

## **The expediency of using corn germ flour in bakery products**

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**Annotation.** Analytical and experimental studies are done due to a new biologically valuable raw material – maize germ meal (MGM). Particle size, chemical composition and technological indicators of MGM are studied.

It is found out that the investigated meal has an average granulation of 0.39 mm and additional grinding is not required. The chemical composition of MGM showed that it is rich in protein - 1.2%, oil - 10.7% and carbohydrates, including mono- and disaccharide content - 5.7%, and fat - 0.4% comparing with wheat flour.

The definition of functional and technological properties showed that MGM has higher water absorbtion, water and fat keeping abilities.

So corn germ flour should be used to expand the range of bakery products and for the correction of Ukrainian nutrition.

**Keywords:** bakery, maize germ meal, granulation, chemical composition, functional and technological properties, range.

**I. Introduction.** Keeping and strengthening of health and following healthy lifestyle of young generation are the current country problems. Good health and high ability to adapt to environmental influence are the ones of the most important conditions for the formation of the personal character.

The health of a young person resistance to unfavorable environmental conditions, mental and physical efficiency, learning efficiency largely depends on good nutrition. Macro- and micronutrient scarcity among the population of Ukraine, in particular proteins, fats, vitamins, minerals and essential amino acids causes poor health and mental development of kids, reducing efficiency and

immunity, metabolic disorders, and therefore reduces physical and intellectual ability of nation [1,2].

**II. Formulation of the problem.** One of the goals of improving the health is using food of functional purpose, in particular bakery products, because bread is a part of daily consumption.

To improve the nutritional value of bread, the following ways are possible:

- increasing the flour yield with the possibility of inclusion of all parts of the aleurone layer and the germ, the richest in minerals, vitamins, proteins;

- adding brans to flour, which were processed beforehand for the improvement of digestibility of the substances they contain;

- adding chemical vitamins, minerals and amino acids to flour, which is obtained from the endosperm which has the least quantity of these substances;

- adding various natural products that contain significant amount of vitamins, minerals and proteins (yeast, soy flour, whey, germs of cereals, skimmed milk powder);

- breeding new species of cereals that are rich in vitamins, minerals or fiber.

**III. The purpose of the article.** Accordingly, we need to choose a plant raw substance containing physiologically functional ingredients for expanding the range of bakery and correction of Ukrainian diet among known protein containing substances.

**IV. Presenting the main information.** Recently researchers and producers pay attention to the usage of products of processed cereals as a source of essential valuable substances in the manufacture. It is basically products of processed peas, soybeans, rice, barley, buckwheat, oats and maize [3].

**Soy flour** in the baking industry in many countries is used as a source of cheap high-grade protein. Protein content of soybeans is 36-48%, which is 3.5 times more than in wheat. As for amino acid composition, they are close to the ideal protein. On the contrary with wheat, soybeans contain more vitamins B, PP, biotin, calcium, potassium and iron. Soybean flour is recommended to add to

social breads, 10-15% - in special kinds with high nutritional and biological value and 20-25% - for dietary products.

However, replacing 10% of wheat flour into soy one, quality of bread is reduced, because of the deterioration of gas making and gas keeping ability of dough.

Besides soy flour, **soy protein and fat enrichment (SPFE)** are produced from soy beans in Ukraine. This product contains up to 40% protein, up to 30% fat, about 5% of phospholipids and 15% fiber. A research done in USUFT reveals that it is advisable to add 5-7% SPFE to the weight of flour during production of bakery products to improve their nutritional value.

**Pea flour** contains 25-30% of protein. As for amino acid composition of proteins pea flour is similar to proteins of milk and meat. Without deterioration of bread quality, pea flour can be added in an amount of 2.3% to the total weight of wheat flour. However, when you add it some structural and mechanical properties of dough and bread become worse.

Rice flour is widely used in the recipes of gluten-free products [4]. It is recommended to add it in a mix with maize flour instead of 10 ... 30% wheat flour. The usage of 10 ... 15% of rice flour instead of wheat leads to increased bread volume by 1 and 2%.

Barley flour contains 9.7% of high-grade protein which is richer in amino acids content comparing with wheat flour, has a better amino acid score for lysine and tryptophan. It has twice more albumin than the chemical composition of wheat flour. Barley flour should be used as high-quality flour enrichment in the amount of 15% [5].

**Buckwheat flour** belongs to special purpose flour, which is used in baby and dietary nutrition. It is made of buckwheat processed within 3 ... 5 min by steam at a pressure of 0.25 ... 0.30 Pa. Studies conducted in NUFT found out that buckwheat flour can be a source of increasing physiological value of bread. The usage of it in a mixture of wheat flour enriches products with protein, vitamins, minerals and other biologically active substances, delaying bread staling process[6].

**Oat flour** contains 64.9% carbohydrate, 6.9% fiber, moreover, soluble polysaccharide  $\beta$ -glucan, which lowers cholesterol content in blood. This flour contains a significant amount of slime. Nowadays this flour is widely used to make a products improving people`s health. *ONAF*T developed dietary bread "Hercules", which contains 20% of oat flour. It is recommended as a treatment and prevention food in case of diseases of the cardiovascular system and gastrointestinal diseases [7]. Scientific studies conducted in *ONAF*T, *NUFT* discover that oat flour can be a component of a mixes, such as buckwheat, barley and oatmeal flour or be added to the dough in an amount of 15% instead of wheat flour.

Oilseeds are accepted as a promising enricher of range of bakery products [8]. Sunflower seeds contain 22% of protein and 64% of oil. A lot of scientists believe that the appropriate usage of sunflower seeds can increase the protein content in baked products. It is added to the dough separately or in a mixes with flaked or extruded cereals. The adding of 20% of sunflower seeds to flour increases protein content by 6% [9].

**Lentil** contain almost all essential nutrients for our body. 100 g contains 50 g carbohydrate and 24 g of plant protein that is easily digested. It includes such elements as iodine, iron, boron, manganese, zinc, calcium, phosphorus, cobalt, magnesium and others. Lentil is rich in vitamins, including B1, B2, and folic acid. Amino acids composition of lentil is close to the amino acid composition of the ideal protein. Despite the useful properties, lentil has some disadvantages. As any bean, it improves gas production, so people suffering from overgrowth and diseases of the gastrointestinal tract, shouldn`t use this seeds [8].

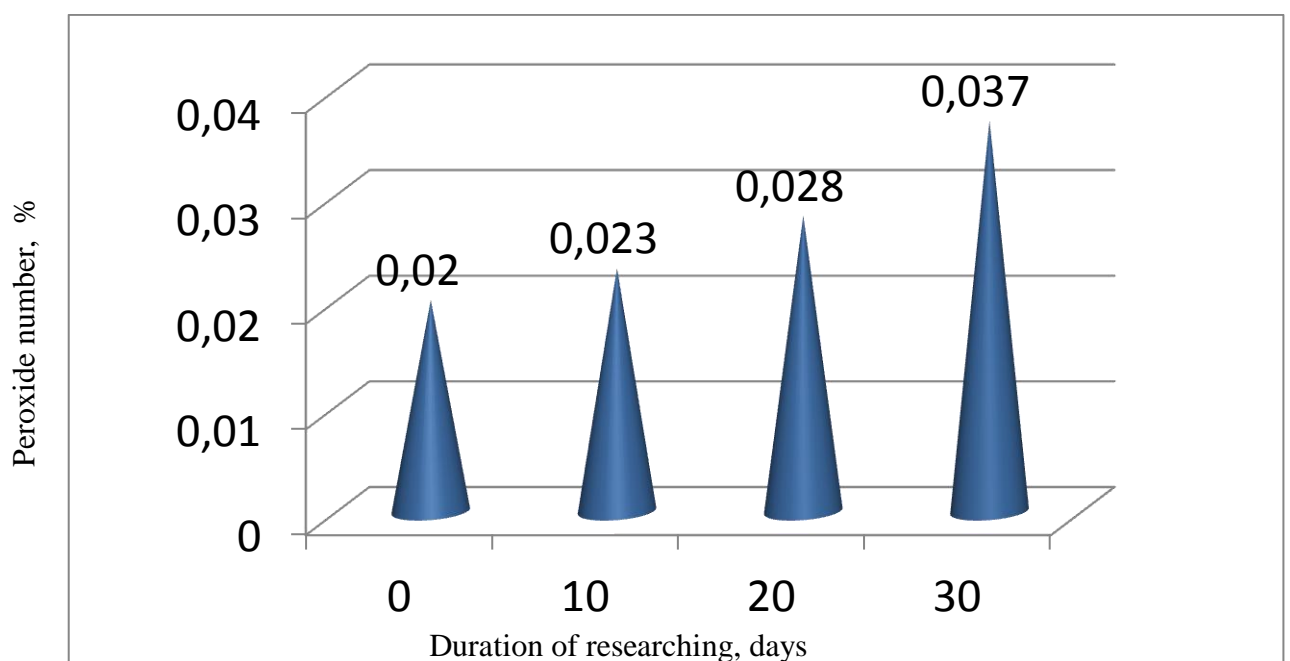
**The germ of wheat** is a source of increasing protein, vitamins and minerals in bread. There are 33-39 % proteins, sugar 21-30%, 13-19% lipids, minerals 4-6%, 8-11% fat, fiber content 2-3% in germ composition. Germ`s chemical composition of lysine, methionine, tryptophan germ protein is similar to egg protein. It consists of 80% unsaturated fatty acids (oleic, linoleic, linolenic), which are vital for human [8]. Dried germ in an amount of 5-15% is included to most recipes of bakery products abroad. The addition of wheat germ instead of certain amount of flour in

the production of bread from the mixes of wheat and rye flour intensifies biochemical processes of making raw dough. A lot of glutathione (0.45% for SR) is in a raw germ. By activating proteolysis, it adversely acts on baking properties of flour. As result of an action of proteolytic enzymes water absorbing and elasticity of dough decreases [8]. As a promising raw material for the creation of functional bakery products we suggest using maize germ meal, which is a by-product in the process of obtaining maize grits, produced by domestic enterprises in sufficient quantities. According to the research facility we have chosen maize germ meal (MGM) produced by "Skvirsky Combinat of Bakery Products," as energy-intensive raw materials and biologically valuable. In the laboratory of NUFT in Department of Technology and Restaurant Business investigated granulation and chemical composition of maize germ meal. It is found out that the investigated additive has an average particle size of 0.39 mm. This research of supplement size is almost the same size as wheat flour and it allows the usage of an additive without additional grinding. Chemical composition is shown in the Table. For control wheat flour was chosen as the main component of the production of bakery.

**Table - Chemical composition of studied samples**

<b>Name of component</b>	<b>Wheat flour</b>	<b>MGM</b>
protein, %	10,3	11,5
fat,%	1,3	11,0
carbohydrates, %	73,3	56,2
starch	68,5	45,3
mono- and disaccharides	1,6	7,3
fiber	3,2	3,6
part of moisture, %	14,5	12,3
ash, %	0,8	3,3

The data show that the studied materials compared to wheat flour contain 1.2% more protein, 10.7% more fat and carbohydrates, including mono- and disaccharides – 5.7% , fiber - 0.4% and ash – 2.5%. Maize germ meal is characterized by reduced moisture content of 2.2%. This figure should be considered in the production of bakery products. The ash content of MGM is 2.5% higher than of wheat, it indicates a high mineral content, they are potassium, magnesium, phosphorus, iron and sodium. In tested flour there is a significant portion of fat. So much interest in the study of physical and chemical parameters of the studied additives is introduced to peroxide index number. Initial peroxide number in the MGM is 0.02%. The study was conducted during one month.



**Fig. Effect of time on peroxide number of fat corn germ flour**

The figure shows that during the storage of raw materials this number increases which must be considered to the process of making cupcakes. This phenomenon can lead to the bitterness of raw materials and the deterioration of quality of the products. The research of MGM technological indicators showed that the water absorbing ability of researched meal at temperature of 30 ° C and 60 ° C is higher than in wheat flour, due to a slightly higher content of protein and highly hydrophilic non-starch polysaccharides, and connected with the beginning of the

gelatinization of starch granules. At the temperature of 90 ° C water absorbing ability of maize germ meal changes less. This difference at these temperatures is probably due to both lower starch content in MGM and a slightly higher temperature of the gelatinization of maize starch. Ginal results show that MGM is characterized by considerably higher water-keeping ability comparing with wheat flour and correlates with indicators of water absorbing ability. It is primarily connected with a high content of fiber as well as the peculiarities of its fractional composition, as cellulose has the ability not only to link but to keep water. The indicator of fat keeping ability of wheat flour and maize germ meal is almost the same.

**V. Conclusions.** So, all realized studies proved the expediency of using MGM to expand the range of bakery products of high biological value.

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