-dose exposure through the consumption of grain-based products, limits for tolerable daily intake (TDI) were set if the respective data were sufficient. The determination of ARfDs or TDIs is generally based on toxicity testing in animals or on epidemiological data, and the inclusion of a safety factor, which is intended to account for the inaccuracy of extrapolation to humans. The EU and national food safety authorities have put risk management measures into place surveying threshold levels for mycotoxins in feed- and foodstuffs.

Bioactive compounds in peach fruit under cold storage

Vassilis Fotopoulous

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The aim of this study was to understand the antioxidant metabolic changes of peach (cvs. 'Royal Glory', 'Red Haven' and 'Sun Cloud') and nectarine fruits (cv. 'Big Top') exposed to different combinations of low-temperature storage (0, 2, 4 weeks storage at 0°C, 90% R.H.) and additional ripening at room temperature (1, 3 and 5 d, shelf life, 20°C) with an array of analytical, biochemical and molecular approaches. Initially, harvested fruit of the examined cultivars were segregated non-destructively at advanced and less pronounced maturity stages and qualitative traits, physiological parameters, phytochemical composition and antioxidant capacity were determined. 'Big Top' and 'Royal Glory' fruits were characterized by slower softening rate and less pronounced ripening-related alterations. The coupling of HPLC fingerprints, consisted of 3 hydroxycinnamic acids (chlorogenic, neochlorogenic, ferulic) and 6 flavonols (catechin, epicatechin, rutin, quercetin-3-O-glucoside, procyanidins B1 and B2), and spectrophotometric methods disclosed a great impact of genotype on peach bioactive composition, with 'Sun Cloud' generally displaying the highest contents. Maturity stage at harvest did not seem to affect fruit phenolic composition and no general guidelines for the impact of cold storage and shelf-life on individual phenolic compounds can be extrapolated. Subsequently, fruit of less pronounced maturity at harvest were used for further molecular analysis. 'Sun Cloud' was proven efficient in protecting plasmid pBR322 DNA against ROO• attack throughout the experimental period and against HO• attack after 2 and 4 weeks of cold storage. Interestingly, a general down-regulation of key genes implicated in the antioxidant apparatus with the prolongation of storage period was recorded; this was more evident for CAT, cAPX, Cu/ZnSOD2, perAPX3 and GPX8 genes. Higher antioxidant capacity of 'Sun Cloud' fruit could potentially be linked with compounds other than enzymatic antioxidants that further regulate peach fruit ripening.

Multi-analyte allergen analysis by LC/MS/MS

George Seiragakis

Technical Director Food Allergens Labs (Athens, Larnaca, Rethimno, Warswaw)

New allergy labelling legislation came into effect on 13 December 2016, which requires food businesses to provide allergy information on food that is sold without packaging (in catering outlets, bakeries, and sandwich bars). Most common methods for food allergens detection are Elisa and PCR . Both of them have limitations in some food allergens (egg, milk and celery).

Liquid chromatography tandem mass spectrometry (LC–MS–MS) is an alternative method for allergen detection that is highly specific, sensitive, and can analyze multiple allergens in a single analysis. LC/MS/MS detection is also not as strongly influenced by food processing, and has the capability for accurate quantitation of the allergens. LC–MS–MS allows direct analysis of multiple allergenic proteins in a single preparation; is more sensitive; and allows more accurate quantitation than traditional approaches. Allergenic proteins are extracted from samples and are subsequently digested into peptide fragments that are directly analyzed using their characteristic molecular masses. The analysis of multiple target peptides and their unique masses and fragmentation patterns improves the reliability of allergen detection compared to ELISA techniques. Detection of multiple allergens including peanut, milk, egg, and wheat proteins can be performed by the chromatography of 19 unique peptides.

Although sample preparation for LC–MS–MS analysis of allergens might takes longer than that for analysis by Elisa and PCR techniques, the benefits that LC/MS/MS can bring to the analysis of allergenic proteins is significant as you could have by a single injection up to eight different food allergens.

Enzymes, diffusion and chemical degradation, three factors that impact vitamin C and vitamin B9 when processing fruit and vegetables

Catherine M.G.C. Renard

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Vitamin C (ascorbic acid and dehydroascorbic acid) and vitamin B9 (folates) are two important water-soluble vitamins found in fruit and vegetables. Both are reputed to be fragile molecules, although purely chemical degradation is actually limited in many food processing instances. The presentation will give an overview on the mechanisms that drive their losses in fruit and vegetable processing as well as means to palliate them, with a specific focus on the results of EU Project "Optifel" and of French project Ribenut.

Chemical degradation is by far the most studied mechanism. For vitamin C it may follow two pathways, the most common and the most rapid being oxidation, as dehydroascorbate, the product of (reversible) ascorbic acid oxidation is highly unstable and degrades rapidly and irreversibly in ketogulonic acid, itself rapidly degraded. At high temperatures and low pH ascorbic acid can also be degraded by a much slower hydrolytic pathway, but the oxido-reductive mechanisms tends to dominate even at low oxygen concentration. Of all the various folate vitamers, 5-methyltetrahydrofolate, the most abundant in most fruit and vegetables, is actually one of the most sensitive to oxidative degradation. This loss can be presented by elimination of oxygen or by protection, e.g. by ascorbic acid.

Enzymic degradation occurs at low temperatures (when endogeneous enzymes are not yet inactivated). The contact between enzyme and substrate is facilitated by tissue degradation, e.g. by senescence, slow temperature rise or freeze-thaw sequences. Even stored frozen, major loss can be observed in non-blanched fruit or vegetables. However in most instances enzymic degradation can only occur in a limited time period (between tissue destructuration and enzyme inactivation) and can easily be limited by adequate temperature regimes. High pressure processing however can lead to marked enzymic conversion.

The third mechanism, leaching, is actually usually neglected, although it is a fast phenomenon, in line with the short durations of many process operations, and it can be a major contributor to vitamin loss specially if the thermal treatments are short or carried out in a lot of water. This was clearly demonstrated by comparing folate losses from peas and Brussel sprouts with the same heat treatment either in water or in sealed plastic bags.

Leaching appears as an underestimated mechanism in the loss of water-soluble vitamins such as vitamins C and B9. Limiting the contact between vegetables and both water and oxygen seems to be an important measure to limit vitamin losses during processing.

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ORAL PRESENTATIONS

Authenticity and health value of fruit juices

Markowski Jarosław [1], Piecko Jan [1], Stępień Teresa [1], Popińska-Gil Wioletta [1], Maciej Król [2]

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Growing consumers demand high-quality NFC fruit juices lead to the large development of NFC (not from concentrate) juice market. Nowadays the share of NFC apple juices exceeds 25% of total volume. The vast majority of these products are produced by medium scale enterprises which, developing very fast not in all cases put enough pressure on quality issues. It has to be remembered that cultivar and maturity (processing in season, from apples after storage), and technology, especially pasteurisation and cooling techniques. The quality of the end-product is thus a function of many factors. The market evaluation shows the necessity to raise the level of awareness among producers, especially small entities, which might have difficult access to the knowledge and technology necessary to ensure high product quality.

All apple NFC juices taken from the market were authentic taking into consideration the absolute quality requirements given in AIJN Code of Practice for fruit juices. The content of lactic acid in samples tested between 2014 and 2016 was at or below the LOD of the HPLC method, which suggests that producers keep to the acceptable hygiene standards of raw material and production facilities. The concentration of patulin in all tested samples was below the maximum permissible value laid down in section A of the AIJN Code of Practice (50 μg/l). However, 14% showed concentrations higher than 10 μg/l. The goal and principle of juice producers should be to eliminate patulin, or at least to keep it below the maximum values permissible in products for children, as defined by Commission Regulation 1425/2003, i.e. below 10 μg/l.

A deviation of the sugars profile from ranges defined by the AIJN Code of Practice suggests that the apple NFC juices has been excessively pasteurised, or not cooled directly after pasteurisation and packaging. It is crucial to improving the quality of production technologies; because at present, not only the sugar profile is affected, but also the juice colour and the sensory evaluation of the product falls as a consequence. An untypical sugar profile can also be caused by the use of overripe (storage) apples or apples of a single variety.

The concentration of minerals in the analysed samples deviated from the requirements of the AIJN Code of Practice. Observed deviations were not combined with other irregularities in juices composition. Thus it can be concluded that the technology of cloudy NFC juice production may have a different impact on the extraction of minerals (calcium, magnesium, phosphorus) from apple pomace from that used for clear juice. The phenomenon requires further study and detailed comparisons under controlled conditions.

Despite the authenticity and quality issues fruits juices have a tremendous impact on human health. Literature data show that fruit and vegetable juices have a similar or sometimes higher composition of health-promoting compounds as raw fruits. Moreover, some compounds, e.g. β-cryptoxanthin and lutein are better absorbed from orange juices than fruits while lycopene from tomato juices have better bioavailability due to the changes which occur during thermal treatment of tomatoes. Our latest pilot research showed that apple juices with a high content of fibre – smoothies have a delayed kinetics of the glucose compared to clear juice, this opens new opportunities for the formulation of healthy juices for groups of consumers which rejects fruit and vegetable juices due to concerns or diseases related to glucose metabolism.

ACI as a practical tool for comparison of antioxidant activity in fresh vs commercial juices*

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Fruits and vegetables are important components of a healthy diet. The growing recognition of their nutritional and protective value (vitamins, minerals, dietary fibers and antioxidants) is increasing through last decade (1). The most commonly used fruit and vegetable products are widely available juices. The main aim of our study was to compare fruit and vegetable pre-packaged juices with freshly preparedonesin regard totheir antioxidant activity. Second goal was to compare antioxidant activity of juices based on different fruits and vegetables. Twelve different berry juices, six different citrus and nine vegetable juices, available on Serbian markets, were analyzedand compared with freshly prepared juicesofthe same fruits/vegetables. Antioxidant activity ofsamples was evaluated by three various antioxidant microassays (DPPH, FRAP, ABTS) (2). All three methods are spectrophotometric, but they are based on different mechanisms. Namely, FRAP is method that utilizes single electron transfer (SET) reaction mechanism (3), while ABTS and DPPH assays are usually classified as SET reactionspointing out that these two radicals could be neutralized either by direct reduction via electron transfers orby radical quenching via H atom transfer (HAT) (4).Taking into account these facts, we determined antioxidant potency composite index (ACI) of analyzed juices by assigning all assays (DPPH, FRAP, ABTS) with equal weight, assigning an index value of 100 to the best score for each test, and then calculating an index score for all other samples within the test as follows: *antioxidant index score = sample score/best score*100* (5). ACI is a valuable novel approach inexpression of overall antioxidant capacity of foods and beverages.
Obtained results suggest that beet juices showed the highest ACI value (92,7 %) among all analyzed juices, and it was followed in descending orderwith berry juices, citrus and vegetable juices.When commercial and fresh juices were compared,significantly higher values only for citrus fresh juices ($p<0,05$) werenoticed.Interestingly, lower ACI values for freshly prepared vegetable juices were found and possible reason for this may be chemical structure (eg, glycosylation, esterification, and polymerization) of vegetable antioxidantsthat become free and more potent after technical processes.From the results of this study it can be concluded that fruit/vegetable juices contribute to daily intake of antioxidants, weather they are freshly prepared or commercial, and that ACI value could be useful ranking tool for making tables of foods with potent antioxidant characteristics.

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Content of chosen elements in broccoli stored in controlled atmosphere.

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Broccoli (*Brassica oleracea*) belongs to cabbage family. Broccoli are known for their anticancer compounds (sulphoraphane, indolie-3-carbinol), but also are rich in vitamin C, folic acid and sugar (very important for forecasting storage abilities). Broccoli are widely cultivated in Europe, for directly consumption and for storage purpose.
Most important factor for consumers is floret color (most desirable is green), unfortunately during storage broccolis florets open and turn yellow. This could be countered by the appropriate concentration of gases in atmosphere during storage period.
The aim of conducted research was to define optimal atmosphere gases composition for maintaining best quality of broccoli during 3 month storage. The research was conducted in 2016/2017 at the Research Institute of Horticulture on broccoli Chronos cv. Broccoli were grown in commercial farm and after harvest were transported to the Division of Storage and Postharvest Physiology Fruit and Vegetables of the Research Institute of Horticulture. Then were stored 3 months in controlled atmosphere (CA) and dynamic controlled atmosphere (DCA). Content of atmosphere for CA was 0,5-1% O_2: 0,5% CO_2 ; 0,5-1%O_2 : 1% CO_2 ; 0,5-1% O_2: 2% CO_2; 1% O_2 : 1% CO_2 and for DCA 0,5%; 1%; 2% CO_2. After harvest and after storage sulforaphane (HPLC method), inolo-3-carbinole (HPLC method), folic acid (HPLC method), vitamin C (Tillman's method) and sugars (reducing and total by Bertrand's method) were determined. After storage the highest level of sulforaphane and indolo-3-carbinole were found in broccoli stored in normal atmosphere (2,26 mg/100g FW and 11,81 mcg/100g FW respectively). Vitamin C content was highest for broccoli stored in DCA 0,5% CO_2 and 1% CO_2 (25,91 mg/100g FW and 17,48 mg/100g FW respectively). The content of folic acid decreased in all storage vegetables regardless of storage conditions.

This work was performed in the frame of multiannual programme "Actions to improve the competitiveness and innovation in the horticultural sector with regard to quality and food safety and environmental protection" (task 3.5), financed by the Polish Ministry of Agriculture and Rural Development.
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Characterization and quality evaluation of mistletoe spirits

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Since ancient times alcoholic beverages has been closely associated with diet, drunk in all societies of the world and based on the ingredients, which are locally available. Moderate and regular consumption of phenolic-containing alcoholic beverages has been associated with health benefits. In Istria, one of several Croatia's Adriatic regions, mistletoe is used for *Biska* production. *Biska* is a brandy produced by maceration of mistletoe (*Viscum album*) in spirit or fermented grape marc brandy.
The aim of this work was to evaluate mistletoe spirits quality and whether they contain polyphenols and have antioxidant activities. The total polyphenol content (TPC) and antioxidant activity were estimated using spectrophotometric methods (Folin-Ciocalteu, DPPH and FRAP). Some spirits have high TPC, DPPH and FRAP antioxidant activities and stimulation of moderate consumption of mistletoe spirit is justified. As analysis of aroma compounds is one of the most important steps in the evaluation of spirit quality, the aroma composition of mistletoe spirits was determinated for the first time, using GC/MS, with solid-phase microextraction (SPME) as sampling technique. A total number of 166 aroma compounds in mistletoe spirit samples were determinated. What is more, pH of mistletoe spirit samples was measured in order to check whether pH can serve for quick detection if mistletoe spirit was obtained by the maceration in ethyl alcohol of agricultural origin or in distillate made from various raw materials. Principal component analysis (PCA) was used to create biplots, which visualize total polyphenol content (TPC), DPPH and FRAP measured values vs. samples and sample compound distributions vs. samples. FTIR spectra in combination with chemometrics (Partial least squares (PLS) was used to create calibration models for fast prediction of total polyphenol content (TPC) and total antioxidant capacities (DPPH and FRAP) in unknown mistletoe spirit samples. The determination coefficients in calibration and prediction models were greater than 0.8, suggesting strong correlation of predicted parameters based on the FTIR spectra.

Keywords: mistletoe, spirit, polyphenol, FTIR, aroma

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Popular methods of grilling and meat products contamination by polycyclic aromatic hydrocarbons

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Polycyclic aromatic hydrocarbons (PAHs) constitute a diverse and ubiquitous class of chemical contaminants present throughout the environment. Since 2005, according to the European Commission Recommendation 2005/108/EC, further analyses of benzo[a]pyrene and other genotoxic compounds from the 15 PAHs listed by Scientific Committee on Food of the European Union are necessary in food (Commission of the European Communities, 2005). The current legislative act setting the maximum permissible limits for the content of benzo[a]pyrene and the sum of four heavy PAHs in food is Commission Regulation (EU) No. 835/2011 (Commission of the European Communities, 2011).

Occurrence of PAHs in food can be a consequence of the environmental deposition as well as the thermal treatment processes used in the preparation and manufacture of foods. Processing procedures like, grilling, smoking and roasting are recognized as a major source of potentially high level of food contamination. The safety of grilled food in the aspect of PAHs contamination depends on many factors, including especially the method of grilling and the type of grill applied.

The aim of the study was to assess the level of grilled meat products contamination by PAHs depending on the type of grill used. The methodology of work included grilling of the selected sausages available on the market, with the use of the most popular types of grill and consequently 15 heavy PAHs analysis based on the QuEChERS procedure and HPLC-FLD/DAD method.

On the basis of the obtained results it was found that the highest levels of the total 15 heavy PAHs content were stated in the sausage with the highest fat content, prepared on a traditional (carbon) grill without the tray. Significantly lower levels of contamination were determined in sausages grilled on traditional grill with aluminum trays and electrical grill with cast iron surface compared to sausages grilled using a carbon grill without the tray. However, in none of the analyzed sausages, the level of the sum of 4 heavy and marker PAHs and B[a]P did not exceed the current permissible limits, which has been set in the Commission Regulation (EU) No 835/2011. Therefore, it can be concluded that the analyzed sausages do not pose a health risk for consumers, what undoubtedly was influenced by the optimal degree of their grilling.

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An intestinal inflammation cell tri-culture model: study of the interaction with a citrus carotenoid (β-cryptoxanthin)

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Intestinal inflammation is a worldwide problem related to a homeostasis imbalance associated with permeability alterations and defects of the immune function with direct consequences on nutrients malabsorption [1–3]. Today it is therefore important to find possible ways to prevent or reduce the nutritional and pathological consequences of intestinal inflammation, and to understand the mechanisms involved. In this context, *in vitro* models are needed in order to investigate the effect of food phytochemicals on intestinal inflammation. Indeed, among the food phytochemicals, carotenoids have been shown in previous studies to present anti-inflammatory effects[4]. Studies suggest that β cryptoxanthin (βCX), one of the main citrus carotenoids might have a role in inflammatory bowel diseases and colon carcinogenesis prevention[5,6]. This work presents preliminary results of the development of the intestinal inflammation *in vitro* tri-culture model (Caco-2, enterocyte-like cells; HT29-MTX, Goblet-like cells and THP-1, macrophages-like cells) and its interaction with βCX. **Material and methods**. Intestinal cell lines (Caco-2/TC7, HT29-MTX) were cultivated (9:1) using an insert system allowing two separated compartments; apical (Caco-2/TC7:HT29-MTX) and basal (THP-1). After differentiation of Caco-2/TC7:HT29-MTX (21d) and THP-1 (48h), inflammation was induced by a pro-inflammatory cocktail (LPS [*E.coli*]-IFNγ) and pro-inflammatory cytokines (TNFα, IL-6, IL-8) were quantified (ELISA) after 18h stimulation. Intestinal monolayer permeability was assessed by TEER measurement and phenol red test and the presence of a mucus layer was evaluated by staining techniques. The βCX effect on these parameters and its absorption were evaluated. **Results.** Intestinal epithelium permeability increased in presence of THP-1 cells. A mucus layer, produced by HT29-MTX cells, covered the epithelial cell monolayer. LPS/IFNγ induced pro-inflammatory cytokine production in the basal compartment was observed. The presence of βCX micelles induced a decrease on cytokine production, but its absorption through the cell monolayer was not modified during inflammation. **Conclusions and perspectives.** Co-culture and stimulation conditions have been established allowing the development of an *in vitro* model of intestinal inflammation. Preliminary results show a potential anti-inflammatory effect of βCX without changes of its absorption during inflammation. Supplementary experiments are needed to validate these results and to test other phytochemicals.

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The seeds of hemp as a functional additive in yoghurts

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The hemp seeds are a byproduct of industrial production of hemp fibre. Hemp seeds are good source of fat (36%) and proteins (25%). Those seed also contain carbohydrates (28%) and fibre (28%). Hemp fibre mostly consists of insoluble fraction (80%) [Callaway, 2004]. The most abundant fatty acids found in hemp seeds are linoleic and linolenic, those fatty acids are essential fatty acids [Wolfe, 2009]. Moreover amino acids present in hemp seeds improve function of liver, pancreas and nervous system [Wolfe, 2009]. Additionally hemp seeds contain high amounts of phosphorus (1160 mg/100g of seeds), potassium (859 mg/100g of seeds) and magnesium (483 mg/per 100g of seeds) [Rodriguez-Leyva and Pierce, 2010]. Hemp seeds can be the source of polyphenols in the human diet. Russo and Reggiani (2015) stated that total polyphenol content of hemp seeds comprised flavonoids such as tannins ranging between 21.4-24.9 mg /100 g, cyanogenic glycosides in amounts of 0.5 -0.9 mg /100 g and saponins at 4.7 - 5.3 mg /100 g. The phenolic acids present in hemp seeds, in addition to their ability to inhibit tumor growth, have contributed to the prevention of mutagenicity and have shown antimicrobial activity [Parus, 2013].

The aim of this study was to analyze the microbiological, physio-chemical and organoleptic properties of yoghurts fortified with hemp seeds. In this research content of selected biologically active compounds (polyphenols) in hemp seeds and antioxidant properties of yoghurts using ABTS were determined. It was noted, that yoghurts were not spoiled and the amounts of yoghurt strains were appropriate after 28 days of storage. Moreover yoghurts with addition of hemp seed were characterized by higher concentration of polyphenols, antioxidant activity against ABTS and good sensory acceptability comparable to natural yoghurt.

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Physicochemical characteristic of industrial aromas in a powder form

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There are about a thousand of aroma components, and the single aroma consists of even a few dozen ingredients. The performance of drying process of food aromas varies, some of them are easily dried (without local overheating, with high yield), other are difficult to dehydrate due to stickiness causing reduced efficiency of the process. The influence of aromas components on the course of drying and physicochemical properties of obtained powders is important. In addition, as many Polish companies have spray dryers not equipped with systems to prevent local powder deposits in the chamber, and in such dryers powders from the cyclone container and the chamber are mixed together to reduce losses, it is also crucial to investigate is there are any differences between the properties of powders retrieved from different locations in spray drying installation.

The aim of the study was to compare the physicochemical properties of microcapsulated vanilla and raspberry aromas, obtained by spray drying in an industrial conditions at "Pollena-Aroma" company. An additional aim of this work was to compare the physicochemical properties of powders taken from different locations of the spray dryer (cyclone container and chamber).

Powdered raspberry flavors compared to vanilla were characterized by poorer followability, lower bulk density, lower particle size, and lower glass transition temperatures. It can be concluded that depending on the taste, food flavors had significantly different physicochemical properties. From a practical point of view, the knowledge of the effect of aroma chemical composition on the drying process and powders physical properties is valuable in planning the production process. Due to the frequent use of selected types of flavors (vanilla and raspberry) in the food industry, it was important to investigate the characteristics of their physical properties, which are important in the packaging, transport and dosing processes.

It was found that the powders from the chamber were characterized by higher particle size distribution compared to the powders from cyclone container. In addition, significant color differences were noted between the powders taken from different locations of the spray drier - lower brightness and greater color saturation were observed in the powder from the chamber. Powders from the chamber, compared to those collected from the receiver, had higher internal porosity (lower particle density). Only in case of raspberry aroma, a significant influence of the place of collection on the content of aromatic components and the taste perception was found. Thus, it can be concluded that the place of collection has a great influence on physicochemical properties of aromas in powder form. Due to differences in physicochemical properties of the powders taken from various places of the spray dryer, it is recommended to use a new generation dryer in which the powder is collected only from the cyclone container.

Analytical methods for exhaustive characterization of Brassica plants and dietary products based on them

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Glucosinolates (GLs), and particularly two classes of their degradation products - isothiocyanates (ITC) and indoles - released upon myrosinase catalyzed hydrolysis, belong to the most promising chemopreventive dietary components. Despite their wide use in plant research, studies on chemopreventive mechanisms and industrial utilization in the production of e.g. dietary supplements, the methods of reliable characterization of myrosinase-GLs system have suffered form the lack of readily available standards, as well as also reliable routine methods. The biological potential ascribed to ITC and indoles, in the case of actual *Brassica* plant samples, is still assessed based on GL content, though it is well known that these two types of derivatives are not the only ones that are formed following myrosinase action. This means that the relationship between content and composition of bioactive *Brassica* ingredients and biological effect cannot be properly assessed or predicted.

The aim of our research was to optimize known or to develop novel methods that will ensure precise description of GLs-myrosinase system in any source, natural or processed, and will enable to relate the rate of formation of ITC/indoles to biological effects observed. The methods optimized or newly established include: determinations of GLs by HPLC-ESI-MS with published list of ions for most frequent GLs [1], myrosinase activity by pH-static and spectrophotometric methods [2], total ITC determination improved by adding SPE enrichment [3], indoles by HPLC with spectrophotometric (abundant compounds) and fluorescent (low-content compounds) detection [4], as well as novel derivatization of ITC to dithiocarbamates enabling their identification and sensitive quantitation by HPLC-DAD-MS [5]. Also the DAD-HPLC-MS method of determination of free and bound flavonoids for *Brassica* plants have been optimized [6].

The developed methods were applied to characterize an array of *Brassica* samples, the examples of which will be given. GL conversion rate to ITC and indoles was found to differ significantly not only between *Brassica* species but also between individual plant parts and was independent of myrosinase activity. The yield of conversion of individual GLs to ITC was also not identical. The biological activity in tests used turned out to be mostly related to indoles, some of which were particularly toxic. The developed set of methods should ensure better and safer exploitation of chemopreventive potential of *Brassica* plants.

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Antioxidant activity of chosen spices' constituents

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The subject of the study were oriental spices (cinnamon, cloves, chili pepper, black pepper, caraway). In the obtained ethyl acetate extracts the content of biologically active compounds was determinated: carotenoids and polyphenols (spectrophotometrieally), volatile compounds (GC/MS), also alkaloids responsible for pungency (HPLC-DAD). The evaluation of antioxidative properties of compounds contained in the spices towards synthetic ABTS radical cations was performed; tests of inhibition of linoleic acid oxidation in an emulsion system and enzymatically catalyzed reactions of lipoxygenase and xanthine oxidase were also conducted.
Examined spices were a good source of bioactive compounds of proven antioxidant activity, which including in the diet may help organism redox balance. The richest in carotenoids was chili pepper extract while in phenolics or volatile compounds – clove extract. Their antioxidant activity depended upon the content of bioactive compound belonging to different classes. For $ABTS^{\bullet+}$ deactivation ability in clove extract a terpenoid compound (eugenol) was mainly responsible, in black pepper extract – phenolics, and in other extracts probably carotenoids. Extracts investigated showed an ability to slow the formation of linoleic acid hydroperoxides in the non-enzymatic model, and some of them also in the enzyme-catalysed systems. The biggest ability to slow hydroperoxide formation was noted in non-enzymatic reaction and the lowest – in xanthine oxidase-catalysed reaction. Regardless of the oxidation process, the antioxidant activities of the extracts were retained: the best activity exhibited clove extract, next cinnamon extract, and the least - black pepper or caraway. Even though clove extract was the richest in terms of antioxidant activity and the content of investigated antioxidants, eugenol present in the extract, being the most important component for the antiradical activity, was much worse an antioxidant comparing to synthetic compounds – over twice lower than propyl gallate and over 30 times lower than TBHQ.

Supercritical carbon dioxide extraction of furocoumarins from food and herbal matrices.

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The furocoumarins are a group of plant secondary metabolites present in a variety of species, particularly of *Rutaceae* and *Apiaceae* families. These compounds are often described as phytoalexins, although their physiologic role is not yet fully understood. The furocoumarins can intercalate DNA and, after excitation with UV-A radiation, create adducts with nucleosides which suppress cell replication. This feature allows using them in the phototherapy of skin disorders (such as psoriasis); but it can also be a threat, because accidental contact with plants rich in furocoumarins can lead to serious sunburns.

The objective of the work was to examine the possibility of using supercritical carbon dioxide extraction for the isolation of furocoumarins from a plant material. The impact of process parameters and mass transfer kinetics were investigated using Broken and Intact Cell (BIC) model presented by Sovová.

Three matrices, known for high content of furocoumarins, were selected for the experiments: dried grapefruit pomace (*Citrus* × *paradisi*), seeds of *Psoralea corylifolia*, and dried roots of *Angelica archangelica*. The milled samples were extracted with supercritical carbon dioxide at various conditions using Spe-ed SFE-4 apparatus (Applied Separations). Additionally, Soxhlet extraction with methanol was performed to determine the total content of furocoumarins in the samples. The quantification of furocoumarins was carried on with an HPLC method presented by Frérot and Decorzant.

The total content of furocoumarins in plant material was 0.74, 1.01 and 2.63 mg/g for *C. paradisi*, *A. archangelica*, and *P. corylifolia*, respectively. The impact of density of carbon dioxide on the solubility of analytes was confirmed; the relationship presented by Chrastil was used to link both parameters. The shapes of extraction curves enabled their description with BIC model; the obtained mass transfer coefficients were comparable with literature values for other groups of compounds. The structure of analytes had a slight impact on the kinetics of extraction.

Carbon dioxide proved to be an effective alternative for organic solvents for the isolation of furocoumarins from plant material. The biggest advantages of method are high selectivity and fast separation; on the other hand the process requires significant initial expenses for the equipment.

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Acidic, electrokinetic and structural properties of zinc ions/pectin systems

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Pectins are polysaccharides which occur in the primary cell wall and middle lamella of higher plants. Due to their properties they are used as gelling, thickening and stabilizing agents. Pectin structure is complex which has an influence on their gelation ability. We can distinguish three main pectin polymers: homogalacturonan which is composed of linear chain of D-galacturonic acid units, rhamnogalacturonan I which contains segments of D-galacturonic acid and L-rhamnose residues and rhamnogalacturonan II which consists a backbone of D-galacturonic acid units (7-9) with four side chains of neutral sugar residues [1]. Some of the carboxyl groups of D-galacturonic acid may be esterified and ratio of methyl-esterified galacturonic acid units to all these units is called as the degree of methylation. Due to this parameter pectin may be classified as the low and high-methoxy pectin. The low-methoxy pectin forms a gel in the presence of cross-linking agents, such as calcium ions, at pH=2-6 while the high-methoxy pectin gels at high sugar concentration and pH<3.5 [2].
It is possible that divalent metal ions other than Ca^{2+} may bind to pectin. Therefore, the aim of this study was to characterize acidic, electrokinetic and structural properties of systems composed of pectin and zinc ions. Zinc belongs to microelements having numerous functions in human body. Pectin may be applied to enrich food in this microelement. In this research, pectin were isolated from apples by sequential extraction using water, CDTA and sodium carbonate with the addition of sodium borohydride (this fraction was used for further studies). Galacturonic acid content in this pectin fraction was measured using Continuous Flow Analyzer (Skalar, The Netherlands). Proper amounts of zinc chloride were added to 0.01 % solution of pectin fraction to obtain the metal ions to galacturonic acid molar ratios in range from 0 to 30. The aggregation index, electrolytic conductivity and electrophoretic mobility were determined using Zetasizer Nano ZS (Malvern Ltd., UK) and the measurements of pH were executed using Oakton pH Spear (Osprey Scientific Inc., Canada). The structural properties of samples were analyzed by means of the atomic force microscopy (Multimode 8 with Nanoscope V controller, Bruker, Billerica, MA, USA). The change of the aggregation index sign from positive to negative, which is related to disappearance of differences in optical properties between dispersed and dispersing phases, allowed to determine the gel point. The significant neutralization of negative electrical charge concurrently with a change of hydrogen ion concentration in solution was observed.

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Design of a new functional fermented maize yogurt-like product containing phytosterols and papaya/melon extracts

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Cereal-based fermented "yogurt" may constitute a strategy to formulate functional foods with a probiotic effect and enriched with bioactive compounds such as carotenoids, phytosterols and tocopherols. Cholesterol-lowering phytosterols, along with other compounds (vitamin E and various types of carotenoids), contribute to reduce among others the risk of cardiovascular pathologies. The aim of this work was to develop a functional yogurt-like food obtained from fermented maize with additional fruit extracts, by standardizing the pasteurization and the fermentation, with different ratios of bacterial starters.

The manufacturing process includes different unit operations such as maize soaking, crushing, sieving, pasteurization and to finish, a lactic fermentation which was carried out in a fermenter with pH and temperature monitoring. Before pasteurization, commercial dispersible phytosterols associated with tocopherols were added, just like freeze-dried fruits as sources of carotenoids. Two *Lactobacillus* strains, *L. plantarum* (CNCM I -3069) and *L. casei* (CNCM I-4592) were used either pure or mixed (50%-50%) at a concentration of 10^6 CFU/g (MRS 37 °C - 48h). The fat-soluble compounds were analyzed by UPLC-DAD-Fluorescence. Their bioaccessibility (i.e. transfer in micelles) was evaluated with an *in vitro* digestion system previously described [1].

After 13 hours at 37 °C, the simple and co-fermentations gave the final concentration of 10^9 CFU/g which is supposed to be optimal to obtain a potential probiotic effect. *L. plantarum* showed the shortest latency period while *L. casei* had the highest specific growth rate. The 50%-50% fermentation confirmed these results with a final pH around 4 after 20 hours of fermentation. Among the carotenoids present in the final product made with *L. plantarum*, β-carotene increased significantly ($p < 0.05$) between 10 and 20 hours of fermentation, while lycopene increased in the product made with *L. casei.* Globally, fermentation allowed to get 1.1 to 1.6 times more carotenoids, while α-tocopherol and β-sitosterol tended to be stable. Interestingly, carotenoids bioaccessibility increased during fermentation from 1.6 to 2.2 times in the product made with *L. casei* while a trend was observed in the other fermented products.

This study allowed to demonstrate the stability of biologically active compounds incorporated in a functional fermented food made with maize. Overall, it underlined the positive action of fermentation with both starters: the extracted quantity of carotenoids was significantly increased. This type of functional food may be a complement and/or an alternative to conventional dairy products already marketed.

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Ripened cheese as a source of bioactive peptides

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Cheese has a long history in the human diet. In ancient times, cheese was primarily a concentrated form of milk with the benefit of a prolonged shelf life. Recent advances in nutrition science have highlighted the contribution of cheese to nutrition and health. It is a rich source of essential nutrients, in particular, proteins, essential amino acids, vitamins, minerals and also short chain fatty acids. Bioactive peptides from proteins, which are the main subject of this speech, can be generated either by fermentation processes during cheese-manufacturing [5] or by gastrointestinal digestion after consumption [1, 2]. As cheese is a complex food matrix containing a large number of different peptides which change with the ripening time, they are produced during secondary proteolysis through the action of proteinases and peptidases. As long as they are bound in the proteins they are biologically inactive [4] and can only be active after they have been released from their parent protein. Then, they can exert a wide range of biological activities such as antimicrobial, opioid, blood pressure-lowering, cholesterol-lowering, mineral binding, immunomodulating and anti-carcinogenic activities [3].
During the speech, the characteristics of cheese, distinguishing it as an important source of bioactive peptides with various activities will be discussed. Bioavailability of bioactive peptides from cheese will be described as well. The blood-pressure lowering activity will be highlighted as milk proteins are the main source of this kind of biopeptides and it is the best-studied and *in vivo*-confirmed effect. Attention will also be paid to other activities expressed by bioactive peptides from cheese, such as anti-carcinogenic, antioxidative and opioid.

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Comparative analysis of coumarin content in various species of sweet clover (*Melilotus*)

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Melilotus is an annual or biennial plant belonging to *Fabacea* family. There are approx. 25 species including white sweet clover (*Melilotus albus*) and yellow sweet clover (*Melilotus officinalis*). The plant has been used as forage crop, promoted for soil stabilization and a nectar source for honey bees. *Melilotus*, especially yellow sweet clover is used in medicine, due to the high content of coumarins (1). The coumarins are classified as secondary plant metabolites, from the group of lactones, and exhibit remarkably diverse therapeutic effect depends on their chemical structure. The major compound identified in *Melilotus* are coumarin, dicoumarol, melilotic acid, melilotin, o- and p-coumaric acid (2). Coumarin has sedative, spasmolytic, anti-inflammatory, antithrombotic activity, it strengthens the lymphatic vessels and stimulates blood flow. According to literature members of the *Melilotus* genus are extremely diverse in terms of the content of coumarin (1,3).

The aim of this study was to determine the content of coumarin and its derivatives in the sweet clover cultivated in the Podkarpackie Voivodeship. The research material was harvested, dried leaves and flowers of white sweet clover (annual n=1, biennial n=2) and yellow sweet clover (biennial n=1). Qualitative and quantitative analysis of coumarin and related compounds was carried out using high-performance liquid chromatography (HPLC) with UV- ViS detector. Antioxidant activity was determined using FRAP test, and total phenolic content was measurement using TPC method

Coumarin, melilotic acid and o-coumarin acid have been identified. In all tested cases flowers exhibit higher content of coumarin than leaves. On the other hand, the leaves contained higher content of melilotic acid. The content of coumarin ranged from 4.19 mg/g d.w. (annual white) to 9.32 mg/g d.w. (biennial white) in flower and from 1.62 mg/d.w. (annual white) to 4.77 mg/g d.w. (biennial white) in leaves. The melilotic acid content was at a similar level in the flowers, from 1.55 mg/g d.w. (yellow) to 2.55 mg/g d.w. (biennial white). Moreover, the content of melilotic acid was varied depending the plant origin from different localization, (from 2.77 mg/g d.w. to 12.25 mg/g d.w for biennial white sweet clover). The o-coumarin acid was identified at the lowest level, up to 0.09-0.33 mg/g d.w. in flowers, and 0.07- 0.36 mg/g d.w. in leaves, respectively,. Research has shown that sweet clover, especially leaves are a rich source of polyphenols and exhibit high antioxidant potential. Received values were ranged from 4.68 mgGAE/g d.w. and 49.89 μmolTrolox/g d.w. (flowers of biennial white sweet clover) to 10.15 mgGAE/g d.w. and 153.57 μmolTrolox/g d.w. (leaves biennial white sweet clover) in TPC and FRAP tests, respectively.

Studies have shown variation in the content of coumarin and its derivatives as well as content of polyphenols compounds and antioxidant activity depending on the species or variety of *Melilotus.* For the first time the comparison of the content of coumarin in the species of sweet clower from Poland was made.

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POSTER SESSION I

PI-1. Production of healthy juices and drinks with probiotic cultures

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Provision of normal life of a person can be carried out only with full satisfaction of the body's needs for basic nutrients. Therefore paying attention to the relatively high need of people for essential nutritional factors along with the increase in the assortment of such products it is important to increase their nutritional and biological value. This can be achieved through certain technological methods of raw materials processing one of which is fermentation. Fermented products have antioxidant, anticarcinogenic, probiotic properties.

The study, development and production of products obtained as a result of fermentation of raw materials by lactic acid bacteria call special interest. These microorganisms have a high metabolic activity. They participate in the synthesis of vitamins, hydrolysis of bile salts and cholesterol. They also have an antagonistic effect on the opportunistic and pathogenic microflora and favorably affect digestion and eliminate the dysbiotic disorders in the human body.

Due to good taste, dietary and health-improving properties fermented products are in high demand among the population.

Moreover it is of some interest to use juices and beverages with probiotic properties for carbohydrate-containing raw materials. Such raw material is Jerusalem artichoke (lat.. - Heliánthus tuberósus). In its chemical composition Jerusalem artichoke is a good nutrient medium for microorganisms. The bulk of dry substances of tubers of Jerusalem artichoke (24.1-26.7%) are carbohydrates, mainly fructosans among which the most valuable is inulin ($C_6H_{10}O$)n - an organic substance from the group of polysaccharides, a polymer of D-fructose.

Due to its unique chemical composition tubers of Jerusalem artichoke have a positive effect on the human body making it healthier. They almost do not accumulate nitrates, heavy metals and radionuclides. They also contain fiber, pectin, organic acids, proteins, essential amino acids and vitamins.

In this paper the carbohydrate composition of Jerusalem artichoke and its change during fermentation was investigated. For fermentation saline (c = 3%), various strains of Lactobacillus plantarum, Lactobacillus acidophilus were used. The fermentation was carried out for 11 days before reaching a total acidity of 0.8%. The mass fraction of fructose, glucose and sucrose was determined using high performance liquid chromatography. The experiments were carried out on an Agilent 1200 chromatograph (manufactured by Agilent Technologiens, USA), with a refractometer.

The technology of production of fermented products from Jerusalem artichoke tubers provides for the initial preparation of raw materials. It includes the following technological operations: sorting, washing, treatment of tubers by microwave currents and inspection. Microwave treatment was performed in order to inactivate the polyphenol oxidase enzyme.

Most of the technologies for making food products from Jerusalem artichoke presupposes the implementation of such a technological operation as "cleaning" which results in a darkening of the tubers which leads to a deterioration in both the organoleptic parameters of the finished product and to a decrease in its biological value. This is due to the destruction of plant cells resulting in increased access of oxygen to the crushed tissues and creates favorable conditions for the action of oxidoreductases. In turn cleaning the tubers of Jerusalem artichoke from the skin is a very laborious process because tubers are irregular in shape and in industry there is no equipment that would allow carrying out this technological operation and preserve biologically valuable substances contained in raw materials.

It is known that polyphenol oxidase catalyzes the oxidation reaction of o-diphenols, as well as mono-, tri- and polyphenols to form the corresponding quinines with the molecular acceptor being molecular oxygen. Its action is associated with the formation of dark-colored compounds - melanins. The enzyme exhibits optimum activity at an acidity of about 6 pH units. Therefore the work carried out studies of the activity of polyphenol oxidase in different layers of Jerusalem artichoke. For this purpose the activity of the enzyme in the skin and in sections with a depth of 2 mm and 10 mm was determined. An oxidative reaction of the aqueous suspension of the raw material was carried out in the presence of pyrocatechol and ascorbic acid followed by titration with potassium iodate.

As a result of the conducted studies it was revealed that in the Jerusalem artichoke the polyphenol oxidase enzyme is localized in the skin but some of its quantity has been found in the tuber body. An optimal microwave treatment regime was established with the aim of inactivating the enzyme and the changes in the phenolic compounds studied in the choice of the regime.

The microbiological parameters of the semi-finished product after processing with microwave currents were also determined which confirmed the possibility of excluding from the technological process of the production of fermented juices and beverages the skin of the Jerusalem artichoke. Due to such preparation of raw materials for further processing the technological process is reduced and organoleptic parameters of the finished product are improved, its biological value is increased.

The main stage in obtaining products with probiotic properties is fermentation. It consists of a preliminary period, the main fermentation and fermentation.

At the preliminary stage the secretion of cell sap, the intensive development of lactic acid bacteria wherein the acidity of the product reaches 0.3-0.4%.

The main fermentation is characterized by the accumulation of lactic acid, the release of gases and the formation of foam.

The freezing takes place at low temperatures. At the same time fermentation ends, gas evolution ceases, organoleptic and physicochemical indicators of product quality change. The acidity of the product reaches 0.6-1.2%. Lactic acid which accumulates in the product in the amount of 0.7-0.8% prevents the development of unwanted oily acid, putrefactive and other bacteria.

As a result of the experiments with the use of different lactic acid microorganisms the preference was given to L. plantarum AH 11/16 was. On the basis of fermented juice the recipes for blended (mixed) juices and beverages were developed in the assortment.

Using the developed mathematical models adequately describing the dependence of the organoleptic quality indices of products obtained on the basis of fermentedJerusalem artichoke from the mass fractions of their main components the composition of juice and drink recipes in the assortment which is optimal by a generalized organoleptic evaluation was determined.

As a result of the research the technology of fermented juices and beverages with probiotic properties was developed. In the process of fermentation changes in the carbohydrate composition of tubers of Jerusalem artichoke was examined. It was shown that the selected strain Lactobacillus plantarum AH 11/16 metabolizes glucose in the first stages with further fermentation - sugar-like oligosaccharides enriching the fermented juice with fructose. The optimal proportions of the prescription components of healthy juices and beverages obtained on the basis of fermented Jerusalem artichoke are established.

PI-2. Properties of selected confectionery products enriched with cocoa bean extracts of *Forastero* variety

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Phenolic compounds of plant origin are importantlow molecular mass antioxidants. They are part of human diet due to their presence in fruits, vegetables, cereals, nuts, seeds, beverages like tea and wine, as well as chocolate and chocolate products. Over the last few years, cocoa polyphenols have been reported in many studies as bioactive compounds with antioxidant, antiradical and anticarcinogenic properties. They have been shown to protect against diseases like coronary heart disease, cancer, and neurodegenerative disorders, mostly through their antioxidant and antiradical properties (Bruna et al., 2009; Record et al., 2003; Valls et al., 2009).

The aim of the study was to determine antioxidant properties of selected confectionery productssupplemented with the whole extracts and their fractions obtained from raw and roasted cocoa beans of *Forastero* variety coming from Peru.

Purification and fractionation of extracts from raw and roasted cocoa beanswas performed by countercurrent partition chromatography (CPC). Confectionery products enriched with obtained feeze-dried preparations included shortcrust cookies and fatty masses. These products were supplemented with the amount of 1, 0.75, and 0.5% by total weight of the product. The analyses performed on the obtained research material included evaluation of the antiradical propertiesexpressed as the reduction of the stable free-radical DPPH and hydroxyl radical (•HO). Additionally, the qualitative and quantitative composition of phenolic compounds was performed using UHPLC-DAD technique.

Obtained results confirm that enrichment of confectionery products (fatty masses and shortcrust cookies) with freeze-dried extracts of raw and roasted cocoa beans as well as fractions obtained with CPC technique, enhances their antioxidant and antiradical properties. Additionally, the process of roasting affects the extent of degradation of phenolic compounds present in cocoa beans. The qualitative and quantitative analysis of the composition of phenolic compounds has shown amuch higher content of phenolic compounds in shortcrust cookies then in obtained fatty masses.

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PI-3. Physiological parameters of laboratory rats fed diet enriched with cocoa bean extracts of *Forastero* variety

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Good nutrition is of utmost importance when comes to a healthy lifestyle. A proper diet, combined with physical activity, helps to reach and to maintain a healthy weight, reduces the risk of chronic diseases, and promotes overall health. Such diet includes antioxidant-rich foods, the simplest examples being fruits, vegetables, cereals, and products manufactured from plants. Cocoa polyphenols have attracted considerable attention during the years due to their antioxidant, antiradical, and anticarcinogenic properties. [1,2]

The aim of the study was to determine the physiological indicators of laboratory rats as a response to a diet enriched with the extracts of raw and roasted cocoa beans of *Forastero* variety.

The influence of cocoa extracts supplementation on the activity of selected rat faecal bacterial enzymes was studied during long-term feeding of laboratory rats. The rats were fed four types of diets, two standard ones and two supplemented with freeze-dried extracts of raw and roasted cocoa beans. The standard diets included one being a modification of AIN-93 diet, elaborated at American Institute of Nutrition and widely applied as a model diet for rats, and second being an example of a high-fat diet. This second standard diet, referring to the dietary habits of a significant part of the population of economically developed countries, contains an increased energy from fat. This 'faulty' diet was enriched with raw and roasted cocoa bean extracts, with the aim of checking the possibility of limiting the physiological effects of such type of diet as compared to the standard one. During the 4-week experimental feeding samples of rats feces were subjected to analysis and after its completion, biological samples were collected i.e. intestines content, blood, and organs retrieved individually from each rat.

The results of the research indicate that the change in rats' diet composition caused a step increase in the activity of the analyzed enzymes, indicating the rapid reaction of the intestinal microflora to the composition of the applied diet. Moreover, the extracts applied in the diets have differentiated the activity of some of the rats' intestinal microflora enzymes.

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PI-4. Interaction of (+)-catechin with selected food proteins

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Calorimetry measurements are often applied in order to obtain information on intermolecular interaction. Such measurements are frequently done for complexes consisting of proteins and ligand, proteins and other protein, fat or DNA. Isothermal titration calorimetry (ITC) technique can accurately describe the investigated process in terms of thermodynamic properties of macromolecules. The characteristics of the process, using thermodynamic parameters, allows determining what kind of interaction is required to create a complex compound. A single ITC experiment and subsequent analysis can simultaneously determine all binding parameters (n, K, ΔH, ΔS).

The aim of the study was to determine the influence of the cocoa beans' polyphenols on the interaction with selected proteins.

The research shows how proteins of different provenance interact with (+)-catechin, one of the phenolic compounds found in cocoa beans. The experiment was carried out with *isothermal* titration calorimetry technique. Two different temperatures were applied, 20 and 36.6 °C. The ITC analysis provides information on thermodynamic parameters, which describe each examined compound. The parameters include stoichiometry (n), dissociation equilibrium constant (K_D), association equilibrium constant (K_A), enthalpy (ΔH), entropy (ΔS), enthalpy of reaction (ΔG), molar heat capacity (ΔCp), and peak area obtained on a thermogram.

ITC technique allows determining the stability of the resulting complex compounds. It is determined based on the reaction enthalpy (ΔH) and bindings constant (K_A). The more negative the enthalpy of the reaction, the higher the value of the dissociation constant (K_A) and the more stable the complexes are formed by the compound. The obtained results show that catechin forms a stable complex with bovine collagen. The ability to create such stable complexes by bovine collagen results from the absence of impurities in the composition of this protein. The most favorable temperature for the formation of (+)-catechin-bovine collagen complex is 36.6 °C. *Based on the Gibbs free energy* (ΔG), it has been determined that the studied complexing reactions are spontaneous and due to the negative surface area under the peak, accounted as an exothermic reaction, not requiring external energy supply.

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PI-5. Rose-scented Geranium Essential Oil as a Nutraceutical Ingredient

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The main objectives of this study was to investigate, *in vitro* and *in vivo* (real fruit juices of Orangina®), the therapeutic and antimicrobial activity of the RGEO against spoiling and pathogenic microorganisms, in an attempt to contribute to its use as alternative products for microbial control and food preservation.

RGEO was obtained by steam distillation of fresh plant material in a stainless steel distillation apparatus. The volatile oil was obtained with a yield of 0.15%. The chemical composition of the volatile oil was investigated by Gas Chromatography-Mass Spectrometry. Citronellol has been found to be the major component (29.13%), followed by geraniol (12.62%) and citronellyl format (8.06%).

Antimicrobial screening of rose-scented geranium oil was determined against different microbial strains by disc diffusion and vapour diffusion methods. The Minimum Inhibitory Concentrations (MIC) were assessed by the agar dilution method. The results, obtained from the disc diffusion assay, revealed that the RGEO exhibited potent antibacterial activity against all Gram positive bacteria at the volume of 10 µL per disc. Else, *S. aureus*, *B. subtilis* and *E. faecalis* were the most susceptible strains with Diameters of Inhibition Zones (DZI) varied from 20 to 21 mm. As seen in the earlier methods using RGEO in liquid phase, the DZI due to the EO vapour also augmented with increasing volume of oil. Among the yeasts, it was interesting to note that the RGEO exhibited the strongest inhibitory effect against *Candida albicans*.

The results from the measurement of MIC indicated that *C. albicans* was the most sensitive strains tested, showing the lowest MIC values (0.125 mg/mL). The antimicrobial activity of RGEO could be due to citronellol and geraniol. In addition, the components in lower amount could also contribute to the antimicrobial activity. Regarding the anti-yeast activity of RGEO in a food matrix, complet growth inhibition of *C. albicans* was observed in Orangina® juice mixed with EO compared to the stored juice with chemical additives. RGEO could be considered suitable alternatives for use in the food industry as a natural antimicrobial agent.

Further, the purpose of the present study was to evaluate the anti-inflammatory and analgesic activities of RGEO using the carrageenan-induced paw edema and croton oil-induced ear edema tests. RGEO (100 mg/kg) was able to significantly reduce the paw edema with a comparable effect to that observed with diclofenac, the positive control. In addition, RGEO showed a potent anti-inflammatory activity by topical treatment in the method of croton oil-induced ear edema. When the dose was 5 or 10 µL of RGEO per ear, the inflammation was reduced by 73 and 88%, respectively. In addition, histological analysis confirmed that RGEO inhibited the inflammatory responses. In the antispasmodic test, our results revealed that the RGEO produce significant anti-nociception according to assessment of abdominal writhes.

Our results give strong impetus to the consideration of RGEO as a potentially useful analgesic and anti-inflammatory agent both for the prevention and treatment of painful and acute inflammatory skin diseases.

Finally, rose-scented geranium essential oil could be used as a pharmaceutical agent in folk medicine as well as a food preservative. Its use as a nutraceutical ingredient seems fully justified.

Keywords : Rose-scented geranium, *Pelargonium graveolens*, Essential oils, Food preservative, Nutraceutical, Citronellol, *Candida albicans*, Antimicrobial activity.

PI-6. Virgin Olive Oil as Functional Food: Chemical implications on Quality and Health Benefits

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Among vegetable oils, Virgin Olive Oil (VOO) has nutritional and organoleptic properties that to make it unique and a essential component of the Mediterranean diet. VOO is a fat extracted from the fruit of the *Olea europaea* (olive tree), a traditional tree crop of the Mediterranean area, where whole olives are pressed to extract olive oil.

The importance of VOO is mostly linked both to its high content of oleic acid a balanced contribution quantity of polyunsaturated fatty acids and its richness in phenolic components, which act as natural antioxidants and may contribute to the prevention or treatment of numerous human illnesses.
The VOO is mainly used in cosmetics, medicine, cooking and soaps. The health benefits of VOO include treatment for colon, breast cancer, diabetes, heart problems, arthritis, high cholesterol, weight loss, digestion, aging and cancer. It has been used by mankind for many centuries. It is a staple ingredient for many culinary preparations and also serves a variety of therapeutic purposes.

In this presentation, we summarize the state of the art of knowledge and discuss the extent to which there exists evidence for the health benefits of the chemical components of VOO. This paper provides a comprehensive review of the most significant characteristics of VOO. Processing, composition, sensory quality and health benefits are the examined aspects.

Keywords: Virgin Olive Oil; *Olea europaea*; Functional Food; Phenolic Compounds; Polyunsaturated Fatty Acids; Olive Oil Health Benefits.

PI-7. Nutraceuticals and Functional Foods: Their Role in Human Health Promotion and Disease Prevention

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In recent years there is an increasing attention in functional food and nutraceuticals which provide health benefits and are alternative to modern medicine. Nutrients, herbals and dietary supplements are major constituents of nutraceuticals which make them instrumental in maintaining health, act against various disease conditions and thus promote the quality of life.

Various studies have linked functional foods as helpful in combating a number of degenerative diseases; as such, a lot of research on functional attributes linked directly to the health benefits of various plant and animal foods have been observed in recent years. Consumption of bioactive ingredients in fruits and vegetables has been linked to help combat diseases such as cancer, cardiovascular diseases, obesity, and gastrointestinal tract disorders.
Although huge number of naturally occurring health-enhancing compounds are of plant origin, there are a number of physiologically active constituents in animal products as well that merit attention for their potential role in best health. Marine foods have frequently been considered as “heart food” because of their omega-3 constituents which are recognized to lower blood triacylglycerol and, possibly, cholesterol levels. Therefore, food factors from both plants and animals may be participating in human health promotion.

Besides, linking the consumption of functional foods and nutraceuticals with health claims should be based on sound scientific confirmation. However, not all foods on the market today that are claimed to be functional foods are supported by enough solid data and research to merit such claims.

The aim of this paper is to provide an extensive overview of the clinical aspects of functional foods and nutraceuticals. It contains information on both nutritional challenges and potential health benefits of functional foods and nutraceuticals. Hence, it categorizes a variety of functional foods according to the type of evidence supporting their functionality, the strength of that evidence and the recommended intakes.

Keywords: Nutraceutical and Functional Foods; Nutrition; Phytochemical; Phenolic Compounds; Probiotic; Health benefits.

PI-8. Interactions between food ingredients to decrease energy density and increase satiety

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Given the high costs of obesity and comorbidities in terms of health care expenditure and quality of life, prevention strategies are paramount. In Western Europe obesity has risen by 9-15% in the last 10 years. Food consumed outside the home accounts for half of total food expenditure and is higher in calories, of poorer nutritional quality and served in large portions, hence promoting over consumption.[1] In conventional restaurants, portion control is equally important. Not only does this help control food cost o reduce food waste, but it also creates culinary nutrition in restaurants and promote health.[2]

The aim of this research was to evaluate whether the relationship between portion size and energy density as a general strategy for reducing calories.

Dishes design was made by the working team (chefs, kitchen helpers and nutritionist) of the selected restaurant. After the nutritional composition analysis, the nutritionist proposed improvements focused on: selected ingredients, cooking methods or portion sizes/energy density were done in order to improve the nutritional profiles of those dishes. Calculated nutritional values of the menus were obtained from the ingredients used and the total weight of the final product. Energy, macronutrient and micronutrient contents were calculated separately for each dish and for each menu combination of dishes (1 starter + 1 main course + 1 dessert) using the software DIAL 2.12 (Alce Ingeniería, Madrid,Spain) according to the USDA National Nutrient Database (http://ndb.nal.usda.gov/) and the Dietary Guideline of Spanish population (SENC, 2011; EFSA, 2009; FAO/WHO, 2008) using recommended nutrient intakes as standard references. To assess whether the manipulation of the stylized dishes was successful, a sensory pre-test with 15 restaurant employees was conducted. The goal of the pre-test was to examine the discriminate validity of the three items in which changes had been applied (presentation of the dish, taste and portion size). In order to make proposed modifications acceptable by consumers, it is necessary that the quality of menus must not be affected and also the product demand should not decrease. Four menus were analyses for nutritional composition analysis; 11 starters, 10 main courses and 4 desserts: total of 25 different dishes and 153 possible combinations of dishes.

The analysis of variance indicated that custom significant changes ($p < 0.05$) in the portion size, being less after the intervention. The restaurants were able to reduce fat in 18,4% of the main course ($P > 0,0460$) and for Valentian paella to reduce fat by 31,8% with 30,4 % total reduction of energy.

This study supports the need for ongoing collaboration between chefs and nutritionists to ensure that appealing healthily menu items are more widely available in restaurants and that research is directed towards understanding the most effective ways to develop and promote these items.

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PI-9. Selected biologically active compounds in bee products

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Introduction

Bee products were appreciated by the man already in ancient times. Due to their nutritious and medical properties, are being used as dietary components and in the folk medicine. Therefore a research on the chemical composition of these products is important. He is different for each of them and very much compound. Properties of pollen to a large extent depend on species of plants from which he was collected by bees. Individual plants, because are producing pollen which differs in not only colour or shape, but also chemical composition and quantitative. Next substances being found in a propolis, unlike pollen, are moved close within chemical groups, but diversified mainly in their composition. Moreover, the composition of bee products is conditioning their biological activity, direction of pharmacological action, therapeutic application. A royal jelly which by many important associations he has can be an example in relatively lots active hormones and enzymes. Also a pollen in which the amount of the white is ahead of products of the animal protein is a good example. Thanks to the rich chemical composition, multidirectional action and safe doses obtained from bee products there are many medicines.

The aim of this work was to indicate selected biologically active compounds in bee products, such as: beebread, pollen, royal jelly, raw propolis and propolis as diet supplement.

Methods

The following parameters of bee pproducts were determined:

- water content by drying in 100°C,
- total ash content by incinerating samples in a muffle furnace at a temperature of 550°C,
- total proteins content was measured using the Kjeldahl method,
- glucose and fructose content by enzymatic method,
- sodium and potassium content using a flame photometer,
- total polyphenols content were analyzed with Folin-Ciocalteu's phenol reagent method, using gallic acid as the standard,
- free radical scavenging activity of the extracts was determined by using 1,1-diphenyl-2-picrylhydrazyl (DPPH),
- ability to chelate ferrous ions as well.

Conclusions

1. Results showed that products like pollen or beebread, have high nutrition value.
2. All of the examined products have also antioxidant properties, but especially valuable in this respect are raw propolis and propolis „plus".
3. Among propolis products, propolis "plus" dietary supplements were better. This product had higher total protein content, potassium ions content, polyphenols content and stronger antioxidant properties in comparison to raw propolis.

PI-10. Innovative freeze-dried strawberry gels – selected physical properties

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Aerated food products are very popular in our live, even if we are not aware of the use of aerated food with a specially designed structure. Aerated gels with strawberry pulp can be used in developing of innovative food, which can be preserved by the freeze-drying process, what ensures attractive properties. Investigations conducted with the use of freeze-dried strawberry model shown that selection of gel composition (different hydrocolloids) and preparation conditions (aeration time) allow to produce gels with controlled microstructure and properties (Ciurzyńska et al., 2017).

Presented research are the third stage of the project designed to develop an innovative freeze-dried strawberry gels. The objective of this work has been to explain the influence of structure on selected properties of freeze-dried gels with different composition and aeration time. To strawberry pulp a hydrocolloids: low-methoxyl pectin (LMP), mixture of xanthan gum and locust bean gum (KG+LBG), as well as mixture of xanthan gum and guar gum (KG+GG) were added. Samples were aerated for 5 and 9 minutes and freeze-dried. For obtained samples structure, organoleptic properties (aeration), porosity and shrinkage were investigated.

Freeze-dried strawberry gels have different structure depending on the type of hydrocolloid used. In most cases the time of aeration has insignificant effect, which may mean that structure was created mostly during freeze-drying process. In freeze-dried gels with low-methoxyl pectin pores were the smallest as an effect of the highest shrinkage value, while gels with the mixture of xanthan gum and locust bean have bigger free spaces. Samples with the mixture of xanthan gum and guar gum have a porous structure different from that of the other samples. Most of the surface was structured with very fine spaces, clearly aerated and delicate. Shrinkage value was the lowest and similar for samples with the mixture of hydrocolloids. Freeze-dried strawberry gels were characterised by high porosity value (80-90%), what was confirmed in sensory analysis as high intensity of quality discriminant (aeration) (5,6-7,6) points in 9-point scale.

Acknowledgements

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PI-11. The BIOPEP - database of food biologically active peptides and proteins

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Peptides derived from food proteins affect biological, functional, immunological and sensory properties of food products as well as provide information concerning product composition, authenticity or history. Proteins apart from their function as the nutrients act as the precursors of peptides with variety of functions. BIOPEP database of protein and peptide sequences has been designed mainly for scientists working in the area of food and nutrition (http://www.uwm.edu.pl/biochemia website). BIOPEP database consists of four sequence databases: proteins, bioactive peptides, allergenic peptides with their epitopes and sensory peptides. The information concerning peptide or protein covers its sequence; data about activity or taste; references or in the case of allergenic protein database reference, sequence of experimental and theoretically predicted linear epitopes. Sequence analysis options include the construction of profiles of the potential biological activity, epitopes or sensory activity (i.e. location of appropriate fragment(s) in a protein chain); calculation of the quantitative parameters A and B useful for evaluation and classification of proteins as precursors of bioactive or sensory peptides as well as immunogenic fragments. The options available include also the simulation and design of proteolysis as well as data mining. BIOPEP contains also the collection of links to other databases and programs (Useful links). More detailed survey data concerning the programs accessible via BIOPEP website are available in our review articles (Minkiewicz et al. 2008b; 2009). Proposed workflows for use of BIOPEP database of bioactive peptide sequences cover among others: use sequences of peptides as queries for database screening or identification of peptides from BIOPEP among products of protein hydrolysis. Selected examples of applications of the database, described by other authors will be presented. Our intention was to establish BIOPEP as the database integrating information about various properties of fragments originating from food proteins. To date, apart from the data concerning different biological properties of peptides, BIOPEP may serve as a tool supporting the experimental and theoretical studies on food-derived biopeptides. All subelements of the BIOPEP database are continuously updated with the new sequences as well as calculation functions helping to evaluate the protein value as the source of biopeptides.

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PI-12. Phytosterols, squalene and tocopherols content in SC-CO_2 extracted chia seeds oils: effect of modifier addition and process duration

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Chia oil is one of the richest plant sources of n-3 α-linolenic acid and contains significant amounts of lipophilic phytochemicals, such as tocols and phytosterols. Extraction of oil by the use of supercritical fluid is environmentally friendly because it does not require inflammable organic solvents. The most commonly used supercritical solvent is CO_2 which is safe, non-toxic and easily available at a high purity level and low price (Huang et al. 2012). Supercritical CO_2 is a non-polar, effective solvent for plant lipids. A good way of improving the supercritical carbon dioxide (SC-CO_2) extraction grade of polar or amphiphilic compounds is the addition of modifiers which can increase the solvating power. Another important factor influencing the composition of final product is extraction time.

In the present study, oil extraction was conducted using supercritical fluid extraction using pure SC-CO_2 or SC-CO_2 enriched by 2, 6, and 10% of acetone, and simultaneously changing the extraction time (1 h vs. 5 h). Obtained oils were analyzed for phytosterols, squalene and tocols content. The oil yield was also calculated.

Oil recovery by the SFE process varied from 27.3% (1h with pure SC-CO_2) to 97.4% (5h with SC-CO_2 enriched by 10% of acetone) in relation to the total lipid content. The 5-hour process obtained almost all available lipids (94.1–97.4%), while the 1 h process obtained a maximum of 63.9%. An increase in the extraction time from 1 to 5 h for pure SC-CO_2 resulted in an approx. 3.4-fold higher yield of oil.

The phytosterol content in oils varied from 4,093 (1h, 10% acetone addition) to 5,060 mg/kg (1h, pure CO_2). The main representative of phytosterols was β-sitosterol, with a share from 65.2% to 68.9%. Less abundant were campesterol (14.3-16.4%), 25-hydroxy-24-methylcholesterol (8.6-12.1%) and stigmasterol (5.4-7.4%).

The tocopherol content varied from 677.0 to 1,243.6 mg/kg of oil. These values were determined in oils extracted by 5 h + SC-CO_2 with 10% acetone and by 1 h with pure SC-CO_2, respectively. The main tocopherols were a mixture of β/γ-tocopherol, followed by α- and δ-tocopherols, with an average share of 76.8%, 19.6%, and 3.6%, respectively.

Squalene content varied from 18.7 mg/kg (5 h extraction with pure SC-CO_2) to 63.5 mg/kg (1 h extraction with pure SC-CO_2). The largest amounts of this compound were found in oils extracted in the short-term process. However, during this short-term process, an increase in acetone modifier addition resulted in an approx. 2-fold diminished concentration of squalene. Similar effect was observed in the case of phytosterols and tocopherols content. It can be explained by faster mass transfer of lipophilic compounds at the beginning of the process.

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PI-13. Content of selected bioactive components and antiradical properties in raw cranberries and dried cranberry products

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Cranberry is a plant known for hundreds of years. North America has grown at least since the sixteenth century, and in Europe began to be imported in the nineteenth century. It is also grown in Poland. Cranberries are a rich source of bioactive ingredients including polyphenols, organic acids, fiber and vitamins. Most of these compounds are strong antioxidants, they prevent the formation of free radicals and have an antibacterial effect. Cranberry extracts are commonly used in medicine, including for the treatment of diseases of the urinary system, the oral cavity and the periodontium. The compounds contained in cranberry fruit lower cholesterol, improve blood circulation, reduce the risk of atherosclerosis. In addition, cranberry has a strong anticancer effect. In cranberry products, depending on how they are made, the amount of bioactive ingredients varies [1]. In fruits after heat treatment at high temperatures is much less. This is due to the thermolability of bioactive ingredients [2].Cranberry contains many oxidoreductive components, including polyphenols, which is why selected bioactive ingredients have been identified in the studies and the antiradical properties of extracts derived from cranberries have been studied.

The research material was fresh and dried cranberry sweetened with cane sugar, pomegranate juice and chocolate. Chocolate before the research was removed from the fruit. The total ash and the content of selected minerals (Na, K and Ca) were measured by flame photometry. The total content of vitamin C, polyphenols and carotenoids were also determined by spectrophotometric method. The ability of extracts to inactivate stable DPPH radicals and ABTS cation radicals by spectrophotometric methods was also determined.

Based on the research, it has been found that both fresh and dried cranberry fruits contain a lot of polyphenols (respectively: 1 g/100 g d,m in fresh fruits, 853 mg/100 g d.m. in cranberry with chocolate 795 mg/100 g d.m. in cranberry fruit with cane sugar, 727 mg/100 g d.m. in cranberry fruit with pomegranate fruits). Fresh cranberries were characterized by higher content of polyphenols and vitamin C than dried cranberries. In contrast, more carotenoids were found in dried cranberries.

Dried cranberries were a very good source of microelements. Most of the sodium (263 mg/100 g), potassium (1065 mg/100 g) and calcium (210 mg/100 g) were in dried cranberry fruit with pomegranate juice.

Both fresh and dried cranberry fruits showed strong antioxidant properties. After analyzing the results it seems that the best in terms of the content of bioactive compounds and antiradical activity against DPPH and ABTS radicals was cranberry sweetened with cane sugar.

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PI-14. Effect of type starch carrier and spray drying on the color strength and the anthocyanins content in reconstituted juice from different red fruits

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Most ingredients are supplied in powdered form and therefore the technologies involved in manufacturing these food ingredients have become very important. Fruit juice in the powder form is stable and easily dosable which generally finds greater usage in many food and pharmaceutical products such as flavoring and coloring agents. The major function of converting fruit juices into powder form is to maintain the stability and the functionality of the ingredients until they are utilized. There is certainly scope for developing ingredients based on natural anthocyanins with standardized levels of the beneficial compounds, for inclusion into a finished functional food product. Anthocyanins are found in a wide range of fruits and are responsible for their red to purple colours. Anthocyanin pigments are labile compounds that will undergo a number of degradative reactions while reduced water activity will enhance stability. Anthocyanin pigments in dried forms can exhibit remarkable stability. The loss of important nutrients can also be minimized during the spray-drying process by judiciously selecting the encapsulating shell materials.

In this study the clear fruit concentrates (Brix 65) from strawberry, cherry, raspberry, redcurrant, blackcurrant and chokeberry were micro-encapsulated by spray-drying using modified OSA starch (E1450) as both a coating material and drying aid, and the same juice concentrates spray-dried with maltodextrin DE7 was set as the comparison (both recipes are dried with a 50% carrier to 50% juice solids ratio). The dryer operated in co-current pattern and the inlet and outlet air temperatures and rotary wheel atomizer speed were maintained at 160 °C, 70 °C and 24 000 rpm, respectively.

Particle size distribution, microstructures, bulk density, flowability, hygroscopicity, degree of caking, dispersibility, total anthocyanins content, color of the samples, and overall color difference between the reconstituted powder and the juice concentrate were found out. The retention of the total anthocyanins during the drying process was > 80%, and a total color difference $\Delta E < 5$, suggesting spray drying was a satisfactory technique for drying heat-sensitive polyphenols. Powders from blackcurrant showed the highest anthocyanins content and the color strength, followed by powders from chokeberry and powders from cherry, raspberry, redcurrant and strawberry; however there were no statistically significant differences between the samples with OSA starch and maltodextrin DE7. The powders that were stored for 12 weeks at 20 °C in the absence of light presented low degradation of anthocyanins (<3%).

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PI-15. Genotoxicity of polyphenolic extracts obtained from leaves

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Polyphenols are secondary metabolites which occur in all parts of plant. The highest concentration of polyphenols was detected in leaves. Polyphenols are strong antioxidant and antimicrobial agents. Studies indicated that polyphenols possess wide range of pharmacological activities like: anticancer, antidiabetic, antiallergic, anti-inflammatory, hepatoprotective, cardioprotective, and gastroprotective activity. In recent years, increasing interest in the use of natural bioactive compounds as cancer preventive or therapeutic agents has been observed. The aim of this study was to evaluate genotoxic activity of polyphenolic extract obtained from *Aronia melanocarpa*, *Cornus mas* and *Chaenomeles superba* leaves. Leaves were collected on 10th July in Lodz region. Total phenolic content (TPC) was determined using Folin-Ciocalteu method and antioxidant activity was determined using DPPH radical method. Polyphenolic compounds were identified and quantified using LC-MS and HPLC methods. Basic DNA damage (genotoxicity) was evaluated with the comet assay using the Caco-2 cell line. Microscopic observations of any morphological changes in these cells was analyzed by Giemsa/May-Grünwald staining. *Chaenomeles superba* leaves exract revealed the largest content of polyphenols. All extracts showed antioxidant activity and the strongest was observed in *Chaenomeles superba* and *Cornus mas* leaves extracts. Two major groups of polyphenols were identified: phenolic acids and flavonoids. In addition, *Cornus mas* extract showed the presence of monoterpnoid compounds (iridoids) which have strong anti-inflammatory activity. The extracts increased DNA damage at concentrations of 0.63%, 0.16% and 0.08%. They also induced morphological changes like: chromatin condensation, cytoplasmic vacuolization, nucleus lysis, necrotic cells, nucleus fragmentation, partially detached cells and binucleated cells. These changes indicate strong cytotoxic activity against human colon adenocarcinoma cell line.

PI-16. Influence of pectin concentration on cross-linking process

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Pectin is a group of polysaccharides which is composed mainly of D-galacturonic acid units [1]. One of their properties, the gelation ability, depends on a lot factors such as pectin structure and their concentration, sugar and cross-linking agent concentration, pH and temperature [2]. The gelation process of low-methoxy pectin is related to "egg-box" model which assumes the interaction of calcium ions with non-esterified galacturonic acid residues. However, in the absence of these ions the aggregation of this type pectin is possible. The mechanism of aggregation may be connected with the formation of hydrogen bonds between carboxylate and/or hydroxyl groups of galacturonic acid residues between chains or within one chain and also hydrophobic interaction of methyl ester groups [3]. Therefore, the aim of this research was to study the influence of pectin concentration on cross-linking process. The sequential extraction of pectin from apples using water (water soluble pectin fraction - the WSP fraction), CDTA (chelator soluble pectin fraction - the CSP fraction) and sodium carbonate with sodium borohydride (diluted alkali soluble pectin fraction - the DASP fraction) was conducted. The DASP fraction was used for further studies. The aggregation index, relative mean hydrodynamic diameter, electrophoretic mobility and electrolytic conductivity were measured by means of Zetasizer Nano ZS (Malvern Ltd., UK). Moreover, the measurements of pH (Oakton pH Spear, Osprey Scientific Inc., Canada) and atomic force microscopy images (Multimode 8 with Nanoscope V controller, Bruker, Billerica, MA, USA) were executed. On the basis of determined physicochemical properties of samples it was managed to appoint the gel points for DASP fraction. Even at the lowest content of pectin in the DASP/pure water systems the samples have already been aggregated. At the DASP concentration higher than 0.01% the changes of the samples aggregation occurred. They were connected with the pectin network extension. The gel point was obtained at the DASP concentration range of 0.2-0.3%. The hydrogen bonds were involved in this cross-linking process.

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PI-17. Nutritional value of selected of the new generation food products

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Consumer awareness of the need to eat fruit and vegetables is constantly growing. At the same time, they are seeking new, attractive forms of products which, apart from the nutritional and health-promoting values, provide an interesting alternative for traditional food. The proposals offered by food producers include low-calorie and fat-free crispy snacks produced in the innovative drying technology (less than 40°C), without preservatives or flavour enhancers. Chips obtained by drying at low temperature are characterized by natural appearance as well as high taste and smell values.

The aim of the paper was to evaluate the content of selected components in chips available in the retail network. The raw material used in the research included apple, pineapple, tomato, carrot, red beet and sunchoke chips. The tests included determination of dry matter, sugar and nitrate (III) and (V) content. Dry matter content was determined by using the drying method and the contents of total sugars and reducing sugars were spectrophotometrically determined according to TEST G-26 [Talburt, Smith 1987]. The content of nitrates (III) and (V) was assayed with the iono-selective method with a multifunctional computer device CX-721 provided by Elmetron [Baker and Thompson, 1992].

The dry matter content ranged from 885 g kg^{-1} for sunchoke chips to 991 g kg^{-1} for carrot chips. The highest total sugar content was found for pineapple chips (686 g kg^{-1} d.m.), and the lowest was for carrot chips (365 g kg^{-1} d.m.). The total sugar content for sunchoke chips amounted to 684 g kg^{-1} d.m.; for apple chips 650 g kg^{-1} d.m; for red beet 495 g kg^{-1} d.m; and for tomato chips 475 g kg^{-1} d.m. The content of reducing sugars was much varied. The highest values were found for apple chips (596 g kg^{-1} d.m.) and the lowest was for red beet chips (35.8 g kg^{-1} d.m.). A high content of nitrates (V) was determined in red beet chips (14.7 mg kg^{-1} d.m.), followed by sunchoke chips (854 mg kg^{-1} d.m.), carrot chips (840 mg kg^{-1d}.m.), apple chips (611 mg kg^{-1} d.m.), tomato chips (363 mg kg^{-1} d.m.) and pineapple chips (161 mg kg^{-1}d.m.). On the other hand, the content of nitrates (III) was the highest for red beet chips and the lowest for tomato chips, amounting to 2,550 and 33.8 mg kg^{-1} d.m., respectively.

The application of the innovative drying technology (less than 40°C) to produce chips makes it possible to obtain a product without a significant loss of components. As a result of reduced water content, dry fruit and vegetables are characterized by concentrated nutrient contents. However, for products with a high ability to accumulate nitrates, there is a risk of exceeding the acceptable daily intake (ADI) of those compounds. Assuming the consumption of 1 serving (18g) of red beet chips by a person weighing 60 kg, there is a risk of exceeding ADI for nitrates (V) by about 5%. Such a risk does not exist for other examined samples. Producers should therefore carefully select the raw material to produce such snacks.

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PI-18. Content of quercetin glycosides and quercetin in spring onion

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At present small onions are increasingly being used in a variety of culinary recipes because of theirs fresh, delicate taste and valuable nutritional and functional properties. Spring onions are small bulbs, which have different soil requirements then a common onion. In case of onion cultivation, the soil should not contain too many minerals because of the probability of too high growth of bulbs. The growth time of the onion is definitely shorter than of a common onion, from the end of March to the end of July.

The aim of the study was to determine the content of quercetin glycosides in spring onions, depending on a variety and the levels and disposition of quercetin glycosides in layers of onions. The present investigation characterizes the quercetin glycosides composition of commercially important onion varieties grown in Poland (Alonso F1, Hystore F1 and Robusta). Alonso F1 is an early variety, recommended for long-term storage. Hystore F1 is a late variety intended for very long storage. Robusta is a known, late variety, cultivated in Poland for over 30 years. The quercetin glycosides were characterized in the outer paper layer, two flesh layers and the inner part of three onion varieties.

Samples were crashed in liquid nitrogen and the dry matter content were determined by AOAC method. Content of quercetin glycosides and quercetin were determined by HPLC method with DAD detection. The outer paper layer contains more quercetin aglycone, while the two flesh layers contain the majority of quercetin 4'-*O*-glucoside and quercetin 3,4'-*O*-glucoside. The outer paper layer of onion contains from 832,2 to 1881,4 mg/100g d.m of quercetin aglycone. The first flesh layer onion contains from 1012,7 to 1697,7 mg/100g d.m of quercetin 4'-*O*-glucoside and from 641,6 to 756,3 mg/100g d.m. of quercetin 3,4'-*O*-glucoside. The second flesh layer onion contains from 308,7 to 541,4 mg/100g d.m of quercetin 4'-*O*-glucoside and from 243,7 to 343,4 mg/100g d.m. of quercetin 3,4'-*O*-glucoside. In case of analysis of major monoglycosides, it can be concluded that more quercetin 3-*O*-qlucoside is present in flesh scales, while quercetin 4'-*O*-glucoside has a higher concentration in outer paper layers. As for diglycosides, quercetin 3,4'-*O*-glucoside is present in larger amounts in fleshy layers, while quercetin 7,4'-*O*- glucoside predominates in dry scales.

PI-19. Activity of hydroxycinnamic acids from coffee as inhibitors of acetylcholinesterase involved in Alzheimer`s disease development

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The enzyme acetylcholinesterase (AChE) hydrolyzes choline esters, including acetylcholine. As a result of cholinergic neurons losses associated with aging or inflammation, the concentration of acetylcholine in the brain significantly decreases. Inhibition of AChE allows more effective usage of acetylcholine concentrations in brain and improve cholinergic neurotransmission. Phenolic acids such as hydroxycinnamic acids (HCAs) contained in coffee were considered in this study as potential AChE inhibitors, and their interfering with Alzheimer's development.

The aim of the research was to evaluate the degree of AChE inhibition by single HCAs and extracts of green, light and dark roasted Arabica and Robusta coffees. The calorimetric titration (ITC) of AChE solution with HCAs or coffee extracts in the presence of acetylcholine was conducted. Based on the energetic effects IC_{50} was determined, which was the concentration of an inhibitor causing the decrease of AChE activity by 50%.

HCAs showed varied activities of AChE inhibition and the influence of both the degree of esterification with quinic acid and methylation of phenolic ring was observed. Coffee extracts were characterized by different concentrations of HCAs and the observed activity of AChE inhibition was only in part correlated with the HCAs contents in the brews.

Coffee extracts can be used as a part of prevention against neurodegenerative diseases. The activity of the extracts from roasted coffees despite the low contents of HCAs suggests that during the roasting are formed compounds exhibiting BChE inhibition activity and future research should be aimed on their identification.

PI-20. The influence of edible coatings on the change of the selected properties of pumpkin fruits during storage

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Fruits of *Cucurbita maxima* Duch. are the source of many valuable nutrients. Not only their dietary but also curative and cosmetic properties are highly rated (Nawirska et al. 2008). The quality of pumpkin fruits during storage is influenced by various factors. Species, climatic and cultivation conditions, maturity as well as storage conditions are considered as the most important ones (Wojdyła et al. 2007). There is a great number of measures, e.g. seven/ten-day long storage at elevated temperature after harvest or immersing in the solution of sodium hypochlorite, in order to extend the shelf-life of pumpkin fruits. However, apart from all of the measures, pumpkin is still considered as a seasonal raw material – only some of the varities may be stored for a longer time, e.g. *Cucurbita maxima* varieties: *Melonowa Żółta* – until next March after harvesting and *Uchiki Kuri* – until next April after harvesting, *Cucurbita pepo* variety *Jet F1* – up to 6 months) (Nawirska-Olszańska 2011).

The aim of this research was to determine the effect of the presence of edible coatings based on carboxymethylcellulose and carboxymethylcellulose with beeswax on the change of the physicochemical properties of pumpkin fruits *Cucurbita maxima* Duch. variety *Ambar* during storage. Water content and activity, colour parameters, total carotenoids content, L-ascorbic acid content as well as ash content were determined. The structure of pumpkin tissue was also analysed.

It was proved that the presence of edible coatings extended the shelf-life of pumpkin fruits with a simultaneous maintenance of their high quality. Pumpkin fruits of variety *Ambar* coated with edible coatings based on carboxymethylcellulose and carboxymethylcellulose with beeswax were stored for 4 weeks longer in comparison to uncoated fruits. The first unfavourable changes in the appearance of uncoated samples were observed after 4 weeks of storage while coated samples maintained their original appearance. Nonetheless, the presence of edible coatings did not have an unambiguous impact on the content of bioactive compounds. Edible coatings acted mainly as a barrier preventing water losses while storage. Thanks to this the turgor of pumpkin fruits was maintained and the process of shriveling was stunted. What is more, the process of coating limited the development of microorganisms. Nevertheless, more research is needed to design such a coating which would also enable a significant retention of biocompounds.

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PI-21. Cold-pressed oil cakes as a source of pro-health compounds

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The oilseed pressed cakes are by-product from cold pressing of seeds in oil production. For the most part animal feed, may be a valuable source of ingredients in the human diet. Flax (*Linum usitatissimum*) in recent years has attracted considerable interest as a result of studies which attribute potential health benefits to its components, including the prevention of chronic noncommunicable diseases (diabetes, lupus nephritis, arteriosclerosis and hormonedependent types of cancer). Positive effects on disease prevention providing health-beneficial components such as alpha-linolenic acid, lignans and other polyphenols as well as non-starch polysaccharides.

The aim of this study was to determine quantitative relations and properties of bioactive components of cold-pressed flaxseed oil-cake of two variety (gold and brown) from two local oil mill companies (Wielkopolska region). Assessment of antioxidative capacity of flaxseed cakes using ABTS method (antioxidative potential expressed in mg of Trolox) were evaluated [Re et al. 1999]. Total polyphenols were determined using the Folin–Ciocalteu reagent described by Chandler and Dodds [1983] with Shetty et al. [1995] modification. Gallic acid was used to prepare the standard curve. The content of phenolic compounds in the test samples remained at the level of 3,62 - 4,0 mg / g. d.m. The highest ABTS•+ scavenging activity was observed in the brown flaxseed cake form the first company. There was no correlation between the content of phenolic compounds, antioxidant activity and flax variety. The presence of lignans in all flaxseed cakes was also confirmed.

It has been shown that flaxseed cakes from Polish local companies are good source of pro-health compounds and therefore may be used as a valuable addition in food production.

Keywords: flaxseed cake, antioxidative activity, polyphenols content

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PI-22. Study of the influence of lactic fermentation process on the contents of selected biologically active substances in beverages from amaranth seeds and their antioxidant properties

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Amaranth seeds are characterized by considerable contents of nutrients and pro-health substances (e.g. squalene). Therefore, they are becoming more and more often the subject of scientific interests, also from a point of view of their utilization in many branches of food industry. Among the advantages of chemical composition, it is worth emphasizing that this protein rich source of high biological value contains small amounts of gluten protein (prolamine), which are responsible for the occurrence of various types of food hypersensitivity.

The aim of the study was to obtain fermented beverages from amaranth seeds and to investigate the effect of fermentation on the content of selected biologically active ingredients and on their antioxidant activity.

The study material consisted of fermented beverages obtained from ground amaranth seeds from the company "Szarłat". Two variants of the fermentation process were used. The first method consisted of inoculating a beverage sample with a mixture of strains containing: *Lactobacillus acidophilus* La^{-5}, *Bifidobacterium* BB^{-12}, *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* and incubation at 43 °C for 5 hours. In the second variant, the sample was inoculated with a mixture of bacterial strains containing: *Lactococcus lactis* subsp. *cremoris*, *Lactococcus lactis* subsp. *lactis*, *Leuconostoc mesenteroides* subsp. *cremoris* and *Lactococcus lactis* subsp. *diacetylactis* and fermented at 30 °C for 24 hours. The control sample was also prepared, which was an unfermented beverage.

Beverages from amaranth seeds were characterized for their active (pH) and volatile acidity. The total polyphenols content were determined with the Folin-Ciocalteu's method by means of spectrophotometry (λ=700 nm) and phytic acid content with modified Thiese method with Wade's reagent (λ=510 nm). The ability of beverages to chelate iron(II) ions was determined by spectrophotometrically method by using $FeCl_2$ and ferrozine (λ=562 nm). Antioxidant activities of the investigated beverages toward radical cations $ABTS^{+\bullet}$ were measured applying the spectrophotometric method (λ=734 nm). Aroma compounds of the beverages from amaranth seeds were also determined (SPME-GC-MS).

The lactic fermentation process caused the decrease in the initial active acidity (about pH 7.0) of the amaranth beverage. Duration and temperature of the fermentation affected the course of the process. Lower value of pH 4.15 was recorded in beverage fermented at 43°C for 5 hours, while pH of the beverage fermented at 30°C for 24 hours was 4.9. The low volatile acidity of the fermented beverages obtained in the tests indicates that underwent a correct, homofermentative fermentation process.

Fermented amaranth seeds beverages were characterized by higher content of polyphenolic compounds as compared to unfermented beverage. Increase the content of polyphenols in fermented amaranth beverages was probably due to the release of polyphenols from persistent bindings with other food ingredients and their altered structure, which allowed them to be analyzed. As a result, higher iron (II) chelation and antiradical activity of these beverages were also observed. However, fermentation of beverages caused partial degradation of phytic acid.

Parameters of the fermentation process of amaranth beverages and type of bacterial strains significantly influenced on the content of biologically active ingredients and their properties. Beverage fermented at 43 °C had higher content of polyphenols and phytic phosphorus and higher antiradical activity than

that fermented at 30 °C. Greater reduction in phytic acid in the fermented beverage at lower temperatures (30°C), but for a longer time (24 hours) than in the sample fermented at higher temperatures (43°C) for 5 hours, is likely due to the longer enzyme exposure duration. Differences between the test samples in terms of the phytic phosphorus contents may also result from the use of different bacterial cultures in amaranth beverages.

The obtained results shown the influence of the fermentation process on the sensory perception of the beverages. Unfermented beverage had a limited volatile profile. The aromatic profile of amaranth beverage is especially formed by: aldehydes, alcohols, organic acids and ketones. The fermentation process has caused increase of the content of acetic acid, butyric acid and hexanal.

PI-23. Probiotic survival in fermented milk sweetened with polyols

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Polyols are being used as bulk sweeteners in human nutrition. These compounds are usually produced by a catalytic hydrogenation of carbohydrates, but they are also naturally occurring in fruits, vegetables, mushrooms as well as in human organism. They are added to foods as alternative sweeteners what might be helpful in the control of calories intake. Additionally, they promote dental health and exert a prebiotic-like effect. The various polyols have different sweetness, solubility, cooling effect, molecular weight and laxative effects, leading to big differences in properties between the different products. In dairy industry, various polyols are using to produce frozen desserts but rarely in fermented milk, because may affect the dairy and probiotic bacteria.

The influence of different polyols on the survival of *Bifidobacterium lactis* BB-12 in fermented milk was studied with sucrose as reference. The sweeteners (sucrose 8%, xylitol 8% erythritol 10,8%, and maltitol 8,8%) were added to the milk before incubation with probiotic bacteria. The sweetness intensity was compared to sucrose which has a relative sweetness value of 100 %.

The fermentation process was performed at 37°C until curd formation. The incubation was terminated by placing samples in the fridge at 5˚C. After this, the titratable acidity (°SH), pH and the number of viable bacteria were analysed once a week in 7th, 14th, 21st and 28th day of refrigeration. Moreover, a sensory profile of fermented milk with different sweetness addition was evaluated.

The fermentation time of milk sweetened with erythritol was over 8 h longer when compared to the other sweeteners. Different types of polyols did not impact significantly on pH of fermented milk during refrigerated storage. However, milk sweetened with polyols was characterized by higher total acidity, than milk with sugar addition. The acidity of all samples increased until 21 day of storage and then decreased. The number of viable BB-12 bacteria in all products was between 7,54 and 9,33 log CFU per 1 g during refrigerated storage. Fermented milk with xylitol showed a significantly higher number of viable bacteria during time of analysis when compared with control sample ($p<0,05$). From the other hand milk sweetened with maltitol was characterized by the lowest number of bifidobacteria from the 21st day of refrigerated storage. Probiotic milk with xylitol was considered as the least sweet and with maltitol as the sweetest. Milk with erythritol showed similar sweetness as control but the taste was also considered as the most chemical and artificial.

The results showed that erythritol was the least suitable sweetener to probiotic milk with BB-12, in view of longer fermentation time and disadvantage of taste.

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PI-24. Phenolic compounds content and antioxidant activity of fruit vinegars

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Background

Fruit vinegars are the part of the food that have valuable pro-health properties in view of the fact that they include some compounds that are biologically active[1]. Polyphenols are the kind of compounds like that. Their content depend on the type of raw material and also on technology which were used in vinegars production[2]. The aim of this study was to determine the influence of usage of difference variety of fruits and technology of obtaining the final product on phenolic compounds content and antioxidant activity of fruit vinegars.

Materials and Methods

In this research to obtain the fruit vinegars three kind of juices from Cornelian cherry fruits (*Cornus mas* L.) from 3 cultivars: 'Florianka' (red colour-R), 'Yantarnyi' (yellow colour-Y) and 'Koralovyi' (coral colour-C) were used. Two technological methods were used. The first of them consist in spontaneous method of alcoholic and acetous fermentation, whereas the second: in the first step, alcoholic fermentation was conducted with the use of yeast *Saccharomyces cerevisiae*-Safspirit Fruit and the second step consist in spontaneous acetous fermentation. During research the value of pH and extract in obtained fruit vinegars was controlled. The total polyphenolic content of the vinegars was determined using the Folin-Ciocalteu (F-C) spectrophotometric method. Antioxidant activity was measured with ABTS, DPPH and FRAP tests. The FRAP method is the type of reaction that determine ability to sweep radicals

Most Important Result

In this research fruit vinegars obtained from Cornelian cherry fruits was characterized by difference amount of total polyphenol compounds: from 326,60 to 757,27 mg GAE/100 mL. In prior literatures do not found any research in which amount of polyphenols in fruit vinegars were as high as in obtained vinegars in this study. Antioxidant activity determined with the tests FRAP and DPPH was higher in vinegars obtained from two-round process. Similar to the polyphenol results, the highest antioxidant properties was determined in red and coral vinegars. Antioxidant activity measured with ABTS method was on average level of 20,56 mM TE/100 mL of product.

Key Conclusions

Conducted research have proven that variety of Cornelian cherry fruits and method of production technology have influence on antioxidant activity of final products.

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PI-25. Characteristics and antioxidant properties of polish craft beers

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Background

Polyphenols present in beer descended from cereal grains used for malt production (e.g. wheat, barley, rye, oat, rice) and also from hop. Preceding studies show that regular consumption of food which is rich in phenolic compounds can protect the organism from diseases connected with oxidation stress effectively[1]. Apart from the pro-health properties, polyphenols have influence on foam stability, physicochemical characteristics as well storage stability of beers[2]. In this study the level of polyphenols and antioxidant properties of Polish craft beers was tasted.

Materials and Methods

In this research beers brewed in Polish craft brewery located in Lower Silesia were used. All samples were prepared by degassing and filtration. The main parameters were controlled by using near-infrared spectroscopy (NIR), such as: ethanol and extract content, real degree of fermentation (RDF). pH value was also tasted. The total polyphenolic content of the beers was determined using the Folin-Ciocalteu (F-C) spectrophotometric method. Antioxidant activity was measured by using ABTS and FRAP tests. The last one method is the kind of reaction that determine ability to sweep radicals.

Most Important Result

In this study noticed the different level of total polyphenol content in beers receive from Polish craft brewery, that is 24,86-51,87 mg GAE/100 mL. Antioxidant activity determined by tests FRAP and ABTS was the highest in the beer 3III (2,67 mM TE/100 mL and 3,73 mM TE/100 mL), whereas the lowest in the beer 4III (1,30 mM TE/100 mL and 1,58 mM TE/100 mL). The alcohol content was determined in the level of 3,74-6,97%v/v, real extract on 3,61-5,10%, and RDF on the level on 61,52-67,95%. The values of pH amounted from 3,57 to 4,89.

Key Conclusions

Conducted results have proven that basic physicochemical characteristics as well phenolic compounds and antioxidant activity of Polish craft beer used in this research depend on raw materials and also on technology method which were used to obtain them.

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PI-26. Assessing photosynthetic capacity of ten tetraploidal potato clones and cultivars in early August after naturally occurring environmental stress

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The fast O-J-I-P fluorescence provides a rapid, non-invasive tool to characterize plant vitality. It was applied to assess the vitality of potato clones and cvs at the end of the vegetation period, when plants had suffered from different kinds of stress, e.g. a combined heat-drought-light stress, competition with weeds, and attacks of pathogenic organisms and insects. Potatos were cultivated under field conditions at four localities in Poland, at two of them in line with the rules of organic farming (Radzików near Błonie, Chwałowice near Iłża), at the remaining (Młochów, Boguchwała near Rzeszów) with those of integrated production. Measurements were conducted in three consecutive years (2014-2016) during the first two weeks of August. In mid of August clones and cultivars were rated with respect to the survival of green leaves. Three vitality groups were distinguished, viz. clones/cvs 1. being the first dying in the season (2 clones), 2. not in the other groups (4 clones, 'Satina'), and 3. standing longest (1 clone, 'Jelly', 'Tajfun'). Maximum quantum yield and the performance index PI_{abs} were higher under organic cultivation, but in the third group with the highest vitality, the selected chlorophylll fluorescence parameters were almost similar under both production systems. The levels were only insignificantly higher under organic cultivation when compared with the levels of plants grown under integrated production.

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PI-27. Characteristic of ACE-inhibitory activities of dry-cured pork loins inoculated with probiotic strains of LAB

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The aim of the study was to gain knowledge about bioactive peptides with angiotensin I-converting enzyme (ACE) inhibitory activity released during the degradation of dry-cured loins proteins (sarcoplasmic and myofibrillar) by digestive enzymes (pepsin and pancreatin) under simulated digestion and absorption in the gastrointestinal tract.

The material for the study were dry-cured loins produced with using strains of probiotic or potentially probiotic bacteria strains (*Lactobacillus rhamnosus* LOCK900, *Lactobacillus acidophilus* Bauer, *Bifidobacterium animalis ssp. lactis BB12*) as starter cultures.

The research involved providing information about the basics relationships resulting from the hydrolytic degradation of meat proteins by proteolytic enzymes (spontaneous proteolysis by endogenous meat enzymes, the effect of exogenous enzymes of microbial origin in the ageing process and degradation by enzymes of the gastrointestinal tract during simulated digestion). As it was expected, peptides with ACE inhibitory activity has been released. The impact of probiotic strains as starter cultures on the generation of bioactive peptides at product level has been assessed. Digestion in the simulated gastrointestinal tract and absorption *in vitro* enabled to assess the bioavailability and bioactivity of peptide sequences. This helped to determine the relationships and understand the processes to which meat proteins are subjected during first the production process and then simulated digestion and absorption in the gastrointestinal tract. This knowledge can be used to design functional or nutraceutical meat products.

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PI-28. Influence of technological processes on the content of isoflavone aglycones

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Legumes play an important role in the traditional diets of many regions in the world (Messina, 1999). Soybeans production is the largest in the total world legumes production, for example, in 2013 it reached 69% [FAOSTAT]. Legumes, mainly fermented soybeans food are important part of traditional Asian food. Soybeans are unique among the legumes because they are a concentrated source of important secondary metabolites that is polyphenols compounds. Polyphenols principally have been recognized as health-promoting dietary components owing to their antioxidative activity. One of polyphenols group, isoflavones, may act similarly to human estrogen. Aglycones of isoflavone are more bioavailable than glucosides and are absorbed faster and in higher amounts than their glucosides in humans.

The aim of this study was to investigate the differences in bioactive compounds contained in Asian's fermented bean products.

Followed products were used in study: Douchi "1" (An Jun Yong Chuan Te Chan Douchi). Place of origin: Chongqing. Raw material: Soybean; Douchi "2" (Chuan Wei Douchi). Place of origin: Tianjin. Raw material: Kidney bean; Douchi "3" (Chuan Nan Feng Wei Douchi). Place of origin: Sichuan. Raw material: Soybean; Douchi "4" (Qiang Wei Hu Nan Dry Douchi). Place of origin: Hunan. Raw material: Small Black Soybean; Douchi "5" (Wai Zu Mu Yongchuan Douchi). Place of origin: Chongqing. Raw material: Soybean; Natto (Yan Jing). Place of origin: Beijing. Raw material: Soybean (small type); Tempeh. Place of origin: Poznan. Raw material: Soybean; Sufu (Wang Zhi He). Place of origin: Beijing. Raw material: Soybean.

Methods include isoflavone analysis, total polyphenol analysis, determination of antioxidative activity. Extraction of isoflavone was done using the 80% acetonitrile and 80% methanol. Extracts were analysed by HPLC method with DAD detector. Total polyphenols were determined using Folin-Ciocalteu method. Antioxidative activities were measured using the ABTS method.

The results showed that douchi „4" possessed the highest isoflavone content. Natto contained daidzin and genistin in the highest amounts among analyzed products whereas low amounts of daidzein and genistein. Tempeh, douchi „3" and douchi „5" had high amounts of daidzein and genistein with low amounts of daidzin and genistin. Douchi „2" showed the lowest level of each of isoflavone. Douchi „3" and douchi „5" had high amounts of total polyphenols. Natto had the lowest amounts of total polyphenols. Sufu, douchi „3" and douchi „5" were characterized by the highest antioxidative activities. Isoflawone content of fermented bean products depends on row material. Black small soybean douchi (douchi "4") had higher isoflavone content than soybean (douchi "1", "3", and "5") and kidney bean douchi (douchi "2"). The time of natto and tempeh fermentation is short, but different processing and microorganisms may have influence on isoflavone form and content. Natto had more glucosides, whereas tempeh contains more aglicones.

There is possible to choose products with particularly preferred content of bioactive components for particular group of consumer. By using proper raw material and type of fermentation, is possible to control the isoflavones amounts and form.

PI-29. Effect of phenolics concentration on apple juices and French ciders colors

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The color of apple juices and ciders is an important criterion that may influence choice and acceptance of the consumers. Unlike in other countries, in France, consumers accept and often prefer the yellow-orange color that occurs naturally during the process. This color is the result of polyphenol oxidation that occurs during fruit processing. It is catalyzed by polyphenoloxidase (PPO) in the presence of oxygen mainly during the crushing and the pressing of the raw material. Interestingly, apple varieties show a great diversity regarding their polyphenol profiles[1]. In this context, the purpose of the study was to investigate the impact of different proportions and concentrations of the major classes of polyphenols of apple juices in the formation of the colored and non-colored oxidation products. This investigation will help the producers to control and predict the color of the final product (apple juice or cider) depending on the composition of the raw material they used for juice and cider making. Regarding literature data, the main hypotheses were: 1) the color will decrease with the increase of procyanidins concentration, and 2) the color will increase with the increase of chlorogenic acid, epicatechin and phloridzin concentrations[2,3].

Experiments were carried out in model solutions using a central composite design considering four factors corresponding to molecules of the main polyphenol classes: procyanidins, chlorogenic acid, epicatechin and phloridzin). Each factor was coded in five levels (-2, -1, 0, 1, 2) of concentrations that were chosen to cover the range of French cider apple varieties. Finally, 36 model solutions were prepared and the incubation was started by incorporating a crude concentrated PPO extract obtained from a cider apple variety (i.e. *Kermerrien*). Three incubation times were chosen (0, 10, 120 min.). At the end of each incubation time, aliquots were withdrawn and filtered. The color of the solutions was characterized by measuring the CIE L a b parameters. Data were processed by "Statgraphic" software. Results have shown the correlation between factors and color parameters. In the limit of the space that was defined by the experimental design, results showed that: 1) epicatechin had no marked effect on the formation of the color; 2) procyanidins have the highest negative impact on each of the parameters (C,L,h) and appeared to be the main inhibitors of the color formation; 3) phloridzin is important for creation of the color and shows an interaction with chlorogenic acid.

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PI-30. Antioxidant properties of substances of plant origin

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Polyphenols are naturally occurring compounds found largely in the fruits and vegetables. They are secondary metabolites of plants and are generally involved in defense against ultraviolet radiation or aggression by pathogens. Phenolic compounds are composed of aromatic ring containing a hydroxyl group and other substituents. Due to the basic structure of the carbon skeleton, amoung polyphenol are distinguished: phenolic acids (benzoic and cinnamic acids), flavonoids, proanthocyanidins, coumarins, stilbens and lignans and lignins [1, 2].

The flavonoids are the best known group of polyphenols. Flavonoids show antioxidizing properties and aditionally pro-oxidizing characteristics [3]. They are the most common group of polyphenolic compounds in the human diet and are found ubiquitously in plants.

In food, polyphenols may contribute to the astringency, bitterness, flavor, color, odor and oxidative stability. The diets rich in polyphenols compound provide significant protection against the development and progression of many chronic pathological conditions including cancer, diabetes, cardio-vascular problems and aging [4].

In our studies we preper exctract of diffrent plants. We use husk and leaves of wallnut, rosa canina fruits, peel of orange and husk of onion. In the next step we determine antioxidant activity of the extracts, used ABTS, DPPH, FRAP and CUPRAC metods. In addition, we perform IR and change of colour analysis of the extracts.

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PI-31. Grape seed extract as an effective antioxidant in dry-fermented neck technology

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Microbial growth, lipid oxidation and colour are important factors to shelf-life and consequently for the consumer acceptance of dry-fermented pork meat products. Oxidative processes in fermented meat products during long-time ripening and storage lead to the degradation of colour pigments, lipids and proteins that, in turn, can contribute to the deterioration in flavour, texture, colour and nutritional value of meat. Antioxidants are added to meat products during processing to delay oxidation. In an attempt to control this process, food industries usually use commercial antioxidants such as sodium ascorbate. However there is also an alternative – it is possibility of using by-products as effective natural antioxidants in the fermented meats technology. The grape seeds, which are the by-product of juices and wine production, are a rich source of biologically active compounds. They exhibit a broad spectrum of biological, pharmacological and therapeutic activities against free radicals and inhibit oxidative stress. The polyphenol compounds present in seeds can be used in the technology of new products as a source of biologically active compounds, mainly antioxidants. Due to the fact that there are no scientific publications that deal with the problem of using grape seed extract as an effective source of antioxidant substances in dry-fermented pork neck, the present study was undertaken. The aim of the study was to determine the effect of addition of grape seed extract on colour durability and oxidative stability of fermented neck during storage. The effect of natural antioxidants addition present in the extract and sodium ascorbate was compared. Five experimental variants of the meat product were prepared: three with a grape seed extract at the amount of 1 - 5 g/kg of meat, with sodium ascorbate at the amount of 1 g/kg of meat, and no additives. Product color (CIE L*a*b*), pH value, free fatty acid (FFA) content and oxidation intensity (TBARS) were evaluated. The significant effect of the grape seed extract addition at a concentration above 2 g/kg, on the color and oxidative stability of meat, was found. After ripening at 4°C, it was noticed that in necks with extract discoloration of meat was inhibited by reducing the loss of redness and increase of yellow. The value of redness of necks with extract was higher than the other variants by about 20%. It was found that the extract inhibited lipid hydrolysis and limited oxidative processes occurring in the neck during two months of storage with efficacy similar to sodium ascorbate. By 50% FFA higher content was recorded in the control group and 40% higher in the TBARS than in the antioxidant samples. The results of the present study support the use of grape seed extract as an effective antioxidant in the technology of matured pork neck. Among the three tested concentrations of grape seed extract, these higher concentrations showed the most potential as alternatives to commercial antioxidants, for increasing the quality and extending the shelf-life of fermented neck.

POSTER SESSION II

PII-1. Application of sugar beet pulp in biodegradation of 3,5-dinitrosalicylic acid

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Every year the amount of waste produced by food industry increases. Vast majority of it is subjected to incineration or biogas production. However, some of waste material hydrolysates like sugar beet pulp, apple pomace or wort, due to abundance of vitamins, microelements and carbohydrates, are perfect for bacteria or fungi to be used as carbon source or immobilization media.

Nowadays not only growing abundance of food waste is problematic, but also wastes produced by other industries, like textile or military. An example are aromatic nitrocompounds. They are extremely recalcitrant to biodegradation, toxic and tend to bioaccumulate. Therefore, aromatic nitrocompounds pose a serious threat to the environment, especially as methods already developed are either expensive or have doubtful efficiency.

There is a small number of organisms that have developed metabolic pathways for degradation of nitroaromatics like 2,4,6-trinitrotoluene (TNT) or 3,5-dinitrosalicylic acid (DNS). An example of such is *Phanerochaete chrysosporium*, white rot fungi known for its low specific enzymes and resistance to toxic environment. In an experimental process it was immobilized on sugar beet pulps and placed inside continuous flow bioreactors, flushed with 3,5-dinitrosalicylic acid solution. Decomposition of the substrate was controlled periodically using spectrophotometric and HPLC methods.

Results indicate noticeable degradation of 3,5-dinitrosalicylic acid through reduction into amino derivatives. Substrate concentration decreased down to 50% of initial one, depending on mass of immobilizate medium, initial 3,5-DNS content in and pH. However, before up scaling of the process, it is required to optimize process, define metabolic pathway and prepare mathematical model.

PII-2. Microbiological modifications of immunoreactivity of wheat proteins

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Celiac disease, wheat allergy and non-celiac gluten sensitivity are diseases, which require a life-long, gluten-free diet. To be regarded as such, content of this protein complex in the product cannot exceed 20 ppm [1]. Gluten is a complex of structural proteins – glutelins and prolamins. It can be found in wheat, barley, rye, oat and related species. Wheat is one of the most commonly cultivated cereals. Due to the functional properties of gluten proteins, wheat flour is used as an ingredient in various food products [2].

Lowering the immunoreactivity of food products is one of the ways to improve the quality of life of people with gluten-dependent diseases. An effective and safe way is to use fermentation with lactic acid bacteria.

In their studies Gerez *et al*. used a mixture of *Lactobacillus plantarum* CRL 775 and *Pediococcus pentosaceus* CRL 792 to reduce gliadin levels in wheat flour samples subjected to fermentation [3]. Leszczyńska *et al.* used different strains of *Lactobacillus* in their studies. Analyzes showed a decrease in immunoreactivity in the samples with fermented flour [4]. In other studies, Leszczyńska *et al*. have demonstrated that the immunoreactivity of the bread obtained from modified flour is lower than the immunoreactivity of the bread obtained from unmodified flour [5]. Zamakhchari *et al*. used bacteria from *Rothia* type isolated from oral cavity to degrade immunogenic gliadin proteins [6]. Rizello *et al*. in addition to *Lactobacillus* bacteria, used proteases obtained from various *Aspergillus* molds. They have proven that such a mixture is capable of lowering the immunoreactivity of flour [2].

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PII-3. Comparison of the content of selected biologically active compounds in organic and conventional herbs

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INTRODUCTION

It is estimated that out of the 400,000 species of plants in the world there are about 2000 medicinal plants, of which only a small percentage has been examined. Herbal plants are a rich source of various biologically active compounds, such as glycosides, alkaloids, phenols, flavonoids, tannins, mucilages or vitamins.

Comparative studies conducted in recent years of the content of biologically active compounds in organic and conventional foods have shown significant differences in favor of organic products. On the other hand, there is little reports on the content of biologically active compounds in herbs. Therefore, research on the content of polyphenols and flavonoids in frequently chosen by consumers in Poland species of herbs have been undertaken.

EXPERIMENTAL METHODS

Nine species of herbal plants from organic and conventional crops were selected. They were *Cistus creticus*, *Tilia cordata*, *Sambucus nigra*, *Hypericum perforatum*, *Marticaria chamomilla*, *Mentha piperita*, *Melissa officinalis*, *Salvia officinalis* and *Urtica dioica*. In methanolic herb extracts polyphenols and flavonoids were determined by the Singleton [1] and Christ-Müller [2] methods, respectively.

RESULTS

The highest content of polyphenols was found in extracts of organic *Melissa officinalis* (15,922 ± 0,024 mg GAE/g d.m.), *Salvia officinalis* (15,663 ± 0,035 mg GAE/g d.m.), *Cistus creticus* (15,434 ± 0,031 mg GAE/g d.m.) and *Sambucus nigra* (14,846 ± 0,011 mg GAE/g d.m.). The lowest concentration of polyphenols was detected in extracts of conventional *Urtica dioica* (1,453 ± 0,005 mg GAE/g d.m.) and *Marticaria chamomilla* (3,130 ± 0,001 mg GAE/g d.m.).

In turn, the highest content of flavonoids was found in extracts of organic *Sambucus nigra* (5,496 ± 0,033 mg quercetin/g d.m.) and also in organic *Cistus creticus* (3,027 ± 0,008 mg quercetin/g d.m.). The lowest concentration of flavonoids was detected for extracts of conventional *Melissa officinalis* (1,360 ± 0,016 mg quercetin/g d.m.) and *Urtica dioica* (0,485 ± 0,006 mg quercetin/g d.m.).

CONCLUSIONS

The research has shown that herbs, especially those derived from organic crops, are a rich source of antioxidants, especially phenolic compounds. The origin of the raw material is important for the quality of the product, the content of tested antioxidants. For all tested herbs, organic extracts had significantly higher levels of both polyphenol and flavonoids as compared to conventional extracts.

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PII-4. Condensate from the tomato paste production as a source of aroma compounds

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Tomato (*Lycopersicon esculentum* Mill.) is a well-known plant that belongs to *Solanaceae* family. It is one of the widely consumed vegetables, either in fresh form or industrially processed. Tomato paste (concentrate) is the product prepared by concentrating the juice or pulp obtained from mature red tomatoes strained or otherwise prepared to exclude the skins, seeds and other coarse or hard substances in the finished product and preserved by physical means. More than 400 volatile compounds, such as aldehydes, alcohols, esters, ketones, sulphurs and volatile phenols have been found in tomatoes. Fresh tomato aroma is composed mainly of aliphatic aldehydes: (Z)-hex-3-enal and (E)-hex-2-enal that are the most powerful aroma-active compounds. Other important constituents are alcohols such as 2-phenyletanol, (Z)-hex-3-enol, benzyl alcohol as well as ketones, e.g. 6-methylhept-5-en-2-one and pent-1-en-3-one. Among monoterpenes neral, geranial, and linalool belong to the main constituents. Processed tomato aroma has similar composition [1, 2].

Condensate originated from tomato pulp concentration process for tomato paste production was collected in experimental stand, built by FMS Spomasz Pleszew S.A. Within the time of the technological process, four subsequent fractions of condensate were collected in time intervals adequate to 25%; 50%; 75% and 100% of the total concentration time.

The condensate fractions were studied for the total soluble solids °Brix and pH. Aroma volatiles were isolated by extraction with dichloromethane and their chemical composition was investigated using gas chromatography-mass spectrometry (GC-MS).

The total soluble solids content increased with the subsequent condensate collection and ranged from 7,3 to 31,1 °Brix. At the same time, pH slightly decreased from 7,02 to 6,88. Total content of volatile compounds in the first fraction was high (320 mg/L), and it was much lower in other fractions (39-20 mg/L). Volatile mixtures composed of more than one hundred constituents. *2*-Phenylethanol was the main component of each fraction and amounted to 22,7% of total volatiles in the first fraction and 8,0-11,2% in other fractions. This study revealed that this alcohol, one of the key tomato aroma components, is responsible for the overall aroma of tomato condensate fractions. It is a major contributor to flavor in many foods, including fresh fruits, such as tomato**,** cheese, bread, wine, and olive oil. 2-Phenylethanol is also the major constituent of scent of many flowers, most notably roses and it is the most used chemical fragrance in cosmetic. Other compounds present in significant amounts in at least two fractions were undecan-2-one and benzyl alcohol. It was not surprise that highly volatile short-chain aldehydes, alcohols and ketons were present in condensate only in trace amounts or were not identified.

This study revealed that the first fraction of condensate obtained during concentration of tomato pulp is a potential sources of tomato aroma and can be used in vegetable products technologies.

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PII-5. Synergistic effect of polyphenol oxidases and peroxidases in relation to selected phenolic compounds and cloudy apple juice and colour stabilization under supercritical carbon dioxide

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Apple juice is one of the most frequently consumed juices in the world and recognized as a promoter of health because of its high content of bioactive compounds such as polyphenols (1). The majority of consumers prefer cloudy apple juice as a light, whitish yellow juice with significant cloudiness (2). Fresh apple juice is highly susceptible to enzymatic browning, because of the high activity of oxidizing enzymes, like polyphenol oxidases (PPO) and peroxidases (POD). Supercritical carbon dioxide (SCCD) is one of the promising non-thermal methods of reducing tissue enzyme activity present in fruit juices (3).

The aim of work was investigation of the influence of storage time on colour changes in fresh and SCCD treated (60 MPa, 30 °C, 30 min) apple juice as well as evaluation of synergistic effect of PPO and POD regarding to selected phenolic compounds.

Material for this study were cloudy apple (cv. *Golden delicious*) juices prepared on juice extractor (J 80 Ultra, Robot Coupé, France) and immediately spectrophotometrically assesed for: colour changes at L*a*b* system (Hunter Lab, Colour Quest XE, Germany) during 24 hours as well as PPO and POD activity (6705 UV/VIS, Janeway, England). Effect of commercial PPO and POD enzymes on gallic acid, chlorogenic acid, and catechol was determined at model solution at pH optimal for each enzyme. Colour parameters: lightness (L*), redness (a*), yellowness (b*) and calculated coefficient: total colour difference indicated minor changes in apple juice treated by SCCD compared to fresh squeezed juice during 24 hours at room temperature. L* of raw juice decreased during storage time whereas a* and b* increased up to 17th hour of storage; during this time dE increased systematically up to 42. Longer storage time did not influence on the colour changes up to 24th hour. On the contrary L* of SCCD treated juice increased whereas a* and b* decreased during first 4 hours of storage. dE increased up to 10 during first 4 hours and only up to 15 during next 20 hours.

The highest activity as well as synergistic effect of PPO and POD was noted for catechol and chlorogenic acid, respectively. Mixture of PPO and POD showed 25 and 15% higher activity in relation to selected compound compared to each one acting separately.

Apple juice is very sensitive for enzymatic oxidation as well as colour changes. The highest changes took place during first 17th hours of storage therefore application of supercritical carbon dioxide could be promising technique to obtain high quality and stable apple juices.

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PII-6. Acoustic, mechanical and bioactive properties of osmotically pretreated freeze-dried strawberries

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Products enriched in additional substances such as calcium salts, ascorbic acid or natural fruit concentrates significantly increase the components level in diet, which very often is insufficient. The product thus obtained is also characterized by better structural and reconstructive properties. In order to achieve the stability of the osmotically dehydrated plant material, further drying is required.
The objective of this study was to analyze the effect of osmotic solution type and time of the process applied prior to freeze-drying of strawberries on the acoustic, mechanical and bioactive properties of the dried fruit. Frozen strawberries cv. Honeoye were stored for 3 months. Before osmotic dehydration, fruit was thawed at the room temperature (about 25°C) and then immersed in sucrose solution (60%) or chokeberry juice concentrate (60%). Osmotic dehydration was carried out at temperature of 30°C, maintaining a constant mixing (about 1 Hz) for 1, 2 and 3 hours. Before freeze-drying, the obtained osmo-dehydrated strawberries were frozen in the freezer mod 51.20, IRINOX SPA, using freezing temperature at -45°C for 2 hours. Previously frozen osmo-dehydrated strawberries were placed on the shelves of the Alpha 1-4 LSC Plus Christ Company freeze-dryer. The process was conducted with constant parameters: pressure 63 Pa, safety pressure 137 Pa, temperature of freeze-drier heating shelves 30°C, time 24 hours. After freeze-drying process, the strawberries were moved to glass vessels which were tightly closed and stored in a dark place at room temperature until the time of analyses. Water activity and density of dried fruit were determined. The compression test at a speed of 0.5 mm/s was performed on a single dried strawberry and simultaneously recorded acoustic emission conducted by the contact method. The contents of polyphenols and anthocyanins of dried fruit was determinated and also the ability of the extracts to DPPH radicals deactivation. Also bioactive substance content analysis was carried out.
Dried fruit after osmotic pretreatment in chokeberry concentrate characterized by lower final water activity in comparison to fruit subjected to sucrose osmotic dehydration. The density was similar. The solution and time of the osmotic dehydration affected the textural properties of dried strawberries as well. It was demonstrated that osmotic dehydration of strawberries in chokeberry juice concentrate and sucrose solution preceding the freeze-drying process resulted in increasing the hardness of fruits in comparison with control samples (no osmo-dehydrated). The number of events, amplitude of the sound and acoustic energy also increased. Osmotic pretreatment of fruit in chokeberry juice concentrate during longer time from 1 to 3 hours caused reduction of the number of events EA in dried samples. Both the osmotic substance and the dehydration time had an effect on the bioactive substances content of freeze-drying strawberries. Strawberries dehydrated 1 hour and 3 hours in chokeberry juice concentrate contained polyphenols at 4662 and 5001 [mg acid GAE/100 g d.m.]. Less polyphenols content were found in strawberries dehydrated in sucrose 1hour - 2581 [mg acid GAE/100 g d.m.] and 3 hours - 3076 [mg acid GAE/100 g d.m.]. The content of anthocyanins was higher in strawberries osmotically dehydrated in sucrose than in chokeberry juice concentrate. The longer time of osmo-dehydration process caused increase of anthocyanins content.

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PII-7. Analysis of non-enzymatic *L. sativum L.* antioxidant system during exposure to zinc in nanoparticle form

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Heavy metals can cause oxidative stress in living cells. The effect of such stress is the formation of free radicals that contribute to cell damage. Plants can neutralize the harmful effects of heavy metals. One of the responses to unfavorable environmental conditions is the activation of a non-enzymatic antioxidant system.

Widely used in the industrial zinc particle is increasingly replaced by nano form. Nano zinc is popular in the daily life as a component of plastics, ceramics, glass, cement, rubber, foods and many others. This causes its increased amount in the environment and the possibility of penetration into living organisms. Due to the increasing use of nanoparticles of zinc, their level in the environment is likely to increase.

The aim of the experiment was to investigate the response of *Lepidium sativum* to different concentrations of ZnO in nanoparticle form.

0.5 g of *Lepidium sativum* seeds were seeded in 200 g of soil contaminated with 1 ppm, 10 ppm and 100 ppm of different forms of nanoparticles zinc oxide with a molecular size of <50 nm and <100 nm. The experiment was performed in triplicate. After 14 days of cultivation, non-enzymatic response of *Lepidium sativum* was investigated under oxidative stress conditions. Changes in levels of phenolic acids, flavonoids and pigments were investigated.

By analyzing the concentrations of flavonoids in the above-ground parts of *L. sativum* cultivated in different variants of pollution, it can be observed that concentrations remain at a similar level, regardless of the variant of the experiment. By analyzing the concentration of phenolic acids in the above-ground parts of plants cultivated on Zn-contaminated substrates in various forms and concentrations, was observed decrease of its, especially for plants cultivated on zinc nanoparticles, which may be related to limited activation of the antioxidant system.

The analyzes indicated that the carotenoids and anthocyanins content increased during exposure to Zn ions, regardless of their form and concentration. The highest concentration of carotenoids was observed for a plant sample grown on soil contaminated with ZnO nanoparticles of size >100 nm, at a concentration of 100 mg. By comparing the concentration of carotenoids in plants grown on soil contaminated with nanoparticles, it can be seen that the central concentration of zinc resulted in a decrease in carotenoid concentrations compared to the other variants of the experiment. The results showed an increase in chlorophyll a and chlorophyll b in all variants except chlorophyll and zinc nanoparticles with a size of <50 nm and concentrations of 1 mg and 10 mg, and nanoscale zinc with a size of <100 nm and a concentration of 1 mg.

These tend to be in line with literature data, which indicates that plants undergo an antioxidant system during growth at unfavorable environmental conditions (eg, increased carotenoid concentrations). Higher concentrations of the same compound act toxic to the plant, causing a reduction in antioxidant concentrations. On the other hand, extreme concentrations of pollutants force the plant to adapt to environmental conditions, so that the concentration of antioxidants is increasing again.

In conclusion, zinc nanoparticles of size <50 nm did not activate non-enzymatic antioxidant system. The use of zinc nanoparticles of size <100 nm resulted in a lowering of content of phenolic acids in the upper parts of the plants and maintaining the concentration of flavonoids at the same level as the control.

PII-8. Bioactive compounds in fruits of lesser known species of orchard plants

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Fruits constitute a wealth of valuable bioactive components (polyphenols, vitamins, fibre) that have a beneficial effect on human health. Thanks to their properties, they can act preventively against many of the diseases that modern society is struggling with. Current world literature provides a great deal of evidence confirming the beneficial influence of regular fruit and vegetable consumption on human health [1]. The observed physiological and biological effects of a diet rich in fruits and vegetables are due to the increased intake of proanthocyanidins, chlorogenic acid [2] and anthocyanins [3], as well as vitamins, fibre and minerals.

Among the fruits we have many species that rarely "sit on our table", and are extremely rich in bioactive substances and exhibit high antioxidant activity. These include: blackberry (*Rubus fruticosus* L.), honeysuckle berries edible (*Lonicera caerulea* L.), saskatoon berry (*Amalanchier alnifolia* Nutt.), quince (*Cydonia oblanga* Mill.), wild rose (*Rosa rugosa*), cornelian cherry (*Cornus* L.) and sea buckthorn (*Hippophaë rhamnoides* L.).

The great source of vitamin C, which strengthens our immune system and alleviates the effects of colds, are fruits of wild rose (1500 - 4000 mg/100 g), sea buckthorn (up to 1000 mg/100 g) and cornelian cherry (150 - 350 mg/100 g). In addition, sea buckthorn is rich in fats, primarily omega-7, carotenoids and phenolic compounds. Wild rose provides, in addition to vitamin, also a lot of carotenoids including lycopene and β-carotene. Cornelian cherry is also a good source of anthocyanins: glycosides of delphinidin and cyanidin.

If we want to provide anthocyanins in our diet, that have strong ability to scavenge free radicals, thereby reducing the symptoms of many serious diseases, such as cardiovascular diseases or even cancer, we should reach for blackberries, honeysuckle berries edible or saskatoon berry that are rich in these bioactive compounds. In addition, blackberries contain ellagitannins, saskatoon berries - carotenoids, and cornelian berries contain also, besides anthocyanins, other phenolic compounds including proanthocyanidins.

A recommendable species of fruit is the quince, which contains a large amount of proanthocyanidins with a high degree of polymerization, which are characterized by one of the highest values of antioxidant activity among flavonoids. While the essential oils derived from quinces are used in the treatment of upper respiratory tract infections.

This work was performed in the frame of multiannual programme "Actions to improve the competitiveness and innovation in the horticultural sector with regard to quality and food safety and environmental protection", WP1.4, financed by the Polish Ministry of Agriculture and Rural Development.

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PII-9. Effect of canolol (4-vinylsyringol) addition on bioactive compounds content in stored edible plant oils

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Introduction

Plant oils are a valuable ingredient in our diet, not only because of the high energy content of these products but first of all, they contain many bioactive compounds with proven beneficial effects on human health. For example, unsaturated fatty acids and phytosterols are associated with reduced risk of cardiovascular disease and cancer, as well as lowering the level of blood cholesterol (especially LDL fraction), carotenoids play a significant role in vision processes and prophylaxis of sight organs, are capable of scavenging singlet oxygen and free radicals, tocopherol compounds are intermediary in the transfer of electric impulses between cells, and affect the activity of various enzymes, squalene is a component indispensable for the synthesis of cholesterol, vitamin D, steroid hormones, and shows immunomodulating activity, while phenolic compounds have properties not only antioxidative but also anticarcinogenic and anti-inflammatory ones. The current literature data indicate that not only phenolic compounds, but also derivatives of phenolic acids are an important group of ingredients in plant foods. This group of compounds includes canolol (4-vinylsyringol), which is formed by the decarboxylation of sinapic acid and shows antioxidative properties stronger than these of well-known antioxidants like vitamin C, β-carotene, α-tocopherol or quercetin. Our previous study showed that canolol addition at a concentration of 20-80 mg/100 g to edible plant oils such as cold pressed rapeseed and flaxseed oils, rapeseed refined oil and extra virgin olive oil increased the durability of these products.

The aim of the study, materials and methods

The aim of this study was to investigate the effect of canolol addition on changes of bioactive compounds content in popular edible plant oils during storage.

The research material was commercial plant oils available on the Polish market: cold pressed rapeseed and linseed oils, refined rapeseed oil and extra virgin olive oil. The study was subjected the mixtures of this edible plant oils prepared by the addition of phenolic acid derivative – canolol (4-vinylsyringol) in amount of 20, 40, 80 mg/100 g. In order to show the differences in bioactive compounds content, fresh and stored (accelerated oxidation test in temperature of 110°C) oils were tested. All oil samples were determined for the composition and content of individual fatty acids, for contents of sterols and squalene (gas chromatography using GC-MS QP2010 PLUS (Shimadzu, Kyoto, Japan)), as well as for contents of tocols, carotenoids and phenolic compounds (HPLC technique using the Agilent Technologies 1200 HPLC system (Santa Clara, CA, USA)). Results obtained were subjected to a statistical analysis using STATISTICA v.12.5 software (StatSoft, Kraków, Poland).

Results and discussion

Analysis of data obtained during the research showed the protective properties of the phenolic derivative for bioactive compounds found in edible plant oils, which were largely dependent on the type of oil. The most effective action of canolol was observed with refined rapeseed oil and cold pressed flaxseed oil, while for extra virgin olive oil this action was the weakest (a drop in the total content of individual ingredients by up to 50% compared to fresh oil). Various canolol effects were observed in the mixtures with cold pressed rapeseed oil.

Canolol has slightly influence on changes in fatty acid composition, but noticeable differences can be seen with squalene contents. Additionally, this additive protects in particular such bioactive compounds as lutein (carotenoids), α-tocopherol (tocols), β-sitosterol and Δ5-avenasterol (sterols).

The presence of canolol in the stored oils caused, that the content of bioactive compounds was higher compared to oils without any additives. The content of sterols was higher by 33 (cold pressed rapeseed oil) - 41% (refined rapeseed oil), squalene by 17 (extra virgin olive oil) – 78% (cold pressed rapeseed oil), carotenoids by 9 (refined rapeseed oil) – 57% (cold pressed flaxseed oil), and in the case of tocols there was an increase up to 2% (refined rapeseed oil).

The addition of canolol was also a good way to enrich the product with phenolic compounds, whose contents in the oil mixtures was 7.20 mg/100 g for refined rapeseed oil, 14.99 mg/100 g for cold pressed flaxseed oil, 15.44 mg/100 g for cold pressed rapeseed oil and 17.55 mg/100 g for extra virgin olive oil.

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PII-10. Biologically active peptides derived from casein of different animal species - an in silico approach

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This work presents an in silico approach to compare the potential biological activity of peptides present in bovine, goat and sheep caseins, due to the fact that caseins are the major proteins of milk. The casein sequences have been acquired from the universal protein knowledgebase UniProt: (P02662, P18626, P04653, P02663, P33049, P04654, P02666, P33048, P11839, P02668, P02670, P02669), available at http://www.uniprot.org/uniprot [3]. The sequences were analyzed with the BIOPEP database available at http://www.uwm.edu.pl/ biochemia [1].
The aim of the study was to detect the differences in the profiles of potential biological activity of peptides of caseins derived from the above-mentioned three animal species. The profile of potential biological activity of protein is defined as the type and location of bioactive peptides in a protein chain.

Results
The four casein fractions namely: α_{S1}, α_{S2}, β and ϰ [2] contained in their sequences the fragments with 24 different bioactivities. The highest number of peptides representing 17 bioactivities were found in bovine β-casein. They were e.g. hypotensive, hypoglycemic, antiamnestic or antithrombotic. β-Caseins from bovine, sheep and goat contained 409, 351 and 347 biopeptides, respectively. The peptides derived from goat and sheep β-casein possessed 14 bioactivities. The bovine α_{S2}-casein was found to be the best precursor of antibacterial peptides (17) when compared with sheep and goat peptide profiles. Moreover, it was reported that some bioactive peptides present in all caseins possessed bitter taste.

Discussion
Casein is the major milk protein in all mammalians. The differences in the sequence of parent protein reflected the differences in profiles of their potential biological activity. For example, bovine β-casein sequence had two amino acid residues more comparing with sheep and goat β-caseins (224/222 amino acids, respectively). It affected the number of biopeptides found in caseins of all species i.e. bovine, sheep and goat (409, 351 and 347 biopeptides, respectively). However, caseins from all three species analyzed can be useful as a substrate to produce peptides helpful as lifestyle diseases preventive food components.

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PII-11. The antioxidant content of selected herbs from Mongolia

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Summary

Herbs and spices are very often used in nutrition and medicine. Nowadays, new plants are repeatedly explored to find biologically active compounds beneficial for health. Thus, we started to investigate several herbs from Mongolia.

This research reports antioxidant activities of selected medicinal herbs, collected in the northwest and alpine region in Mongolia. The free radical content: DPPH Troxol, phenol and flavonoid contents were analyzed.

It was determined that the amount of antioxidant in Thymus golicus, Cacalia hastate L and Gentianella azurea is higher and almost the same 0.9897, 0.9864 and 0.9874mg/ml respectively than Oxitropis glandulosa while the result of Oxitropis glandulosa is less than half of the above amount (0,4121mg/ml).

The highest result of total phenol content in the herbs belonged to Thymus golicus (1.19755 mg/ml). Meanwhile, Gentianella azurea and Oxitropis glandulosa were almost the same at 0.89910 and 0.84737 mg/ml. The lowest content of the antioxidant was determined in Cacalia hastate L at 0.67760 mg/ml.

The total flavonoid content in Oxitropis glandulosa was higher than in others analysed herbs (0.72995mg/ml). In comparison to this result, the lowest was 0.17284 mg/ml in Cacalia hastate L.

The effects of consumption of several wild herbs, the contents of their biologically active compounds, their quality, health adverse effects and pharmacological effects require further research.

PII-12. The discoloration potential of potato tubers depending on the content of organic acids and genetic conditions

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Acceptance of potatoes on the market by consumers is based not only on estimation of their taste value, but also on their colour and blackspot. The flesh of tubers in commercial varieties is usually white to yellow, which is directly affected by genetic and environmental factors.
Tuber darkening is caused directly by bioactive components, such as ascorbic acid and polyphenols, e.g. chlorogenic acid, caffeic acid, vanillic acid, p-coumaric acid, gallic acid and rutin, with chlorogenic acid accounting for approx. 90% of all phenolic compounds in tubers [Nara et al. 2006; Reddivari et al. 2007; Wang-Pruski & Nowak 2004]. Polyphenolic compounds can bring about negative qualitative changes in potato tubers in the form of enzymatic and non-enzymatic darkening: discolouration of raw tubers and their colour changing to brown when cooked. High susceptibility of tubers to darkening is a serious issue since it causes considerable loss in processing, preparation for consumption and storage.
The aim of the study was to assess the reaction of genotype and variable environmental conditions concerning the content of compounds which affect the process of enzymatic discoloration potential of potato tubers.
A three-year experiment was conducted with seven selected tetraploid potato clones and three established varieties. Organic and integrated cultivation was applied at four soil sites. The content of ascorbic acid [Abdelmageed et al. 1995] and susceptibility to blackspot [Dean et al.1993] was determined immediately after the potatoes were harvested. Subsequently, the material was lyophilised and the concentration of chlorogenic acid in it was determined [Griffiths et al. 1992]. The assay was performed with a Shimadzu UV-1800 UV-VIS spectrophotometer.
Regardless of the site and system of cultivation, the potato clones and cultivars under study can be classified as plants with low or medium susceptibility to darkening of raw tubers (AU_{474} – 0.199). Flesh tubers of the 'Satina' cv. was the most susceptible to darkening, which was similar to the new breeding lines (tetraploid clones, TG-97-403, 13-VIII-45, 13-VIII-49). Organic cultivation does not involve the application of easily available forms of nitrogen, as is the case in integrated cultivation, owing to which larger amounts of total polyphenols (chlorogenic acid) are produced in integrated cultivation. The result of this study has confirmed this relationship, because the content of chlorogenic acid was the lowest in organic production (212.5 mg kg^{-1} f. w.) and the highest was in integrated cultivation (332.8 mg kg^{-1} f. w.). The system of potato production had a significant effect on the content of ascorbic acid in potato tubers, which was 235.7 mg kg^{-1} f. w., and 191.8 mg kg^{-1} f. w. in the integrated system. The tubers susceptibility to discoloration potential at sites with an integrated cultivation system was 0.212, a 0.185 (Abs. 475) at sites where potatoes were grown in the organic system. These findings have shown that the system of potato cultivation affects the susceptibility to blackspot of tubers.

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PII-13. Micro and macroelements in fruits of lesser known species of orchard plants

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Demand for food of high nutrient density is growing as a result of increased consumer awareness about healthy eating patterns. The current level of consumption of fruit and vegetables in Poland does not provide the human body with sufficient quantity even of those ingredients for which these products are considered a good source of minerals such as magnesium, potassium or calcium. To meet the demand for potassium, copper, manganese, fruit and vegetable consumption, including processed ones, should be increased 2-3 times, up to the level that occurs in Greece or Italy. For this purpose, lesser-known species could be used in Poland to extend the market of fruits and processed products considering that some species such as wild rose (*Rosa rugosa*), sea buckthorn (*Hippophaë rhamnoides* L.), honeysuckle berries edible (*Lonicera caerulea* L.), cornelian cherry (*Cornus* L.), saskatoon berry (*Amalanchier alnifolia* Nutt.), blackberry (*Rubus fruticosus* L.) are a rich source of nutrients. Due to their health and nutritional qualities, they provide a well-balanced and varied diet. In addition, the results of our own research indicate that the fruits of some species are particularly rich in mineral elements, for example, rosehips in iron, while the blueberries in manganese.

On the other hand, it should be borne in mind that human activity causes pollution of the environment with harmful substances such as heavy metals, which in turn enter the food chain. The tendency of plants to accumulate heavy metals depends on the crop species or even cultivar. It is important to note that metals are not biodegradable, hence once introduced into the environment, they circulate constantly, although they may change their chemical form. Incorrect storage conditions of plant raw materials can lead to the conversion of nitrates (nitrates V) to nitrites (nitrates III). Nitrates III can contribute to the destruction of vitamins A and B, which results in the decreased nutritional value of the vegetables, fruit and processed products. Considering the above, in order to ensure adequate food safety, regulations and legal standards have been developed to define maximum levels of contamination. The necessity of constant monitoring of food products of plant origin is governed by applicable national and EU law.

To determine the nutritional value and functional properties of less known species of orchard plants it is necessary to determine not only bioactive substances such as phenolic compounds but also to investigate for the safety reasons, accumulation of heavy metals and nitrates contents.

This work was performed in the frame of multiannual programme “Actions to improve the competitiveness and innovation in the horticultural sector with regard to quality and food safety and environmental protection”, financed by the Polish Ministry of Agriculture and Rural Development.

PII-14. Characterization and quantitative analysis of phenolic compounds in *Cistus incanus* and *Cistus Crecitus* leaf aqueous extracts using UHPLC-DAD-ESI-HR-MS^n

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Cistus is a common plant and has been widely used in Mediterranean folk medicine as anti-inflammatory, antiulcerogenic, antimicrobial, cytotoxic and vasodilator remedies agents.[1] These biological activities are thought to be associated with the presence of phenolic compounds, such as flavonol glycosides based on quercetin, kaempferol and myricetin, as well as phenolic acids. Phytochemical composition depends on the cultivar, climatic and agronomic conditions, maturity stages, post-harvest management, and storage conditions. However, there is still a great lack of comprehensive profiling of the bioactive compounds in various *Cistus* cultivars.[2,3,4]

Thus, the aim of this work was to obtain a comprehensive characterization of the phenolic composition of *Cistus incanus* and *Cistus Crecitus* leaf aqueous extracts, using ultrahigh-performance liquid chromatography combined with a diode array detection ((UHPLC-DAD) system and electrospray ionization high-resolution mass spectrometry (UHPLC-ESI-HR-MS).

The phytochemical analysis of *Cistus* leaf aqueous extracts showed the presence of a wide variety of phenolic compounds from different subclasses. Ellagitannins (punicalin, punicalagin and punicalagin gallate isomers), proanthocyanidins (gallocatechin, gallocatechin-(4α-8)-catechin), flavonol glycosides (including derivatives of quercetin, myricitrin and kaempferol), phenolic acids and O-glycosylated phenolic acids (hydroxyferuloyl-rhamnose isomers) were identified and quantified in two different *Cistus* species. Phenolic compounds such as phenolic acids, flavonoids, and ellagitannins, had previously been reported in *Cistus* infusions but more isomers were found in our study. The results revealed that *Cistus incanus* leaf aqueous extracts had higher ellagitannins and flavonol glycosides contents than *Cistus Crecitus* infusions. These compositional differences could influence the bioactivity of *Cistus* leaf aqueous extracts. These findings contribute to a better understanding of *Cistus* being considered as a natural medicine.

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PII-15. The influence of botanical and geographical origin of honey on its physicochemical anf functional properties

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Honey is a natural substance, with a sweet taste and a thick consistency, produced by bees of the species *Apis mellifera.* It consists of a complex mixture of carbohydrates, water, and a small amount of proteins, vitamins, minerals, and phenolic compounds. Used by the millennia as both food and medicine, honey improves the antioxidant capacity of products, cholesterol and glycemic index, modulation of the immune system, and has shown an antibacterial effect. Due to the high nutritional value and unique taste, honey becomes more and more acceptable to consumers and is often used as a substitute for other sweeteners [1]. Due to its antioxidant properties, it has gained a reputation as a functional ingredient and is acquired practically in every country in the world. Currently, honey is used as a dietary supplement with medicinal properties, valued all over the world. This has led to its use in the treatment of many diseases. However, it should not be treated as a medicine, but rather as a potential dietary supplement [1].

Bee honey, which is obtained according to all beekeeping principles, is distinguished by its high quality. It is a biologically active product that exhibits valuable nutritional and therapeutic properties [2].

The aim of the research was to determine the influence of botanical and geographical origin on the formation of antioxidant properties and selected physicochemical properties of honey such as water activity, acidity, and color.

The research material was varietal honey originating from different regions of cultivation of the plant material from which the honey was obtained, i.e. acacia and multifloral honey coming from Poland, Bulgaria, and China.

The analyses performed on honey samples included determination of the antioxidant properties using DPPH radical [3] and Folin-Ciocialteau method, an indirect method determining the total number of polyphenols [4]. Selected physicochemical properties, i.e. water activity, acidity, and color were also determined.

The results of the study indicate that analyzed honey samples were characterized by a very different total polyphenol content. Taking into account the aspect of botanical origin, the content of polyphenols in the tested honey was in the range of 9.97 mg GAE /100 g to 79.32 mg GAE/100 g for acacia honey and in the range of 62.31mg GAE/100 g to 253.37 mg GAE /100 g for multifloral honey. Meanwhile, given the geographical origin of honey, within the acacia honey, the highest content of polyphenols was characterized by the sample collected in Poland – 79.32 mg GAE /100 g, while the lowest was determined for Chinese honey – 9.97 mg GAE /100 g. In case of multifloral honey, Bulgarian one was characterized by the highest content of polyphenols (253.37mg GAE /100 g), while Polish honey contained the lowest amount of these compounds (62.41mg GAE /100 g). Studies concerning the antioxidant properties of honey expressed as DPPH radical scavenging ability have shown that the multifloral honey samples were characterized by better properties than acacia honey. The IC_{50} value, meaning the amount of the sample needed to inhibit radical activity in 50%, was on average 26% lower for the former. Taking into account the influence of the geographical origin, Bulgarian honey, both acacia and multifloral, was characterized by the best antioxidant properties. The comparative analysis of total polyphenol content in honey samples, their antioxidant properties, and colour, have shown that multifloral honey, which is darker (L*value reaching on average of 44.74), was characterized by a higher content of total polyphenols and better antioxidant properties than acacia honey (L*=54.93), regardless of their geographical origin.

Based on the results of the conducted research, it may be concluded that the botanical origin of honey has a significant influence on the formation of their physicochemical and functional properties. Slightly smaller differences were observed taking into account the geographical origin, however again, the most valuable in this respect is honey collected in Bulgaria.

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PII-16. The impact of combined pretreatment methods on bioactive compounds content in dehydrated cranberry

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Keywords: cranberry, polyphenols, anthocyanins, flavonoids

In food industry cranberry fruits are a valued raw material thanks to richness of bioactive compounds contained therein. Cranberry can prove to be difficult to process due to its peel, and it requires sugar addition so that a cranberry taste can be acceptable by consumers. A fresh cranberry is an extremely sour fruit hence it cannot be consumed directly. Therefore, it becomes legitimate to develop new methods of cranberry treatment and processing which would result in obtaining a product fully accepted by consumers. The research was aimed at investigating the influence of combined pre-treatment methods, with the use of reduced pressure and ultrasounds, on chemical properties' change in dehydrated fruits of swamp cranberry (*Vaccinium oxycoccus*).

The pre-treatment was conducted with the use of blanching (at a temperature of 90°C for 5 minutes), lowered pressure (300 mmHg) and ultrasounds (at frequency of 21 kHz and power of 180 W) in multiple combinations: a) a blanched material placed in osmotic solution and the pressure was lowered three times in 10 minutes' intervals, b) a blanched material placed in osmotic solution and treated with lowered pressure for 10 minutes, and then treated with ultrasounds for 20 minutes, c) a blanched material placed in osmotic solution and treated with ultrasounds for 20 minutes, and then treated with lowered pressure for 10 minutes. Two osmotic solutions were used: 61,5% sucrose solution and 30% sucrose solution with addition of 0,1% steviol glycosides. The pre-treatment was performed for 30 minutes, and then osmotic dehydration was held for 72 hours. After osmotic dehydration an overall acidity, total polyphenolic, total anthocyanins and total flavonoids content were determined in the obtained product.

The use of pre-treatment of cranberry fruits resulted in reduction of both overall acidity, and active compounds' content such as polyphenols, anthocyanins and flavonoids, which was due to cranberry components being transited to the solution. During the treatment a depletion of polyphenols content by 8,6-39,2% anthocyanins content by 23,2-35,2% and flavonoids content by 20,1-34,5% were observed when compared with a reference sample (BL). In this case the major changes in bioactive properties occurred in consequence of using 61,5% sucrose solution. It should be noted that the greatest changes were reported in fruits treated with blanching and ultrasounds for 20 minutes, and subsequently treated with lowered pressure.

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PII-17. The influence of total phenolic content on sensory profiles of extracts from freeze-dried black chokeberry and black currant fruits and pomaces

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Berries are considered to have significant health benefits due to their nutritional properties, particularly antioxidant activity against cellular oxidation reactions. Unfortunately, high amounts of biological active plant-based compounds such as phenols and polyphenols, flavonoids, isoflavones result in unfavourable sensory profiles of some berries as those substances are bitter, acrid or astringent. Black chokeberry (*Aronia melanocarpa E.*) and black currant (*Ribes nigrum*) are rarely consumed as fresh fruits because of their sour and incisive taste and therefore are aversive to the consumers. Because of high health-promoting properties of black chokeberries and black currants it seems crucial to use those fruits, their pomaces or extracts as additives in new food products but sensory factors and consumers' preferences need to be taken into account.

The aim of the study was to investigate the sensory profiles of freeze-dried black chokeberry and black currant fruits and pomaces and evaluate correlation between the sensory attributes and total phenolic content of their samples. The freeze-drying of fruits and pomaces was chosen as an optimal method of processing samples because of its positive influence on preserving high content of bioactive compounds and sustaining analysed characteristics in comparison with fresh fruits [1].

The 2% water extracts were prepared in order to conduct the sensory analysis by 10 sensory experts. The Quantitative Descriptive Analysis (QDA) [2] method was used. The intensity of the following attributes chosen by the consensus: colour, clearness, fruity aroma, off-odour as well as sweet, sour, bitter, astringent, fruity and off-taste was evaluated on 5-point scale. In addition, all four samples were subjected to the general evaluation. Total phenolic content was determined in 80% ethanolic extracts by Folin-Ciocalteu spectrophotometric method [3] with some modifications.

Analysis of the results obtained by QDA method indicated than extracts from pomaces were more intense in colour than fruits extracts. The extract from black currant pomace showed higher astringency than the extract from black chokeberry pomace. All extracts had low intensity of off-odour, bitter and off-taste that were statistically insignificant. In case of the general evaluation, the highest overall quality exhibited black chokeberry fruit extract, while the lowest – black chokeberry pomace extract. The highest total phenolic content was found in black chokeberry pomace extract which was twofold higher than in black currant pomace extract. The undertaken study allowed to find some correlation between sensory attributes and total phenolic content of analysed fruits and pomaces.

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PII-18. Accumulation of selected phytochemicals in wheat grain in relation to organic, integrated and intensive cropping system

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Cereal products are still basis of the human diet all over the world. Currently, about 95% of the wheat grown worldwide is a hexaploid species (*Triticum aestivum*), with most of the remaining 5% being tetraploid wheat (*T. durum*) (Shewry 2009). However, a return to the cultivation of ancient (primitive) species, such as einkorn (*T. monococcum* var. *monococcum*), emmer (*T. turgidum* var. *dicoccum*) and spelt (*T. aestivum* var. *spelta*) has been observed (Shewry and Hey 2015). Despite their limited availability, there is a growing interest among consumers in food produced from above mentioned wheat species (Ziegler et al. 2016).

The aim of the study was to compare the content and composition of selected low molecular phytochemicals (sterols, tocols, carotenoids, phenolic acids and alkylresorcinols) in the grain. The research material constituted of four wheat cultivars (bread, durum, spelt and einkorn), cultivated under three cultivation regimes (organic, integrated and intensive).

It has been found that the used wheat genotypes were highly variable in the content and composition of studied phytochemicals. The most abundant with these compounds was grain of einkorn, while the least abundant was grain of bread wheat. Among the used genotypes, einkorn grain was the most abundant in phenolic acids, sterols and carotenoids, while spelt was the most abundant in tocols and alkylresorcinols. Organic cultivation favoured the accumulation of most phytochemicals, but this effect was highly cultivar-dependent.

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PII-19. Biologically active compounds and allergens content in chosen *Apiaceae* spices derived from organic and conventional cultivations

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The aim was to investigate the impact of environmental conditions on the allergenic and antioxidant potential of spices from the *Apiaceae* family. As environmental influence was considered ecological or conventional way of cultivation. The content of polyphenols, flavonoids and antioxidant capacity by FRAP and DPPH assay were determined in ecological and conventional spice samples. The content of biologically active compounds was significantly higher in spices derived from organic farming. Simultaneously, the allergenicity of spice samples derived from conventional and ecological cultivations was tested using indirect ELISA assay with antibodies against Bet v 1, LTP and profilin. Panallergens content in spices derived from organic cultivation was in many cases higher compared to conventional spice samples. In response to the serum of patients allergic to spices from *Apiaceae* family, the highest immunoreactivity was found in ecological parsley, the smallest - in conventional dill. The results showed that the content of allergenic proteins and antioxidants in spices varies depending on the method of cultivation.

PII-20. Influence of heavy metal ions on *Petroselinum crispum* and *Coriandrum sativum*

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The aim of this study was to investigate the impact of different concentrations of selected heavy metals – mercury, nickel, copper and zinc on the allergenic and antioxidant potential of spice plants from the *Apiaceae* family such as parsley (*Petroselinum crispum*) and coriander (*Coriandrum sativum*). The effect of metal ions on factors, such as growth and morphology were also investigated. The collected plants were subjected to biometric measurements and then the results were analyzed statistically. Inhibitory effects on plant growth have been reported in response to most heavy metals. Contamination with metal ions usually reduced the total length of the plant, except for copper, which stimulated plant growth. In the case of copper, the length of the root, shoot, and the distance to the node also have been increased. Additionally, parsley and coriander extracts were examined for polyphenols and flavonoids content and antioxidant activity using DPPH and FRAP method. It was demonstrated, that the lowest applied concentrations of heavy metals led to the increased antioxidants content, which then decreased with increasing metal concentrations. It was also tested the allergenic potential of plant samples by ELISA assay with antibodies against Bet v 1, LTP and profilin allergen. The results showed that the Bet v 1 and LTP content was higher for plants grown on the soil contaminated with heavy metals compared to controls, while profilin content varied depending on the type and concentration of metal ions applied to the soil. The results showed that soil contamination by metal ions affects the content of allergenic proteins and antioxidants in the spice plant

PII-21. Antioxidant efficacy of thyme extracts obtained by solvents with various polarity

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The fatty acids of the omega-3 and omega-6 family, which are included in EFA groups and referred to as vitamin F, are considered the most valuable components of bio-oils. Unfortunately, bio-oils with the high content of polyunsaturated fatty acids undergo rapid oxidation. Their susceptibility to oxidation is correlated with the share of the individual unsaturated acids and the degree of unsaturation [Czaplicki et al. 2016]. Studies carried by Czaplicki et al. (2016) and Tańska et al. (2016) have shown that the induction time for most of the bio-oils is 4 to 5 times shorter than for rapeseed oils and that it does not exceed 2-3 hours at 110^{o}C. The bioactive compounds found in these oils, i.e. tocopherols, carotenoids or squalene, do not provide a sufficient protective barrier. The inclusion of antioxidants is the simplest and most cost-efficient method for inhibiting the oxidation processes. Use of synthetic antioxidants (such as BHA, BHT) to maintain the quality food products has become common place. But consumer concern regarding their safety has motivated the food industry to seek natural alternatives [Brewer 2011].

Plant extracts, generally used for their flavoring characteristics, often have strong H-donating activity thus making them extremely effective antioxidants. This antioxidant activity is most often due to phenolic acids, phenolic diterpenes, flavonoids and volatile oils. Antioxidant components of herbs and spices may be removed as extracts, essential oils, or resins. Extracts are soluble fractions that can be removed from plant materials by solubilizing the component(s) of interest in an aqueous, lipid, alcohol, solvent, or supercritical CO2 phase then removing it [Brewer 2011].

The main aim of the study was to compare of antioxidant efficacy of extracts prepared from dried thyme herb used to stabilize a cold pressed linseed oil. Thyme extracts were prepared using solvents of different polarity: water, methanol (60%, 80%, 100%), isopropanol, acetone and hexane. Extracts before being added to the oil were stripped of solvent to eliminate its possible effect on oil stability. All extracts have been found to prolong the induction time of linseed oil, but the compounds extracted from thyme with water, 60% methanol and acetone have been found to be less effective in inhibiting oxidative processes (only about 5% increase in induction time), while isopropanol extract prolonged induction time by approx 20%.

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PII-22. The content of polyphenols and flavonoids in Ceylon and Turkish black teas

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Tea is one of the most popular drink around the World. Polyphenols and flavonoids are nutritionally important components contained in teas. These ingredients are of antioxidative activity and other health promoting properties e.g. non-steroidal, anti-inflammatory, antibacterial [1,2,3,4,5,6]. The strength of antioxidative activity of phenolic compounds depends on the chemical structure, amount present and oxidation status [7]. The amount of polyphenols and flavonoids in commercially available teas varies mainly due to tea variety and the method of they manufacturing [8].

The aim of current study was to compare the content of polyphenols and flavonoids in black teas cultivated in different regions i.e. Turkey and Ceylon, flavored with bergamot and non-flavored, available on polish commercial market.

Sixteen tea variates were studied. The Folin-Ciocalteu method was used to determine the content of polyphenols, while flavonoids content was measured according to the method provided in Polish Pharmacopoeia. IR spectra of analyzed teas was registered in the spectral range 4000–400 cm^{-1} using FT-IR spectrometer System 2000 (Perkin Elmer) with the DTGS (deuterated triglycine sulphate) detector. Statistical model was developed with the use of TQ Analyst software.

The content of polyphenols and flavonoids varied significantly depend on tea variety. Turkish teas were of the highest content of polyphenols and flavonoids. The differences might depend on tea leaf size. As Turkish teas were better fragmented extraction process was more effective. Discriminant model to distinguish Turkish from Ceylon teas was developed. All samples studied were properly classified to one of two homogenous groups.

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PII-23. Content of bioactive compounds in buckwheat herbs

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Common buckwheat, also called *Fagopyrum esculentum Moench*, belongs to the Polygonaceae family. It has been cultivated for centuries, but only in recent years has interest in this raw material increased. After a period of limited cultivation of buckwheat, its pro-health properties were appreciated. Buckwheat in some countries such as China, Japan, and Poland is recognized as a valuable source of so-called "functional food". Buckwheat seeds contain proteins with high biological value as well as bioactive compounds, mainly polyphenols. Health benefits attributed to buckwheat include plasma cholesterol level reduction, neuroprotection, anticancer, anti-inflammatory, antidiabetic effects, and improvement of hypertension conditions. Buckwheat is a multi-use plant. Seeds are used to produce groats, flour, pasta and bread. Buckwheat flowers are very fragrant and are attractive to bees that use them to produce a special, strongly flavored, dark honey. In China, leaves and flowers of buckwheat are also used in traditional medicine. The use of fresh buckwheat is not common in Europe, whereas in Asia the young herb is extensively used as a vegetable, and green leaf flour is used as an additive or a natural food coloring. Food producers utilize buckwheat herbs for tea production, which decreases cholesterol and glucose level in the blood. Among fruits, vegetables and grain crops and grapes, buckwheat are the most important rutin containing foods. No rutin was found in cereals and pseudocereals except buckwheat. However, the concentrations of bioactive compounds widely fluctuate among cultivars, environmental conditions, storage and postharvest treatments which may affect plant quality and health beneficial compounds.

The objective of this study was to investigate the content of bioactive compounds in buckwheat herbs. Material for this study were buckwheat leaves and flowers samples collected from cultivations localized in Poland (Lubelskie region) produced in the 2017. Two buckwheat varieties were used for the analyzes Kora and Luba. Leaves were dried using a laboratory dryer at room temperature (20°), 40° and 150°. For the content of the bioactive compounds the UPLC-MS method was performed.

In total, 15 different bioactive compounds in buckwheat flowers and in leaves were found. Among them the most important were rutin, quercetin and chlorogenic acid. The highest content of rutin showed the leaves dried at 20°C (1487,01 mg/100g) and 40°C (1530,48 mg/100g). Variety and conditions of cultivation also affected the content of the compounds in the plant. The highest content of the rutin was the Kora variety (1487.01 mg/kg). Investigation of bioactive compounds content in flowers were performed only at 20°C. In flowers rutin content were found as 50% of all bioactive determined compounds before catechin and chlorogenic acid, 27% and 9 % respectively. It has been shown that buckwheat herb (leaves and flowers) is a rich source of bioactive compounds.

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PII-24. Influence of high hydrostatics pressure and cold plasma on vitamin C and phenolic compounds in cucumber juice in comparison to thermal pasteurization

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In recent years there has been an increasing interest in non-thermal methods of food preservation, such as high hydrostatic pressure (HHP), cold plasma, high pressure homogenization (HPH) or pulsed electric field (PEF). Current research proof that those novel techniques are useful for increasing the shelf-life of fruit and vegetable products while keeping higher quality through high retention of bioactive compounds. Additionally, non thermal treatment does not cause significant sensory changes. HHP is already used on the industrial scale for preserving fruit, vegetable, dairy and meat products. Non-thermal plasma is most commonly used for the decontamination of food packaging materials and the surface of food products and could be used for juice preservation as a new method [3].

The aim of this study was to determine the influence of HHP and cold argon plasma (CP) on vitamin C and total content of polyphenols in cucumber juice in comparison to traditional thermal pasteurization (TP).

Fresh cucumbers were purchased at Warsaw fruit-vegetable street market. Cucumbers were washed, squeezed (DA-1200, Oscar) and preserved by:

- HHP (pressure 500 MPa; time 5 min; temperature 22°C±2°C);
- CP (1 min; temperature 22°C±2°C);
- TP (15 min; temperature 85°C±2°C).

Preserved cucumber juice was analyzed immediately after process and during 3 months of storage (at 1 month periods) at 4°C, whereas a control sample (CS) was fresh untreated juice. Content of vitamin C was determined by microfluorometric method [1], whereas the total content of polyphenols was determined spectrophotometrically using Folin-Ciocalteu reagent [2].

The total polyphenol content in CS was as high as 14.0 mg gallic acid equivalent in 100 mL. HHP treatment resulted in insignificant changes of polyphenols after pressurization and 3 months of storage. Significantly lower content of polyphenols was noted for sample treated by CP, whereas during storage the content of these compounds significantly increased above the level noted for juice directly after processing. Increase of polyphenols could be caused by structural changes of higher polyphenols into lower molecular weight compounds with higher affinity to Folin-Ciocolteu reagent. TP caused almost 60% degradation of polyphenols, whereas storage time did not contribute on the further degradation.

Vitamin C content in CS was 5.8 mg/100 mL. Each preservation method used in this study caused significant degradation of vitamin C. The highest content of vitamin C was noted in HHP-treated (2.2 mg/100 mL) and CP-treated (1.4 mg/100 mL) cucumber juice, whereas TP caused total degradation of vitamin C. After the first month of storage no vitamin C was noted in all storage juices.

Obtained results confirm that HPP and CP methods could be used for increase the shelf-life of cucumber juice with higher retention of phenolic compounds and vitamin C compared to thermal pasteurization. However, long storage time caused considerable degradation of bioactive compounds, especially of vitamin C.

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PII-25. Analysis of the selected bioactive compounds in ice cream supplemented with microalgae (*Arthrospira platensis*) extract

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The research is aimed at evidencing that ice-cream formulations incorporating algae can have health-benefiting effects on human body. The main task of the project is to design ice-cream product line that distinguish itself from regular ice-cream by increased anti-oxidant activity resulted from inclusion of the algae extract. The currently known research evidences that ice-cream can be effective as carriers of health-promoting probiotic bacteria, which in turn encourages also application of other microorganisms in particular algae of specific strains (e.g. *Spirulina platensis*) as a supplement to ice-cream. In submitted research, the level of polyphenols and antioxidant activity expressed as degree of inhibiting generation of cationo-free radical from DPPH•+ solution were analyzed. Preliminary results based on antioxidative activity tests measured with potential to quench free radicals have shown that ice-cream formulations enriched with algae extract exhibit significantly higher potential achieving inhibition level of 39.7% in the mint ice cream samples as compared to 32.8% inhibition for the control sample without algae. Futhermore, each of the examined samples (dairy, pistachio, mint) ice creams versions supplemented with *Spirulina* were characterized by enhanced antioxidant activities expressed as potential to quench free radicals and the carotenoids content.

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PII-26. Physicochemical properties of elderberry powers

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The anthocyanins presented in elderberry are important for the beneficial health effects associated with their antioxidant properties and also as a popular source of food colorants [1, 2]. However, the use of this colorant in food products may face some problems due to their stability loss during storage. To overcome these problems and improve the bioactive compounds stability, encapsulation technologies can be applied, such as spray drying. The spray drying process produces a good quality final product with low water activity and reduced weight, resulting in easier transportation and storage.

The aim of the work was to characterize the physicochemical properties of spray-dried elderberry juices with the potential use as food colorants or functional ingredients.

Maltodextrin, gum acacia, inulin, and trehalose were used as carriers in the spray-dried experiment. All carriers were added at the total juice solids to wall materials ratio 2:1 and 1:1 (weight basis). Elderberry juices were spray dried using a semi-industrial spray drier LAB S1. The operational conditions of the drying process were: inlet air temperature of 160ºC, spray disk speed of 39000 rpm, raw material flux rate of $0.5 \cdot 10^{-6}$ $m^3 \cdot s^{-1}$.

The mean of particle size of elderberry powders ranged from 15 to 23 μm. The high solubility obtained in all the powders is a promising result regarding the application of these powders. The sorption isotherms for elderberry powders indicated that the sample were stable up to water activity less than 0.65. The darkness of the powder, expressed by the L* value, was increased with increase of the carriers concentration. The obtained elderberry powders are good source of colorants, which it can be used successfully as an ingredient for food production.

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PII-27. The stability of anthocyanin pigments during production and storage of fruit beverages with addition of sweet whey

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Fruit beverages with addition of sweet whey are characterized by high nutritional value resulting from polyphenol and vitamin C content derived from fruits, and proteins and amino acids content derived from milk. Low stability of anthocyanins is causing a serious problem during production and storage of fruit beverages with addition of dairy products. The aim of this study was to determinate the influence of whey addition on anthocyanins stability during production and storage of fruit beverages.

Two types of strawberry, raspberry and highbush blueberry beverages were prepared. Beverages formulated with red fruit juice (40%), apples juice (30% or 60%) and sweet whey (30%) were pasteurized (90 °C for 10 min.) and stored in the dark at 22±1°C during 7 months. *The physicochemical analysis and anthocyanins content* were determined directly after the production of beverages and after 1, 2, 3, 5, 7 months of storage. The anthocyanins content in beverages were analyzed using high-performance liquid chromatography. The pH was measured with a digital pH-meter at 20 °C. Total acidity was determined by potentiometric titration with NaOH 0.1 N to pH 8.2. Color was measured on beverages using a Konica Minolta colorimeter model CM-3600d.

Beverages with addition of whey presented a higher pH value and lower titratable acidity than beverages produced from apple and red fruit juices. The results obtained demonstrated that the addition of sweet whey accelerates the thermal degradation of fruit anthocyanins during pasteurization step. Directly after production the anthocyanin contents in beverages without whey were 10-38% higher than in beverages with addition of sweet whey. The difference can be related to the higher pH of beverages with whey or/and presence of protein, which might bind to anthocyanins [Wallace & Giusti, 2008; Oliveira et al., 2015].

Anthocyanin content in beverages showed a significant decrease during storage, especially for the first 3 months. The anthocyanin content in beverages was more affected by storage time than by addition of sweet whey. Linear regression analysis confirmed that degradation of anthocyanins during storage of beverages followed first–order reaction kinetics. The half-life of anthocyanin in beverages with sweet whey was higher than the $T_{1/2}$ of the fruit beverages without addition of sweet whey and, consequently, the rate of degradation of the beverages without sweet whey was higher. A decrease in anthocyanin concentration in beverages without addition of sweet whey can be related to the polymerization reaction. Comparing the rate of anthocyanins degradation during storage of beverages obtained from different species of red fruit, it was found that there are considerable differences. The highest stability has anthocyanins contained in highbush blueberry beverages. The differences in main aglycon of different fruit (malvidin in blueberry vs. pelargonidin and cyanidin in strawberry and raspberry) might account for the improved stability showed by blueberry anthocyanins [Giovanelli and Buratti 2009; Verbeyst et al. 2012].

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PII-28. The biological activity of honeydew honey produced in the podkarpacie region

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Honey is recognized as having different biological properties, including antioxidant effects. The components responsible for its redox properties are phenolic acids, flavonoids, vitamins, and enzymes, as well as a small amount of mineral content, particularly Cu and Fe (da Silva, et al, 2016). In addition to the high antioxidant activity, honey also possesses antibacterial, analgesic, anti-inflammatory and renewing properties (Alvarez-Suarez et al., 2014). There are many varieties of honeys and generally, they are divided into three groups: nectar, honeydew and nectar-honeydew honeys. Southeastern Poland is at the forefront of honey producers in this country and coniferous honeydew honey is specific for this region. The Podkarpacki honeydew honey since 2010 has a European label 'Protected Designation of Origin', which means that right to its production has only beekeepers producing honey in conifer forest in Podkarpackie voivodeship.

The aim of the study was to determine the biological activity of honeydew honey produced in the Podkarpacie region and to compare it with local nectar honey.

Fifty samples of varietal honeys including honeydew (n=20), multifloral (n=20) and buckwheat (n=10) have been studied. Antioxidant activity of honey samples was determined by PCL method using the Photochem (Jena, Germany) device, test were performed in 2 versions; determining the water (ACW) and fat (ACL) soluble antioxidant fractions. As a reference methods standard DPPH, FRAP and TPC tests were applied. Enzymatic activities were determined using synthetic substrates (Sigma Aldrich, USA) for N-acetyl-β-glucosidase (NAG), β-galactosidase (β-GAL), α-mannosidase (α-MAN), β-mannosidase (β-MAN), α-glucosidase (α-GLU), and acid phosphatase. . Determination of the diastatic activity of honey was performed using Phadebas Honey Diastase Test (Magle AB, Sweden). The concentrations of 8 elements (K, Ca, Mg, Mn, Zn, Fe, Cu, Se) were determined by optical emission spectrometry with inductively-induced plasma (ICP-OES) using a Thermo iCAP 6500 spectrophotometer (Thermo Fisher Scientific Inc., USA).

The antioxidant activity of honeydew honey was lower than for buckwheat honey and higher than for multifloral honey regardless of the analytical method. For PCL-ACW method antioxidant power amounted 19.75±6.27, 24.05±3.02 and 16.82±6.07 mmol AA/kg for honeydew, buckwheat and multifloral honey, respectively The diastatic activity was also the highest for buckwheat honey and reached 37.22±6.18 DN, while in honeydew honey 28.55±13.03 DN. Among three honey types studied, honeydew honey was the most abundant in minerals as K, Cu, Fe, K and Mg, The concentration of K in honeydew honey was 2504.74 mg/kg while for buckwheat and multifloral honeys it was 616.60 and 1020.81±756.02 mg/kg, respectively. Both, honeydew honey and buckwheat are classified as dark honeys considered to have better properties than honey. Studies have confirmed that honeydew honey has a higher antioxidant activity than the most commonly used multifloral honey and slightly lower than buckwheat honey. However, high antioxidant activity of the Podkarpacki honeydew honey compared to multifloral honey indicates the relationship between the biological activity of honey and its chemical composition.

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PII-29. Influence of growing conditions on the content of biologically active compounds in tomato purée

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Tomatoes are a source of many biologically-active substances such as lycopene, polyphenols, as well as nutrients like carbohydrates, vitamin C or minerals. Studies presented in literature and related to the influence of the growing system on bioactive substance contents are contradictory. For instance, some of them show higher lycopene levels in tomatoes from conventional cultivation (1), while others - from organic system. These studies rarely include the effect of cultivation system on the quality of processed products and changes occurring during their storage. Therefore, the aim of the paper was to investigate the tomato growing method on chemical composition of tomato purée directly after liquidizing, pasteurization, and storage.

The study material consisted of raspberry tomato (Faworyt cv.) originated from three plantations localized in the same district of Mazovian province. Farm A used natural partridge and pigeon manure for soil fertilization, and tomatoes were treated with the liquid nettle manure once a week. Farm B applied bovine manure to fertilize the soil, and Miedzian 50 WP was used once when potato blight symptoms appeared. Farm C used mineral fertilizer Planta and made 4 protective sprayings during vegetation period as a soil fertilizer. Tomatoes were processed to produce the purée with subsequent pasteurization processing (100 °C, 15 min). Hot purée was poured to jars and stored for 3 months. The purée was subject to lycopene determination by means of spectrophotometric technique, vitamin C – by microfluorimetry, total polyphenols – Folin method, and potassium content – flame photometry.

Non-pasteurized tomato purée from cultivation A contained more lycopene (121.4 mg/100 g DM) and total polyphenols (1.03 g GAE/100 g DM) than purées from farms B and C, that contained 91.6 and 80.8 mg/100 g DM lycopene as well as 0.86 and 0.76 g GAE/100 g DM total polyphenols, respectively. Potassium content was the highest, while vitamin C the lowest in tomato purée from cultivations A and C, which amounted respectively to 4.4 g/100 g DM and about 270 mg/100 g DM. Pasteurization process did not significantly affect the levels of lycopene, potassium, and polyphenols, whereas it contributed to considerable decrease in vitamin C content in all purées. After 3-month storage, tomato purée from farm A contained the highest amount of lycopene (120.7 mg/100 g DM), polyphenols (0.81 g/100 g DM), while the lowest – vitamin C (11.7 mg/100 g DM).

Growing conditions had remarkable influence on the contents of bioactive substances in purées. Tomato purée from organic cultivation (A) – fresh, pasteurized and stored – contained the highest amounts of lycopene, total polyphenols, but exhibited the lowest content of vitamin C.

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PII-30. Influence of cocoa bean roasting on the content of phenolics in chocolates

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Chocolate is one of the most popular and most frequently bought confectionery products. It is obtained from cocoa beans in a multistage process. The individual processing steps, with the proper parameters, shape the physical and sensory properties of the finished product. The features of chocolate depend on the type of beans and, in fact, on their mixtures, which properties are determined by the region of origin, variety, and cultivation conditions. All the desired properties of chocolate are shaped at each stage of processing. Roasting is one of the main processes that affect the quality of chocolate.

Apart from the qualities of chocolate (gloss, breakthrough, melting in the mouth but not in fingers), cocoa bean products are also valuable sources of natural antioxidants that occur among non-fat ingredients of cocoa beans. Their content is determined by type (species) of beans, crop conditions, as well as the parameters used during processing, including high temperature and time of its operation, oxygen availability, and the degree of fragmentation.

The aim of the study was to analyse the content of antioxidant compounds and minerals in cocoa beans, cocoa paste and chocolates obtained from roasted and unroasted cocoa beans. Total polyphenol contents with Folin-Ciocalteu reagent, the ability to deactivate DPPH radicals and the content of minerals (potassium, phosphorus, magnesium, iron and sodium) by high performance liquid chromatography with UV-VIS detector.

Polyphenol content in chocolates was significantly higher than in beans from which they were produced. Furthermore, roasted beans were characterized by higher polyphenols than unroasted grains. The ability to scavenge free radicals remained at a high level in both chocolates and beans. This ability was diminished after the roasting of cocoa beans and after the entire chocolate production process with respect to the beans of origin.

The content of minerals in the final product was significantly lower than that of the raw material. This could be due to the composition of additives in chocolate production. On the other hand, most unroasted beans were characterised by higher content of minerals than roasted ones. The purification process of the cocoa bean husk could have resulted in a decrease of mineral contents in chocolates.

Based on the conducted studies, the effect of the type of cocoa beans and the technological process on the properties of the obtained chocolates was shown. The cocoa roasting process had an effect on both polyphenol content and mineral concentration of the product.

PII-31. Health-promoting properties of selected new generation food products

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At present, vegetables have ceased to be perceived only as a source of nutrients. Their other values, primarily related to the content of natural antioxidants, have also become important. Consumer interest has increased, not only in functional food obtained from the eco-friendly raw materials, but also in functional food. Consumers expect that by eating fresh and processed vegetables they will not only be able to control their body weight, but also support their body in preventing and even treating some diseases (Shahriari et al. 2013). Additionally, the changing lifestyle of consumers has brought about a change in their expectations towards the market offer and resulted in a search for convenient food with high nutritional values. This approach can be seen in the search for processed vegetable products, mainly in the form of snacks. However, processing and storage processes are based on varied compression parameters (pressure/time/temperature), which result in a loss of health-promoting components (antioxidants).

Research was undertaken to evaluate the antioxidant activity and the content of bio-active compounds in fruit and vegetable chips. The study involved examination of pineapple, red beet, apple, carrot, tomato and sunchoke chips. Chips were obtained by innovative drying technology (less than 40°C), without preservatives or flavour enhancers available in the market. Processing by drying at low temperature makes it possible to obtain food products with quality levels close to the original raw material. The study involved determination of the plant pigment content: total carotenoids, total chlorophyll (chlorophyll a and b), betalains (betacyanins and betaxanthins) and antioxidant activity (FRAP). All assays were performed spectrophotometrically, with the use of SHIMADZU UV-1800. Carotenoid and chlorophyll pigments were determined according to Welburn [1994], betalain pigments according to Nillson [1970] and FRAP [Benzie, Strain 1996].

The content of total carotenoid content ranged from 44.8 mg kg^{-1} for apple chips to 910 mg kg^{-1} d. m. for carrot chips. The highest total chlorophyll was found for red beet and tomato chips (9.2 mg kg^{-1} d. m.) and the lowest was for sunchoke chips (0.8 mg kg^{-1} d. m.). It was observed that chlorophyll a accounted for about 90% of total chlorophyll for all chips under examination. For red beet chips, the assays also included determination of betalain pigments: betacyanin and betaxanthin, whose content amounted to 9,59 and 6,46 mg kg^{-1} d. m., respectively. The research demonstrated the highest antioxidant potential, FRAP, for red beet chips and sunchoke chips (about 0.90 mmol kg^{-1} d. m.) and the lowest for carrot chips (0.25 mmol kg^{-1} d. m.). The antioxidant value of red beet chips results from a very high content of betalain pigments, for carrot chips from the β-carotene content, for tomato chips from lycopene and in sunchoke and fruit chips it was from a high concentration of ascorbic acid and total polyphenols.

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