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THE MOST IMPORTANT INDICATORS OF NUTRITIONAL VALUE BAKERY PRODUCTS

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Abstract

Energy value of the main nutrients: when 1 g of proteins is oxidized, an average of 4.1 kcal is released in the body, when the same amount of carbohydrates is oxidized - 4.1 kcal, fats - 9.3 kcal. Proteins, carbohydrates and lipids (fats) of bread are not completely absorbed. It is possible to increase the protein content while reducing the amount of carbohydrate - starch - by adding protein-containing raw materials. In a narrower sense, the addition of essential substances to replenish their losses during use, production and storage means “recovery”

Keywords

Nutritional value of bread, bread, bakery and bakery products, energy value,

The nutritional value of bread, bakery and bakery products is a set of properties that satisfy the physiological needs of an individual for energy and essential substances.

Energy value is the most important indicator of the nutritional value of bakery products. This is the ability of a food product to release a certain amount of energy for a given product during “combustion” in the human body [1,2,3]. Energy value of the main nutrients: when 1 g of proteins is oxidized, an average of 4.1 kcal is released in the body, when the same amount of carbohydrates is oxidized - 4.1 kcal, fats - 9.3 kcal. Proteins, carbohydrates and lipids (fats) of bread are not completely absorbed. When calculating the energy value of bakery products, it is necessary to take into account the digestibility coefficient of the nutrients they contain [1,4,5,6].

To increase the nutritional value of bakery products, the following measures are taken: adjusting the chemical composition of bread through the use in production, in addition to traditional raw materials, of dietary supplements - biologically active additives, which make it possible to obtain products for preventive and therapeutic nutrition and with functional properties [2,7,8,9].

To create bakery products with increased nutritional value, it is necessary, together with the use of various traditional baking raw materials, to also use new

types of raw materials, dietary supplements, which allow you to change the composition of products depending on the type of product in a specific direction. For example, to increase the amount of dietary fiber in products, an increased content of bran, whole grains is introduced, or microcrystalline cellulose is used. It is possible to increase the protein content while reducing the amount of carbohydrate - starch - by adding protein-containing raw materials[1,2,3,10,11].

As biologically active additives, they are used as nutraceuticals, substances that allow you to change the chemical composition of bread, optimize the nutritional value of the product, and parapharmaceuticals - substances, when added, the products are given dietary properties: regulating the systems of the human body and the activity of its individual organs [12,13,14].

Fortification of food products with missing micro and macronutrients is a serious intervention in the traditional structure of human nutrition. The need for such intervention is due to objective reasons: changes in lifestyle, nutritional value and the range of food products used; therefore, its implementation is possible only with the use of practice-tested and scientifically based principles [15,16,17,18].

In the broadest sense, the term "fortification" means the addition of various essential nutrients to food products: micro- and macronutrients, vitamins, phospholipids, dietary fiber, polyunsaturated fatty acids, as well as any other biologically active substances of natural origin, regardless of their quantity, recruitment and intervention goals [19,20,21,22].

"Nutrification" is very close in meaning to the term "enrichment," but its definition emphasizes the purpose of adding essential substances: increasing the nutritional value of food products. In a narrower sense, the addition of essential substances to replenish their losses during use, production and storage means "recovery" [23,24,25,26].

To reduce energy costs and reduce the total volume of food consumed among the population, there is a need to move from the outdated principle of compensation for losses to the special enrichment of food products with essential substances to the required level, which exceeds the natural level in a given product. To denote this process in foreign countries, the term "strengthening" or "fortification" is used [27,28,29].

In addition to the above, the concept of "standardization" should also be noted, which means the addition of essential substances for leveling, leading to a uniform level of content of these nutrients in one product, but in different batches and types [30].

All terms refer to the introduction of essential nutrients into the composition of the fortified food product. In turn, the term "supplementation" has a

fundamental difference from those previously discussed, consisting in the additional intake of micronutrients with pharmaceuticals: tablets, capsules, syrups, etc., to achieve a sufficient level of their intake from food or other positive effect.

Bakery products are the most important products in human nutrition, therefore one of the most important tasks of technologists is to increase their nutritional value. To the substances necessary for the human body that determine nutritional value, essential amino acids and minerals. To characterize bread related to nutritional value, quality indicators such as crumb looseness , aroma, appearance and, of course, taste of the product are also important. The ability of the body to absorb substances and the energy value of bread are also of great importance [31,32,33,34,35].

Depending on the type and variety of baked goods, it contains 5-8% proteins. They are high-molecular complex substances that consist of a large number of amino acid residues. The source of protein formation in the human body is the amino acids of food proteins. They play an important role in the functioning and formation of tissues of the human body and are not replaced by any other substances.

The biological value of protein for the body is associated with its amino acid composition, as well as the content of amino acids that are not synthesized in the human body (essential) - valine, tryptophan, phenylalanine, leucine, threonine, methionine, isoleucine, lysine. The most deficient of these are threonine and lysine. In addition, the quality of proteins is directly proportional to the ratio of individual non-synthesized amino acids that is favorable for the human body. Bread proteins cannot be called complete; they lack the most important amino acids: threonine and lysine. The lack of amino acids increases with the increase in the recipe of premium flour. The amino acid composition of a bakery product becomes more valuable the more it is combined with other food products: meat, milk or cottage cheese. The digestibility coefficient of bread proteins ranges from 0.75 to 0.87 [36,37,38].

Products of plant and animal origin are used as additives that increase the biological value of bread. Fortifiers of plant origin include processed products of sunflower, beans, peas, rapeseed, soybeans, peanuts, cotton and others. They are used in the form of isolates or concentrates containing up to 90% protein, or in the form of cereals or flour containing about 50% protein.

In bakery products with unchanged recipe in an amount of 1-1.6%. The higher the grade of flour that makes up the bread, the lower the lipid content in it. Lipids are the body's energy reserve and a structural part of all its tissues. During the digestion process, carbohydrates and lipids replace each other. The digestibility of

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lipids contained in bread is 52-86%, the digestibility coefficient of 0.92 depends on the type of fat used in the recipe.

The content of these substances in bread and bakery products is about 46% of the total amount of nutrients. The largest part of the carbohydrates contained in bread is starch, which is a complex polysaccharide that, under the action of amylolytic enzymes, decomposes into simple sugars. The gelatinization of starch grains during the bread production process simplifies digestion and the action of digestive juices, and increases the digestibility of the finished product. Up to 66% of the starch contained in bread is fully absorbed by the body. First grade wheat flour contains less starch than the same high grade flour. In wheat - less than in rye of the same variety.

And also there are their own sugars: glucose, sucrose and maltose. Their content is very small. Simple sugars are absorbed by the digestive tract without conversion, disaccharides are converted into simple sugars and are also very quickly absorbed by the intestinal mucosa.

Contained in bread include fiber, dietary fiber, and hemicellulose, pentosan - accompanying high-molecular carbohydrates that enter products from grain shells. In bread, the cellulose content ranges from 1-2%. The content in bread made from lower grade flour is higher than in products made from premium flour. Despite the fact that cellulose is not completely absorbed by the digestive tract, it plays a vital role in vital processes. The total digestibility of carbohydrates is 9 1-92%, the digestibility coefficient is 0.97 [39,40,41].

The production of flour from wheat or rye grains leads to inevitable losses of micronutrients - vitamins, which are removed along with the grain shell. Further use of flour in the production of bakery and flour confectionery products is accompanied by a further decrease in the amount of these important biological substances[19]. In Fig. 1 shows that the greatest loss of vitamins is for thiamine (B1) - 58%. The maximum losses of other vitamins found in baked goods are: niacin (PP) – 78%, pyridoxine (B6) – 70% [42].

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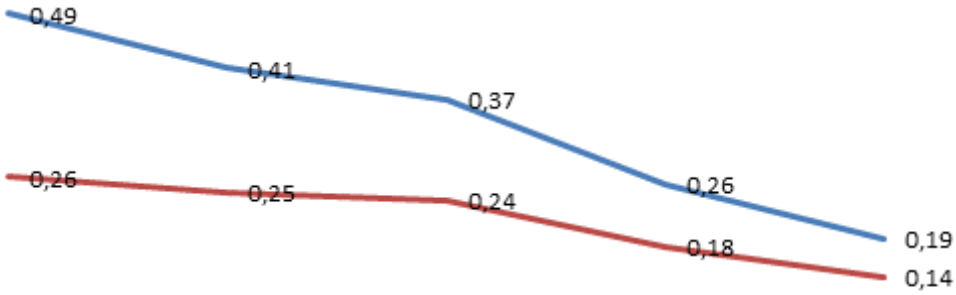

Figure 1 - Mass fraction of thiamine in wheat grain and products of its processing, mg/100 g

Amino acids are substances of organic origin that play an important role in regulating metabolism. One of the main tasks of modern food production is both the development of methods for determining the content of vitamins and vitamin-like substances, and the vitaminization of products itself during the production process.

Products made from flour containing a large number of grain shells and germ are richer in vitamin B1 than products made from premium flour.

Bakery products are suitable for regions with an unfavorable environmental situation, for certain groups of the population, as therapeutic and therapeutic-and-prophylactic nutrition, as well as for the production of mass products from premium wheat flour, characterized by a low content of vitamins. This problem can be solved by carrying out the following activities: breeding work, full use of the vitamins of the grain itself, fortification of flour at flour mills, maximum preservation of vitamins during the production of bakery products, enrichment of the product during the cooking process in bakery production [43].

Practical and scientific principles for fortifying flour have been developed: choosing the most deficient vitamin supplements, regulating the level of vitamin content, technologies for using substances to fortify products. Fortifiers have been developed for the baking industry, including vitamins. Sanitary and hygienic standards for recommended levels of vitamin supplementation have been developed and are presented in Table 2.

Table 2 - Recommended standards for vitamin content for fortifying flour and bakery products.

Product name	Amount of added vitamins, mg/100 g of product, mg/100 g of product		
	B 1	B 2	At 6

Wheat flour of the highest and first grades	0.5-06	0.4-0.6	-
Bakery products made from premium and first grade flour	0.27-0.4	0.27-0.4	-
Preventive bakery products	0.6-08	0.5-0.8	0.5-0.8

Preparations of water-soluble vitamins can be added as part of any liquid component. The effectiveness of using a solution of table salt with a concentration of 20-26% for this purpose and keeping vitamins in it for 24 hours has been shown. In this case, the "ripening" of the solution occurs. The smallest particles of vitamins are covered with a salt shell, which contributes to the uniform distribution of vitamins throughout the entire volume of the dough [44].

An effective way to increase the preservation of vitamins in baked goods is to use them in the form of special premixes or encapsulated preparations. To fortify food products, vitamin and mineral mixtures are used - premixes, most often industrially produced, which are engaged in the development of preparations for various branches of the food industry. The following vitamin and mineral complexes are provided for the fortification of flour, bakery and flour products [45,46].

The mineral value of bakery products is determined by the amount of minerals they contain, which is 1-2% by weight of the product.

The composition of the human body should include the following minerals: iron, calcium, phosphorus, potassium, magnesium and others, in an amount of 3.5%, depending on its body weight.

During the period of body formation and immediate growth, in adolescents, pregnant and lactating women, and old people, the need for phosphorus and calcium increases sharply.

For the adult population, the optimal ratio of phosphorus and calcium in food is 2:1. Microelements necessary for the human body include cobalt, copper, fluorine and others. They regulate many physiological processes. The ratio of phosphorus and calcium is better in wheat and rye with a lower flour yield. The higher the grade of flour from which the bread is made, the less minerals the baked product contains. They are rich in magnesium, sulfur, potassium, and phosphorus, but the calcium content is negligible [47].

To optimize the ratio of phosphorus and calcium salts in baked goods, calcium must be added to it. For these purposes, dairy products and milk are widely used

in industry. They contain complete proteins and sufficient amounts of calcium, in the form of easily digestible lactate. Bread that is prepared with the addition of milk powder contains more calcium. For the same purpose, fishmeal is used in baking.

phytase, an enzyme that breaks down phytic phosphorus compounds, as well as minerals: phosphorus, calcium and others, are also used.

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