EURASIAN JOURNAL OF ACADEMIC RESEARCH
Innovative Academy Research Support Center
IF = 7.899 www.in-academy.uz

STUDY OF THE PROCESSES OF PRODUCING HIGH-QUALITY FLOUR FROM LOCALLY GROWN WHEAT

Uzaydullayev A. O.
Khazratkulov J. Z.
Toshqulova M. R.
Gulistan State University, Faculty of Production Technologies, Ph.D. in Technical Sciences, Assoc. Prof. of the "Food Technologies" department
Gulistan State University, Faculty of Production Technologies, teacher of the "Food Technologies" department
Gulistan State University, Faculty of Production Technologies, student of the "Food Technologies" department
https://doi.org/10.5281/zenodo.15640394

ARTICLE INFO

Received: 05th June 2025
Accepted: 10th June 2025
Online: 11st June 2025

KEYWORDS

Flour, Vitamins, Microelements, Endosperm, Wholemeal flour, Heat, Baby food, Germ, Fiber, Biochemical.

ABSTRACT

Flour and groats hold one of the most important places among food products. These products are essential sources of energy, protein, vitamins, and minerals necessary for the human body. In the production of flour and groats, cereal crops such as wheat, rye, rice (paddy), barley, oats, and corn are mainly used as raw materials. In recent years, the volume of flour and groats production in our country has been steadily increasing. This growth is linked to population growth, the relevance of food security issues, and the policy of modernizing the food industry.

Modern technologies and advanced scientific research are leading to the development of new production systems that increase the nutritional value of flour and groat products, preserve their biologically active properties, and enable the production of ready-to-eat food products. Today, the production of enriched flour varieties containing high levels of protein, dietary fiber, vitamins, and microelements has been established. At the same time, the production of groats and semi-finished products that significantly reduce cooking time or do not require cooking at all is expanding.

The efficiency of grain processing has significantly improved, with a reduction in electricity consumption and an observed enhancement in the nutritional and biochemical quality of the products. In particular, the complete processing of grain—i.e., obtaining flour, groats, and other by-products—ensures the rational and economically efficient use of resources.

In the flour production process, different parts of the grain—the endosperm, germ, and bran—are milled in specific proportions. If the flour contains only the endosperm part, it is referred to as refined flour. Conversely, if the entire grain, including the bran, endosperm, and germ, is milled together, the resulting product is called wholemeal flour (or whole wheat flour).

Today, various grades of flour differing in protein, starch, vitamin, and mineral content are being produced using modern mills equipped with high-efficiency, automated, and digitalized technological lines. These products are widely used in the bread, pasta, confectionery, and baby food industries, and are adapted to meet the nutritional needs of different social groups of the population.

EURASIAN JOURNAL OF ACADEMIC RESEARCH
Innovative Academy Research Support Center
IF = 7.899 www.in-academy.uz

Biochemical Properties of Grain and Flour

The biochemical properties of grain are determined by its chemical composition, the distribution of these substances across its anatomical parts, and the activity of hydrolytic enzymes. During the preparation and processing of grain, its biochemical properties can change significantly under the influence of water and heat during hydrothermal treatment.

The nutritional and biological value of flour and groat products depends on the effective management of technological processes, taking into account the chemical composition and properties of the grain.

In organizing and managing technological processes, it is essential to consider that grain is a living organism.

Under suitable conditions, when moisture and heat are present in the required amounts, the grain begins to germinate and a new plant starts to develop. All the processes that occur in living organisms—such as respiration, exchange with the environment, synthesis, and breakdown of substances—also take place in viable grain. These processes are regulated by the enzyme system, and their intensity depends on the grain's moisture content and temperature.

The processes that occur at all stages of the grain's condition and its interaction with the surrounding environment are regulated by biological systems.

Dry grain remains in a dormant state (anabiosis). However, when the grain's moisture content and temperature increase (up to 45–55 °C), enzyme activity intensifies, initiating processes in the grain that lead to the development of a new plant from the germ. The maximum activity of enzymes is determined by their nature—that is, the presence of relatively free (loosely bound) water in the grain and the prolonged influence of temperature activate them.

The Chemical Composition of Grain and Its Anatomical Parts

The cereal grains used for flour and groats are mainly characterized by a high starch content. Legume seeds, on the other hand, are rich in protein—for example, soybeans also have a high oil content (see Table 1.4). Grains used as groats tend to have a high fiber content, which is explained by the preservation of their husk. The uneven distribution of chemical substances within the grain's anatomical parts is related to the distinct biological functions of the germ, endosperm, outer bran layer, and husk. These differences are presented in detail in Table 1.

Table-1

Content of Main Chemical Substances in Grain, % of Dry Matter

Crop type	Protein	Starch	fiber	Fats	Ash content
wheat	10...20	60...75	2...3	2...2,5	1,5...2,2
rye	8...14	58...66	1,8...3,2	1,7..3,2	1,7...2,3
Barley	11...15	58...68	4,5...7,2	1,9..2,6	2,7...3,1
Oats	10...13	40...50	11,5...14	4,5..5,8	4,0...5,7
Triticale	11...23	49...57	2...3	3...5	1,8...2,2
Rice	8...10	65...75	9,5..12,5	1,5..2,5	4,5...6,8
Millet	10...15	58...65	10...11	1,9..2,3	3,7...4,5
White sorghum	9...14	51...61	5...6,5	2,7..3,7	1,8...2,4
Maize	9...11	68...76	2,5...3	4...6	1,4...1,8
Buckwheat	10...13	66...68	10...16	2,3..3,1	2,3...2,6

Chickpea	21...32	46...61	5...3	1,3..2,9	2,5...4,0
Soybean	30...32	2...4	4...5	15..18	4,0...5,2

Table-2

Content of Chemical Substances in the Anatomical Parts of Wheat and Rye Grain, % of Dry Matter

Cereal grain	Anatomical parts	Protein	Starch	Crude fiber	Pentosans	Fats	Ash content
wheat	Fruit peel	5...8	-	20...22	25...30	1...2	3,5...24,5
	Seed coat	12...20	-	1...1,5	14...36	0...0,2	7...20
	Aleurone layer	16...20	-	5...7	6...8	10...15	14,5...17
	Embryo	24...42	-	2...2,5	9...11	13...24	5,5...6,5
	Starchy endosperm	12...15	75...80	0,1...0,2	2...3	0,7...1,0	0,35...0,5
rye	Peels	1...3	-	22...28	30...35	1...2	4...6
	Aleurone layer	15...18	-	2...4	12...15	10...16	11...16
	Embryo	30...40	-	3...5	6...9	15...20	5...7
	Starchy endosperm	9...12	73...79	0,3...0,5	4...6	0,5...0,8	0,4...0,7

As seen in Table 2, the bran is characterized by a high fiber content, while the germ and aleurone layer are rich in protein and fats. Starch is found only in the endosperm. The anatomical parts of the grain differ significantly in terms of ash content, which is an important indicator used to control the quality of refined flour. The bran mainly contains substances that are indigestible for the human body. The germ and the aleurone layer of the endosperm have a high protein content, but also a high fat content, which can shorten the shelf life of flour. Therefore, during the milling process, the bran and germ are separated from the grain.

The nutritional value of food products is determined by their ability to meet the body's need for essential organic and mineral substances required for human growth and development, as well as the energy needed to maintain work capacity.

To ensure proper physiological functioning, a person should consume food daily that provides between 480 to 2800 kilocalories of energy, depending on age, gender, type of work performed, and climatic conditions The composition of food must be balanced, meaning it should contain a complete set of biologically active compounds. The diet must include proteins, essential amino acids, vitamins, minerals, fats, and other nutrients. For example, proteins, fats, and carbohydrates should be present in the following proportions:

On average, a person should consume the following amounts of essential amino acids and water-soluble vitamins per day through food: Tryptophan – 1.0 g, Threonine – 2.5 g, Isoleucine – 3.5 g, Lysine – 4.0 g, Valine – 3.5 g, Phenylalanine – 3.0 g, Methionine – 3.0 g, Leucine – 5.0 g, Thiamine (Vitamin B1) – 1.75 mg, Riboflavin (Vitamin B2) – 2 mg, Niacin (Vitamin B3) – 20 mg.The average daily protein intake should be about 80 grams.

If the biological value of egg protein is taken as 100, then the biological value of oat grain protein is 78, that of wheat is 62–67, corn is 52–58, millet is 57, and pea protein is 49–51. By consuming various products made from flour and groats, a person can meet approximately 15–20% of their protein requirements, 5–20% of their requirements for microelements, and 17–54% of their requirements for water-soluble vitamins.

The amount of vitamins in bread made from high-grade and first-grade wheat flour is significantly reduced. In bread made from high-grade wheat flour, the thiamine content is 1.5 times lower, and the niacin content is 2.5 times lower.

Various methods can be applied to increase the biological value of flour and groats. During the milling process, it is possible to form different quality grades of flour by combining flour streams from each technological system, taking into account the content of protein, vitamins, and microelements. By rationally blending flour streams, it is possible to produce high-protein, low-protein, and other types of flour.

When the flour extraction rate exceeds 70%, the content of biologically valuable substances in the flour also increases. The higher the flour yield, the greater its biological value. However, at the same time, the amount of fiber—indigestible by the human body—also increases. For example, flour obtained from the 3rd break system contains 0.30% fiber, while flour from the 7th break system contains 1.59% fiber, which is more than five times higher.

In flour and groats production, hydrothermal treatment of the grain increases the nutritional value of the final products. When wheat grain undergoes accelerated and high-temperature hydrothermal treatment, the vitamin content in high-grade flour increases significantly.

References:

1. Mirziyoyev, Shavkat Miromonivich. Yangi O‘zbekiston taraqqiyot strategiyasi. To‘ldirilgan ikkinchi nashri.-Toshkent: “O‘zbekiston” nashriyoti, 2023. -416 bet.
2. Егоров Г.А. и др. Практикум по технологии муки, крупы и комбикормов. М., Агропромиздат, 1991 г.
3. K.K.Sattarov, G.K.Tuxtamishova, A.O.Uzaydullayev, S.K.Kuzibekov, A.M.Jankorazov. Don va don mahsulotlarini saqlash texnologiyasi. Qo‘llanma. Guliston: Ziyo nashr-matbaa, 2024 yil, -420 bet.
4. Nurmukhamedov, A. A., Jankorazov, A. M., Khazratkulov, J. Z., & Tashmuratov, A. N. (2023). Methods of Improving the Frying Process in the Production of Vegetable Oils. Journal of Advanced Zoology, 44(S-2), 1961-1969.
5. Nurmuxamedov, A., & Jankorazov, A. (2023). ANALYSIS OF THE METHODS OF IMPROVING THE FRYING PROCESS IN THE PRODUCTION OF VEGETABLE OILS. Science and innovation, 2(A1), 266-271.
6. Nurmuxamedov, A., & Jankorazov, A. (2023). METHODS OF IMPROVING THE FRYING PROCESS IN THE PRODUCTION OF SOY OIL. Евразийский журнал академических исследований, 3(4 Part 4), 41-48.
7. Xamdamov, M., Jankorazov, A., Xazratqulov, J., & Xidirova, S. (2023). STRUCTURE OF PROTEINS AND APPLICATION IN THE FIELD OF BIOTECHNOLOGY. Евразийский журнал академических исследований, 3(4 Part 4), 212-220.

8. Jankorazov, A., Xolmamatova, D., & Murodboyeva, M. (2023). ENZYMES AND THEIR INDUSTRIAL APPLICATION METHODS. International Bulletin of Engineering and Technology, 3(3), 102-107.
9. Solijonov, G., Uzaydullaev, A., Kuzibekov, S., & Jankorazov, A. (2023). THE ROLE OF STANDARDIZATION IN THE INDUSTRY AND THE ANALYTICAL METHODS OF PRODUCT CERTIFICATION. Science and innovation, 2(A3), 144-149.
10. Javsurbek, K., Abror, J., Akhmad, N., & Shakir, I. (2023). REQUIREMENTS FOR THE QUALITY OF RAW MATERIALS PROCESSED IN THE INDUSTRY. Universum: технические науки, (1-4 (106)), 47-49.
11. Khazratkulov, J. Z., & Tashmuratov, A. N. (2023). STUDYING METHODS OF IMPROVING THE PROCESS OF APPLE JUICE PRODUCTION. International Bulletin of Engineering and Technology, 3(4), 38-42.
12. Karshievich, S. K., & Uli, K. J. Z. (2021). Dependence of the Content of Trans-Isomerized Fatty Acids on Hydrogenate Indicators. Central Asian Journal of Theoretical and Applied Science, 2(10), 27-30.
13. Xazratqulov, J. Z., & Raxmatov, F. E. (2023). ORGANIZATION OF THE PRODUCTION OF SOFT FEED FOR FISH FARMS GROWN IN LOCAL CONDITIONS. Евразийский журнал академических исследований, 3(12), 126-129.
14. Иссаков, Ш. А. У., Хазраткулов, Д. З. У., Рахматов, Ф. Э. У., & Киличов, А. А. У. (2024). ХРАНЕНИЕ ЗЕРНА, МУКИ, КРУП И КОМБИКОРМОВ РЕЖИМЫ И МЕТОДЫ. Universum: технические науки, 2(1 (118)), 49-51.
15. Nurmukhamedov, A. A., Jankorazov, A. M., Khazratkulov, J. Z., & Tashmuratov, A. N. (2023). Methods of improving the frying process in the production of vegetable oils.
16. Barakaev, N. R., Kurbanov, J. M., Uzaydullaev, A. O., & Gafforov, A. X. (2021, September). Qualitative purification of pomegranate juice using electro flotation. In IOP Conference Series: Earth and Environmental Science (Vol. 848, No. 1, p. 012024). IOP Publishing.