Non-traditional ways of enriching flour and bread products based on local plant raw materials

Nazira Khashimova[1*], *Hakimjon* Khashimov[1], *Gulnoza* Dzhakhangirova[2], and *Dilmurod* Baymirzaev[3]

[1]Namangan Institute of Engineering and Technology, 7, Kasansay, Namangan, 160115, Uzbekistan
[2]Tashkent Institute of Chemical Technology, 32, Navoi Street, Tashkent, 100011, Uzbekistan
[3]Namangan State University, 161, Boburshoh street, Namangan, 160107, Uzbekistan

Abstract. This article provides information on measures to prevent micronutrient deficiency, which is one of the important problems of the population. The purpose of the research work is to determine the phytochemical composition of the green peel of locally produced walnuts and justify their use for the enrichment of flour products. Its quality is checked in accordance with the established requirements of state standards. Indicators of the level of toxicological safety of walnut peel greens were determined according to generally accepted methods in accordance with the requirements of Sanitary Rules, Norms and Hygiene Standards of the Republic of Uzbekistan. According to the results of a laboratory study, the amount of toxic heavy metals and pesticides in raw materials did not exceed the normative indicators, no harmful compounds were noted. The data obtained indicate that the studied raw material complies with the regulatory requirements of toxicological safety. The microbiological composition of the studied raw materials was determined by growing substrates on agar media under conditions favorable for the growth of a colony of microorganisms, and then the species composition and amount of microflora were determined by phase-contrast microscopy.

1 Introduction

In recent years, non-observance of healthy eating culture among the population led to the increase of various diseases. According to the World Health Organization, more than 2 billion people in the world are deficient in vitamins and minerals, especially important biopolymers such as vitamin A, iodine, iron and zinc. From year to year there is a trend towards the spread of hypoelementosis (deficiency of magnesium, iodine, iron, etc.) and hypovitaminosis (lack of vitamins A, B, D, etc.) [1-3].

To date, the creation of products containing a wide range of biologically active nutrients widely consumed by the population remains an urgent task. Growing attention to the use of local raw materials in production is causing great interest in obtaining additional nutrients from various plants both in our country and abroad [4-7].

* Corresponding author: khoshimova1983@gmail.com

It is important to use non-traditional raw materials containing physiologically active substances when developing recipes with a functional orientation that positively affect human health, and when expanding the range of bakery products [8-11].

The abundance of biologically active substances in plants, i.e. carbohydrates, organic acids, dietary fibers, nitrogen, minerals, aromatic substances and vitamins, creates the need for their effective use in the food industry, especially in the bakery sector. In the food industry, the use of additional raw materials prepared from fruits, berries and vegetables, making them into juice, extract, puree, paste and powder, and the economic efficiency of processing is very high. For example, in the food industry such products as natural and condensed juice, puree, powder, pulp, jam, extract (with apple pectin), cellulose are widely used. Such products contain carbohydrates (sugar, cellulose, pectin substances, hemicellulose, starch), acids (malic acid), macro and microelements (K, Na, Ca, P, Mg, Fe), vitamins (C, B1 B2, B6, PP) distinguished by wealth. They are widely used in the preparation of bread and flour confectionery, as well as in the activation of pressed, dry and liquid yeast. Raw materials obtained from apples make it possible to enrich bakery products with sugar, dietary fiber, minerals and vitamins.

In addition, secondary raw materials made from grapes: juice, molasses and powder of grape pulp occupy a special place in the food industry. The amount of sugar and some macronutrients (K, Ca, P, Mg) obtained from grapes is higher than from apples. Grape products are very rich in vitamins B1 B6 and PP, and contain a large amount of acid.

Up to 50% of waste (including peel and seeds) is generated during the processing of pomegranate in the food industry. The bark contains coloring and pectin substances, sugars, organic acids and other components. The use of pomegranate powder makes it possible to strengthen gluten, increase the gas-forming ability of the dough, increase its lifting power, enrich the bread with nutrients and minerals.

According to the results of the research, the amount of cabbage, beetroot and carrot puree 10% relative to the flour mass improves the structural and mechanical properties of the dough. Increases the microflora of the fermenter and increases its activity.

Pumpkin fruits contain carbohydrates, nitrogenous and mineral compounds. It has 8-10 percent dry matter, including organic acids and vitamins. The bulk of the dry matter (up to 10%) is sugar. The sugars of pumpkin consist mainly of sucrose, less glucose and fructose. Pumpkin and raw materials obtained from its processing occupy a special place in the production of bakery products and are promising raw materials that affect the progress of the technological process and the quality of semi-finished and finished products [12].

Pumpkin, amaranth and sesame are promising raw materials with functional properties and high nutritional value. They have an optimized nutritional value and high economic efficiency in the enrichment of flour products. Enriched flour products of this type are a source of quickly digestible and easily digestible protein. Of particular importance is the high content of tocopherol, B vitamins and some micro- and macroelements in the flour [13, 14].

Today, gluten-free types of flour confectionery products are also produced in the food industry. Gluten-free products generally contain starches from corn, potatoes, and rice. However, products made from such raw materials are characterized by low nutritional value, lack of micronutrients, and rapid aging. High concentrations of fat, sugar, additives are required to improve the taste, texture and appearance of gluten-free products.

A promising way to increase the nutritional value of bread products is the inclusion of natural strengthening substances in their formulation, including oat flour processing products.

In the improvement of the production technology of bread products from wheat and rye flour, beet powder, carrot and pumpkin suspensions are added to them together with yeast.

2 Materials and methods

According to the above information, fortification with fruits and vegetables can be the basis for creating a product with high nutritional value.

In addition, non-waste technologies for the enrichment of food products at the expense of industrial secondary raw materials are being created. Considering these aspects, we believe that the vitamins and minerals contained in locally produced green walnut husks can be a potential raw material for increasing the biological value of flour and bakery products. Of particular importance are the chemical composition, biological value, versatility, technological properties, low cost and other factors of this recommended raw material.

The purpose of the research work is to determine the phytochemical composition of the green peel of locally produced walnuts and justify their use for the enrichment of flour products.

3 Results

The peel of green walnut variety "Ideal" was taken as the object of the study. The reference sample (control) is a grain of spring soft wheat. Sampling of green walnut husks was carried out according to the developed technical instructions.

Its quality is checked in accordance with the established requirements of state standards. Indicators of the level of toxicological safety of walnut peel greens were determined according to generally accepted methods in accordance with the requirements of Sanitary Rules, Norms and Hygiene Standards of the Republic of Uzbekistan **(**№ 0366-19**).**

Fig. 1. Walnut green husks, dried husks, husk powder and flour enriched with this powder.

The table below presents the results of the study. When studying the chemical composition of the peel of walnuts and comparing the results obtained with cereal crops (in our case, with wheat grain), certain differences were revealed in the amount of vitamins and minerals (Table 1).

Table 1. Vitamin and mineral composition of green walnut husks and wheat flour, mg (g, mcg)/100g.

№	Nutrients	Powder of husk	Wheat flour
1	C (Ascorbic Acid)	1 g	-
2	A (β-carotene)	0.012	-
3	P (Routine)	4.8	-

4	B_1 (Thiamine)	0.3 mcg	0.24
5	B_2 (Riboflavin)	0.1 mcg	0.08
7	B_5 (Pantothenic)	-	0.17
8	B_6 (Pyridoxine)	0.5 mcg	0.4
9	B_9 (Folic Acid)	-	19.5
10	Vitamin PP	-	2.2
11	E (Tocopherol)	0.6 mcg	2.2
12	Na (Sodium)	1.2	12
13	Mg (Magnesium)	148.0	40
14	K (Potassium)	441.0	176
15	Ca (Calcium)	188.0	24
16	P (Phosphorus)	416	115
17	Mn (Manganese)	3.8	0.3
18	Fe (Iron)	2.9	2,1
19	Cu (Copper)	1.6	0.06
20	Zn (Zinc)	3.5	0.42
21	F (Fluorine)	0.003	2.2
22	I (Iodine)	6.85	-

According to the data in Table 1, the studied samples of green walnut husk powder are similar in chemical composition to wheat flour. However, a number of substances contained in the supplement, such as P (rutin) - 4.8 mg, C (ascorbic acid) - 1 g, I (iodine) - 6.85 mg, P (phosphorus) - 416 mg, in flour in general . In addition, their large number is of great importance. Therefore, it is possible to achieve the creation of functional foods with increased nutritional value by introducing these types of additives rich in biologically active substances into flour and bakery products.

4 Discussion

Studies have shown that the green skins of walnuts contain tannins. All tannins are active antioxidants that have a general strengthening and healing effect on the human body.

Laboratory tests have shown that the supplement contains substances that are safe for the human body. Since tannins are active antioxidants, adding them to the composition of the additive serves to extend the shelf life of the prepared products.

All types of food raw materials, as well as finished products, must comply with the requirements of medical, biological and sanitary quality standards. The content of carcinogenic food substances and pathogenic microorganisms in any product, including raw materials, must not exceed the permissible maximum concentration. With this in mind, we conducted laboratory tests to determine the indicators of environmental and epidemiological safety of the researched additive.

According to the results of a laboratory study, the amount of toxic heavy metals and pesticides in raw materials did not exceed the normative indicators, no harmful compounds were noted. The data obtained indicate that the studied raw material complies with the regulatory requirements of toxicological safety.

The microbiological composition of the studied raw materials was determined by growing substrates on agar media under conditions favorable for the growth of a colony of microorganisms, and then the species composition and amount of microflora were determined by phase-contrast microscopy.

The results of the study were analyzed and confirmed that additives made from locally grown green walnut husks meet the requirements of Sanitary Rules, Norms and Hygiene Standards of the Republic of Uzbekistan **(**№ 0366-19**).**

However, in the production of bread and bakery products from wheat flour, there should be certain standards for the use of additives made from green husks of walnuts. According to the information presented in the above sections, the bark contains a large amount of iodine, and its excess is harmful, like any other substance. At the same time, the presence of dyes in the composition of this additive affects the quality of bread and causes excessive darkening of its core. In view of the above, we recommend introducing this supplement in limited quantities (no more than 6 percent).

Fig. 2. Appearance of Obi bread 1. Control sample. 2. A sample of bread made from flour with the addition of walnut green husks cookie.

Therefore, it is desirable to find a technological solution that allows increasing the nutritional and biological value of the product without increasing its norm when using the studied raw materials. Of course, such a solution should also be convenient for small bakeries. The use of the recommended technology should not involve the purchase of separate equipment and complex production lines [15].

The process of collecting and processing green walnut husks was carried out in the following order (Figure 3):

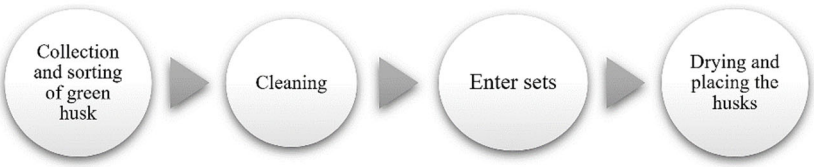

Fig. 3. Technological scheme of the process of harvesting and processing green walnut husks.

The green husks of walnuts are ground in coffee grinders before being added to the flour product. The reason for this is that the trace element iodine contained in the supplement is volatile, and losses of this trace element increase during grinding and storage. Therefore, before adding this additive to the flour mass, it is recommended to grind the required amount.

5 Conclusion

Based on the analytical review of scientific research works, it was recommended that walnut green husks should be used in the production of bread products. The nutritional value and technological properties of locally grown walnut green husks were investigated; the effectiveness of their modification (peel processing) was determined. It has been proven that the addition of trace element iodine to wheat flour of type I, which has high nutritional properties, at the same time increases the amount of other types of vitamins and minerals in

its content. High nutritional and biological value of enriched flour products was determined. It has been shown that the addition of walnut green husks to the bread products made from it in the proportions of 6% covers the human body's daily allowance of iodine. According to the research results, it was proved that the addition of bread to the flour product did not affect the glycemic index and glycemic load. The calculation of the wholesale production prices of the product determined the feasibility and economic efficiency of using walnut green husk additives in the flour product. According to the results of scientific research, it has been confirmed that the use of walnut green husk additives is effective in the production of bread and flour confectionery products from wheat flour. The recommended additives did not have any effect on the properties of flour and other types of raw materials used in the recipe for the production of bread and flour pastry products from wheat flour. It shortens the time of bread dough rising by 30 minutes and the duration of kneading dough dough by 10-15 minutes. This allows to speed up the production process of bread products. It serves to increase the efficiency of technological processes.

References

1. Zilikha Moldakulova, Meruyet Bayisbayeva, Galiya Iskakova, Fatima Dikhanbayeva, Assel Izembayeva, Viera Sottnikova, Eastern-European Journal of Enterprise Technologies **5(11(113)**, 61-72 (2021). https://doi.org/10.15587/1729-4061.2021.242648
2. E. Pastushkova, E. Kryukova, A. Arisov, V. Tiunov, L. Kokoreva, E3S Web of Conferences **222**, 06027 (2020). https://doi.org/10.1051/e3sconf/202022206027
3. Dini Cecilia, María Alejandra García, Sonia Z. Viña, Food & Function **3(6)**, 606-620 (2012). http://dx.doi.org/10.1039/c2fo30036b
4. Yaqin Wang, Ching Jian, npj Science of Food **6(49)** (2022). https://doi.org/10.1038/s41538-022-00163-1
5. Lourdes Georgina Itati Ojeda, Carolina Elizabeth Genevois, Veronica ´ María Busch, Heliyon **9(7)**, e17774 (2023). https://doi.org/10.1016/j.heliyon.2023.e17774
6. E.A. Aukhadieva, et al., Modern Innovations, Systems and Technologies **3(3)**, 0401-0410 (2023) https://doi.org/10.47813/2782-2818-2023-3-3-0401-0410
7. C. Jike, Z. Qian, Modern Innovations, Systems and Technologies **2(4),** 0233-0263 (2022) https://doi.org/10.47813/2782-2818-2022-2-4-0233-0263
8. Sergey Gur'ev, Vitaly Popov, Food processing: techniques and technology **51(3)** 2021
9. Lauren Menegon de Oliveira, Andressa Jantzen da Silva Lucas, Carolina Lopes Cadaval, Myrian Sallas Mellado, Innovative Food Science & Emerging Technologies **44**, 30-35 (2017)
10. Z.B. Yessimsiitova, et al., Bulletin of the Kazakh National Medical University **3**, 212-214 (2018)
11. A. Nicolosi, V.R. Laganà, D. Di Gregorio, Foods **12(8)**, 1661 (2023) https://doi.org/10.3390/foods12081661
12. Natalia M. Derkanosova, Anastasiia A. Stakhurlova, Irina A. Pshenichnaya, Irina N. Ponomareva, Olga V. Peregonchaya, Svetlana A. Sokolova, Foods and Raw Materials **8(2)** (2020) http://doi.org/10.21603/2308-4057-2020-2-223-231
13. L.G.I. Ojeda, C.E. Genevois, V.M. Busch, Heliyon **9(7)**, e17774 (2023). https://doi.org/10.1016/j.heliyon.2023.e17774

14. Isaac Amoah, Noamane Taarji, Paa-Nii T. Johnson, Jonathan Barrett, Carolyn Cairncross, Elaine Rush, Sustainability **12(18)**, 7785 (2020). https://doi.org/10.3390/su12187785
15. V.V. Losev, M.V. Saramud, I.V. Kovalev, Informatics. Economics. Management **2(3),** 0425-0437 (2023) https://doi.org/10.47813/2782-5280-2023-2-3-0425-0437