

Editorial

New Perspectives in Chemical and Functional Properties of Natural Products

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Natural, i.e., unprocessed products are becoming more and more popular among consumers and food producers. Chemical composition, as well as the content of health-promoting ingredients, is extremely important. Unprocessed food (natural products) should be the basis of a human diet to contribute to maintaining optimum health.

This Special Issue of *Applied Sciences*, entitled “New Perspectives in Chemical and Functional Properties of Natural Products”, presents lots examples of research related to different natural products which could be used as a part or the basis of daily meals to improve beneficial properties of the whole human diet.

The accepted manuscripts comprise eighteen original research papers, which are summarized below.

Brassica vegetables are among the most important vegetables consumed in Europe and all over the world, due to their availability at local markets throughout the year, affordable cost, and consumer preference. Kapusta-Duch et al. [1] evaluated the influence of different processing conditions (blanching and boiling) on the stability of selected macro- and micronutrients in fresh kale, rutabaga, green (Romanesco) and purple cauliflowers, and after thermal treatment. The contents of mineral compounds such as calcium, magnesium, potassium, and sodium were established using the validated atomic absorption spectrometry method with atomization in a flame (FAAS, Varian AA240FS of the Varian Company, Palo Alto, CA, USA), in accordance with the Polish Standard PN-EN-15505:2009, whereas for iron, manganese, zinc, and cuprum contents, Polish Standard PN-EN 14084:2004 was applied. As shown in this study, blanching and boiling affect the mineral contents of Brassica vegetables. Of the examined Brassica vegetables, the largest losses, on average by 39.4%, were found for potassium. Regarding the microcomponents present in all examined vegetables having undergone cooking, the largest declines were in iron, by 35.0% on average.

Leszczyńska et al. [2], in their study, compared the contents of basic nutrients (proteins, fats, digestible carbohydrates, dietary fiber, and ash), steviol glycosides, selected antioxidants (vitamin C, total polyphenols), and antioxidant activity in dried leaves of *Stevia rebaudiana* Bertoni cultivated in Poland, Paraguay, and Brazil and were directly available for sale. Dried leaves of *S. rebaudiana* grown in Poland had significantly higher contents of dietary fiber, and lower protein and ash contents, compared with those derived from Paraguay and Brazil. The former had, however, considerably higher contents of total steviol glycosides, stevioside, and rebaudioside D compared with the remaining two plants. In the Paraguayan dried leaves, the contents of rebaudioside A, C, and E and rubusoside were found to be significantly lower. Dried leaves of *S. rebaudiana* Bertoni, cultivated in Poland, contained substantially more vitamin C and a similar content of total polyphenols, compared with those from Brazil and Paraguay.

Thymoquinone (TQ) is a promising therapeutic substance which is being extensively studied in many diseases, such as diabetes mellitus, cancer, hypertension, and others. The powerful antioxidant properties of thymoquinone may greatly help in minimizing gentamicin (GM) nephrotoxicity. Metformin is a well-known, clinically approved oral



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hypoglycemic drug that exerts many other actions, including antioxidant properties. The aim of Alsharidah et al.'s [3] study was to evaluate the possible antioxidant and reno-protective effects of TQ and metformin in GM-induced nephrotoxicity in the same model (rats) at the same time. In addition, we aimed to further understand the effects underlying GM-induced nephrotoxicity. They concluded that both TQ and MF effectively alleviated the oxidative stress in GM-induced nephrotoxicity in rats, with TQ, but not MF, producing a complete reno-protective effect. Further studies evaluating different reno-protective mechanisms of TQ should be conducted.

In traditional Yemeni medicine, various preparations of *Loranthus regularis* (*L. regularis*), such as powder, decoctions, and infusions, are commonly used to treat diabetes, kidney stone formations, and inflammation. Alanazi et al. [4], in their research, evaluated the antinephrotoxic effects of *L. regularis* extract in experimentally induced diabetes in male Wistar rats. A single dose (60 mg/kg/day) of Streptozotocin (STZ) was used to induce type 1 diabetes. Animals were then treated for four weeks with *L. regularis* extract (150 or 300 mg/kg/day) by oral gavage. Renal and blood samples were subsequently harvested. This study presents strong evidence of the beneficial therapeutic impact of *L. regularis* against renal complications associated with diabetes. *L. regularis* extract improved renal functions and alleviated cellular damage in diabetic rats. Additionally, the capacity of *L. regularis* to reduce free radical production caused by hyperglycemia and to attenuate inflammation and enhance antioxidative enzyme activities may be due to underlying mechanisms.

The article entitled "Effect of Sucrose on Physicochemical Properties of High-Protein Meringues Obtained from Whey Protein Isolate" by Nastaj et al. [5] reports the possibility of obtaining WPI-based meringues with low sucrose contents (0–15%). They concluded that it is possible to obtain high-protein meringues from WPI at the smallest sugar concentration (5%), which is not used in the industry. A different effect of sugar was observed for liquid and solid forms. Knowledge about the product structure is important for controlling the essential parameters that determine the properties of the final product. A significant reduction in the sugar content enabled them to obtain a product with the characteristic features of traditional meringue and a lower caloric value. The obtained meringues could be an alternative to traditional protein shakes that are very labile without refrigeration.

The research by Kim et al. [6] showed the absorption of collagen peptides in the human body without being destroyed using a buccal delivery system. Collagen peptides permeate the buccal mucosa of swine, and significantly different concentrations of collagen are also analyzed after permeation according to molecular weight. Furthermore, the present study is the first clinical trial to have used a collagen peptide buccal delivery method. The collagen peptide buccal delivery film demonstrated significant improvements in skin hydration, elasticity, roughness, and wrinkle removal on cheeks, with no side effects after 2 weeks of use. To investigate these results, the production of peroxynitrite and interleukin-1 α was analyzed, and the effectiveness may have been due to the complete absorption of collagen peptides via the buccal delivery system and homeopathic effects.

Currants (*Ribes* L.) are shrubs of the order Saxifragaceae, belonging to the gooseberry family (Grossulariaceae). The study by Ziobron et al. [7] concentrated on the basic chemical composition, the content of bioactive compounds, and antioxidant activity in currant leaves. The leaves of black, red, and white currant shrubs were collected in May, and in the beginning of June, July, and August, for two years, between 2018 and 2019. The proximate analysis, including dry matter, protein, fat, ash, and total carbohydrates, was determined. In addition, the polyphenol contents and the total antioxidant activity were assessed using ABTS, DPPH and FRAP assays. The concentrations of polyphenolic compounds and antioxidant activity, measured by ABTS and DPPH methods, were highest in the blackcurrant leaves collected in July at the time of full ripeness of the fruit. The high concentration of phenolic compounds, as well as substantial antioxidant activity in all current leaf extracts, makes currant leaves a rich source of bioactive compounds and potential functional nutraceuticals.

The review entitled “Addition of Bee Products in Diverse Food Sources: Functional and Physicochemical Properties” by Camacho-Bernal et al. [8] focused on providing detailed information on the main findings of innovative food products based on the addition of bee products by highlighting their physicochemical and functional properties and their behavior throughout storage. In dairy products, honey improves sensory attributes such as taste and texture, and results in an increase in phenolic compounds and antioxidant activity; however, viscosity increases and luminosity values decrease, which is seen as unfavorable. Propolis is an effective ingredient for the production of edible fruit films; in sausages and meat products, it generates protective effects similar to synthetic preservatives due to its antimicrobial activity. The addition of pollen in cookies leads to a significant increase in some micronutrients, as well as fiber, protein, phenolic compounds, and antioxidant activity.

Oxidative stress is associated with inflammation, diabetic complications, and advanced glycation end product formation. The intake of flavonoid-rich foods has been reported to have a beneficial effect on human health. The aim of Alshahli et al.’s [9] study was to verify the therapeutic potential of *Phyllanthus emblica* and *Azadiractha indica* against glycation and other oxidative-stress-induced complications such as inflammation using in vitro investigations. This study demonstrated the high phenolic and flavonoid content, excellent free radical scavenging potential, and antioxidant activity of ethanol extracts of *P. emblica* and *A. indica*. Furthermore, *P. emblica* and *A. indica* exhibited high anti-inflammatory, anti-arthritic, membrane stabilizing, anti-glycating, and anti-AGE formation activities. Biophysical studies, including UV-absorption study, AGE-specific fluorescence, and ThT fluorescence study, confirmed that the formation of AGEs inhibited properties of both extracts. They concluded that both plants may be a substantial source of various active chemicals, all of which may contribute to their synergistic effects. To effectively analyze and quantify these impacts, a different research approach is required.

“The Role of Nutritional Habits and Moderate Red Wine Consumption in PON1 Status in Healthy Population” is the title of the study by Navarro-García et al. [10]. The Paraoxonase 1 (PON1) gene is a member of the paraoxonase family located on the long arm of human chromosome 7 (7q21–22). This enzyme has anti-inflammatory, antimicrobial, antioxidant, and antiatherogenic properties, and it is involved in the hydrolysis of a wide variety of substrates, such as lactones, arylesters, organophosphate pesticides, and others. PON1 plays a role in HDL protective properties, and its status is considered one of the determinants for the development of cardiovascular and other diseases. The authors suggest that compounds found in red wine, such as benzoic acids derivatives, stilbenes such as resveratrol, as well as genotype and dietary habits, exert an influence on both the phenotype and concentration of PON1, including macro- and micronutrients, suggesting the relevance of considering the internal and external factors that could exert an effect on PON1 status in human populations. In conclusion, their data acknowledged that the moderate consumption of red wine (120 mL in this study), had a beneficial effect on PON1-specific AREase activity in a healthy Mexican population.

Lentils, a popular foodstuff worldwide, are gaining more interest for their use in alternative diets. An ever-growing demand for new raw materials in the malting and brewing industry is observed, and there is an overall rising interest in a low-gluten lifestyle. Therefore, in the study by Trummer et al. [11], malt was produced from green lentils and used in both laboratory- and pilot-scale brewing trials. Malted lentils were used as 10% and 20% adjuncts at the laboratory scale, following the Congress mash procedure, and the most important parameters (e.g., filtration time, pH, color, extract, and fermentability) of the wort and beer samples were analyzed, with a special focus on the concentrations of metal ions (Mg^{2+} , Ca^{2+} , Zn^{2+} , and Fe) in wort. The production of beer with lentil malt as an adjunct was then scaled up to 1 hl, and several beer parameters were analyzed, including the gluten content and foam stability. The results of this study showed that the gluten content was decreased by approximately 35% and foam stability was enhanced by approximately 6% when adding 20% lentil malt. Furthermore, the use of lentil malt reduced the filtration time by up to 17%. A trained panel evaluated the sensorial qualities

of the produced beers. Overall, the use of green lentil malt shows promising results for its potential use in brewing.

The aim of the next study, by Hamułka et al. [12], was to investigate the quality (oxidative stability), fatty acids (FAs) profile, and their distribution in triacylglycerol (TAG) molecules of hunted game wild fat (HGWF) obtained from wild boar, badger, and wild goose. Health lipid indices were calculated. Determination of the FAs composition was carried out by gas chromatographic analysis of fatty acid methyl esters (FAME). Enzymatic hydrolysis and thin-layer chromatography were used to determine the positional distribution of FAs in the internal and external positions of triacylglycerols (the regiospecific structure of triacylglycerols) of the obtained HGWF. A pressure differential scanning calorimeter (PDSC) was used to determine the oxidative stability of the tested HGWF. The lipid fraction isolated from subcutaneous adipose tissues was dominated by MUFA, on average 46–50% of total FAs, and by SFA, on average 32–36% of total FAs. Palmitic acid was located mainly in the internal position of TAGs of the analyzed HGWF, whereas external positions were occupied by unsaturated oleic acid. Such a structure is responsible for normal fat absorption from food, and it prevents the formation of insoluble calcium salts. Considering the FA profile, quality, and oxidation stability among all tested fat samples, boar fat seems to be the most favorable.

In the study by Drozdowska et al. [13], the authors investigated whether young shoots and mature red cabbage had any effect on prostate cancer cell lines (DU145 and LNCaP). Prostate cancer is one of the most common cancers in men. Recent dietary and epidemiological studies have suggested the benefit of dietary intake of cruciferous vegetables in lowering the incidence of cancer. The health-promoting effects of red cabbage are attributed to the mixture of phytochemicals known for their antioxidant and anticancer activity. The studied vegetables inhibited the proliferation of cancer cells; this process was associated with the induction of apoptosis via caspase-dependent and extrinsic and intrinsic pathways. In addition, the authors observed the regulation of genes and proteins associated with cell survival and apoptotic events.

Oxidative stress, lipid profile, and renal functions are well-known conventional risk factors for diabetes mellitus (DM). Metformin and gliclazide are popularly used monotherapy drugs for the treatment of DM. In their study, Abdel-Moneim et al. [14] assessed the short-term treatment of single- and dual-therapy of glipizide/metformin on oxidative stress, glycemic control, serum lipid profiles, and renal function in diabetic rats. DM was induced in rats with streptozotocin (STZ); then, five different treatments were applied, including group I (untreated healthy control), group II (diabetic and untreated), group III (diabetic and treated with metformin), group IV (diabetic and treated with glipizide), and group V (diabetic and treated with a combination of metformin and glipizide). Lipid peroxidation (LPO), nitric oxide (NO), total antioxidant capacity (TAC), fasting blood glucose (FBG), glycated hemoglobin (HbA1c), total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL), creatinine, and urea were measured. The authors observed that the therapeutic benefits of metformin and glipizide are complementary. Metformin exhibited superior performance in improving glycemic control and decreasing oxidative stress, whereas glipizide was more effective against dyslipidemia. This information could be helpful for the future treatment of vascular patients, antilipidemic medicines, and antioxidant therapy to improve the quality of life.

Plants of the genus *Thymus* L. are traditionally used in medicine and cooking due to the presence of biologically active compounds in them that exhibit fungicidal, antibacterial and other medicinal properties and original taste qualities. However, information on the contents and distributions of elements in the organs of *Thymus* L. is limited. The study of Vasil'eva et al. [15] was to set and compare the elements in organs of wild thyme for different soil and climatic conditions. Two species of wild *Thymus* L. from the Mongolian steppe and on the coast of Lake Baikal were collected during flowering. Twenty-four elements, including Si, in soils, roots, stems, leaves, and flowers were simultaneously determined by atomic emission spectrometry. Elemental profiles of two species of wild

Thymus L. are described. It is assumed that Si is a necessary element of the plant. The predominance of the genetic resistance of plants over the influence of soil and climatic conditions is shown.

The novelty of study of Biezanowska-Kopeć and Piątkowska [16] was the comparison between fresh and dried forms of herbs and spices and additionally between dried in a freeze-drying process and commercially available (in dried forms). The content of total polyphenols (TP) and the antioxidant activity (AA) of fresh herbs (13 in total) and those subjected to the freeze-drying process (stems and leaves separately) were compared. Moreover, the content of TP and AA of commercial food spices (19 in total) of the two leading companies on the Polish market were compared. It was found that fresh herbs and spices exhibited a large accumulation of polyphenolic compounds (from 466.55 to 17.23 CAE/100 g, for lemon balm and ginger, respectively). For freeze-dried herbs and spices, the highest TP content was found for marjoram (3052.34 CAE/100 g—leaves). Among commercial herbs and spices, sage (971.28 CAE/100 g) deserves attention. Fresh herbal spices, particularly oregano, (236.21 $\mu\text{M TE/g}$), had the highest AA. The AA of freeze-dried herbs and spices was much lower (5.27–1.20 $\mu\text{M TE/g}$). The average value obtained for commercially available herbs and spices was 1.44 $\mu\text{M TE/g}$. In the case of AA measured by the DPPH radical, thyme was characterized by the highest activity among fresh marjoram for freeze-dried herbs and spices. For dried commercial spices, the highest levels of AA were found for cumin.

Pumpkin flowers, in their composition, contain many bioactive ingredients that have a beneficial effect on the human body. The aim of the study by Biezanowska-Kopeć et al. [17] was to evaluate the antioxidant activity and chemical composition of flowers of various species and varieties of pumpkins: Amazonka, Ambar, Atlantic Giant, Bambino (*Cucurbita maxima* L.), Butternut, Muscade de Provence, Rouge vif d'Etampes (*Cucurbita moschata* Duch.), and Miranda (*Cucurbita pepo* L.). The total polyphenols, carotenoids, total sugar contents, antioxidant activity, and fatty acid composition were determined. The contents of dry matter, protein, ash, fat, and selected minerals were also determined. Pumpkin flowers of the Atlantic Giant variety were characterized by the highest contents of total polyphenols and sugars and antioxidant activity. They also showed the highest percentage of n-myristic acid (C14:0) and docosanoic acid (C22:0). The energy value of fresh pumpkin flowers, of all varieties, was low, averaging 22 kcal/100 g. Fresh pumpkin flowers are a significant source of iron, covering 60–80% of the EAR standard for adults (Atlantic Giant and Bambino varieties).

Phenolic compounds, antioxidant activity, ascorbic acid, and sugars in honey from ingenious Hail province of Saudi Arabia was the title of the last study of Alshammari et al. [18] in this Special Issue. This paper reports the analysis of bioactive compounds such as phenolic compounds, vitamin C, total phenolic contents (TPCs), radical scavenging activity (RSA), and sugars of five honey samples (Talh, Athel, Sidr, Spring flower, and Langnese) using HPLC-RID and DAD methods. Talh has the highest TPC level, of 26.9 mg GAE/100 g, whereas Spring flower has the lowest level, of 8.2 mg GAE/100 g. Quercetin levels in all samples ranged from 0.28 to 2.68 mg GAE/100 g. Gallic acid, a phenolic compound, was found in three samples of honey at concentrations ranging from 0.81 to 1.08 mg/100 g. The DPPH radical scavenging activities (RSAs) of Talh and Sidr honey samples were found to be high as compared with other samples. The Sidr honey sample had the highest vitamin C content, 2.59 mg/100 g. Fructose and glucose sugar concentrations ranged from 28.35 to 37.81 g/100 g and 20.21 to 32.28 g/100 g, respectively, with a higher fructose ratio. Sucrose was not found in any of the five samples. These findings point to the high quality of honey produced in Saudi Arabia's ingenious Hail province, and therefore may contribute to the therapeutic use of these types of honey, such as in complementary and alternative medicine.

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