SAT-ONLINE-P-2-BFT(R)-10

FUNCTIONAL CHARACTERISTICS OF FOOD OF ANIMAL ORIGIN

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Abstract: *Due to the growing concern of consumers about their own health, nutrition and food quality, in recent years the food industry has focused on the development of food products with functional characteristics (functional food) that have a special specific composition and nutritional quality. Functional foods in addition to traditional nutrients contain functional (bioactive) ingredients that positively affect health and reduce the risk of disease. Functional foods can be foods that naturally contain functional components, foods that are "enriched" with functional ingredients, or foods that remove certain ingredients, which reduces the risk of developing some diseases.*

The functional characteristics of food of animal origin (milk, meat, eggs..) are the result of the natural content of functional components, due to which they have an irreplaceable role in nutrition globally.Incorporating bioactive ingredients in the processing of milk and meat (probiotics, prebiotics, antioxidants..) or the replacement of some components (saturated fats..) with components that have proven positive effect, allows the creation of functional dairy and meat products with favorable health and physiological effect. Today, the production of functional food is steadily increasing, and new products are increasingly accepted by consumers.

The paper is a review of literary data on the functional characteristics of different foods of animal origin and its importance in the diet.

Keywords: *functional food, bioactive ingredients, food of animal origin*

INTRODUCTION

The main role of food is to provide the necessary nutrients for humans, to prevent food-related diseases, as well as to improve the health of consumers (Siro, et al. 2008). As a result of the growing understanding of the relationship between nutrition and health, in recent years functional food has increasingly attracted the attention of consumers and the food industry. Functional food in addition to meeting the basic needs of nutrition, should provide additional physiological and health benefits (Hasler, M.C., 2000). Functional foods include foods and food ingredients that have a beneficial effect on health and reduce the risk of disease (Miletić, I., Šobajić, S., & Đordjević, B., 2008). The knowledge that food with a balanced, enriched nutritional composition has additional health benefits stimulates the development of functional food products, which offer a variety of physiologically active compounds (Grajek, W., Olejnik, A., & Sip, A., 2005). Food of animal origin is important for maintaining the health of the human body (Nestle, M., 1999). This food contains functional ingredients, such as: whey protein, calcium, bioactive peptides, conjugated linoleic acid from meat, n-3 fatty acids from fish, sphingolipids from eggs, probiotics from dairy products, which have a beneficial health effect (Prates, J.A.M & Mateus, M.R.P.C., 2002).

Food of animal origin due to its nutritional composition and chemical characteristics, is suitable for incorporation of bioactive molecules (Martins, N, Oliveira, M.B.P.P., & Ferreira, I.C.F.R., 2018). The use of functional ingredients in products of animal origin offers manufacturers

the opportunity to improve the nutritional and health qualities of their products. Production of functional food of animal origin is constantly increasing. There are various products on the market, such as probiotic fermented dairy products, meat, meat products and eggs enriched with omega-3 fatty acids, which are well accepted by consumers.

EXPOSITION

Milk is considered a natural functional food, because in addition to basic nutrients it also contains bioactive compounds, which are prescribed numerous preventive and therapeutic effects (Mohanty, D.P. Mohapatra S., Misra, S., & Sahu P.S., 2016). Milk with about 300 nutrients in its composition and the favorable ratio of nutrients and protective ingredients is a naturally perfect food (Fox, P.F., and McSweeney, P.L.H., 1998). Milk proteins are an important source of bioactive peptides that have a positive health effect on bodily functions and reduce the risk of obesity and type 2 diabetes. (Bath, Z.F., & Bath, H., 2011a). Whey proteins, such as α-lactalbumin, lactoferrin, lactoperoxidase, serum albumin and β-lactoglobulin possess important biological and nutritional properties particularly regarding disease prevention (Gasmalla, M.A.A., et al., 2017). Their amino acid composition is very close to the biological optimum, due to the high content of sulfur (Antunac, N., Havranek, J., 2013).Whey proteins are rich in amino acids such as isoleucine, leucine, and valine, which, unlike other essential amino acids, are directly metabolized and transmitted into the muscle tissue during exercise and stamina training (Sherwood, S., & Jenkins, D., 2007). Whey proteins also have immunostimulatory, anticancer and antimicrobial properties that promote health (Fox, P.F. 2003). Milk fat is a natural source of conjugated linoleic acid which has a proven anticancer effect (Hasler, M.C. 1998), sphingolipids with antimicrobial and immunomodulatory action and fat-soluble vitamins (β-carotene and vitamins A and D) with anticancer potential (Bath, Z.F.,& Bath, H., 2011). Milk contains calcium and other minerals such as P, Na, K, S, Mg. The functional role of calcium in milk is to prevent osteoporosis and colon cancer (Kralik, G, Grcevic, M., & Gajcevic - Kralik, Z., 2010).

Functional food is developed in almost all food categories, but the most common on the market are fermented dairy products (Menrad, K., 2003). The development of science and the application of new technologies enable the production of functional dairy products which exceed their basic nutritional and physiological values (Tratnik, Lj., Božanić, R., 2012). Milk is suitable for the production of functional foods due to the content of Omega-3, phytosterols, isoflavins, conjugated linoleic acid, minerals, and vitamins (Homayouni, A, Alizadeh M, Alikhah, H, Zijah, V., 2012). Functional dairy products are designed by modifying traditional formulas, by replacing certain components and adding certain ingredients such as probiotics, prebiotics, antioxidants, vitamins, minerals, plants, fruits and more (Martins, N., Oliveira, M. B. P.P., & Ferreira, I. C.F.R., 2018). The design of functional fermented dairy products is done by enriching or modifying their natural basis with probiotic strains of certain bacterial species (probiotics) (Samardjija, D., 2015). Functional fermented milk products, in addition to the basic nutritional value, also have health benefits, due to the activity of living microorganisms from the initial cultures and probiotics that improve human health by improving the balance of intestinal microflora (Sánchez, B., et al. 2009). "Probiotics are living, viable microorganisms that, when present in sufficient quantities, alter the host microflora and thus have a positive effect on its health" (Schrezenmeir, J., & M. de Vrese, 2001). They are isolated from the gastrointestinal tract in humans. *Lactobacillus* and *Bifidobacterium* species are most frequently used as probiotics (Yerlikaya, O., 2014).

The functional and physiological role of fermented probiotic dairy products is direct through consumed microorganisms or indirect through microbiological metabolites as nutrients, created during the fermentation of milk (Gasmala, M.A.A., et al. 2017). To stimulate the growth and metabolic activity of probiotic bacteria, prebiotics are added during the production of fermented products. These are non-digestible or low-digestible food ingredients that benefit the host by selectively stimulating the growth or activity of probiotic bacteria in the colon (Manning, T.S., & Gibson, G.R. 2004). Oligosaccharides, inulin and lactulose are incorporated in fermented dairy products to stimulate the growth of probiotic bacteria, promote intestinal health, control harmful bacteria, strengthen immunity, improve the absorption of minerals and vitamins, and reduce

triglyceride levels and cholesterol. The high content of dietary fiber improves intestinal peristalsis. Added fruits and plant products favor the growth of beneficial bacteria and limit the growth of harmful microorganisms (Martins, N, Oliveira, M.B.P.P., & Ferreira, I.C.F.R., 2018). Kefir is a natural probiotic that contains live bacteria, beneficial to health (Salminen, S., Bouley C., & Boutron, M.C.R., 1998), which improves the peristaltic activity of the intestinal tract (Cardoso, L.V.G., et al. 2003).

Eggs play an important and irreplaceable role in the human diet due to content high-quality ingredients and active compounds that may have a role in the prevention and therapy of chronic diseases (Hasler, M.C. 2000; Lamas, A., et al. 2016). Eggs are a good dietary source of many essential (proteins, vitamins, minerals, fatty acids, amino acids, sphingolipids, choline and n-3 PUFA) and non-essential components (carotenoids, lutein and zeaxanthin) which may promote optimal health (Hasler, M. C., 2000; Miranda, J. M., 2015). Of the vitamins, eggs contain A, D, B_2, B_{12}, K and folate (Kralik G, Grcevik, M., & Gajcevik - Kralik, Z., 2010). In the past, egg cholesterol was thought to be harmful to human health, but changed expert opinion indicates that egg cholesterol does not significantly increase blood cholesterol levels and does not cause atherosclerosis and cardiovascular disease (Sencik, Đ.,& Samac, D., 2017).

Eggs have functional and therapeutic properties due to the content of active compounds important for maintaining health. Carotenoids pigments in egg yolks which are natural antioxidants, conjugated yolk linoleic acid and sphingolipids have anticancer effects and reduce LDL levels in the blood (Sencik ,Đ., & Samac, D., 2017). Choline, from eggs, is a natural nutrient important for the normal development of the brain, especially during pregnancy and lactation, when the mother's reserves are depleted and critical (Zeisel, S.H., 2000). Biologically active compounds from eggs, lysozyme, ovomucoid, cystatin and lecithin have a therapeutic role (Perić et al. 2011). Zinc, selenium, retinol and tocopherol from eggs have an antioxidant role and can protect people from many degenerative processes, and cardiovascular diseases.

Eggs are suitable for the production of functional foods because they can be easily enriched with some nutrients. Eggs are usually enriched with selenium, zinc, omega-3 fatty acids, vitamin E, vitamin A, lutein (Kralik, G., Kralik, Z., Grčević, M., Škrtić, Z., 2012; Sencik, Dj., & Samac D., 2017). The content and composition of fatty acids in eggs can be improved through animal feed by changing the profile of fatty lipid acids in animal feed (Kralik, G, Grcevik, M., & Gajcevik-Kralik, Z., 2010). By adding oils rich in omega-3 fatty acids (flaxseed oil, beet seed, sunflower oil, fish oil and seaweed) in the diet of chickens, their content in eggs can be significantly increased (Kralik, G, Grcevik, M., & Gajcevik – Kralik, Z., 2010, Lamas, A., et al. 2016). Feeding chickens with foods rich in omega-3 fatty acids results in the production of eggs rich in omega-3 fatty acids, which can provide up to 70 percent of their recommended daily allowance (Peric,L., et al. 2011).

Meat and meat products are a natural source of bioactive compounds with a positive health effect, such as vitamins, minerals, peptides or fatty acids (Nowicka, E.P., et al., 2018). Meat and meat products are important foods with essential nutritional components significant for the normal physiological and biochemical processes, such as omega-3, all essential amino acids, fatty acids, high quality proteins, B complex vitamins, especially vitamin B_{12}, iron and zinc (Hoffman, M., Vaskevich-Robak, B., & Schwiderski, F., 2010, Kumar, T.J.N., Nayar, R., Rajagopal, K., 2014, Kausar, T., et al. 2019). Meat is a good source of functional compounds with anticancer properties (conjugated linoleic acid) (CLA), bioactive substances (L-carnitine, taurine, creatine, choline and antioxidants (carnosine and anserin) (Hoffmann, M., Waszkiewicz-Robak B., & Świderski, F., 2010).

The nutritional and functional value of meat products can be improved by adding functional ingredients such as dietary fiber, plant proteins, lactic acid bacteria, herbs, fruits, cereal by-products, legumes, spices and more (Kausar, T., et al. 2019). The addition of natural extracts with antioxidant properties (rosemary, sage, soy, citrus peel, sesame seeds) in meat products prevents the oxidation of lipids, which causes undesirable changes in taste, texture and nutritional value. (Grujik, R., Grujik, S., & Vujadinovik, D., 2012).The composition of meat and meat products can be modified in order to reduce or eliminate certain ingredients, that are harmful to health (Grujic, R., Grujic, S., Vujadinovic, D., 2012). An example of such a functional modification is changes in the

fatty acid composition and cholesterol levels (Bhat, Z. F., & Bhat, H., 2011b). With functional modifications of the animal diet, a certain component in the meat can be reduced or increased. The PUFA content in meat can be enhanced by increasing the level of PUFA in the diet of the animals. Adding vitamin E, selenium, magnesium or iron to the diet of the animals increases their concentration in the meat (Kumar, T.J.N., Nayar, R., Rajagopal, K., 2014).

Fish is an important food of animal origin with potentially positive health effects. As a highly digestible dietary product, fish meat occupies a special place in the human diet (Cvrtila, Ž.I., Kozačinski, L., 2006). The high nutritional value of fish is due to the favorable content and ratio of functional ingredients such as proteins, fats, carbohydrates, minerals and vitamins, the significant content of unsaturated fatty acids, especially omega-3 polyunsaturated fatty acids (Sidhu, K.S., 2003). Proteins are the major functional and structural component of all the cells of the body. Fish proteins are much more digestible compared to proteins from other animal and vegetable proteins. During digestion, the protein in oily and white fish breaks down into polypeptides, peptides and amino acids that have bioactive properties (Sarojnalini, Ch., & Abdul, H., 2019). Omega-3 fatty acids (n-3 fatty acids), alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) have a beneficial health effect and are naturally contained in fish and seafood (Vranešić, B. D., 2011). Increased intake of fish meat allows normal development and functioning of the body and reduces the risk of cardiovascular disease, atherosclerosis, hypertension and other diseases (Kris-Etherton, P. M., Harris, W. S., Appel, L. J., 2002). Omega-3 fatty acids lower serum cholesterol and triglycerides in humans (Stolyhwo, A., Kolodziejska, I.,& Sikorski ,Y. E., 2006). Feed enriched with omega-3 fatty acids, under the same rearing conditions significantly increase the ratio of omega -3 / omega -6 in fish tissues (Skalli, A., et al. 2006). Minerals are important for the biochemical processes in the human body and any deficiency can lead to serious diseases. The higher content of fluoride and iodine in fish meat increases its biological value, and the small amount of sodium makes it suitable for dietary nutrition. Fish meat contains vitamins A, D, E and B complex vitamins (Bogut, I., Opaćak, A., & Stević, S., 1996).

CONCLUSION

In recent years, the demand for functional food has increased as people become more aware of the link between diet and health. The functional characteristics of food of animal origin are a result of the natural content of bioactive components and the functional modifications of the food by incorporating ingredients that have a positive effect on health. Today the production of functional foods has seen a steady increase, and new products on the market are increasingly accepted by consumers. This paper presents an overview on the functional characteristics of different foods of animal origin on the basis of data from the available literature

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