

## *Use of unconventional plant raw material in poultry meat recipe*

**Keywords:** semi-finished products from meat of broiler chickens, freeze-dried ground apples, Brazil nuts

### 1. SUMMARY

The results of studying the combined use of freeze-dried ground apples (in an amount of 7%) and Brazil nut kernels (in an amount of 5 %) in the technology of baked poultry products are presented. The modification of the recipe made it possible to obtain stuffed meat products with improved consumer properties (apple and nut notes in the smell, slight sourish-sweetish tone in the taste, caramel shades in the color) and increased nutritional value (content of dietary fiber, mineral elements Mo, Au, Cu, B, Mn, W, Be, Sn, Fe, Ca, Mg, P, organic acids, protein) alongside a decrease in the amount of butter by 4%.

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## 2. Introduction

Poultry meat is a dietary product with a high content of easily digestible proteins, low content of fat and cholesterol, it costs less than other meat, takes little time to cook and suits well for daily consumption [1]. However, today consumers tend to prefer “healthy” products, which makes producers expand the range of foods enriched with nutrients. This explains the relevance of using plant-based natural additives in meat processing industry, because they improve the quality characteristics of raw meat, and also increase nutritional and biological value of finished products [2].

It is a known fact that apple powder is rich in vitamins, organic and phenol carboxylic acids, monosaccharides, pectins, and dietary fiber, while the Brazil nut is considered a great source of complete protein, such mineral nutrients as Se, Cu, Mn, I, and fatty acids [3, 4, 5, 6, 7]. That is why, these plant raw materials are separately used in cakes, bread, chocolate, cutlets, curd cheese, cereal bars, nut and seed butters [8, 9, 10, 11, 12, 13, 14] to increase their nutrient density. The aim of our research was to study the possibility of combined use of freeze-dried ground apples and Brazil nut kernels in the technology of stuffed meat products with increased nutritional value.

## 3. Materials and methods

The following was used as materials of the research:

- Chilled broiler chicken legs manufactured by OAO Turbaslinskiye Broilery (Republic of Bashkortostan, Blagoveshchensk) in accordance with GOST 31962-13;
- Freeze-dried ground apples manufactured by PAO Sibirskiy Gostinets (Pskov Region, Moglino) in accordance with TU 10.39.25-001-34457722-18;
- Kernels of Brazil nuts of Bolivian origin manufactured by OOO Komservis (Moscow Region, Mytishchi) in accordance with TU 9760-002-76440635-16;
- *Letniy Sad* food additive manufactured by OOO Kulmbakh-D (Moscow Region, Krasnoarmeysk) in accordance with TU 10.89.19-008-58251238-20. Ingredients: dill, garlic, mustard, table salt, maltodextrin, dextrose, E621, dill extract, caraway extract, E100;
- *Chicken pockets with butter and herbs* cooked according to TU 9214-013-64474310-12 by way of baking stuffed broiler chicken legs at 200 °C for 20 minutes.

Control samples were cooked according to a traditional recipe (**Table 1**), test samples were cooked adding 7% dried ground apples, 5% crushed Brazil nut kernels and 4% less butter.

Table 1. Recipe for Laboratory Samples of Chicken Pockets

Ingredients	Amount, kg
Deboned chicken legs	80.0
Butter	19.5
Letniy Sad food additive	0.5

The dosages of the plant raw materials were chosen taking into account the known data published in a number of scientific papers [8, 9, 10, 11, 12, 13, 14]. The test samples of chicken pockets were cooked using deboned chicken legs with skin, flat in shape, with a longitudinal cut in the form of a pocket filled with butter, mixed herbs, ground dried apples, and Brazil nut kernels. The cut was joined with skewers.

The plant raw materials were tested for the content of protein and fat according to MU 4237-86, sugar – GOST 8756.13-87, table salt – GOST 15113.7-77, starch – using standard approach [15]. The meat and meat products were tested for protein according to GOST 25011-2017, fat – GOST 23042-2015, moisture – GOST 9793-2016, table salt – GOST 9957-2015. Sensory evaluation of the laboratory samples was carried out according to GOST 9959-2015. The content of dietary fiber in all samples was determined using the traditional approach [15], content of organic acids – according to M 04-47-12, mineral elements – using iCAP 7200 DUO emission spectrometer.

All measurements were carried out in three replications. Statistical analysis was performed using Microsoft Excel XP and Statistica 8.0 software package. The statistical error of the data did not exceed 5% (at 95% confidence level).

#### 4. Results and discussions

Analyzing the nutritional composition of the non-traditional plant raw materials in comparison with poultry meat (**Table 2**), it was found that Brazil nut kernels contained a relatively high amount of lipids (11 times more), which made it possible to reduce the amount of butter in the recipe, and hence to decrease cholesterol content in the test samples.

Table 2. Nutrient Composition of Materials under Study

Indicator	Results of Raw Material Study			
	Chicken legs	Letniy Sad food additive	Freeze-dried ground apples	Brazil nut
Mass fraction of protein %	18.3±1.6	10.9±0.7	2.41±0.19	18.7±1.5
Mass fraction of fat %	6.2±0.5	-	0.15±0.01	67.5±3.3
Sugar content %	-	-	63.70±4.12	2.70±0.16
Starch content %	-	-	0.60±0.03	0.30±0.02
Mass fraction of table salt %	-	34.9±2.2	-	-
Organic acid content (mg/kg), of which:				
oxalic	-	-	22.11±1.44	-
tartaric	-	-	80.03±6.21	-
malic	-	-	3652.82±211.06	-
citric	-	-	174.70±13.22	-
succinic	-	-	369.52±20.35	-
acetic	-	-	222.92±16.38	-
Dietary fiber content (g/100 g), of which:	-	3.2±0.2	12.3±0.4	7.4±0.4
soluble		1.0±0.1	4.1±0.2	1.9±0.3
insoluble		2.2±0.2	8.2±0.5	5.5±0.4

Apple powder proved to have relatively high levels of sugars, dietary fiber, and organic acids, in comparison with both raw meat and other plant components. It is well known that non-volatile acids in fruits not only determine taste and aroma of finished products, but also contribute to the production of gastric juice and have a choleric effect [16], while insoluble (lignin, cellulose, chitin) and soluble (pectin, inulin) dietary fiber is able to effectively bind heavy metal ions and organic substances [17]. All these factors a priori suggest that this new component in the chicken pockets recipe should have a positive effect on the human organism.

The amino acid content in *Letniy Sad* food additive was due to sodium glutamate (E621) in its composition, while the presence of table salt at the level of  $34.9 \pm 2.2\%$  allowed not to introduce any more of it.

The mineral composition of all plant components turned out to be richer than that of broiler chicken legs in terms of the number of elements (**Table 3**). In terms of the content of micronutrients, which have great physiological importance for the human organism, the Brazil nut contained 12 times more Ca, 7.4 times more Fe, 7.2 times more Se, 6.3 times more Mg, 3.6 times more P and Zn, but the Cu, Mn and Co content were also higher than in the poultry meat. Similarly, the dried ground apple powder contained 2.4 time more Fe, 2 times more Ca and 2.7 times more Si, additionally it's Ag, Au, B, Be, Cu, Ga, Mn, Mo contain were also higher, than the content of poultry meat. Considering 0.5% dosage of *Letniy Sad* food additive as per the recipe, its contribution to the total mineral value of ready chicken pockets can be considered significant only in terms of Na content, which was 38 times more than in raw meat.

The levels of heavy metals in nuts – As, Cd, Pb, not found in semi-finished meat products, did not exceed the regulated norms of TR CU 021/2011.

Chilled chicken legs had a relatively high content of K, Si, as well as Na.

Table 3. Mineral Composition of Materials Under Study

Element	Results of Raw Material Study, mg/kg			
	Chicken legs	Letniy Sad food additive	Freeze-dried ground apples	Brazil nut
Ag	-	-	0,324±0.020	0.233±0.017
Al	1.390±0.092	2.647±0.201	1.199±0.091	3.530±0.240
As	-	0.031±0.002	0.064±0.003	0.046±0.003
Au	-	0.199±0.076	0.545±0.034	0.792±0.061
B	-	5.127±0.342	7.263±0.422	3.381±0.212
Be	-	0.044±0.002	0.031±0.002	0.022±0.002
Ca	71.550±6.610	69.700±4.671	147.205±11.036	857.410±54.320
Cd	-	0.026±0.001	0.015±0.001	0.020±0.002
Co	-	-	-	1.124±0.097
Cr	0.087±0.007	0.028±0.001	-	-
Cu	-	1.526±0.093	0.809±0.054	7.399±0.510
Fe	4.59±0.33	8.550±0.632	11.053±0.561	33.780±2.110
Ga	-	0.399±0.023	0.791±0.038	0.252±0.013
K	9254.210±731.870	13.967±1.020	4563.120±204.478	3226.007±194.550
Li	0.017±0.002	3.412±0.170	-	-
Mg	262.900±21.450	89.230±6.420	139.900±10.025	1668.020±112.440
Mn	-	3.303±0.105	1.529±0.073	6.443±0.421
Mo	-	0.090±0.007	0.242±0.010	0.078±0.005
Na	731.610±53.450	27952.221±987.113	30.540±1.221	-
Ni	1.070±0.340	0.018±0.001	-	2.639±0.193
P	2244.220±204.870	116.109±8.923	893.403±64.260	7975.012±601.210
Pb	-	-	0.212±0.010	0.009±0.002
Sb	0.003±0.001	-	-	-
Se	0.290±0.020	0.043±0.003	0.192±0.009	2.094±0.110
Si	5.730±0.410	8.260±0.653	7.818±0.346	3.196±0.251
Sn	-	0.153±0.008	0.159±0.007	0.142±0.011
Te	0.036±0.002	0.741±0.051	0.822±0.040	0.857±0.062
Ti	0.074±0.005	2.868±0.174	0.423±0.027	0.570±0.040
V	-	0.267±0.019	0.184±0.008	0.229±0.014
W	-	3.423±0.220	3.149±0.116	2.112±0.183
Zn	13.780±1.240	22.880±1.734	11.402±0.773	50.153±3.276

Thus, it was proved efficient to use such plant components in the technology of baked meat products in order to increase their nutritional value.

Tasting of the laboratory samples of chicken pockets established that apple and nut raw materials in the specified ratio had a positive effect on the consumer characteristics of the product. At the same time, the control sample did not have outstanding taste and aromatic properties, with creamy tones predominant, leveling the characteristics of a meat product. The mixture of the plant materials accounted for the formation of apple and nut notes in the smell and a slight sour-sweet tone in the taste of the products. The color on the cut acquired a caramel shade. The appearance, consistency, and juiciness of all samples were consistently high.

When testing physical and chemical indicators, it was found that the samples under study did not differ significantly in moisture, fat, and sodium chloride content (**Table 4**). However, the test samples contained slightly more protein (by 2.1 %), as well as dietary fiber and organic acids, which is a benefit from the standpoint of modern nutritional science.

Table 4. Nutrient Composition of Laboratory Samples of Chicken Pockets

Indicator	Results	
	control	test
Mass fraction of moisture %	61.0±1.5	62.5±1.3
Mass fraction of protein %	24.8±1.1	26.9±1.2
Mass fraction of fat %	10.5±0.7	10.2±0.4
Mass fraction of table salt %	1.5±0.2	1.5±0.3
Sugar content %	-	3.6±0.6
Organic acid content mg/kg, of which:		
oxalic	-	1.5±0.1
tartaric	-	5.6±0.3
malic	-	255.6±17.5
citric	-	12.2±1.0
succinic	-	25.7±0.5
acetic	-	15.5±1.1
Dietary fiber content g/100 g, of which:		1.2±0.2
soluble	traces	0.4±0.1
insoluble		0.8±0.2

The study of the mineral composition of the laboratory samples revealed that the test samples exceeded the control ones in terms of the amount of most macro- and microelements (**Figures 1, 2**). Specifically, as for macronutrients, baked samples with a modified recipe contained more Ca (1.7 times), Mg (35.4 %), and P (20 %); as for microelements – more Mo (473 times), Au (132 times), Cu (56 times), B and Mn (28 times), W (20 times), Be (17 times), Sn (15.8 times), Fe and Ti (1.5-1.6 times), Se (1.4 times), Zn (23.1 %), etc.

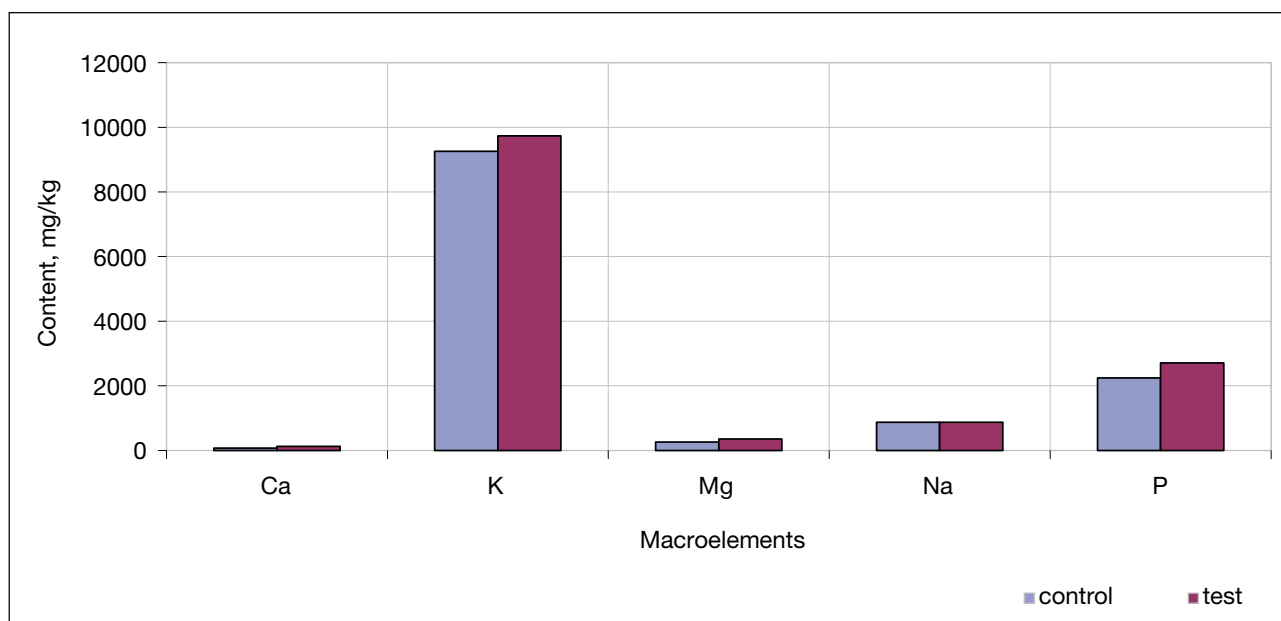


Figure 1. Macroelement Composition of Laboratory Samples of Chicken Pockets

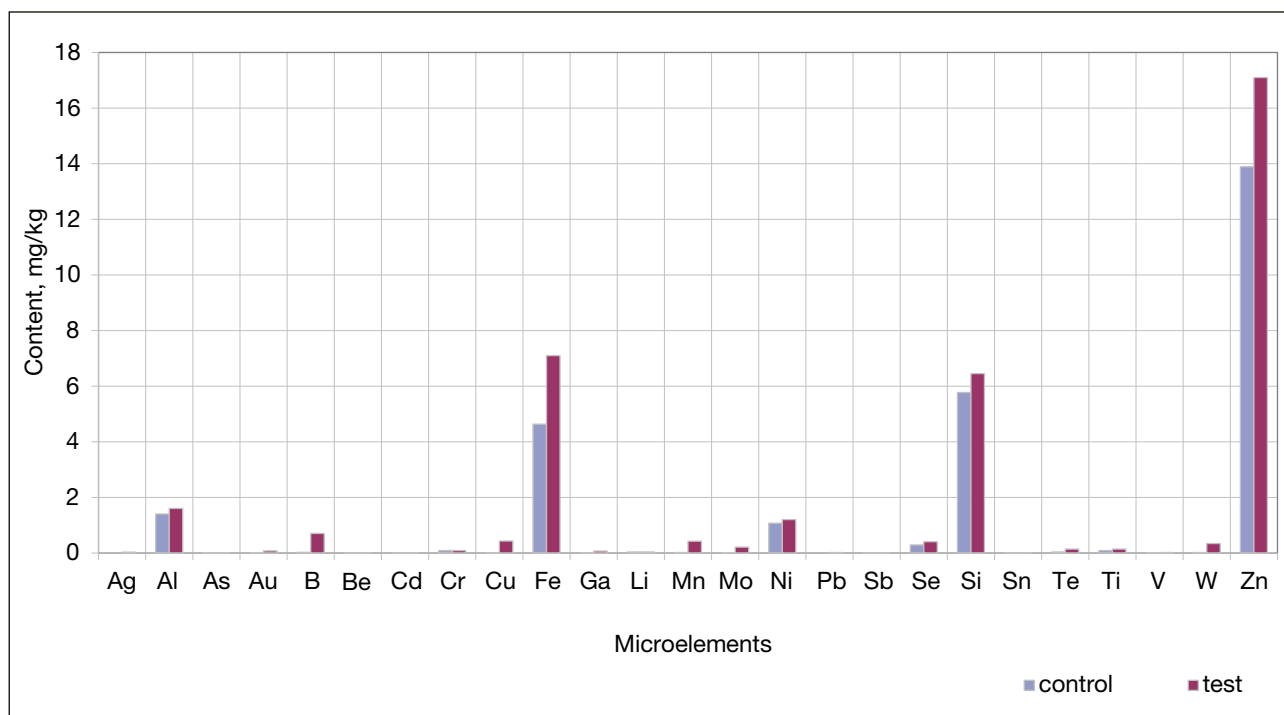


Figure 2. Microelement Composition of Laboratory Samples of Chicken Pockets

Furthermore, the amounts of microelements established according to MR 2.3.1.2432-08 satisfy the daily demand of an adult in Mo by 30.4 %, Cu - by 4.3%, Mn - by 2.1 % if one eats 100 g of baked poultry meat products with the added apple powder and Brazil nut.

Minerals are essential for the human body. They are a part of tissues, hormones, enzymes, intracellular fluid. They are needed for the formation of blood and bone cells, functioning of the nervous system, regulation of muscle tone, processes of energy generation, growth and recovery of the body [18, 19].

## 5. Conclusions

The nutrient composition of the raw materials and finished products was studied. We found that it is possible to use freeze-dried ground apples (in an amount of 7%) and Brazil nut kernels (in an amount of 5 %) together in the recipe of stuffed meat products. Modifying the recipe for chicken pockets, we obtained a product with improved consumer properties, increased nutrition value, and a decrease in the amount of butter by 4%.

## 6. Acknowledgement

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