Techniczne nauki

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ARGUMENTATION OF THE EFFICIENCY OF FOOD FIBERS USAGE IN BREAD AND BAKERY PRODUCTS TECHNOLOGIES

Abstract. *In this article the appropriateness of bread and bakery products enrichment with the food fibers was examined. The main means of the enrichment were analyzed and their efficiency was proved. It has been found that the most favourable among the existing means of bread and bakery products enrichment is adding the purified products of food fibers.*

Key words: *physiologically functional ingredients, food fibers, bread, bread and bakery products, purified products of food fibers.*

I. Introduction

According to the evaluation of the World Health Organization (WHO) experts the lifespan depends on nutrition more than 70%. Violation of the healthy eating principles causes the range of physical abnormality and comes with the resistance and adaptative reserve level decrease, which may be the reason for a lot of diseases. Nutrition should not only obtain the physiological energy requirements of human body, but also perform the preventive and healing functions, protect the organism from adverse environment. All this could be reached due to enrichment of nutrition products with the physiologically functional ingredients.

One of the main nutrition products is bread, so its product-line expansion and improving the formulation is the relevant objective for modern scientists. Recently the consumption of mass bread has decreased and thus the consumption of phylactic

and dietary bread has increased. According to various literary sources for bread and bakery products enrichment vitamin products, micro- and macronutrients, food fibers are used. Special focus is on the food fibers which are on the list of physiologically functional ingredients that are used for preparing the products of functional purpose.

According to the definition made by the first food fibers researchers Trowell and Burcill in 1986, "food fiber is the plant cell remains which are resistant to hydrolysis performed by digestive enzymes of human body". On the one hand, they are the physiologically functional ingredients, which positively influence particular body systems and the organism in general. On the other hand, they possess the handling qualities of food supplements which regulate the structure and physical and chemical qualities of nutrition products [1]. Based on WHO recommendations the product 100g of which contain 3g of food fibers is considered as the source of the functional ingredient, if 100g of product contain 6g of food fibers, the product shall be regarded as the product enriched with the food fibers. In accordance with the data of The Food Nutrition Board of National Academy (FNB), a person should eat 25…38g of food fibers daily. However, the actual level of consumption is fewer than the half of this amount [2]. While eating bread people get only up to 15-20% of recommended intake of food fibers. Thus the increase of nutrition value of this product is of great importance.

Food fibers, added to nutrition products, enhance the synthesis of vitamins B1, B2, B6, PP and folic acid by enteric bacteria, decrease the time of digestive transit, and stimulate the intestinal motility by positively influencing on its florula. As a result, the percent of beneficial lactobacillus and streptococcus. The positive impact of food fibers on human body is not restricted only by these effects. Thanks to high sorptivity food fibers can fix not only the surface molecules of water but also larger substrates, bile acids, pharmaceuticals, xenobiotics, bacteria enterotoxins, carcinogens and remove them from the body. In the gaster the food exfiltration slows down under the action of food fibers, that creates the ongoing feeling of satiation, limits food consumption and enables loss in body mass.

Suchwise food fibers take an active part in metabolic processes of digestive tract and are necessary for normal vital activity of human body. In general, adding the food fibers to bread and bakery products is considered as the most appropriate physiological approach to prevention digestive tract pathology and to complex treatment of digestive and other diseases.

II. Goal setting

To examine the main sources of food enrichment with the food fibers, to prove their effectiveness and to choose the best among them.

III. Results

Analysis of publications on the experience of increasing the nutrition value of bread and bakery products allowed to identify the main ways of enriching with the food fibers, such as integrated use of raw products containing food fibers; adding secondary products that are high in food fibers (bran, flakes and oil crops, frugivorous and vegetable powders, purees, etc.); adding purified concentrate of food fibers that are extracted from cereals, secondary or nontraditional plant material [3-11].

Particular attention is paid to the full use of grain processing products such as bran, wheat germ, crude flour, whole grain with its various pretreatment (crushing, rolling, bioactivation) whole wheat grain and rye. The main means of enrichment the bakery products with the food fibers also include the expansion of its product range through the use of alternative types of flour (oatmeal, barley, corn, rice, etc.). Bread the recipe of which includes such materials is characterized with a high content of food fibers, vitamins, bioabsorbable minerals, essential amino acids and so on.

To enrich bread with food fibers the high-extraction flour is widely used, which efficiently saves all the peripheral parts of grains - shells, aleurone layer and germ. Institute of Food Biotechnology and Geonomics NAS Ukraine has received whole wheat flour from wheat "Zdorovia" (“Health”), the chemical structure of which is close to the grain and is characterized by high content of food fibers, minerals and vitamins. The consumption of the bread from the flour “Zdorovia” (“Health”) should

improve the intestinal motility, help to decrease the level of cholesterol in blood and to clear the body from harmful substances [3].

Among the secondary products of grain and cereal crops processing in the bakery the flakes are mainly used, they are the flattened grains. Flakes contain large amounts of nutrients which are found in the inner layers and protected from the external environment. To improve the plasticity of flakes the grains are usually treated with enzymes before rolling. The scientists have developed the technology of making wheat bread of high nutrition value, using oat and buckwheat flakes and rye and triticale cereals. It was found that adding flakes to bread recipes enriches it with food fibers, micro- and macronutrients and produces bread with excellent quality indicators [5].

As a source of food fibers and a range of other biologically active substances the oil meal is widely used in the manufacturing of bread, which are the secondary products of the production of vegetable oils. The technology of wheat bread enriched with flax meal, which is rich in protein, unsaturated fatty acids, lignans and food fibers, with the proportion of 2,5-5% of the flour weight was suggested. Bread with flax meal can be recommended for people with diseases of the digestive, cardiovascular systems and diabetes, and also with the prophylactic purpose for wide range of consumers [6]. The technology of bakery products of high nutrition value with the addition of seaberry meal, which has high biological activity and protective properties, was developed. Adding it in amount of 5,7% positively impacts on the structural and mechanical properties of bread, improves porosity and specific volume. It was proved that seaberry meal can be added to wheat flour with low gluten produced of low-grade grain and grain with the signs of germination.

One of the perspective directions of bread and bakery products manufacturing for health improvement is the use of products of processing fruits and vegetables rich in biologically active substances. The representatives of such products are fruit and vegetable powder with high content of pectin and insoluble food fibers. The native scientists developed a manufacturing technology of powders, which contain pectin, from beet pulp and apple pomace. The content of pectin in apple powder is 16,6%,

the content of insoluble food fibers – 51%, it is a little less than in beet powder (23% and 57%). The powders are recommended for bread enrichment in amount of 3% from flour weight, as they possess antiradionuclide qualities and with the purpose of increasing the amount of food fibers in ration.

To prevent the risk of diseases associated with a deficiency of micronutrients such as iodine and iron bread with rye flour has been enriched with the kelp powder and anise. Adding the powder in an amount of 5% let improve the quality of bread, reduce the time of fermentation of leaven and enrich it with functional physiological components, the large part of which is the food fibers.

Large-scale studies have been conducted by scientists studying the possibility of using dogberry powder in bread and bakery products technology. Adding the powder in amount of 6% strengthens the gluten, increases the specific volume of end products, extends the shelf life and enriches their chemical composition with food fibers, minerals and antioxidants.

As a functional food supplement for wheat bread production mashed sugar beet has been used. It was found that the adding of it in the amount of 20% of flour weight the bread and bakery products enrich with physiologically important components, including food fibers (1.2%), more than the half of which is represented by pectin (0.64%). This improves the quality of end products and slows their firming [7].

Modern Ukrainian market offers the limited assortment of bread and bakery products enriched with food fibers especially by means of bran cereal and flakes. However, their size distribution involves much larger particle size compared to high yields particles of flour. This can cause irritation of the digestive tract and provides a number of restrictions on the consumption of such food by people with acute diseases of digestive tract, for which the problem of food fibers deficiency remains unsolved. In this regard, the use of finely divided fibers in the global practice of creating functional foods is becoming more common. The majority of finely divided fibers are highly purified products the primary purpose of which is to use them as food supplements that can change the structure and physico-chemical properties of the product [8].

Today, the use of apple, oatmeal and beet fiber concentrates for the enrichment of rye-wheat bread is well-known. It was found that concentrates contain in its composition 64,7-80,2% of food fibers. Adding the apple and oat fiber concentrate in an amount of 10% and beet fiber concentrate – 8% instead of flour in the presence of nonionic surfactant action increases the amount of food fibers without degrading the quality of end products. [8]

The researches of influence of cellular tissue from pumpkin seeds on the nutrition value and quality of bread wheat have been conducted. Use of 7-10% of cellular tissue in the production of food results in improved shape stability of end products and prolongs the preservation of their freshness. Moreover, its chemical structure is enriched with food fibers, protein, B vitamins, carotinoids and minerals [9].

Processed potato products, such as potato fibers, as a source of food fibers, deserve special attention. There is an experience of wheat bread enrichment with the dietary potato fibers "Rotex" of Swedish company "Lyckeby Culinar", which is produced from potato cell walls. According to the research the content of dietary fibers in product is 23%, which includes hemicellulose, pectin, cellulose and lignin [10].

In order to enrich bread and bakery products with food fibers the technology of rye-wheat bread production with the usage of pea fibers, which contain 34.7% more fibers than wheat bran, has been introduced. Bread with pea fibers can be recommended for preventing diseases related to violation of the endocrine system, digestive system, circulatory system [11].

IV. Conclusions

Within the last decades native and foreign scientists have distinguished the main ways of bread and bakery products enrichment with the food fibers. The literary sources analysis has shown that the most popular one is the usage of products with the food fibers of whole grain and flour sorts that aren't used for bread making. However, despite the extra nutrition value the developed goods have some worse organoleptic qualities. Moreover, they are not recommended to be consumed by people who suffer from acute digestive diseases.

When using by-products of plant feedstock (flocks, oilseed meal, fruit powders, puree etc.) as a source of food fibers in bread technology the nutrition value of the bread is supplemented with the particular amount of minerals and vitamins. And in most cases the consumption of the developed bread does not cover the daily need in food fibers, while the increase of the dosage of the stated feedstock negatively influences the organoleptic characteristics of the end product quality.

Among the existing means of bread enrichment with the food fibers the most favorable one is the adding of purified food fiber products. They have the obvious advantage. It is their fineness, which allows consuming the enriched goods by all population groups. Thanks to high content of fibers in the feedstock, neutral taste and light color the enrichment of bread and bakery products do not experience any changes of the flavor profile. The purified food fiber products in bread and bakery goods provide the increase of end products and improve their soft part structure. High content of food fibers allows decreasing of its dosage in bread and bakery products recipes with preserving the recommended daily amount of ballast agent consumption. What is more, the usage of dietary fibers in wheat bread technology will allow getting the product enriched with food fibers, which can be one of the means of solving the problem of healthy dieting in Ukraine under current working conditions.

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