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EXPANDING THE RANGE OF KETO - NATIONAL BAKERY PRODUCTS USING FLAX FLOUR

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Annotation: The article presents research on the development of an assortment of keto-national bakery products using flaxseed flour.

Keywords: Keto bread, national bakery products, low-fat flaxseed flour, Uzbek flatbread “Obi non”.

Introduction. The baking industry of the food industry in Uzbekistan produces a wide range of bakery products.

The main negative trends in modern nutrition are associated with excessive consumption of foods that are unbalanced in nutrient content and with a persistent deficiency of vital ingredients supplied with food. All this is considered today as the cause of the main diseases of civilization (atherosclerosis, diabetes mellitus, immunodeficiency, obesity, dysbacteriosis, etc.). One of the ways to eliminate deficiency conditions and increase the body’s resistance to unfavorable environmental factors is the systematic consumption of food products enriched with a complex of biologically active additives that have a certain physiological effect [1-5]

Recently, much attention has been paid to expanding the range of national bakery products, among which Uzbek flatbreads and puff pastries are gaining great importance. Improving the quality, expanding the range and improving the nutritional value of bakery products is carried out using various food additives and improvers, especially of plant origin
[6-7].

A promising direction for the further development of the food industry is the development of new high-quality domestic food products that meet the physiological requirements of specific population groups and have therapeutic and prophylactic effects.

Due to the fact that bakery products in Uzbekistan are affordable traditional, everyday food products, improving their quality and nutritional value, developing preventive, functional and enriched products contribute to the implementation of the modern concept of healthy nutrition.

The most appropriate and effective way from a physiological, technological and economic point of view to expand the range of baked goods and increase their vitamin and mineral value is to enrich them with plant ingredients, which represent a natural, balanced source of vitamins, dietary fiber, macro and microelements [8-10].

Keto bread is a low-carb bread that doesn't contain the heavy whole grains and whole grains that make traditional bread so carb-heavy [11-13].

Keto bread is made with alternative ingredients such as nut flour, flax flour, coconut seed flour, or fiber. Keto bread is suitable for those who are watching their carbohydrate intake, as its carbohydrate composition is significantly lower than that of regular bread. Thanks to this, keto bread maintains a state of ketosis, in which the body receives energy not from carbohydrates, but from fats.

One of the key ingredients in keto bread is flax seed flour instead of regular, partially substituted wheat flour. Flax seed flour is rich in fiber and omega-3 fatty acids, making for a wonderful keto bread with minimal carbs.

Discussion. Flaxseed flour was obtained from flaxseed by cleaning the seeds from impurities, drying, squeezing the oil and grinding the defatted seeds.
Depending on the fat content, flaxseed meal was non-skimmed, semi-skimmed and defatted.
We used low-fat flaxseed flour, the chemical composition of which is given in Table 1.
Table.1.

Chemical composition of "Low-fat flaxseed meal".

Name of indicators	Low-fat flaxseed meal
Moisture content, %	7,0
Mass fraction of fat (on dry matter), %	5,0
Mass fraction of proteins (per day), %	21,0
Mass fraction of fiber (per day) , %	27,3
Ash content, %	3,7
Vitamins, mg	
Vitamin B_1, thiamine	1.644
Vitamin B_2, riboflavin	0.161
Vitamin B_4, choline	78.7
Vitamin B_5, pantothenic	0.985
Vitamin B_6, pyridoxine	0.473
Vitamin C, ascorbic acid	0.6
Vitamin E, alpha tocopherol, TE	0.31
gamma tocopherol	19.95
delta tocopherol	0.35
itamin RR, NE	3.08
Betaine	3.1
Vitamins, mcg	
Lutein + Zeaxanthin	651
Vitamin B_9, folates	87
Vitamin K, phylloquinone	4.3
Macroelements, mg	
Potassium, P	813
Calcium, Ca	255
Magnesium, Mg	392
Sodium, So	30
Phosphorus, P	642
Microelements, mg	
Iron, Fe	5.73
Manganese, Mn	2.482
Copper, Cu, mcg	1220
Selenium, Se, mcg	25.4
Zinc, Zn	4.34

Non-fat flour corresponded to the component composition of flax seeds. In semi-skimmed flaxseed meal, the oil content was reduced to 9.0%. The value of flaxseed flour is in a large amount of vegetable protein, not inferior in value to soy protein, dietary fiber and minerals.

Flaxseed flour per 100g contains 21g of protein (10g of protein in wheat flour), 5g of fat (1g in wheat flour) and 16g of carbohydrates (70g in wheat flour). As a result, there is a clear advantage in the direction of proteins and less in the amount of carbohydrates.
In addition, flaxseed flour contains: potassium, cobalt, manganese and in small quantities nickel.
Thus, low-fat flaxseed flour is rich in such vitamins and minerals as: vitamin B1 - 164.4%, choline - 78.7%, vitamin B5 - 98.5%, vitamin B6 - 47.3%, vitamin B9 - 8.7% , vitamin PP - 3.08%, potassium - 81.3%, calcium - 25.5%, magnesium - 39.2%, phosphorus - 64.2%, iron - 57.3%, manganese - 124.1% , copper - 122%, selenium - 46.2%, zinc - 36.2%.
Purpose of the study. is to improve the quality and expand the range of keto-national bakery products using flaxseed flour.
Research methods. The work used modern chemical methods to analyze the quality of raw materials and finished national bakery products. Methods of statistical and mathematical processing of experimental and research results were used [14-18]. .
Uzbek flatbreads “Obi non” were chosen as the object of research.
O'z.DSt 1105:2017
The production of Uzbek flatbreads in a modern bakery is in many ways similar to the sequence of operations in the production of bakery products. It includes: reception and storage of main and additional raw materials, preparation of raw materials for production, preparation of semi-finished products (dough or sourdough, and then dough), their fermentation, cutting of dough, primary molding of blanks, proofing, final molding, surface finishing (sprinkling with poppy seeds or sesame), baking, cooling and storage of finished products [19-23].
The recipe for the flatbread “Obi non” according to O’z.DSt 1105:2017 is presented in the table 1.
Table 1.
Recipe for Uzbek flatbread “Obi non”

Raw materials	Consumption of raw materials using the non-steam method
Wheat flour 1s, kg	100
Pressed yeast, kg	1,5
Certified food salt, kg	1,0
Water, l	by calculation
Refined cottonseed oil for lubrication, kg	0,15
Duration of fermentation, hour	2,5-3
Initial temperature, °C	30-32
Final acidity, degrees.	2,5-3

The dough for the production of flatbreads was prepared by straight methods using pressed yeast (Table 1).
The cakes were baked in laboratory conditions. The dough for making flatbreads was prepared using straight-dry methods using pressed yeast (table).
Samples of bread were prepared with the addition of flaxseed flour in an amount of 5-10%. Flaxseed flour replaced part of the wheat flour in an amount of 5-10%.[24-29]
The prepared control and experimental samples of flat cakes were subjected to analysis of organoleptic indicators and physicochemical characteristics. The research was carried out using

modern methods of physical and chemical research used in the practice of baking production. The experimental results obtained are shown in Table 2

Figure.1. Uzbek flatbread "Obi non"

Table 2

Organoleptic quality indicators of Uzbek flatbreads "Obi non" with a dosage of flax flour (non-steam method)

Name of quality indicators	Control (no additives)	Quality indicators of national products with the addition of flax flour		
		5 %	7 %	10 %
Organoleptic quality indicators:				
Appearance: Shape	Round, with a slight thickening of the edge, without pits and dark swellings			
Crust surface condition	Patterned, with thickened edges; not wrinkled, smooth, without cracks or tears			
Surface	smooth, without cracks or tears			rough, without cracks or tears
Crumb condition:				
Bakedness and elasticity	baked, elastic, not wet to the touch,			baked, not wet to the touch, not sticky, not elastic
Porosity	developed, without voids and compactions, average, fairly uniform			underdeveloped, uneven, medium and thin-walled
Color	white	Light gray	grayish	grey
Taste Smell	characteristic bready	bready with a slight taste and smell семянльна	bready with a slight pleasant taste and smell of flax seeds	bready with a strong taste and smell of flax seeds

Analysis of the data given in Table 2 shows that the addition of flax flour instead of wheat flour in the dough composition quantitatively affects the organoleptic indicators of bread quality. An increase in the amount of additive by more than 10% affects the smell of the product. The flatbread acquires a distinct taste and smell of flax seeds.

Table 3

Physico-chemical quality indicators of Uzbek flatbread with a dosage of flaxseed flour (non-steam method)

Name indicators quality	Control (no additives)	Quality indicators of national products with the addition of flax flour		
		5%	7 %	10 %
Physico-chemical quality indicators:				
Crumb moisture, %	33,0	35,0	39,0	40,0
Crumb acidity, degrees	3,0	3,2	3,5	3,7
Diameter, cm	18-20	21-23	25-26	26-27
Edge thickness, cm	2,5-3	3,1	3,1	3,2
Center thickness, cm	1,5	2	2,5	2,7

The addition of flaxseed flour increases the acidity of the dough crumb. This is apparently due to some of the hydrolytic abilities of flaxseed meal.[30-32]

Conclusions: Thus, a qualitative and technological assessment of the indicators of wheat bread with the addition of flaxseed flour in an amount of 5% to 10% confirmed a change in the main physical and chemical indicators of the product. The results obtained showed that a dosage of flaxseed flour in an amount of 5% had a slight effect on the change in the studied characteristics.

The results of the analysis in Table 3 showed that the addition of flax flour in amounts of 7 and 10% instead of part of the premium wheat flour did not affect the physical and chemical indicators of the quality of Uzbek flatbreads. Organoleptic analysis showed that all products had sufficiently developed porosity, elastic crumb, with a slight taste and smell of flax seeds.

Analysis of the data presented in table. 1-3 showed that the addition of flaxseed flour in an amount of 10% contributed to an increase in the specific volume of products by 3% and an improvement in organoleptic quality indicators when compared with samples of products with the addition of 7% flaxseed flour.

Based on the conducted research, it was established that the best physicochemical characteristics are found in samples of bread prepared using straight technology with the addition of 10% flaxseed flour.

Flaxseed meal, which is used to make keto bread, is high in fiber, omega-3 fatty acids, and antioxidants. These components help normalize the digestive system, improve the condition of the skin and hair, and also support the health of the heart and blood vessels. Fiber helps stabilize blood sugar levels, which helps control appetite and prevents overeating.

The unique combination of flaxseed meal and other natural ingredients makes keto flaxseed flatbreads a great choice for those who want to follow the keto diet and take charge of their health.

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