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ORGANOLEPTIC EVALUATION OF THE QUALITY OF THE ENRICHED CHOPPED SEMI-FINISHED MEAT PRODUCTS

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Abstract: *The purpose of our research is to study the possibility of using hemp flour in the production of the enriched chopped semi-finished meat products. The substitution of 10% of minced beef for a similar amount of hemp flour in the recipe of chopped semi-finished meat contributes to: change in the color of the finished product while maintaining acceptable flavor profile; increase in magnesium (2.4 times) and iron (1.5 times) content; increase in lipid content by 22% due to the concentration of polyunsaturated fatty acids. Adding hemp flour to the recipe of cutlets does not adversely affect the physical-chemical quality parameters of the finished product. The possibility of using 10% of hemp flour in the production of chopped semi-finished meat products of increased mineral value is established.*

Key words: *cutlets, hemp flour, quality, production technology, organoleptic evaluation.*

1. Introduction

Enriched products are products that look like traditional food, but in which certain ingredients have been added or replaced by using various techniques that have a positive effect on the body as a whole or on its individual functions.

The main component of enriched products, according to the definition, is functional ingredients due to which the product shows useful, health-promoting benefits [1].

The use of meat as raw material for the production of functional products is very promising. This is provided by the presence in the meat raw materials of a wide range of biologically active substances which have significant physiological effect.

Meat contains complete animal protein, bioactive peptides, minerals (iron, zinc, and selenium), vitamins, fatty acids, etc. They boost immune potential and resistance, stimulate the activity of enzymes of the detoxification system and antioxidant protection, and improve the overall status of the body [2].

The development of enriched meat products has its own specifics because it is

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necessary to preserve the biological activity of the additive during the processing of raw materials and not to degrade the quality of the finished product.

There are the following groups of enriched meat products:

- low-calorie meat products enriched with dietary fiber;
- meat products enriched with minerals;
- vitaminized meat products;
- meat products enriched with prebiotic and probiotic cultures of microorganisms;
- meat products balanced by fatty acid composition.

Stuffed meat products such as chopped semi-finished products, cooked sausages, meat loafs, sausages, bockwursts as well as pastes, canned food, and baby food are the best base materials for the enrichment by various components [14].

For fortified meat products the most suitable ingredients are: minerals, dietary fiber, vitamins, and polyunsaturated fatty acids [12].

For the supplementing of the nutrient deficiency the most promising direction in the production of enriched food products is the use of vegetable raw materials and products in their processing. Herbal supplements are rich in a wide range of biologically active substances such as minerals, vitamins, amino acids, dietary fiber, polyunsaturated fatty acids, and also contain various phytocomponents [7].

Widely known are such classic production technologies and recipes for chopped semi-finished products, which include traditional vegetable raw materials: onions, garlic, bread, cereals, potatoes, cabbage, carrots, soybeans, greens, etc.

The researchers also suggest using unconventional vegetable raw materials in the production of chopped semis such as pumpkin, zucchini, sunchokes, raisins, sea kale, spent grains, milk thistle meal, rhubarb, soy milk, soy cheese (tofu) and protein-carbohydrate product (okara) etc. [3].

In the East, it has long been noticed that fragrant hemp seeds when processed, are very tasty and when added in sweets, improve their taste. Classic recipes of halvah, rahat lakoum, sherbet, baklava, and many other sweets included crushed hemp seeds. In India, hemp was a part of Ayurvedic mixtures and meals. In Ancient Russia hemp seeds were used for cooking porridges, and hemp was added to other types of cereals. Hemp oil, which has a rejuvenating effect, was very popular in all ancient cuisines of the world [5].

Still some nations prepare sweets using hemp. The ground hemp seeds and oil are used. Hemp seeds have a noticeable bitterness, so it is recommended to mix it with other types of cereals, for example, with buckwheat [8]. Porridge from hemp seeds allows to lower blood sugar level, to increase activity, to normalize sleep, to improve appetite and brain activity, and to reduce the risk of nervous diseases [9].

Hemp products are widely used in various industries. Hemp seeds and oil contain bactericide substances, valuable unsaturated acids, glycerides, amino acids, and micronutrients. Experts from the Novi Sad University (Serbia) and the Agricultural Research Institute of Ontario (Canada) disclosed that hemp flour can be used for the treatment of gastric diseases [4]. According to the Serbian and Canadian researchers, the composition of the hemp protein is comparable with the egg or soy protein. The nutrient analysis of hemp flour is presented in Table 1 [11].

2. Material and Methods

The materials of our research are the following:

– hemp flour, produced according to STO 68311059-011-2012 (manufacturer: Research and Manufacturing

Association OOO Kompas Zdorovya, Novosibirsk);

– cutlets "Moskovskiye" were used as a control sample according to the Recipe № 468 [6], test samples — with replacement of a part of minced beef (5, 10, 15% of the weight of raw materials) by the corresponding amount of hemp flour.

Experimental recipes of meat products are specified in Table 2.

The organoleptic evaluation was made using the scoring system of quality assessment. The cutlet samples were tested and evaluated by independent experts in the meat processing industry using a 9-point scale, taking into account the weight coefficients.

The protein mass fraction was determined by the amount of nitrogen using the Kjeldahl method.

The content of nutrients in hemp flour Table 1

Nutrient	Value per 100 g of product	PN, day	% of PN
Dietary fiber (g)	41.0	20	205
– soluble	2.0	–	–
– insoluble	39.0	–	–
Proteins (g)	30.0	65–117 (for men), 58–87 (for women)	25–46 (for men), 34–51 (for women)
Iron (mg)	33.0	10 (for men), 18 (for women)	330 (for men), 183 (for women)
Phosphorus (mg)	1,000.0	800	125
Magnesium (mg)	449.0	800	58
Zinc (mg)	7.2	12	60
Copper (mg)	1.9	1	190
Manganese (mg)	13.0	2.0	650
Potassium (mg)	1,888	2,500	75

Note: PN — physiological need (according to MR 2.3.1.2432-08 "Norms of physiological needs for energy and nutrients for different groups of the population of the Russian Federation. Eligibility guidelines").

Recipes of chopped semi-finished meat products Table 2

Raw material name	Norms, g (per piece)			
	Reference	Test 1	Test 2	Test 3
Minced beef	50	47.5	45	42.5
Hemp flour	–	2.5	5	7.5
Raw fat (pork, beef)	8.94	8.94	8.94	8.94
Onions	1.0	1.0	1.0	1.0
Rusk	4	4	4	4
Wheat bread	14	14	14	14
Water	20.8	20.8	20.8	20.8
Salt	1.2	1.2	1.2	1.2
Pepper	0.06	0.06	0.06	0.06
Semi-finished product mass	100	100	100	100

The content of phosphorus, iron, and magnesium in model cutlet samples was determined by atomic absorption spectroscopy [13].

The mass fraction of moisture was determined by drying the analyzed sample of the product at a specified temperature and calculating the weight loss with respect to the mass of the analyzed sample before drying.

The mass fraction of fat was determined by the fat determination method using the Soxhlet extraction apparatus. The method is based on extracting the total fat contained in meat products.

All measurements were repeated three times. The statistical analysis performed using the following software package: Microsoft Excel XP, Statistica 8.0. The margin of error does not exceed 5% (with 95% of the confidence level).

3. Results and Discussion

3.1. Method for Producing Hemp Flour

Particular attention of researchers in the field of meat products enrichment is focused not only on increasing their nutritional value, but also on studying the effect of additives on the consumer properties of finished products [10]. In this regard, the first stage of the research was to evaluate consumer properties, which imply, first of all, organoleptic advantages of model samples of chopped semi-finished meat products. The results of the research are shown in Table 3 and Figure 1.

Scoring of organoleptic quality indicators of chopped meat semi-finished products Table 3

Name of sample	Average score by indicators						Overall score of the quality
	exterior	color on the cut	smell (aroma)	taste	consistency (softness, stiffness)	succulence	
Reference	8.4 ± 0.2	8.1 ± 0.5	8.3 ± 0.3	8.1 ± 0.5	7.9 ± 0.1	8.0 ± 0.5	8.1 ± 0.3
Test 1	8.2 ± 0.3	7.9 ± 0.3	8.1 ± 0.2	8.1 ± 0.3	7.9 ± 0.3	8.1 ± 0.3	8.0 ± 0.3
Test 2	7.2 ± 0.3	7.3 ± 0.2	7.4 ± 0.3	7.3 ± 0.4	7.4 ± 0.2	7.2 ± 0.2	7.3 ± 0.3
Test 3	4.3 ± 0.2	4.1 ± 0.3	5.2 ± 0.1	5.0 ± 0.3	6.3 ± 0.3	6.0 ± 0.5	5.1 ± 0.3

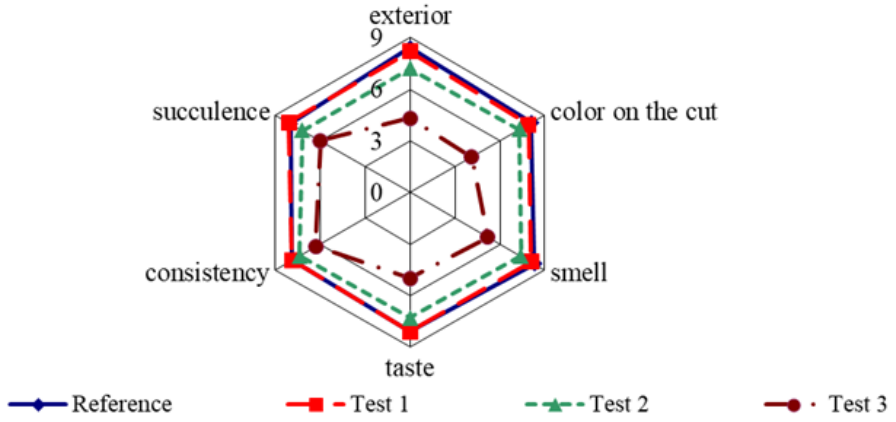

Fig. 1. *Profilogram of chopped semi-finished meat products*

The results of the organoleptic evaluation of the model samples of cutlets indicate the change of consumer properties of the products due to increasing the dosages of hemp flour. Thus, the vegetable additive in amounting to of 5% only slightly changed the exterior of the product: it introduced separate impregnations of dark grey particles. Concentration of hemp flour in amounting to of 10% contributed to a greater change in the taste and aromatic properties of the finished product, but with still acceptable characteristics of consistency and succulence. Increasing the amount of hemp flour to 15% has changed the taste of the sample cutlets because of the presence of a herbaceous hint resulting in the reduction of the quality of the cutlets to a satisfactory level.

The color in the Test 3 was also unacceptable for visual perception of the product. Based on the cumulative result, for further studies we selected a sample with a 10% substitution of minced beef with a similar amount of hemp flour (Test 2), since at this dosage of non-traditional vegetable raw material the product still retains acceptable consumer properties.

The results of the organoleptic evaluation of the model samples of cutlets indicate the change of consumer properties of the products due to increasing the dosages of hemp flour.

The reference sample is characterized by a golden crust on the surface. The surface of the sample is uniformly breaded, without broken and disrupted edges and cracks, the shape is rounded-flattened, and the consistency is soft and uniform. Finished cutlets are succulent, have a pleasant taste and aroma, proper for this type of product without untypical taste and smell. Exterior and view on the cut of the reference sample are shown in Fig. 2.

For the Test sample № 1 (with the replacement of 5% minced beef with the corresponding amount of hemp flour), the golden crust on the surface is also available.

Fig. 2. *Reference sample*

The surface is uniformly breaded, without broken and disrupted edges and cracks, the shape is rounded-flattened, and the consistency is soft and uniform. Finished cutlets are more succulent due to a more dense outer crust, while they have a pleasant taste and aroma, specific for this type of product, with a slight touch of pleasant herbaceous hint, which is almost indistinguishable but gives an interesting and unusual note. Exterior and view on the cut are shown in Fig. 3.

Fig. 3. *Test sample № 1*

The Test sample № 2 (the amount of

minced beef replaced is 10%) differs from the reference sample and Test sample № 1 by a darker surface due to a more pronounced change in the color of the mince. Finished cutlets are succulent, the crust is dense, but the changes in the consistency are already noticeable due to the hemp additives, it becomes more porous, the excess moisture is taken by the flour.

However, cutlets have a pleasant taste and aroma, specific for this type of product, with a slight touch of pleasant herbaceous hint. Exterior and view on the cut are shown in Fig. 4.

Fig. 4. *Test sample № 2*

For the Test sample № 3 (the amount of minced beef replaced with the appropriate amount of hemp flour - 15%), crust on the surface becomes too dark, consistency loses its uniformity due to the large number of inclusions of non-hydrated particles of the hemp flour.

Finished cutlets become even more dry and porous, after cooling they become tough and solid, while they have a pronounced herbaceous taste and aroma, and the additive has caused strong changes in the color of minced meat. Exterior and view on the cut are shown in Fig. 5.

Thus, the vegetable additive in amounting of to 5% only slightly changed the exterior of the product: it introduced separate impregnations of dark grey particles.

Fig. 5. *Test sample № 3*

The 10% concentration of hemp flour in amount of 10% contributed to a greater change in the taste and aromatic properties of the finished product, but with still acceptable characteristics of consistency and succulence.

Increasing the amount of hemp flour to 15% has changed the taste of sample cutlets because of the presence of herbaceous hint resulting in the reduction of the quality of the cutlets to a satisfactory level. The color in the Test 3 was also unacceptable for visual perception of the product.

At the second stage of the research, the comparative nutritional value of the cutlets model samples was studied. The results of the research are shown in Table 4.

A positive effect of the vegetable additive in the investigated concentration was found for supplementing mineral value of chopped semi-finished meat products. As for macronutrients, the samples of cutlets contain more magnesium (2.4 times), and more iron as well as micronutrients (1.5 times). However, the phosphorus content decreased slightly by 15%.

Nutritional value of chopped semi-finished meat products Table 4

Indicator name	Results	
	Reference	Test 2
Moisture weight content, %	63.7 ± 2.3	60.5 ± 2.1
Protein weight content, %	13.5 ± 0.7	12.9 ± 0.7
Fat weight content, %	11.5 ± 0.2	14.1 ± 0.3
Phosphorus content (mg/100 g)	90.6 ± 2.7	77.3 ± 2.2
Magnesium content (mg/100 g)	30.07 ± 1.03	72.23 ± 1.91
Iron content (mg/100 g)	1.98 ± 0.04	2.93 ± 0.02

4. Conclusions

The estimates suggest that the addition of hemp flour in the amount studied to the recipe of the cutlets leads to satisfying a significantly more adult need for mineral elements, which allows the optimization of the food ration by a set of individual micronutrients and the prevention of a number of alimentary-dependent diseases.

The weight content of fat in Test 2 increased by 22% mostly due to the increase in polyunsaturated fatty acids contained in the hemp oil. The weight content of moisture and protein were in the same quantitative range, both in reference and in test samples.

The substitution of the 10% of minced beef for a similar amount of hemp flour in the recipe of chopped semi-finished meat contributes to:

- change in the color of the finished product while maintaining acceptable flavor characteristics;
- an increase in magnesium content (2.4 times) and iron (1.5 times);
- an increase in lipid content by 22% due to the concentration of polyunsaturated fatty acids.

Adding hemp flour to the recipe of cutlets does not adversely affect the physical-chemical quality parameters of the finished product.

So the possibility of using 10% of hemp flour in the production of chopped semi-finished meat products of increased mineral value is established.

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