Наведено результати досліджень функціональних властивостей напівфабрикату паштетних печінкових мас із частковою заміною яловичої печінки на харчовий порошок з баклажанів (3 %, 5 %, 7 %). Здійснено дослідження структурно-механічних характеристик напівфабрикату паштетних печінкових мас, виготовлених за традиційною технологією та з додаванням харчових порошків з різним відсотковим співвідношенням.

Порошки з баклажанів характеризуються високими споживчими характеристиками і можуть застосовуватись як біологічно-активна добавка у продуктах харчування і є найбільш перспективною сировиною для створення продукції спеціального призначення. Додавання порошків розширює асортимент продукції та впливає на хімічний склад продуктів харчування, поліпшує органолептичні, фізико-хімічні, структурно-механічні властивості кінцевого продукту.

Встановлено, що введення порошків з баклажанів до паштетних мас призводить до суттєвих змін структурного стану напівфабрикату паштетів, змінюючи кількісні значення реологічних характеристик та поліпшуючи структуру суміші. Встановлено, що введення порошку з баклажанів приводить до зростання вологозв'язуючої та вологоутримуючої здатності напівфабрикату паштетної печінкової маси, що позитивно впливає на пластичність та ніжність продукту. Пояснюється це тим, що введення порошків до напівфабрикату паштетних мас призводить до збільшення масової частки високомолекулярних речовин, здатних до набухання, що супроводжується зв'язуванням і утриманням вологи. Результатами експериментальних даних визначено, що оптимальні структурно-механічні властивості має паштетна печінкова маса з 5 % вмістом порошків з баклажанів.

Обґрунтовано раціональну масову частку часткової заміни печінки (яловича та куряча) на розроблений харчовий порошок, за якої системи характеризуються найвищими функціонально-технологічними показниками.

Зважаючи на отриманні дані, доведено можливість використання порошків з баклажанів для виробництва напівфабрикату печінкових паштетів. Отримані результати можуть використовуватись підприємствам харчової промисловості для розширення асортименту продукції

Ключові слова: порошки з баклажанів, печінкова паштетна маса, структурно-механічні показники, реологічні властивості

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ESTABLISHING THE EFFECT OF EGGPLANT POWDERS ON THE RHEOLOGICAL CHARACTERISTICS OF A SEMI-FINISHED PRODUCT MADE FROM LIVER PATE MASSES

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1. Introduction

Healthy nutrition is the most important and topical public problem closely intertwined with social stability of society and health of population. On this basis, priority is given to provisioning the population with products having balanced composition, specified functional properties, and contributing to correction of the nutrient budget. One of the solutions to this problem consists in development of food formulations based on the theory of functional nutrition able to compensate for deficiency of essential substances. Nutritional value of products can be raised by combining the for-

mulation components containing both plant and animal raw materials. Combination of various components makes it possible to create products enriched not only in animal proteins but also biologically active substances (food fibers, vitamins, macro- and microelements). In addition to balancing the formulation, the use of essential ingredients provides functional action. Meat raw materials and offal are a source of biologically active substances with a wide spectrum of physiological action. These include bioactive peptides, minerals (zinc, iron, selenium, etc.), vitamins, polyunsaturated fatty acids, edible fibers and the like. Their regular consumption determines functional properties such as improving general state of the organism, stimulating activity of enzymes in the system of detoxification and antioxidant protection, improving immune potential and body resistance. The most common method of combining raw materials consists in production of a variety of minced products and pates making it possible to achieve the synergistic effect. It is important to note that the preventive effect of such products is greater in contrast to the drugs of synthetic combination [1].

Moreover, addition of plant raw materials that are much cheaper than meat and offal has both social and economic effect. Such products are much cheaper compared to prototype dishes. This facilitates product availability to a larger segment of population.

On this basis, it is advisable to explore the possibility of using eggplant processing products in the production of functional pates. The eggplant powder is a promising raw material for the food industry [2, 3]. It is a source of pectin substances, dietary fibers, macro- and micronutrients. The powder was produced using an infra-red dryer at a temperature of 50–60 °C. The eggplants were preliminarily washed, sliced, kept in boiling water with citric acid (1 %) for 5–10 min. and dried to a 10 % moisture content. The dried raw material was ground to a fine powder that passes through a 50 millimetre sieve and then packed and tightly sealed in polyethylene bags and stored in a freezer chamber for further use and analysis with the help of the LLC Venta Lab VHS-350 laboratory grinder (Ukraine), Optimum hydration of eggplant powders was carried out in the temperature range of 45 °C to 60 °C with swelling time of about 10–15 minutes at powder to liquid ratios of 1:3 and 1:4 [2, 3]. Thanks to the technology of infrared drying, maximum possible quantity of essential substances is preserved in the dried eggplant, so it is expedient to add it as a functional ingredient for balancing chemical composition of the formulation. Taking into account advantages of the eggplant powders and popularity of meat products, relevance of development of a technology for preparing offal pate of functional purpose is evident.

2. Literature review and problem statement

Pate is a universal product that is a homogenized protein-fat food system. The classic formulation of liver pates includes offal, dairy products and plant raw materials. Soft consistency of the pates is achieved through special methods of raw material processing and careful choice of ingredients. Present-day technologies are aimed at providing balance of the nutrient budget through enrichment of food products with vital nutrients and removal of harmful substances [4].

Combination of raw materials of animal and plant origin is the most common line of action. Various raw materials are used in the production of combined pates: pumpkins [5], soybeans [6], girasole [7], ground cedar nuts [8], leaves of green tea and lotus, kimchi powder [9]. It was established that partial replacement of the raw material of animal origin with a plant raw material makes it possible to reduce not only caloric content of the product but also content of cholesterol and saturated fatty acids [5–9]. However, production of functional meat products has its own features, since it is necessary to preserve biological activity of the food additive and qualitative indicators of the final product. Therefore, special attention at the stage of choice of additives is paid to safety, permissible concentrations and daily needs of the body in nutrients [4, 10].

It is suggested in [11] to add flour of persimmons of Rojo Brillante and Triumph varieties (Spain) as a functional ingredient. It has been established that persimmon enriches chemical composition of porcine liver pate and exhibits antioxidant properties. However, the issue of optimal additive amount was not resolved and structural and mechanical properties of the product remained nondetermined.

Studies [12, 13] are aimed at replacement of animal fat with plant fat. It is proposed to add olive oil [12] and pastes produced from various types of quinoa (white, red, and black) [13]. Due to the replacement of fat [12], changes in physical and chemical properties, the content of fatty acids, cholesterol and α-tocopherol take place. In spite of the improved chemical composition, consistency and appearance of the pates need applying final efforts. Quinoa pastes [13] increase content of moisture, ash and residual nitrites. Despite the improvement in chemical composition, the use of quinoa pastes has reduced softness and spreadability of the final product, so, further correction of formulation compositions is necessary.

A technology of preparing a liver pate with replacement of pork fat with fish oil is proposed in [14]. Chemical composition of the final product improves due to a 50 % and 75 % replacement. It has been shown that lipid modification of the pate is a good option for improving nutritional quality (less saturated fats and more unsaturated fats). However, the high level of polysaturation raises amount of volatile oxidative lipidic substances necessitating a further study of this improvement line.

Study of pates with addition of flax and hemp seeds is considered in [15]. Content of polyunsaturated fatty acids was increased in a pate. But given that nutritional supplements are also characterized by high fiber content, the products had a thicker structure and increased adhesiveness. In this regard, the technology should be refined.

Thus, the major part of the studies is based on the use of new raw material components, their combination, etc. However, despite numerous advances, there is no clear data on the study of structural and mechanical properties of visco-plastic food products. It is these data that could provide an objective assessment of partially prepared food products, technological and organoleptic properties, such as softness, juiciness, homogeneity, etc. Thus, it is advisable to carry out studies on structural, mechanical and rheological characteristics of partially prepared liver pate masses with addition of eggplant powders.

3. The aim and objectives of the study

The study objective was to determine influence of eggplant powders on rheological characteristics of partially prepared liver pate masses.

This will enable obtaining of partially prepared liver pate masses with specified rheological properties.

To achieve the goal, the following tasks were set:

– to obtain characteristics of behavior of the partially prepared liver pate mass of special purpose under the influence of loads and speeds of their application;

– to determine structural, mechanical and organoleptic properties of partially prepared liver pate masses.

4. The materials and methods used in the study of liver pates with vegetable powders

The studies were conducted during 2016–2019 at the laboratories of Kherson State University and Kherson State Agrarian University (Ukraine).

Beef and chicken liver being a source of proteins, phospholipids, minerals (iron, silicon) and vitamins (of A, D, E groups) was used as the main raw material because it has high consumer characteristics and functional and technological properties [1].

Beef and chicken liver is a by-product used in dietetic therapy because it contains proteins, vitamins A and B, a substantial amount of iron, copper and lipotropic substances (lecithin, methionine, choline). Disadvantage of beef liver consists in a significant amount of purines, uric acid and cholesterol [1]. Besides, because of presence of a large number of acidic radicals in the liver, the acid-base balance in the body shifts to the acid side when it is consumed. It provokes a metabolic disorder and promotes premature aging. Therefore, when consuming the liver, it is necessary to combine it with vegetables that not only normalize acidity but also improve liver digestion in the gastrointestinal tract.

It is recommended to introduce eggplant powders to formulation [2, 3] as a vegetable ingredient when developing partially prepared liver pate masses for the restaurant industry. The powders serve as a source of food fibers, macro- and microelements of well-known benefits.

Four samples of the partially prepared liver pate mass, the main components of which are the chicken and beef liver and eggplant powder taken as the study object (Fig. 1):

– sample 1 (control sample): raw chicken (50 %) and beef (50 %) liver minced and homogenized with other components in a cutter;

– sample 2: eggplant powder added to the obtained liver mass in an amount of 3 %;

– sample 3: eggplant powder added to the obtained liver mass in an amount of 5 %;

– sample 4: eggplant powder added to the obtained liver mass in an amount of 7 %.

The Rheotest RN 4.1 rotational viscosimeter (Germany), which provided absolute values of indicators, a high degree of sensitivity and automation during a series of measurements, was used in determining rheological indicators. A cylinder-cylinder measuring system with a rotor of S1 type was used since the product under study was of substantially high viscosity.

In rheological studies, it is important to obtain reliable flow curves reflecting the material properties during shear. In order to obtain reliable measurement data, compulsory requirements to the tested samples were fulfilled:

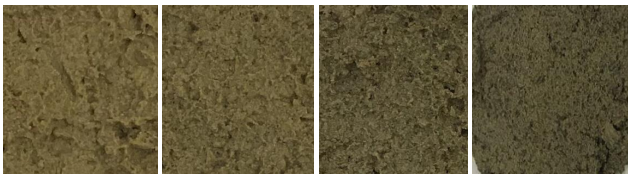
– temperature during the experiment was constant and uniform throughout the sample volume (21 °C);

– the samples had a homogeneous consistency, with no air cavities;

– the samples had no particles prone to deposition or clotting;

– the samples had no particles that are destroyed to smaller particles or liquids under the influence of shear stress and oriented along the flow;

– the samples did not undergo chemical transformations during measurements.



a *b* *c* *d*

Fig. 1. Experimental samples of partially prepared liver pate mass: *a* – control sample; *b* – liver mass with 3 % eggplant powder; *c* – liver mass with 5 % eggplant powder; *d* – liver mass with 7 % eggplant powder

Measurements were made with a current setting of the parameters necessary for conducting the experiment and transmitting its results. Prior to measurements, a 200–800 Pa shift stress range was set and the program automatically selected corresponding values of shear rate [16]:

– 20 measurement points during the experiment;

– the types of charts to be obtained and adjustment of the graphic images;

– a list of experimental data presented in a tabular form.

Values of shear stress $\theta(D)$ and the mixture viscosity $\eta(D)$ depending on the shear rate D were obtained.

The complex quality indicator was determined from formula (1) [4]:

$$\text{CQI}=\sum K_0 \cdot K_i, \quad (1)$$

where K_i are the coefficients of significance of the group of properties (indicators) where K_0 is the value of a complex quality indicator for individual product property groups (shear rate, viscosity, shear stress, moisture-retaining capacity, moisture-binding capacity, organoleptic estimate).

$$K_0 = \sum_{i=1}^{n} M_i \cdot k_i, \quad (2)$$

where M_i is the value of relative quality indicators of the partially prepared product; k_i are the coefficients of significance of individual quality indicators for each group of properties.

5. Results obtained in the study of rheological indicators of partially prepared liver pate masses

5. 1. The study of rheological indicators

Pate belongs to the systems with noncellular crystalline structure and is in a plastically binding state. In its structure, it belongs to bindingly dispersed structures in which one of the phases is structurally fixed and cannot move freely [10].

Since the pate mass is subject to further processing and formation, its important characteristic consists in the limit shear stress which determines form-retaining capacity of the product [16]. Addition of fillers affects the pate characteristics, so it is important to study main rheological characteristics of the partially prepared liver pate masses.

The classic formulation of liver pates includes offal, dairy products and plant raw materials. Pates can be prepared from a variety of products in various combinations [5–15]. Soft consistency of the pates is achieved through special methods of raw material processing and careful choice of ingredients. An increase in nutritional value of pates is achieved by combining the formulation components containing both plant and animal raw materials. Combination of various components makes it possible to create products enriched in not only animal proteins but also biologically active substances (food fibers, vitamins, macro- and microelements) [4].

Variants of formulations of the model compositions of the partially prepared liver pate masses are given in Table 1.

Table 1

Formulations of model compositions of partially prepared liver masses, g

Raw material name	Raw material consumption per 100 g of partially prepared product			
	Sample 1	Sample 2	Sample 3	Sample 4
Beef liver, g	31.60	30.5	29.77	29.04
Chicken liver, g	31.3	31.3	31.3	31.3
Eggplant powder, g	–	0.27	0.45	0.64
Water for powder hydration, g	–	0.83	1.37	1.92
Milk, ml	7.5	7.5	7.5	7.5
Eggs, g	11.0	11.0	11.0	11.0
Butter, g	17.5	17.5	17.5	17.5
Spices, g	0.02	0.02	0.02	0.02
Salt, g	1.1	1.1	1.1	1.1
Yield, g	100	100	100	100

The block diagram of production of partially prepared liver pate masses is shown in Fig. 2.

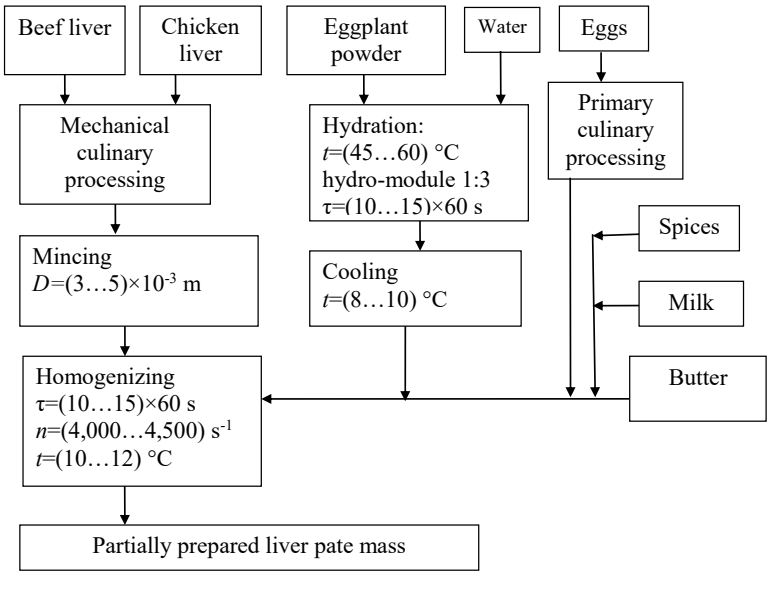


Fig. 2. Block diagram of production of the partially prepared liver pate mass

Addition of fillers affects condition of the pate mass characterized by the following main parameters: viscosity, elastic modulus, shear stress, plasticity, moisture-retaining capacity. It is important to determine structural and mechanical characteristics for qualitative evaluation of the partially prepared liver pate mass [16, 17].

According to the experimental results, changes in viscosity and shear stress were determined during measurements depending on the shear rate in the samples of the partially prepared liver pate mass.

Viscosity and shear stress for the control sample 1 and the samples of pate mass with added eggplant powders had similar appearance. That is, when the velocity gradient increased, viscosity decreased and stabilized before moving to the region of the structural failure and growth of the values of shear stress.

The obtained data have allowed us to analyze the additive effect on rheological characteristics of the pate mass and plot the curves of viscosity and shear stress based on the experimental data (Fig. 3).

Taking into account the graphs (Fig. 3), it has been established that the systems under study had a stable structure and were characteristic of visco-plastic systems. The structure degradation has begun only after reaching the determined stress (Fig. 3). The obtained dependences have made it possible to analyze the additive influence on rheological properties of the partially prepared product. The study results have shown that addition of eggplant powder increased viscosity of the mass compared to the control sample. A 3 % or 5 % addition had no serious impact on numerical values of the system viscosity regardless of the shear rate, that is, the structure was actually the same.

Sample 4 differed significantly from previous samples. It contained 7 % of eggplant powder. The data of the dependence curve have confirmed organoleptic characteristics, namely, the mass had a thicker structure and differed significantly from that of other samples.

These rheologic data may characterize one of the qualitative indicators (consistency) of the product at all stages of its preparation.

Based on the graphs of dependence of the shear stress on viscosity (Fig. 3), extreme values can be distinguished (Table 2).

Table 2

Extreme values of sample characteristics

Indicator/ sample	Sample 1	Sample 2	Sample 3	Sample 4
Time, s	549.8	759.9	705.7	594.5
Viscosity, MPa·s^{-1}	0.156	0.234	0.303	1.115
Limit shear stress, Pa	224.6	316.1	432.6	810
Limit shear rate, 1/s	1,450	1,355	1,430	728.9

The data presented in Table 2 show extreme values of the characteristics before structures of the samples under study failed. The experimental sample 3 was the most proximate to the control sample 1. Structural and mechanical characteristics are the initial parameters in creation of a new scientifically grounded technological process for the production of a partially prepared liver mass since addition of eggplant powders influences structure formation. Therefore, taking into account the data obtained and studying organoleptic parameters, it is possible to determine optimal amount of the eggplant powder to be added.

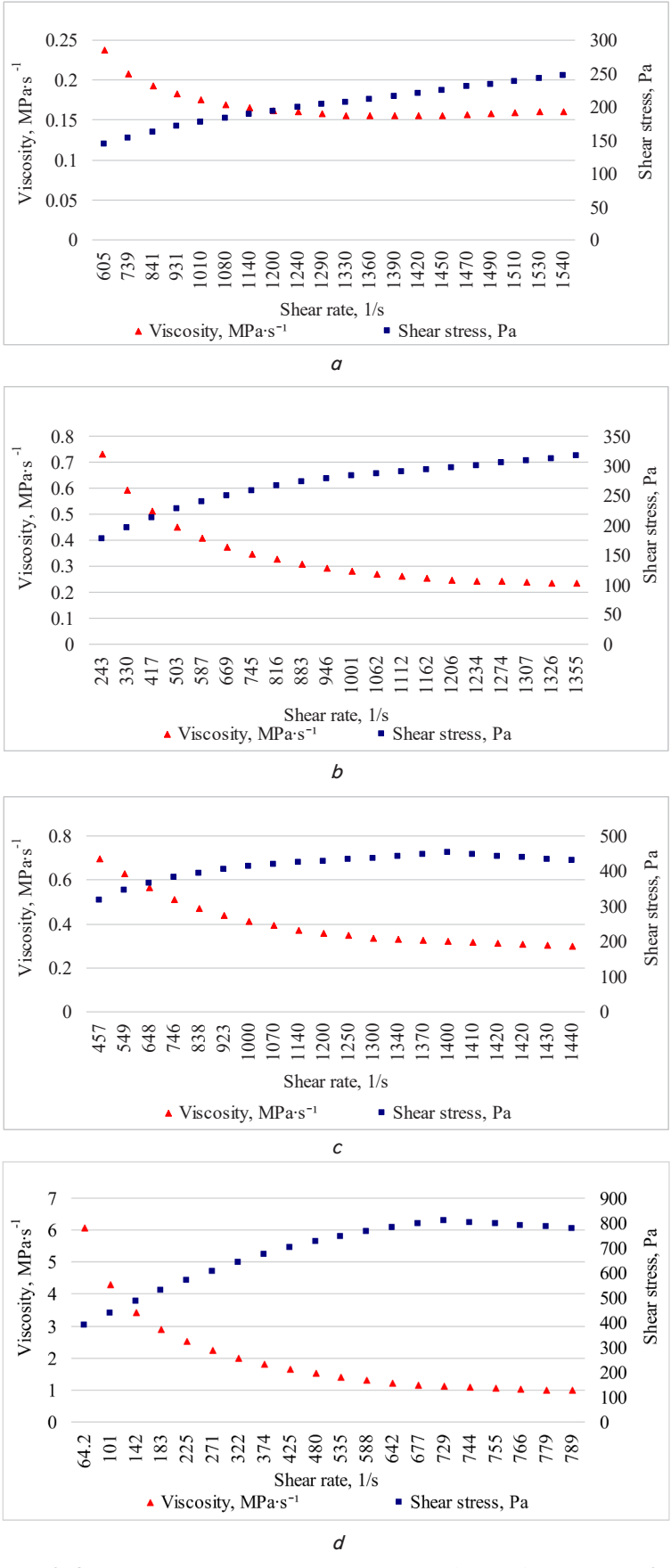


Fig. 3. Stress vs. viscosity graphs: *a* — sample 1 (control); *b* — sample 2 (the experiment with 3 % of eggplant powder); *c* — sample 3 (the experiment with 5 % of eggplant powder); *d* — sample 4 (the experiment with 7 % of eggplant powder)

5. 2. Determination of the optimal amount of eggplant powders

Various methods are used to determine the indicators characterizing quality of the pate mass: mechanical, organoleptic and chemical ones. Organoleptic evaluation of the partially prepared product was made for the main indicators: consistency, color and smell (Table 3).

Table 3

Organoleptic characteristics of the liver masses

Indicator	Pate mass			
	Sample 1	Sample 2	Sample 3	Sample 4
Appearance	Surface of the pate mass is clean and plane			
Consistency	Thick, spreadable	Thick, spreadable, pasty	Thick, spreadable, pasty	Thick, dense
Color	Gray mass	Gray mass	Gray mass	Dark gray mass
Smell	Characteristic of the raw material with no unwanted smell	Characteristic of the raw material with no unwanted smell	Characteristic of the raw material with no unwanted smell	Characteristic of the raw material with no unwanted smell

When determining the organoleptic parameters, it was found that when 7 % of the eggplant powder was added to the pate, consistency and color were deteriorated as compared to the control sample.

Taking into account the data of organoleptic evaluation, functional and technological properties of the product were analyzed in parallel which has made it possible to obtaine quantitative characteristics of the product consistency and adjust them.

Functional and technological indicators with powder content of 3, 5, and 7 wt.% of liver were studied to determine optimum content of eggplant powder in the partially prepared liver pate mass. The results obtained in determining functional and technological properties are presented in Table 4.

Table 4

Determined functional and technological properties of the partially prepared liver pate mass

Indicator name	Eggplant powder content, %			
	Control sample	3	5	7
Yield, %	125	127	127	127
Moisture-retaining capacity (MRC), %	88.2	90.1	90.6	93.1
Moisture-binding capacity (MBC), %	62.0	69.0	74.0	76.0
Emulsifying capacity, %	0.4	0.45	0.47	0.51

The studies have shown that the partially prepared liver pate mass with addition of eggplant powders had a darker color than the control sample. Also, there was an increase in mois-

ture-retaining capacity in the samples of partially prepared products containing the powder.

The increase in moisture-retaining and moisture-binding capacity of the liver pate mass is due to an increase in the weight fraction of high molecular weight substances. Eggplant powders are a source of these substances. Due to introduction of eggplant powders into the pate mass, polysaccharides swell accompanied by binding and retaining of moisture and affecting juiciness and softness of the product.

Taking into account the data obtained, a rational amount of eggplant powder (Table 5, Fig. 4) was determined by mathematical methods based on the change of the complex indicator of quality of the partially prepared product with the change of the additive content.

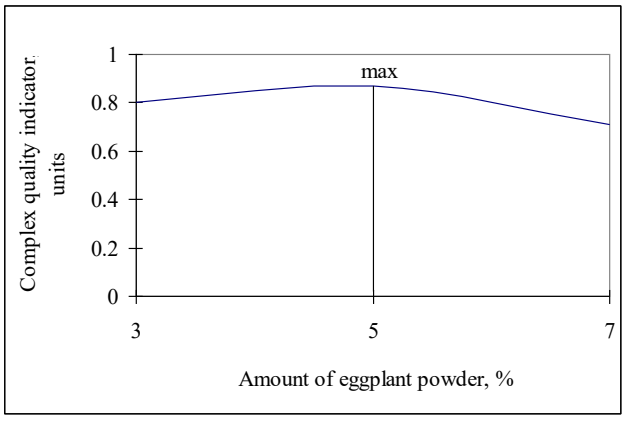


Fig. 4. Dependence of the complex indicator of quality of the liver pate masses on the amount of eggplant powder

Table 5

Determination of rational amount of eggplant powder

Sample	Additive amount, %	Complex quality indicator, unit	Equation system	Optimal amount of the additive, %
Sample 1	3	0.804	$9a+3b+c=0.804$	5
Sample 2	5	0.87	$25a+5b+c=0.87$	
Sample 3	7	0.71	$49a+7b+c=0.71$	

It is evident from Table 5 and Fig. 4 that the sample with a 5 % addition of eggplant powder was the best. With a 7 % content of the additive, the complex quality indicator has decreased and had a lower rating than that of the control sample (0.73 units).

6. Discussion of the results obtained in rheological studies of the liver pate mass with addition of eggplant powders

The obtained dependences (Fig. 3) make it possible to analyze influence of the pate formulations on rheological properties. The study results indicate that addition of eggplant powders to the liver mass materially increased viscosity of the mass compared to the control sample. Addition of eggplant powders in amounts of 3 % or 5 % did not significantly affect numerical values of the system viscosity regardless of the shear rate, that is, the structure was actually the same.

Numerical values of viscosity of the sample 4 containing 7 % of eggplant powder differed significantly from the two previous samples. It was found from determination of organoleptic parameters that when powders were added in amount of 7 %, taste of the liver mass worsened while a 3 5 % addition of powder to the liver mass did not change organoleptic parameters. Rheological studies have also confirmed sharp changes in the sample 4 structure.

Variation of the shear stress was rather significant depending on composition of the samples. As the powder percentage grew, numerical values of this quantity grew as well which indicated an improvement in the form-retaining capacity of the resulting product. Despite the fact that numerical values of the limit shear stress for sample 4 exceeded those of the samples 2 and 3, deterioration of the sample 4 structure has occurred at a much lower limit shear rate.

It is important to note that vegetable components cause rapid damage of the pates during their storage [6, 7, 17], so when creating new pate technologies, it is necessary to take into account this feature. The amount of vegetable components in the pate products should not exceed concentrations of 7...10 %. A larger amount may cause slime formation in the product during its storage because of free moisture. This results in development of microorganisms in the product causing its damage [6, 7, 17]. Therefore, taking into account this feature, samples with addition of 3 %, 5 % and 7 % of eggplant powders were selected for the study.

According to the data presented in Table 4, the tested samples were close to the control specimen in their technological indicators. Addition of eggplant powders positively affects technological parameters of the pate and yield of the final product: the moisture-binding, emulsifying and moisture-retaining capacity and yield of the finished product grow.

Rheological characteristics objectively reflect technological and consumer properties of partially prepared products since they are most sensitive to technological and mechanical changes in the internal structure of the product.

In this context, when creating fundamentally new technologies, it is important to identify impact of the components added to the products prepared by classical technology on change of the new product structure.

Replacement of the main raw material with eggplant powder increased moisture-binding and moisture-retaining capacity of the partially prepared liver pate mass due to the good hydration properties of powders. With an increase in the content of powders, the moisture-binding capacity of the liver pate masses increased in the experimental samples. This trend is seen in Table 3. Analyzing the study data, it was found that when replacing the main raw material (liver) with eggplant powder, moisture-binding capacity of the partially prepared pate increased to the mass of the main raw material.

The results of rheological studies indicate that addition of eggplant powders to the liver pate masses leads to changes in the structural state of the pates by changing numerical values of effective viscosity and shear stress and improving the mixture structure.

The results for the complex quality indicator have proved the possibility of using eggplant powders in partially prepared liver pate masses. Proceeding from the calculation results, the complex quality indicator for the control sample of the partially prepared product was 0.73 and that of the sample with a 5 % addition of eggplant powders it was 0.87.

Thus, the studies confirm the possibility of a partial replacement of beef liver with the eggplant powder. The obtained partially prepared liver pate masses are recommended for further use in restaurants.

Disadvantage of this study consists in the absence of comparison of influence of eggplant powders on structural and mechanical properties of various types of liver (beef, chicken, porcine, rabbit, etc.).

However, it is obvious that the use of eggplant powders in the pate production technologies is possible to create new culinary products with specified properties. This will make it possible to use the powders for normalizing the human body functions. It can be concluded from the above study results that structural, mechanical and organoleptic parameters of the developed partially prepared product are not inferior to those of the control sample. Therefore, it is possible to offer recommendations on expediency of using the technology of pate products. The conducted studies have proven promising production of partially prepared liver pate masses with addition of eggplant powders. Further studies may be aimed at elucidation of quality indicators (mineral, vitamin, amino acid composition, etc.) of the final product. Further development of this study may consist in determining optimal technological parameters of thermal treatment of the partially prepared product in order to maximize biological value of the final product through a thorough choice of equipment, temperature conditions, etc.

7. Conclusions

1. The results of experimental studies indicate that introduction of eggplant powders into the liver pate mass leads to significant changes in structural state of the partially prepared liver pate mass by changing numerical values of rheological characteristics and improving the mixture structure. When adding eggplant powders in amounts of 3 % and 5 %, indicators of the limit shear rate were maximally close to those of the control sample. Experimental data make it possible to assert that the liver pate mass with a 5 % content of eggplant powders had optimal structural and mechanical properties. The results of measurements have shown that the studied samples had a stable structure whose failure commenced only after reaching the determined stress. The limit shear stress was 432.6 Pa for the test samples and 224.6 Pa for the control sample. Numerical values of viscosity that determine qualitative state of the sample structure also exceeded the values of the control sample and made up 0.303 Pa and 0.156 Pa, respectively. This is very important in terms of maintaining the product quality at a high level.

2. It was established that introduction of eggplant powder leads to an increase in moisture-binding and moisture-retaining capacities of partially prepared liver pate masses. When optimal amount (5 %) of additive was introduced, the moisture-retaining and moisture-binding capacities were 90.6 % and 74.0 %, respectively, which positively affected plasticity and softness of the product. Taking into account the data of experimental studies, elucidation of microbiological parameters and chemical composition is prospective for further studies.

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