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PHYSICAL AND CHEMICAL PARAMETERS OF CHOPS MODEL COMPOSITIONS WITH USING OF FLAX SEED

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Abstract. Physical and chemical parameters of chops model compositions using flax seeds was studied. Found that using of flax seeds in the chops model compositions in the amount of 5% promotes the water-retaining capacity, therefore, the texture and richness of products are improved.

Key words: chopped semi-finished products, model compositions, flax seed, fatty stuff, physical and chemical, structural and mechanical properties.

Introduction

Chopped semi-finished products are made from minced meat. These are burgers, steaks, schnitzels, round steaks. Except using of raw meat in their production melange, egg powder, wheat bread, soy and milk protein preparations, plasma, onions and vegetables (cabbage, potatoes, carrots) and rusks flour and spices are used.

Formulation of Problem

Natural semi-finished products from only chopped meat are rarely made due to technological reasons, in particular because of poor structure of meat, as well as economic reasons. Other ingredients that are used in the manufacture of chopped semi-finished products are usually cheaper than meat, which reduces the cost of the final product. Such additives like bread, potatoes, egg products, meat proteins stabilize the structure and improve the consistency of finished products [1, 2].

Analysis of Recent Research Results

Cutlets, steaks, schnitzels, rump steaks, minces are produced in chilled and frozen state. Chopped semi-finished products, which are produced only in frozen state include meatballs, knels, croquettes, dumplings, curd dumplings and ravioli [3, 4].

Frozen food market today is quite developed, and frozen foods have become a fixture of life in the big city. Their use can significantly reduce the cooking time, give some free time for consumers to communicate with family and friends [5, 6].

The most popular semi-finished meat products remain to ravioli group. At the same time the leading position in growth rate chopped semi-finished products have: the annual growth of production is 10–15%, which is two times higher than the increase in production of ravioli (5–7% per year). The reason for such significant growth in demand for chopped semi-finished products groups is increasingly widespread development of fast food chains, many of which include burgers and other minced meat dishes in the menu [7, 8, 9, 10].

One way to improve the quality of products and improve the structure of nutrition in the diet is the introduction of new non-traditional types of material of vegetable origin. Created products should contain a balanced set of proteins, lipids, minerals, vitamins, and ballast substances, also should have high taste properties. Such kind of products in the future semi-finished product produced with the use of flax seeds in the recipe will become.

Flax seed is a special dietary food product, which has unique properties. It contains protein of high biological activity, which in its composition is close to the ideal protein. According to the literature, flax seed is a valuable source of various biologically active substances. It contains 18 - 20% protein, 29 - 43% lipids, 20 - 22% carbohydrates, 3,5 – 5,0% ash. The content of chemical substances in flax seed depends on the degree of maturity, features of a variety and the area of cultivation.

In this context, and due to the lack of functionalities in Ukrainian food products market scientific basis and development of chopped semi-finished products technology using functional ingredients of plant origin, including flax seed is important.

Purpose of Research

The aim of this study was to investigate the possibility of using flax seed in the technology of meat products, including chopped semi-finished products.

Results of Research

The study was conducted in the laboratory of the department of the meat, fish and seafood of National

University of Life and Environmental Sciences of Ukraine.

In the production of meat products was used: beef meat cutlets (ТУ У 46.38.031), trimmed pork fat, drinking water (ГОСТ 2874); bread from wheat flour of first grade (ГОСТ 27842); bread crumbs (ГОСТ 28402); salt of first grade (ДСТУ 3583).

In the experimental samples of chopped semi-finished products fatty material was replaced to flax seed flour in amount of 5% (2nd research sample), 10% (3rd research sample), 15% (4 research sample), respectively. As a control sample chopped semi-finished products were taken manufactured according to ДСТУ 4437.

In the performance experimental studies were carried out by the following methods: moisture content - dry the sample to constant weight at 105 ° C (ГОСТ 4288-76); proteins - determination of total nitrogen by Kjeldahl method (1 Antipova L. et.al. 2001), lipids - accelerated method with the use of butyrometer [11] extraction-weight Soxlet; carbohydrate content - calculated by the actual content of the samples moisture, protein, lipids , minerals; ash content - by ashing method; active acidity - potentiometric method at pH metrminivoltmeter pH-673 M; water-binding capacity - rapid method of Grau and Hamm in the modification of Volovinskoyi, Kelman; moisture and fat-keeping ability and stability of mince - by Salavatulinoyi method, etc., water-binding capacity - by Shoha, water absorption ability - by centrifugation; the maximum voltage shift - using automated penetrometer AP-4/2; adhesion properties - in a laboratory setting by Tyshkevych, weight loss during heat treatment of products - weighing before and after heat treatment (after cooling to a temperature of 40 ± 2 ° C).

The reliability of experimental results was evaluated by mathematical statistics using Student criterion, the degree of confidence – 0,95.

One way to ensure profitability of the meat production enterprise is modernization of finished products. Modern development of food industry has created conditions for the emergence of food combinatorics the process of creating new types of formulations of food by well-founded quantitative selection of basic raw materials, ingredients, food additives, biologically active additives, the combination of which ensures the formation of the desired organoleptic, physico-chemical properties of the product, given level of food, biological and energy value.

In the manufacture of culinary products, including chopped semi-finished products state of moisture in the meat is very important - the amount of moisture held in mince and the form of its relationship with the components of meat. State of water in mince can be represented by the following dynamic scheme: solidly bound moisture ↔ weakly bound moisture ↔ weakly bound excess moisture.

In this scheme solidly bound moisture is mostly moisture adsorption moisture; weakly moisture provides optimum richness and texture of the product, weakly bound excess moisture appears during heat treatment of the product. The finished product containing as much water as needed to cover its ability to keep solidly and weakly bound moisture has optimal structural and mechanical properties. At the same water content increasing of solidly bound moisture part in mince causes the increasing of its hard creating properties. On the contrary, reducing of its part leads to a shift of balance and the separation of excess moisture during heat treatment of the product - spoilage and reduction of product yield.

Due to the fact that in the production of chopped semi-finished products the amount of moisture held by meat system as well as forms of its relationship with the components of meat has a great practical importance, we have investigated the dependence of water-binding capacity and moisture of model minces on the content of flax seed in it.

The study of physical and chemical parameters of model food compositions of chops (table 1) indicates that the active acidity of prototypes slightly decreases with the increasing of flaxseed flour content, which has a lower pH level.

Thus, the result of experimental studies found that total moisture content in the research samples remained at control sample, but there is a change in the ratio of solidly and weakly bound moisture. Thus, the 2-sample test, with 5% fat substitute with raw flax seed flour the part of weakly boundmoisture by 6,0% lower than in control. This explains the more elastic, tough texture and richness of research sample of cutlet weight compared with controls as it was determined organoleptically. With increasing of flaxseed flour content in the cutlet mass the quantity of weakly bound moisture decreases as water-binding capacity increases accordingly (table 2). In particular, the water-retaining capacity of model food composition of control samples was 41,9%, whereas in the research samples, the figure fluctuated between 60,9% (4th sample) to 64,7% (2nd sample). This difference was statistically significant ($p < 0,05$).

As a result of experimental studies it was found that with increasing of water-binding capacity of meat, water-retaining, on the contrary, decreases. Experimental model samples of food compositions in which the formula 5% of fatty material was replaced to the flaxseed flour (2nd sample) had the best functional and technological properties.

Table 1. Active acidity and quantity of weakly bound moisture in model food compositions with flax seed.

Samples	Active acidity, pH	Moisture content, %	Weakly bound moisture content, %	
			of sample weight	of general moisture
1- control	5,52±0,07	72,6±0,8	26,5±0,7	35,9±1,0
2-research	5,51±0,05	71,8±0,7	24,9±1,2	33,9±1,4
3- research	5,48±0,06	71,5±1,3	23,2*±0,9	32,7*±1,0
4- research	5,47±0,04	71,1±0,9	21,9*±0,8	30,3*±1,1

Note. * *Difference* with the control sample is statistically correct, $p < 0,05$.

Table 2. Functional and technological parameters of model food compositions.

Samples	Water-binding capacity, %	Water-retaining capacity, %	Fat-retaining capacity, %	Weight loss during heat treatment, %
1- control	41,9±2,1	68,8±0,3	81,9±2,1	18,7±0,9
2-research	64,7*±1,3	67,9*±0,4	83,0±1,9	20,4*±0,6
3- research	62,8*±1,1	66,4*±0,5	83,2±2,2	20,8*±0,4
4- research	60,9*±1,3	66,9*±0,6	83,5±2,3	21,5*±0,7

Note. * Difference with the control sample is correct, $p<0,05$.

Table 3. Structural and mechanical parameters of model food compositions.

Samples	Boundary shear stress, Pa		Adhesion, Pa
	semi-finished products	finished products	
1- control	412±16	2830±110	2889±90
2-research	408±12	3318*±125	2758±110
3- research	393±17	3318*±120	2954±120
4- research	352*±15	3651*±158	3150*±140

Note. * Difference with the control sample is correct, $p<0,05$.

Fat-retaining ability of model cutlets with adding of flax seed flour, on the contrary, increased compared with controls: in the recipe where 5% of fatty material was replaced to the flax seed flour (2nd sample) - by 1,6%; in experiment 3 with 10% replacement of the fatty material - by 1,5%. Relative fat-retaining ability of samples increases in direct proportion to the content of flax seed flour in the cutlet weight and therefore decreases in the proportion of fatty material. Thus data of improving the ability of fat-retaining ability in meat products using herbal supplements is proved.

Effect of additives on moisture and ability to determine changes cutlet weight loss when cooked. To determine losses during heat treatment and the content of essential nutrients in the finished product with model compositions flax flour formed patties and fried. Found that during frying samples lost more weight than the control. Thus, the weight loss during frying 2 prototypes with the highest content of flax flour is 21,5%, which is 2,8% more than in controls. These findings are consistent with studies of water-retaining ability of the model compositions flax flour.

Thus, the replacement of more than 15% of fatty material to the flax seed flour is impractical, because it causes the worsening of functional and technological characteristics of the system and organoleptic properties of the finished products.

To assess the influence of flax seed flour on the structural and mechanical properties of model food compositions boundary shear stress and adhesive properties were studied (table 3).

Study of rheological properties of model compositions with flax seeds showed that adding flax seed flour in cutlet weight increases shear stress to the maximum. When replacing 5 and 10% of fatty material shear stress in the cutlet mass is close to its rate in the control, which is 416 Pa.

Adding flax seed flour to the cutlet weight in the amount of 15% (4th sample) increases the adhesion ability in the cutlet weight, on the contrary from 5 and 10%.

After heat treatment (roasting) of semi-finished products of model compositions with flax seeds dependence of shear stress takes the opposite character: with increasing of flax seed flour content its value increases. It should be noted that in the experiments with the replacement of fatty materials from 10 to 15% the rate of shear tress is higher than the rate in the finished control sample (2830 Pa).

The observed differences in structural and mechanical properties of the control and research samples is coordinated with the results of organoleptic evaluation of finished products and water-retaining capacity of cutlet weight.

Conclusions

1. Thus, according to the obtained data, with the decrease of flax seed flour in semi-finished products water-retaining capacity increases and, consequently, texture and richness of the products improves.

2. Summarizing the data, we can conclude that, due to the consistency of finished meat products, it is reasonable to limit the replacement of fatty material at 5%.

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ФІЗИЧНІ І ХІМІЧНІ ПАРАМЕТРИ МОДЕЛЬНИХ КОМПОЗИЦІЙ ВІДБИВНИХ ЗА ДОПОМОГОЮ НАСІННЯ ЛЬОНУ

А. І. Веретинська, Ю. Г. Сухенко, Н. М. Слободянюк

Анотація. Були вивчені фізико-хімічні параметри моделей композицій відбивних з використанням насіння льону. Встановлено, що використання насіння льону у котлетних модель композиціях в кількості 5% підвищує водоутримуючу здатність, тому, текстура і соковитість продуктів поліпшується.

Ключові слова: рубані напівфабрикати, модельні склади, насіння льону, жирні речі, фізико-хімічні, структурно-механічні властивості.

ФИЗИЧЕСКИЕ И ХИМИЧЕСКИЕ ПАРАМЕТРЫ МОДЕЛЬНЫХ КОМПОЗИЦИЙ ОТБИВНЫХ С ПОМОЩЬЮ СЕМЕНИ ЛЬНА

А. И. Веретинская, Ю. Г. Сухенко, Н. М. Слободянюк

Аннотация. Были изучены физико-химические параметры моделей композиции с использованием семян льна. Установлено, что использование семян льна в моделях композиций котлет в количестве 5% повышает водоудерживающую способность, поэтому, текстура и сочность продуктов улучшается.

Ключевые слова: рубленые полуфабрикаты, модельные составы, семя льна, жирные вещи, физико-химические, структурно-механические свойства.