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PERSPECTIVES FOR DEVELOPMENT OF GLUTEN-FREE PRODUCTS

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Currently, production of food products that reduce various diseases, including genetic ones, is the promising and progressive direction of the industry.

Such genetic disease is celiac disease or gluten-sensitive enteropathy. This disease is characterized by the features of the deficiency of the enzyme that cleaves a certain fraction of protein substances – gluten [1, p. 44].

It is known that by the chemical formula of cereals proteins, they are divided into simple, which, when hydrolysis, form only amino acids, and conjugated proteins, which are a combination of simple protein with some substance.

Simple proteins (protein) by solubility are divided into such groups.

Albumins are proteins soluble in water and saline solutions. These are complete proteins, they contain all the essential amino acids.

Globulins are proteins, soluble in weak solutions of salts, but insoluble in pure water. They are also complete. A large number of them is contained in legume crops.

Prolamins are proteins soluble in 60 ... 80% ethanol and insoluble in water and salt solutions. Biologically, these proteins are less valuable because they contain little lysine, and sometimes tryptophan.

Glutelins are proteins, soluble in weak solutions (0.2%) of alkalis. In water, solutions of alcohol and solutions of salts they are insoluble.

The last two factions are called «gluten» [1, p. 44, 2, p. 45].

Earlier it was thought that celiac disease is very rare. But in the nineties years of the last century in the USA 1: 2500 patient was diagnosed. And after 10 years, due to the advent of more simple and modern methods of analysis, it became known that in the USA this ratio is 1: 133 [2], in Italy – 1: 100 [3, p. 36], in Finland – 1: 99 [2, p. 45]. According to the latest data, the number of this disease on the Earth is approaching 1% of the population. According to the Ukrainian Celiac Society, about 200 thousand of people of different age groups are registered on the territory of Ukraine, but according to unofficial data, this figure is 2 ... 3 times higher.

When patients with celiac disease eat gluten foods, their inner membranes of the small intestine ruin and the ability to split and absorb nutrients is damaged. As a result, patients can have many different diseases of the gastrointestinal tract and other diseases: anemia, osteoporosis, epilepsy, joint disease, diabetes and even malignant tumors of the small intestine of the patient [4, p. 244].

There are no drugs for celiac disease today. The main method of control of this disease is a strict life-cycle diet with the complete exclusion of all products containing gluten, namely all that is prepared from wheat, rye, barley and oats. The basis of the diet of patients with celiac disease should be rice, corn, buckwheat, meat, vegetables, fruits, beans, potatoes.

Particular attention, as the gluten-free raw material for food products, belongs to rice, corn, buckwheat and amaranth [5, p. 324].

Rice (Oryza) is one of the most valuable crops in the world. The main product of rice grains is rice groats, dietary product with high nutritional properties [6]. By nutrition, 1 kg of rice grains is equivalent to 3,500 calories.

Absolutely dry substance of groats contain: proteins – 6 ... 8%, fats – 1,7 – 2,2%, carbohydrates – 65 ... 70%, cellulose – 10,2 ... 10,9%, ash – 3,2 ... 5 , 2%, starch 55 ... 75%. According to absorption (96%) and digestion (98%).

Starchy rice grains are small, native starch is difficult to hydrolyze with amylase [7, p. 281]. Sugars are represented by sucrose, maltose, raffinose, glucose and fructose.

Almost 62,000 hectares of arable land are occupied under the rice crop rotation in Ukraine, mainly in the south of the Kherson region, as well as in the Danube river basins, in the Odesa region. on unproductive saline soils [8, p. 29].

Corn (Zea mays) is known as raw material for feed, alcohol, starch, cereals, flour, canning, brewing and food concentrate industry.

The content of protein substances in corn grain, depending on the variety and environmental conditions, according to various authors, is within 8 ... 12%, starch - 60 ... 80%. In this case, corn starch contains 21 ... 23% amylase and 77 ... 79% amylopectin [9, p. 51].

Buckwheat (Fagopyrum) is a valuable raw material for cereal and flour mill production.

Buckwheat is a traditional agricultural crop grown in Central and Eastern Europe and Asia. The main manufacturer countries of buckwheat are: China – about 42% of the total production in the world, Russia – slightly more than 34%, Ukraine – about 10%. It is also grown in Poland, Brazil, the USA, France, Japan and other countries.

Food, medical and preventive properties of buckwheat are due to its unique chemical formula. Buckwheat grains contain 9.5-14.1% of proteins, 1.8-3.1% of fats, 80.5-84.1% of starch, 1.2-2.2% of cellulose, sugar, organic acids, mineral salts, vitamins [10, p. 785].

High biological value is due to proteins. Proteins of buckwheat are easily digested, more complete in comparison with proteins of other cereals, and on nutritional value it is not inferior to proteins of legumes.

The main nutrients of buckwheat are carbohydrates. They are starch, dietary fibre and sugar.

Amaranth (Amaranth) attracts the attention of researchers and practitioners to its richness and balance of protein, high content of vitamins, mineral salts. The uniqueness of the amaranth is its extremely high nutritional value and edibility of all its parts without exception: stems, leaves, seeds.

Amaranth on the content of proteins (13-19%) has the largest coincidence with the theoretically calculated ideal protein, and on balance of the amino acid composition (nonessential and essential amino acids) is equal to the protein of breast milk. For comparison, the coefficient of evaluation to the ideal protein: amaranth – 75, cow's milk – 72, soybeans – 68, barley – 62, wheat – 60, corn – 44, peanuts – 32. Moreover, 100 g of amaranth protein contain 6.2 g of lysine – an essential amino acid, which is

not present in such quantities in other plants. In the absence of lysine, food is simply not absorbed and the protein «passes by» the body.

Amaranth seeds are rich in complex of polyunsaturated fatty acids (linoleic, palmitic, stearic, oleinic, linolenic), with a content of 77%, while 50% belongs to linoleic acid.

Gluten-free malt. It is known that when germinating the grain is enriched with biologically active substances: low molecular weight proteins, sugars, amino acids, vitamins, enzymes and phytohormones. There is no doubt that the use of germinated gluten-free grain (malt) in the production of food products, including for patients with celiac disease, will make it possible to significantly increase the efficiency of their use, which is achieved both due to the valuable substances of the grain from which the malt is prepared, and due to biologically active substances, which are formed at its germination [11, p 29].

Malt is a cereal grain that sprouted in artificial conditions at a certain temperature and humidity. Germination is carried out for the accumulation of hydrolytic enzymes to change the chemical formula and grain structure.

The finished malt has excellent taste and smell and allows to get wort with high extraction. Particular attention was paid to optimizing the malt drying process in order to maintain maximum activity of amylolytic enzymes of free and soluble nitrogen. Depending on the drying methods, malt can be used to prepare dark and light beers. Currently, the recipes of gluten-free beer are developed using corn, buckwheat and rice malt.

One of the most valuable ingredients in food products is protein substances and amino acids, which are especially essential. A protein that does not contain several or even one essential amino acid is considered to be inferior. It is known that the lack of essential amino acids in foods results in the delaying the progression of the organism. And in rice malt, compared to its grain, these indicators are only increasing, thereby increasing the usefulness and nutritional value of this product.

References:

1. Kuznetsova L.I. Technology of gluten-free bakery products for therapeutic and prophylactic nutrition / I.L. Kuznetsova, G.V. Ternovsky. *Storage and processing of agricultural raw materials*. 2010. № 11. p. 55-57.

2. Tsyganova T. Formation of recipes for the production of nonprotein and gluten-free products / T. Tsyganova, D. Schneider, E. Kostylova // *Bakery Products*. 2011. № – 12. p. 44 – 46.

3. Yaroslavtseva E. Gluten intolerance / E. Yaroslavtseva // *Baking and confectionery industry of Ukraine*. 2011. № 1. p. 36 – 37.

4. Shendry, T. Celiac disease. A Guide to Successful Diagnosis and Treatment / T. Shendry, M. Bernadette, A. Runnin // *The Journal for Nurse Practitioners*. 2009. N 4. P. 244-253.

5. Zeltner D. Real-time PCR system for the detection of the gluten-containing cereals wheat, spelt, kamut, rye, barley and oat \ D. Zeltner, M. A. Glomb, D. Maede \\ *Eur Food Res Technol*. 2009. Vol. 228. P. 321 – 330