

7.2 Expansion of the range of flour culinary dishes for special purposes

According to the World Health Organization, a person's health depends on 70% of nutrition and lifestyle and only 15% on the organization of medical services.

The prevalence of diseases in the world caused by food intolerance (in particular, celiac disease) is 1 case per 100 people. In this regard, it is possible to avoid exacerbation of hereditary chronic diseases of the gastrointestinal tract, disorders of digestive processes by developing gluten-free food products.

Consumers' demand for gluten-free food products is dictated by the urgent need to provide consumers with alimentary-dependent diseases with high-quality special products [281].

In the development of low-protein and gluten-free products, non-traditional plant crops are used. In the context of import substitution and import independence, the obtained products will make it possible to supplement the diet of people with impaired gluten metabolism with nutrients, as well as diversify the range of culinary products for the category of people who adhere to a low-protein diet.

At the heart of the problem of relieving a number of symptoms in case of exclusion of gluten from food products is the development of optimally selected prescription ingredients to exclude "gluten-associated diseases" in humans.

Improving the standard of living and health of citizens is outlined in the priority areas of the state policy of Ukraine.

The need to improve the level and duration of life of the population confirms the importance of solving the problem of providing the population with alimentary-dependent diseases with high-quality and safe food products. The solution of these issues will be based on the development of gluten-free food products, which are vital for children and adults with pathology caused by the provocation of various immunological reactions from the gastrointestinal tract.

The relevance of the development of gluten-free targeted products is also confirmed by the request to provide children with hereditary diseases and allergies in

general education institutions with individual nutrition in accordance with the new norms and procedures for organizing meals in educational institutions [282].

In this regard, the development of recipes for gluten-free, lactose-free dishes and culinary products with a reduced sugar content is vital for children and adults with pathology caused by provoking various immunological reactions from the gastrointestinal tract, will be based on consumer preferences.

Ukraine is the leader in the production of plant crops in the world, primarily wheat. The recommended annual intake of cereal products for an adult should be 83 kg/year, which is 675 kcal/day or 30-40% of the total caloric intake of food.

This amount is ensured by the consumption of 250 g per day of bread, flour products, cereals and flour confectionery.

Grain raw materials are the second source of protein, dietary fiber, macro- and microelements after meat.

The chemical composition of the most common cereal crops is shown in Table 1 [283].

Table 1

Chemical composition of the most common cereal crops, % [283]

Raw	Proteins	Fats	Carbohydrates			Ash	Humidity	Energy value, kcal
			Mono- and disaccharides	Starch	Dietary fiber			
Soft wheat (contains gluten)	11,8	2,2	2,0	54,5	10,8	0,5	14,0	301
Durum wheat (contains gluten)	13,0	2,5	2,5	55,5	11,3	0,9	14,0	305
Rye (traces of gluten)	9,9	2,2	1,5	54,0	16,4	1,7	14,0	283
Barley (traces of gluten)	10,3	2,4	1,3	54,6	14,5	2,6	14,0	288
Oats (traces of gluten)	10,0	6,2	1,1	53,7	12,0	2,7	13,5	316
Kukurudza	10,3	4,9	1,6	58,2	9,6	1,4	14,0	325
Millet	11,2	3,9	1,9	52,4	13,9	2,9	13,5	298
Rice	7,5	2,6	0,9	61,4	9,7	1,1	14,0	303
Amaranth	13,6	7,0	1,7	57,3	6,7	2,9	11,0	371
Quinoa	14,1	6,1	1,6	52,2	7,0	2,8	13,3	368
Gretchka (overwhelmed)	13,5	3,4	1,5	55,4	11,3	2,1	13,0	357
Gretchka (green)	12,6	2,6	1,4	55,4	11	2,8	14,0	329

Based on the data in Table 1, it can be concluded that the use of non-traditional plant crops, such as green buckwheat and quinoa, is appropriate due to the high energy value, as well as the content of protein substances. It is special that these cultures do not contain gluten.

It is important to take into account that the nutritional value of cereal products depends on how the macro- and micronutrients of the original grain will be preserved [283].

Soft wheat, rye and oats are excellent for the manufacture of flour products and dishes, but the listed cereals may contain gluten, or traces of it, in case of violations of harvesting or storage of crops, and they cannot be used as the main raw material in the production of gluten-free products.

A comparison of the main types of flour currently used as raw materials for the production of flour dishes – gluten-free pancakes for special purposes – was carried out.

The decisive factor in the choice of flour is the technology for the production of gluten-free flour products, this is due to the absence of gluten, which leads to a violation of the structure of the dough. Substitution of wheat flour should not lead to a deficiency of other components of the chemical composition.

The calorie and nutritional value of 100 g of green buckwheat and quinoa flour are shown in Table 2 [283].

Table 2

Nutritional value and calorie content of flour from non-traditional plant crops compared to wheat flour [3]

Складові, г на 100 г	Wheat flour	Green buckwheat flour	Quinoa flour
Proteins	10,33	12,6	14,1
Carbohydrates	76,31	68,0	64,2
Zhiri	0,98	2,6	6,1
Starch	81	55,4	68,2
Sajarosa	0,27	1,4	0,5
Dietary fiber	2,7	11,0	7,0
Calcium (mg)	15	20,0	47,0
Iron (mg)	4,64	6,7	4,6
Magnesium (mg)	22	20,0	2,0
Copper (mg)	0,14	6,0	0,6
Calorie content, kcal	301	329	368

A study of the chemical composition of green buckwheat flour and quinoa flour revealed (Tables 1, 2) that the mass fraction of protein in them exceeds in traditional plant crops, such as wheat (on average by 3%) and a higher content of calcium by 3 times (quinoa flour) and iron by 0.5% times.

It was found that green buckwheat flour has the highest content of carbohydrates (68 g per 100 g) and starch (55.4 g) among all gluten-free types of flour studied.

Quinoa flour also has a high starch content – 64.1 g per 100 g. It is advisable to mix them not in equal proportions, because for kneading the dough you will need a much larger amount of liquid (milk), which will lead to an increase in the cost of production. Dishes with the addition of these types of flour will be more elastic due to the fact that there is no gluten in these types of flour, and the starch content is an important factor for frying pancakes. However, it is worth considering that starch instantly settles in the pancake dough, so it is necessary to constantly stir the dough before heat treatment.

Therefore, the use of these types of flour in the manufacture of the dish will increase the nutritional and biological value of the product.

All of these positive properties of quinoa flour and green buckwheat indicate the feasibility of their use in the preparation of gluten-free products.

Model samples of pancakes were prepared according to traditional technology with the complete replacement of premium wheat flour and white crystalline sugar with pumpkin puree, the recipe for pancakes made of premium wheat flour No. 1082 from the Recipe Book was taken as a control sample [284].

Variants of model samples of pancakes with different ratios of gluten-free types of flour were developed.

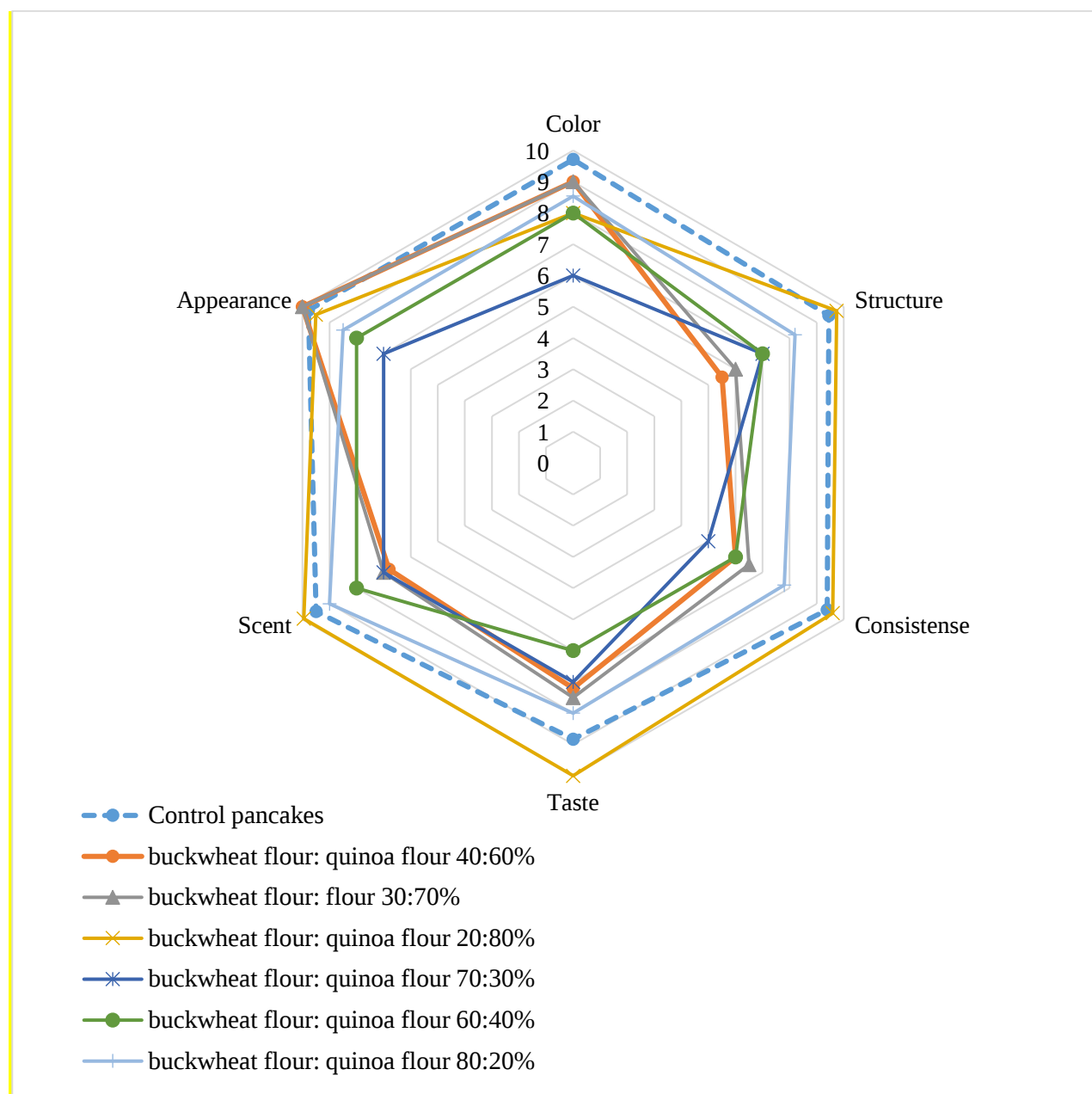
In the studies, options with the ratio of green buckwheat flour to quinoa as 40:60%, 30:70%, 20:80%, 60:40%, 70:30%, 80:20% were chosen. However, the best option, which is closest to the control, was chosen 20:80%. As a binding agent and to increase the nutritional value of pancakes, pumpkin puree with an age content of carotene is added.

Pancakes made from gluten-free types of flour differed slightly in shape from the control sample made from wheat flour. In terms of color, the most similar to the control

sample were samples of green buckwheat and quinoa flour, which have a light cream hue.

Based on the above data, it was concluded that it is expedient to use two types of flour in the mixture at the same time in the 35:9% variant [285].

Next, an organoleptic assessment of the pancakes was carried out using the Harington scoring scale (10-point scale), the results of which are presented in Figure 1.



**Fig. 1 – Pancake Quality Polygon
Depending on the ratio of green buckwheat flour to quinoa flour**

The organoleptic evaluation of gluten-free flour dishes is close to the control sample.

At the same time, an increase in the proportion of quinoa flour in the dispersed system of the dough has a positive effect on the color of the finished pancakes, but negatively affects the consistency, that is, it gives strength and density to the structure.

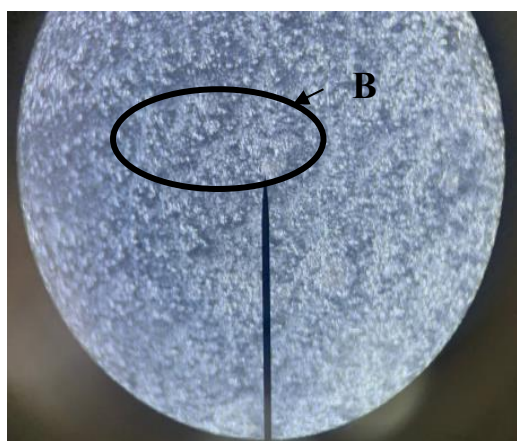
The proposed recipe for a dish made from buckwheat flour to quinoa as 20:80% is called "Snail" (Table 3).

Table 3

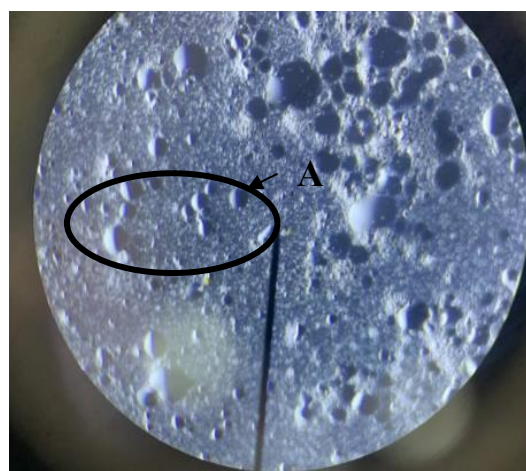
Recipes for pancakes made from a mixture of gluten-free flours and a control sample

Raw	Vitrati sirovini, g per 1 kg pancake semi-finished product			
	Control		Snail	
	Gross	Net	Gross	Net
Premium wheat flour	416	416	—	—
Milk	1040	1040	900	900
Chicken eggs	2 1/13 pcs	83	2 1/13 pcs	83
Green buckwheat flour	—	—	83,2	83,2
Quinoa flour	—	—	332,8	332,8
Garmelon puree	—	—	60	116
White sugar	25	25	15	15
Table salt	8	8	8	8
Dough weight	—	1538	—	1538
Oil	16	16	16	16
Exit	—	1000	—	1000

The next step was to study the microstructure of the dough (Figure 2).



(a)

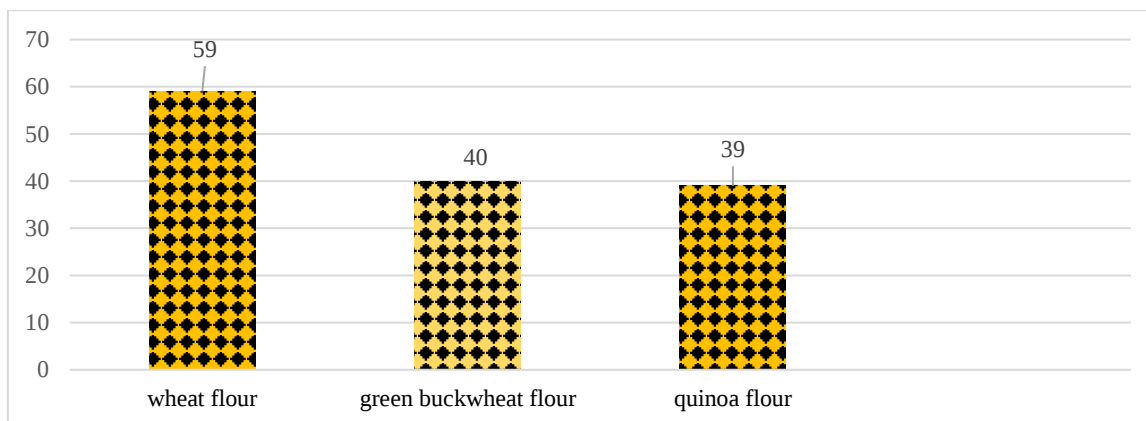


(b)

Fig. 2 – Microstructure of the dough:
a) control, b) "Snail" (x100 times)

According to the results of the research (Fig. 2), it was found that the dough of the developed gluten-free dish has a high content of bubbles (**figure A**), which is associated with the specific protein-polysaccharide composition of the recipe composition, in contrast to the dough based on wheat flour (**figure B**), which is characterized by better gas-holding capacity when whipped.

The main indicator of the quality of ready-made flour culinary dishes is the kinematic viscosity of the dough from which they are prepared (Figure 3).



Rice. 3 – Kinematic viscosity of pancake dough, m²/s

The results of the study of the kinematic viscosity of the dough (Fig. 3) indicate that the dough of green buckwheat and quinoa has a lower viscosity, which leads to the need to increase the share of these types of flour in the recipe. Therefore, in order to obtain the desired properties, it is advisable to mix green buckwheat flour with quinoa seed flour, which confirms the feasibility of the selected ratios of these types of flour.

Based on the physicochemical quality parameters of ready-made pancakes from mixtures of gluten-free types of flour (Table 4), it was found that the mass fraction of moisture of the studied samples varies in the range of 44.2-46.9 %; titrated acidity 3.4-3.9 degrees; the mass fraction of sucrose in the studied samples is 13.2-13.5%; There is no gluten in the test samples.

Table 4

**Physicochemical Indicators of Quality of Pancakes from a Mixture of
Gluten-Free Flours**

Indicator	Control	Snail
Mass fraction of moisture, %	44.2±0.2	46.5±0.2
Acidity, deg.	3±0.1	3.4±0.1
Fat weight, %	6.9±0.1	6.5±0.1
Масова частка цукру, %	11.7±0.5	13.2±0.5
Gluten content, mg/kg	30	–

Conclusions and suggestions. Despite the wide range of culinary products in the restaurant industry, the issue of shortage of specialized flour culinary products and dishes for people with food allergy to gluten is acute, which determines the relevance of the chosen research topic.

The dynamics of the spread of celiac disease is increasing every year, the number of people suffering from allergies is growing, in which the consumption of any product containing gluten poses a potential danger to health.

The possibility of using new types of gluten-free flour (quinoa and green buckwheat flour) in the recipes of flour culinary dishes – pancakes – has been studied.

The composition and technology of making ready-made pancakes from gluten-free types of flour are scientifically substantiated. New data have been obtained showing the feasibility of mixing various gluten-free types of flour in the recipes of flour culinary dishes, taking into account the nutritional value, organoleptic indicators, structural and mechanical properties of the dough, with the establishment of the optimal ratio of green buckwheat and quinoa.

Regulated organoleptic and physicochemical indicators of the quality of a new dish, which differs from the control of the absence of gluten, have been determined.