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Commonly Consumed Functional Foods and Food Ingredients

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Abstract

Functional foods are the food or food components that provide additional benefits to human metabolic functions and physiology. With these features, functional foods are effective in both protection from diseases and reaching a healthier life. Prebiotics, probiotics, dried food (fibers, tea, herbs etc.), fermented foods (yogurt, kefir, vegetables), and a wide range of products are counted as functional foods. Food components such as omega-3 fatty acids, isoflavones, carotenoids, beta-carotene and lycopene, sulforaphane, polyphenols, soluble fibers (barley and oats) are effective in preventing diseases. Recently, world states have been focusing on creating a healthy and sustainable nutrition policy. It is thought that functional foods will be on the agenda in the future with the increasing awareness of people in the direction of healthy nutrition and their importance will increase.

Key words: Functional foods, Health, Nutrition.

Introduction

In recent years, there has been an increase in excessive spending on health care in the world, and people have tried to find ways to stay healthy to avoid this worrying situation. Today, the perception of food has changed in the direction of eating to benefit from nutrition by increasing the physiological functioning of the system, rather than just eating/drinking something to fill the stomach (Adadi et al., 2019).

The importance that people attach to their health has led them away from products with medicinal effects, such as medicines, natural products and functional foods (Özdemir et al., 2009). Functional foods must demonstrate functional effects when consumed within normal consumption patterns (Adadi et al., 2019).

Functional foods include a wide range of products, including prebiotics, probiotics, dried foods (fibers, probiotics, tea, herbs, etc.), fermented foods (yogurt, kefir, vegetables) and fresh fruits and vegetables. Bioactive components of this type of food are minerals, vitamins, peptides, proteins, n-3 polyunsaturated fats, antioxidants, enzymes and symbiotics (Deschenes, 2007).

Functional Foods

Functional foods as a basic definition are the ones that have a potentially positive impact on health beyond basic nutrition, help promoting optimal health conditions and reduce the risk of noncommunicable diseases (Granato et al., 2017). Functional foods were first discussed in Japan with the term FOSHU (Foods For Specific Health Use), then in the US in the early 1990s (Özdemir et al., 2009).

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According to the International Institute of Life Sciences, functional foods should contain a variety of related components to improve health or reduce (prevent) the risk of the disease. At the same time, these nutrients should provide benefits beyond basic nutrition. To classify food as functional, its health characteristics need to be supported by scientific evidence (Boluda et al., 2017).

The research has shown that it has extra physiological effects in the body in addition to being known for nutritional values by the definition of functional foods. These effects are due to the substances in their structure, today's serious cardiovascular diseases (CVD), diabetes, cancer, and many other chronic diseases may play a role in the prevention and delay (Alaşalvar and Pelvan, 2009).

Omega-3 fatty acids (fish and flax seeds), isoflavones (soybeans), carotenoids, beta-carotene, and lycopene, (carrots, tomatoes, and other red/orange vegetables and fruits), sulforaphane (broccoli), polyphenols (tea and wine), soluble fibers (barley and oats) are effective nutrient components to resist disease (Coşkun, 2005).

Functional foods may be a natural food (tomato-lycopene) containing a functional agent, or a functional agent (iodized salt, omega-3 fatty acid egg) or food with a harmful composition removed (sodium-reduced salt). Additionally, functional foods are produced by modifying certain compounds in the food (yogurt-protein-bioactive peptide), increasing bioavailability (processed tomato lycopene) and using different combinations of these (Dayısoylu et al., 2014). Functional properties are also imparted to foods by biologically active ingredients. These compounds can be the animal origin (zoochemical) or of plant origin (phytochemicals) (Açıkgöz and Önenç, 2006). Besides, phenolic substances, antioxidants, dietary fibers, oligosaccharides, probiotics, prebiotics, vitamins, polyunsaturated fatty acids, sulfur-containing components, phytoestrogens, and plant sterols are added to food to make the food functional (Dayısoylu et al., 2014).

Dairy products are the most preferred products in the functional foods market with 53%. Yogurt products, probiotics, prebiotics, and fermented milk beverages are among the most consumed dairy products. While demand for functional foods varies in the context of traditions, cultural structure and laws in the world countries, the most demanding products worldwide are stated as whole wheat and high-fiber products (40%). When the evaluation is made in terms of development rate, probiotic products market is in the forefront both in the world and in our country (Giray and Şahin, 2012).

Types of Functional Foods

Health effects of functional dairy products are grouped as gastrointestinal, cardiovascular health and osteoporosis and other conditions (Seçkin and Baladura, 2011). Also, these products have anticarcinogenic, antimutagenic, lowering serum cholesterol levels, improving the immune system (Sağdıç et al., 2004).

The most important functional dairy products are probiotic products containing probiotic bacteria as dairy products are suitable for transporting beneficial bacteria into the intestinal tract (Barat and Özcan, 2016).

Yogurt and fermented milk beverages are the most produced products as probiotics. In recent years, the combination of fermented dairy products with classic yogurt starters as well as probiotic cultures has added extra physiological effect and nutritional value to the product (Barat and Özcan, 2016). Kefir and koumiss are samples of traditional fermented dairy products. Fermented dairy products are known to contain greater amounts of peptide than natural milk. Bioactive peptides derived from milk proteins have been shown to have many physiological bioactivities. These effects can be listed as an antihypertension, antimicrobial, antioxidative, antithrombotic, immunomodulatory, mineral binding and soothing effect. This feature of fermented dairy products can be said to be related to the proteolytic potential of starter cultures (generally lactic acid bacteria) (Kınık and Gürsoy, 2002).

The research has shown that probiotics have immune-stimulating, controlling infections, reducing the frequency of diarrhea, serum cholesterol, and lactose intolerance. It also acts as an antibiotic, suppressing tumors and protecting against colon/bladder cancer. Fermented dairy products, especially probiotic yogurt, are products that contain Lactobacilli spp to help maintain a healthy colon (Ashwini et al., 2019).

An egg has antibacterial, antiviral, anti-cancer, and protective properties against diseases (Yüceer et al., 2012). It is rich in vitamins A, D, E, K, and B and mineral substances such as iron and phosphorus and contains all essential nutrients required for adequate and balanced nutrition. It also has the best protein quality among animal products (Açıkgöz and Önenç, 2006) and has four main nutritional components (proteins, lipids, all necessary vitamins (except vitamin C) and minerals). Because of these properties, eggs are used for nutritional enrichment of various food types (Martin et al., 2017, Martin et al., 2018).

An egg is the only food that contains all the growth factors necessary for the development of the embryo. Eggshell is a mineral source, egg white is a protein source and egg yolk is an important and functional bioactive component in terms of fat. Egg protein has higher bioavailability compared to other food proteins and has important benefits for low birth weight reduction, ideal weight control and ideal muscle development in infants. Besides, the egg has a high bioavailable choline content, which reduces the risk of memory loss due to aging in children's a brain/mind development and memory strengthening. Also, it reduces the risk of cataract and cancer with xanthophyll pigment (Yüceer et al., 2012).

Meat proteins are another animal source with high biological activity as functional and nutritious. Bioactive components of meat include creatine, taurine, conjugated linoleic acid (KLA) and peptides. The effects of bioactive peptides on living organisms are in the form of antimicrobial, antithrombotic, hypocholesterolemic, antioxidant, opioid, and immune system regulation (Şimsek and Kılıç, 2016).

Honey has been recognized to exhibit a wide range of biological activities, and some studies have shown that honey phenolic compounds are mostly responsible for the beneficial effects of human health (Afrin et al., 2019). Natural honey contains up to 200 substances, phenolic compounds, minerals, proteins, free amino acids, and small components (vitamins), mainly fructose and glucose. Honey has a high potential to be used as a natural food antioxidant. Phenolic acids and flavonoids, some enzymes (glucose oxidase, catalase), ascorbic acid, Maillard reaction products, amino acids, and proteins contribute to this activity (Leyva-Daniel et al., 2017).

Bee pollen is a beekeeping product consisting of flower pollen obtained from different plant species. It has been used both in traditional medicine and in human nutrition for thousands of years because of its therapeutic and preventive functions, its nutritional and physiological properties. The main components of bee pollen are plant-derived varying amounts of carbohydrates (13–55%), protein (10-40%), crude fibers (0.3-20%), and lipids (1-10%). Nine essential amino acids make up about half of the protein. Bee pollen contains small components such as vitamins (folic acid, tocopherol, β-carotene and B complex), minerals (Zn, Cu, Fe, K, P, Ca, Mg), and traces elements. It also contains carotenoids, phenolic compounds (especially flavonoids and phenolic acids), and terpenes. Therefore, because of its composition, bee pollen is considered one of the most nutritious nutrients of nature (Conte et al., 2018).

Another commonly used functional beekeeping product is propolis. Propolis is widely used in various folk and traditional medical systems to prevent and treat various diseases. Commercially, propolis is sold as cosmetics, healthy food, and drinks. It is also available in the form of capsules, mouthwash solutions, creams, throat lozenges, powders, and other products or derivatives (Mak et al., 2018).

Another example of the most important sources of animal-derived functional foodstuffs and raw materials is seafood. Fish oils are one of the most used functional products in the food and pharmaceutical sector with their proven functional properties (Yılmaz et al., 2006). Seafood compositions include omega-3 fatty acids, proteins, vitamins, bioactive peptides, various minerals, and enzymes. With this feature, it has established a rich source position in functional foods (Mısır, 2012). Omega-3 fatty acids are naturally found in oily fish such as salmon, as well as in some seeds and nuts such as flax seeds, walnuts, and almonds (Yıldız et al., 2018).

Omega-3 compounds (eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) and Omega-6 compounds (γ-linolenic acid (GLA) and arachidonic acid (ARA)) are among polyunsaturated fatty acids (PUFA) (Ji and Huang, 2019). PUFAs are known to exhibit various health benefits and these fatty acids are an important nutrient source for the functional foods industry (Rai et al., 2019). Polyunsaturated fatty acids have been shown to play a role in the prevention of cardiovascular diseases, inflammations, autoimmune diseases, depression, and neurological diseases. EPA and DHA also play a role in the control of asthma and rheumatoid arthritis (Li et al., 2019). Consumption of N-3 PUFAs has been reported to provide significant benefits for the functioning of the brain and retina, particularly for the growth of infants (Xi et al., 2016) and positively correlated with bone mineral density in postmenopausal women (Nawata et al., 2013).

DHA is found in significant amounts in various seafood (fish, shellfish, micro, and macro algae, and even some mammals) (Echeverría et al., 2017). DHA supplementation improves memory and cognition, and studies have shown that DHA has a direct neuro-supporting effect on nerve cells in vitro (Ghazale et al., 2018). DHA supplements are popular in daily life, especially in pregnant and lactating women (Gould et al., 2017).

Prebiotics are dietary components that are classified as soluble or insoluble fiber that can selectively increase the beneficial components of the native intestinal microbiota (Gurpilhares et al., 2019). Today, the main well-known prebiotics are indigestible carbohydrates such as fructooligosaccharides (FOS), inulin, galactooligosaccharides (GOS), and lactulose (Xavier-Santos et al., 2020). Prebiotics has positive effects on both human and animal health such as gastrointestinal system (pathogen inhibition, immune modulation), cardiometabolic (cholesterol-lowering), mental health (energy and cognition), and bones (improved mineral absorption) (Amorim et al., 2020). Prebiotics can be found in a variety of sources such as milk, honey, fruits, vegetables, and seaweed (Gurpilhares et al., 2019).

Dietary fibers are one of the indigestible and absorbable functional foods components in the small intestine of humans. In the large intestine, it undergoes complete or partial fermentation (Ekici and Ercoşkun, 2007, Dülger and Şahan, 2011). Dietary fibers are edible parts of plants (Ekici and Ercoşkun, 2007) and their main source is cereals, fruits, and vegetables (Dülger and Şahan, 2011). Dietary fibers consist of non-starch cellulose, hemicellulose (such as β-glucans, arabinoxylans), and polysaccharides such as pectin (Ekici and Ercoşkun, 2007).

Low dietary fiber consumption is considered to be associated with the incidence of many chronic diseases, including cancer, cardiovascular disease, obesity, and type 2 diabetes (Cassidy et al., 2018). Besides, dietary fibers have been reported to have physiological effects on mineral absorption, glucose and lipid metabolism, regulate large-bowel functions, and have protective effects on obesity, diverticulosis, constipation, and hemorrhoids (Dülger and Şahan, 2011). A high-fiber diet can increase the level of beneficial bacteria in the intestine (Ajanth Praveen et al., 2019).

Fruits are considered as excellent functional foods. Because fruits contain natural antioxidants such as carotenoids, vitamins, phenols, flavonoids, dietary glutathione, endogenous metabolites. These antioxidants can remove free radicals, peroxide decomposition, single and triple oxygen quenching, enzyme inhibition, and synergistic effect (Wang, 2007).

Lycopene is a natural pigment that gives red color to fruits such as tomatoes, guava, rosehip, watermelon, pink grapefruit (Holden et al., 1999). In the daily diet, tomato products are an important source of lycopene (Rao et al., 1998). Studies have shown that lycopene is an important micronutrient that has protective properties against prostate cancer, lung cancer, and a wide variety of stipel cancers (Shi et al., 2002).

Numerous studies in recent years have shown that d-limonene in citrus is associated with protection in some types of cancer (Chiralt et al., 2002).

Whole grain and legume grains, red-purple fruits and vegetables, nuts and whole tea; phenolic compounds (phenolic acids, flavonoids, etc.), phytic acid, vitamins (A, C, E), carotenoids, tocopherols, and peptides (glutathione, cysteine) are naturally present. These antioxidant compounds have important effects on health. In addition, it is stated that anthocyanins in the sub-groups of phenolic compounds reduce the risk of cardiovascular disease and cancer, and have an analgesic and antidiabetic effect (Erbaş et al., 2008, Doğan and Kanberoğlu, 2012).

Flavonoids are considered to be antiallergic, anti-inflammatory, antiviral, anticarcinogenic, and also act in certain metabolic pathways in mammals (Skrede and Wrolstad, 2002).

Carotenoids are known to prevent oxidative stress-related diseases and are naturally pigmented bioactive compounds that have a potential application in the functional foods industry (Raia et al., 2019). Antioxidant properties of some carotenoids against reactive oxygen/nitrogen species have been associated with reduced risk of development of various degenerative diseases (Xavier and Mercadante, 2019).

Among the important functional foods, soy products contain high amounts of soy proteins, isoflavones, omega – 3-fatty acids, and dietary fiber. It is known that people in the Far Eastern countries, attracting attention with their long lifespan, consume soy products intensively (Nilüfer and Boyacıoğlu, 2008).

Isoflavones in soy products have health benefits. These include cancer prevention (Wu et al., 1996), prevention from heart disease (Anthony et al., 1998), osteoporosis prevention by increasing bone mass density (Anderson and Carner, 1997), and reduction of postmenopausal syndromes in women (Chang S.K.C., 2002). The soybean protein content is higher than meat and soybean supports weight control with low-fat content. Also, when soy is used regularly reduces cholesterol (Nilüfer and Boyacıoğlu, 2008).

Among the plants; oilseeds, especially soybeans (Glycine max), are the main dietary source of tocopherols (Tewari et al., 2017). α-Tocopherol is the most abundant and biologically active form of hydrophobic vitamin E (Fang et al., 2019). α-Tocopherol is an effective lipophilic antioxidant that plays an important role in protecting cells from reactive oxygen species and is used to reduce oxidation in foods (Zhang et al., 2019).

Conclusion

Consequently, the concept of functional foods can be indicated as the world states have been recently focusing on developing a healthy and sustainable nutrition policy, as well as dealing with chronic environmental problems such as rapidly increasing population, global warming, and climate change.

In addition to the functional foods that are known to be important today, researches need to be increased for the functional components that need to be investigated. Functional foods in our country should be fully defined and the public should be informed correctly. Not only should the labeling information of functional foods be regulated according to reality, but also legal arrangements should be made to meet the concept of functional foods in our country in a holistic way.

It is thought that functional foods will be on the agenda in the future with the increasing awareness of people in the direction of healthy nutrition and their importance will increase.

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