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Agri-Food Chain Wastes and Food By-Products: Importance on NutriFood Chemistry and Anticarcinogenity

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Abstract

The diverse types of by-products can be evaluated by various branches of agrifood industry due to their selected desired properties. The pulps, dregs and wastes in food processing depends on the quality of by-product management, while ensuring the environmental protection and sustainability. It has been currently estimated that many cancer-related deaths could be prevented by adequate lifestyle modifications, particularly changes in nutrition and diet. Dietary polyphenols and other bioactive substances have received much attention for their health benefits, including anticancer properties. In this study content, it has been dealed the importance of agri-food chain wastes and food by-products on nutrifood chemistry and anticarcinogenity.

Key words: *Agrifood, food, by-product, anticarcinogenity*

1.Introduction

Most food waste derivatives from the drink industry (26%), followed by the dairy and ice cream industry (21.3%), the production and preservation of fruits and vegetables (14.8%), the manufacture of grain and starch products (12.9%), the production, processing and preservation of meat products (8%), the manufacture of vegetable and animal oils and fats (3.9%), the production and preservation of fish and fish products (0.4%) (Tokusoglu,2018a).

Food by-products or food industry shelf-stable co-products as liquid, pomace, or powder forms can be obtained from fruits, vegetables, meats, seafoods, milk and dairy, cereals, nuts, fats and oils processing. Those above-mentioned by-products may be evaluated as a source of dietary phytochemicals including phenolic antioxidants, carotenoids, bioactive other polyphenols, dietary fibers, as a source of proteins, peptides and aminoacids, may be evaluated as extruded products. as a sources of collagen, gelatin, and as a sources of various food additive materials (Tokuşoğlu, 2018a). However, the some of by-products can be utilized as compost for plants, can be used as animal feed, can be utilized as industrial materials. By using spray drying methodology or jeotermal drying technology; the vegetables and fruit by products, meat by-products, fish by-products, dairy by-products, cereal and nut by-products can be performed as effectively. For gaining of bioactive components from each processes; powder and hydrolizate flow diagrams have been prepared and applied as firstly and then economical feasibility have been carried out. Then experimental prosedures have been utilized for each bioactive components from food by-products.

2.Fruit and Vegetable By-Products

The current methods for further utilization of product-spesific waste of fruits and vegetables have been developed along traditional lines and these utilizations are closely bound to the agricultural origins of the raw materials. Bioactive constituents potentially extractable from the targeted plant food by-products include majorly phytochemicals, fibers, natural flavor compounds, sugars, polysaccharides, ethanol, and proteins and its derivatives. The solid by-product, often called as ''waste'' or ''pomace'', is obtained by pressing of fruits or vegetables and can contain pulp, peels, seeds and, stones. The processing of fruits and vegetables results in high levels of waste materials including

peels, seeds, stones, and oilseed meals (Tokuşoğlu, 2018ab).

In the innovative technologies, new aspects regarding the utilizing of above-mentioned wastes as by-products for further exploitation on the manufacturing of high-value products, food additives or supplements with high nutritional value. Due to the high consumption and industrial processing of the edible parts of fruit wastes such as peels and seeds of fruit (apple, pear, orange, pomegranate, tomato) residues, citrus fruit skins as waste, mango residues, pineapple residues, residues of other exotic tropical fruits (avocado, banana, guava, jackfruit, longan fruit), chestnut residues, olive residues, sugarcane bagasse are generated in large quantities in big cities. Besides the peel or leaf or stem fractions of cabbage, cauliflower, celery, Chinese cabbage, coriander, cucumber, eggplant, endive lettuce, fennel, ginger, green pepper, lotusroot, potato, rape, scallion, spinach are utilized as a sources of dietary phytochemicals, dietary fibers by manufactured powder forms and also are used as extruded products (Tokuşoğlu, 2018b).

By-products of fruit and vegetable as a sources of majorly phenolics and dietary fibre and minerals that have a wide range of action which includes antitumoral, antiviral, antibacterial, cardioprotective and antimutagenic activities. Epidemiological studies have pointed out that fruits and vegetable consumption imparts health benefits including certain types of cancer, reduced risk of coronary heart diseases. The health benefits of fruits and vegetables are majorly attributed to bioactive nutrients as phytochemicals, carotenoids, vitamines (ascorbic acid, tocopherol etc.), also to dietary fiber of these products (Tokuşoğlu, 2018a).

Dietary supplements and/or food fortification may be alternative for above-mentioned healthy constituents. By-products of fruits and vegetables are sources of these healthy compounds and it has been considered these highly desired constituents of by-products of fruits and vegetables.

3.Animal Derived By-Products

The animal-derived wastes include wastes from bred animals, wastes from seafood, and wastes from dairy processing as thirdly. The recovered biomolecules and by-products can be used to produce functional foods or as adjuvants in food processing or in medicinal and pharmaceutical preparations (Tokuşoğlu, 2018ab).

3.1. Meat By-Products

The majority of the by-products in the meat industry is produced during slaughtering. Slaughter house waste consists of the portion of a slaughtered animal that can not be sold as meat or used in meat-products. Such meat by-products includes internal organs, fat or lard, skin, feet, abdominal, the contents of the gastro-intestinal tract, blood, bones, tendons and the powders has been produced from these by-products. Appropriate utilization of meat by-products is important for the profitability of the meat sector.Meat by-products are produced by slaughter houses, meat processors, wholesalers and rendering plant (Jayathilakan et.al.,2012; Tokuşoğlu,2018a).

One of the major by-products of meat is slaughterhouse blood that is an inevitable part of the meat production in food chain and represents a rich source of protein. The physicochemical characteristics and utilization of animal blood in various food and industrial applications has been well explored. The angiotensin-converting enzyme inhibitory, antioxidant, anticarcinogen, antimicrobial, and other bioactive peptides are derived from various slaughterhouse animal blood sources. Furthermore, the effect of enzyme choice, degree of hydrolysis, and peptide sequence or size on the potency of these bioactivity. The by-products of meat containing ash biomass includes

phosphorous (P). It is known that some high phosphorous ash can be in sludge ash, meat and bone meal (MBM) and phosphorous from the biomass ash is very important practical significance for biomass energy, biomass ash disposal and phosphorous resource (Tan and Lagerkvist,2011; Tokuşoğlu,2018ab).

It is reported that by-products including organs, fat or lard, skin, feet, abdominal and intestinal contents, bone and blood of cattle, lambs and pigs represents 66.0, 68.0 and 52.0% of the live weight, respectively. It is determined that many organ meats contain more polyunsaturated fatty acids (PUFAs) than lean tissue while brain, chitterlings, heart, kidney, liver and lungs contain lowest level of monounsaturated fatty acids (MUFA) and the highest level of polyunsaturated fatty acids (PUFA). Meanwhile, chicken visceral wastes are rich sources of PUFA concentrates and, in particular, of omega-3 essential fatty acids.

Bioactive peptides from meat by-products generally contain between 3-20 amino acid residues and various generated peptides are denominated bioactives peptides due to their determined health benefits to the consumers like antihypertensive activity (Tokuşoğlu, 2018a).

3.2. Seafood By-Products

Seafood by-products can be dealed with as fish by-products and shellfish by-products. Fish or shellfish by-products are one of the most important raw materials for food, nutraceutical, pharmaceutical, and biotechnological applications. Seafood product processing discard account for about three-quarters of the total weight of catch. Seafood processing has also been used as a possible waste utilization. It is known that the major components of seafood discard products are tongue, cheeks, stomach, liver of fish, protein bioactives from residual fish, marine bioactive lipid components (omega 3,6, DHA,EPA), fish skin, carotenoid bioactives and chitinous materials from shellfish products, gut enzymes, flavor products, anti-freeze proteins from seafood blood (Tokuşoğlu, 2018ab).

Fish skin waste but also bones and fins could be used as potential sources to isolate collagen and gelatin. Fish collagen and gelatin are currently utilized in diverse fields containing food, cosmetic, and biomedical industries. Collagen and gelatin are unique proteins compared to fish muscle proteins and they are generally rich (above 80%) in non-polar amino acids including glycine (Gly), alanine (Ala), valine (Val), proline (Pro) aminoacids whereas gelatine geerally contains glycine unites, proline and 4-hydroxyproline residues. Collagen and gelatin could be also isolated from bone and fins of fish processing by-products. By-products are represented by fish stomachs and viscera silage and fish sauce. It has been stated that carnivorous fishes have high stomach pepsin contents, and a silage made from minced viscera, or from the separated stomach. By ultrafiltration, concentration, and spray-drying, a cod stomach silage can give a pepsin preparation (Baiano,2014; Tokuşoğlu,2018ab). Fish oil from fish processing waste, and marine fish wastes are rich sources of polyunsaturated fatty acid concentrates and, in particular, of omega-3 essential fatty acids. (Baiano,2014; Tokuşoğlu,2018a).

Shellfish by-products are good sources of antimicrobial compounds and ketocarotenoids; it is known that shellfish derived peptides as bifunctional ingredients (Pezeshk et.al.,2015; Tokuşoğlu,2018a). Shrimp processing leads to massive amounts of shrimp biowaste and the major constituents of the shrimp by-products such as protein, chitin (deacetylated chitosan), lipid, minerals and also valuable carotenoid astaxanthin.

Chitosan, a valuable bioactive compound, has widely used in food, agriculture, biotechnology, cosmetics, medicine and waste treatment. Shrimp

wastewater and especially crab shells are also good sources of astaxanthin and bioactive peptides. Astaxanthin (3,3-dihydroxy-β,β-carotene-4,4-dione) from seafood by-products is a ketocarotenoid oxidized from β-carotene, that plays biological roles and possesses a number of desired properties for food and medical applications owing to it is natural ketocarotenoid, nontoxic, high versatilite, hydro and liposolubility property, its attractive pink color, its biological functions as vitamin A precursor and superior antioxidant characteristics (Tokuşoğlu, 2018b).

3.3.Dairy By-Products

Dairy by-product whey is also very good source of peptides with remarkable biological activities. It is stated that main by-products of dairy industry are whey, buttermilk, ghee residue and sometimes skim milk. Whey is an abundant by-product of the dairy industry that corresponds to the liquid fraction remaining after milk clotting and casein removal during cheese manufacturing. Whey includes the lactose and non-casein proteins of milk. It is reported that ovine and caprine whey proteins including β-lactoglobulin (β -Lg) and α-lactalbumin (α -La) and derived-peptides have good biological properties (Tokuşoğlu, 2018ab).

It is reported that whey protein hydrolysates enriched in free amino acids (AAs) and hydrophilic peptides could have been responsible for the rised insulinotropic response of BRIN-BD11 cells. In this context, the potential utilization of whey protein hydrolysates and peptides can be performed as natural complementary approaches; these could be implemented through dietary intervention and food-drug therapies for type 2 diabete management by inhibiting DPP IV activity and thence increasing the half-life of incretin hormones. It is also stated that the bioactivity of other components of cheese of whey including lactose, oligosaccharides and minerals is good known (Tokuşoğlu,2018a).

4.Cereal and Nut By-Products

Cereal (flax seed, barley, oat etc) by-products are also so important and phenolic compound extracted from cereal brans, which antioxidants provide resistance against free radical damage, cancer and cardiovascular diseases. γ-oryzanol from rice bran, which is a potent antioxidant, **a cholesterol reducing agent, a tumor inhibiting agent,** and a preventing agent in menopausal syndrome treatment, β-glucans extracted from barley flour, which improve lipid metabolism, reduce the glycaemic index, and lower plasma cholesterol, lignan concentrates from flaxseed, **which act as anti-cancer, antioxidant**, antibacterial, antiviral, and anti-inflammatory agents (Izydorczyk, and Dexter,2008; Tokuşoğlu,2018b) .

Recently nut by-products has also very importance in food technology. Especially walnuts are unique due to their perfect balance of n-6 and n-3 polyunsaturated fatty acids (PUFAs), a ratio of 4:1,which has been shown to decrease the incidence of cardiovascular risk. Furthermore, the heart benefits of walnut intake include reducing inflammationand improving arterial function.9–11. Besides walnut phenolics may also have a protective effect on the susceptibility of LDL cholesterol to oxidative modification and on atherosclerosis. Walnut flour (WF) may be obtained from kernel press-cake. WF provides appreciable amounts of protein. It was shown that glutelins of walnut flour have been shown to be highly digestible. The amino acid (AA) composition of WF is dominated by the acidic AA residues of aspartate and glutamate together with relatively high levels of arginine (Tokuşoğlu,2018ab).

5. Conclusion

It is concluded that the dried functional powders of food by-products derived from fruits and vegetables, meat,

seafood, milk, dairy products and cereals and as well as their chemical, functional properties, bioactive features and utilizations are great important owing to their possible antioxidative, anticarcinogenic reports. Recent pharmacological evaluations and clinical studies of mentioned derivatives prove their health importance for human nutrition and utilization.

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