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Chicken Nuggets Recipe and Technology Development with Dietary Fiber

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Abstract

The work' aim was to research and develop a recipe and technology for chopped semi-finished poultry meat products and assess their safety. The objects of study were wheat dietary fiber and Mechanically separated chicken. There were studying the influence of wheat dietary fiber on the functional and technological properties of raw minced meat and finished product. For determining the quality indicators of chopped semi-finished products, physical and chemical studies of the product were carried out before and after heat treatment. The work presents results of the indicators of water and fat-holding capacity, and losses during heat treatment.

Disciplinary: Food Technology and Agriculture.

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1 Introduction

Poultry meat products are popular among the population of all countries because neither religious nor ritual restrictions impede the consumption of poultry meat. It ensures a constant and steady increase in the annual consumption of poultry meat per capita (Petracci et al., 2013). Such dynamics of poultry meat production are also justified by the fact that poultry meat is a dietary and biologically valuable food product. It is useful for children, sick and older people, and other

consumers of protein of animal origin, of which there are more and more in Russia (Karre et al., 2013). In addition, in comparison with animal meat, poultry meat is economically affordable for the middle and poor strata of the population (*Avian Virol. Curr. Res. Futur. Trends*, 2019). The industrial division of carcasses facilitates the people's demand for poultry meat into separate parts for retail chains (Cortez-Vega et al., 2013; Miller et al., 2020; Schmidt et al., 2020).

A critical marketing technique in increasing the sale of poultry meat is the production of various semi-finished poultry products and culinary products, which meet the requirements of consumers of different social groups (Vasyleva et al., 2021).

Recently, the assortment of minced meat semi-finished products has significantly expanded, the recipe of which provides for the use of various vegetable raw materials (Grubor et al., 2020). Modern trends in the nutrition of a person striving to lead a healthy lifestyle require meat products with a minimum energy value, a minimum amount of fat, an increased amount of protein, and the presence of substances that improve digestion, absorption, and metabolism (Obeid et al., 2019).

The second factor determining consumer preferences is the negative attitude towards soy proteins in the formulation of meat products (B.N. et al., 2019). The illusion created by the media that the use of soy proteins causes almost all the defects in the organoleptic parameters of meat products, as well as the fear of genetically modified objects in traditional food products, make consumers refuse meat products containing soy protein (Okolie and Ehiemere, 2009).

One of the ways to solve these problems can be the use of dietary fiber in the formulations of meat products. Dietary fiber or fiber has recently become quite fashionable in specialized food products and everyday mass products (Szymandera-Buszka et al., 2021). The ideological basis for their use is the introduction of ballast substances into the human diet. They improve digestion in the presence of a large amount of refined food. In addition, it has a minimum energy value, the ability to bind moisture and fat, creating a specific structure in the finished product, and, finally, the harmlessness of using these additives (Balestra et al., 2019).

This work aimed to study and develop a recipe and technology for chopped semi-finished poultry meat products and assess the safety of the technology being developed.

Dietary wheat fiber

Mechanically separated chicken

Figure 1: Materials of Study

2 Materials and methods

Following the purpose, the object of the study was dietary wheat fiber (DWF), mechanically separated chicken (MSC), broiler chicken skin (BCS) and liaison (see Figure 1).

In terms of organoleptic characteristics, dietary wheatefiber must meet the requirements specified in Table 1.

Table 1: Organoleptic indicators of wheat dietary fiber

Indicator name	DWF characteristic
Appearance	homogeneous powdery mass
Taste and smell	odorless, insipid taste
Colour	White

Mechanically separated chicken by GOST 31490-2012. Mechanically deboned poultry meat as appropriate. Technical conditions.

For the purpose of the optimal level of introduction of hydrated PS into the model minced meat systems, was using DWF with step of 2.5, 5, and 10% instead of meat. The optimal level of DWF was determined by organoleptic evaluation of the finished product. There has been evaluating the taste, smell, and consistency.

The next task of the research was to study the effect of DWF on the functional and technological properties such as pH, water (WHC) and fat-holding capacity (FHC).

The production of semi-finished products was carried out in accordance with the scheme (see Figure 2).

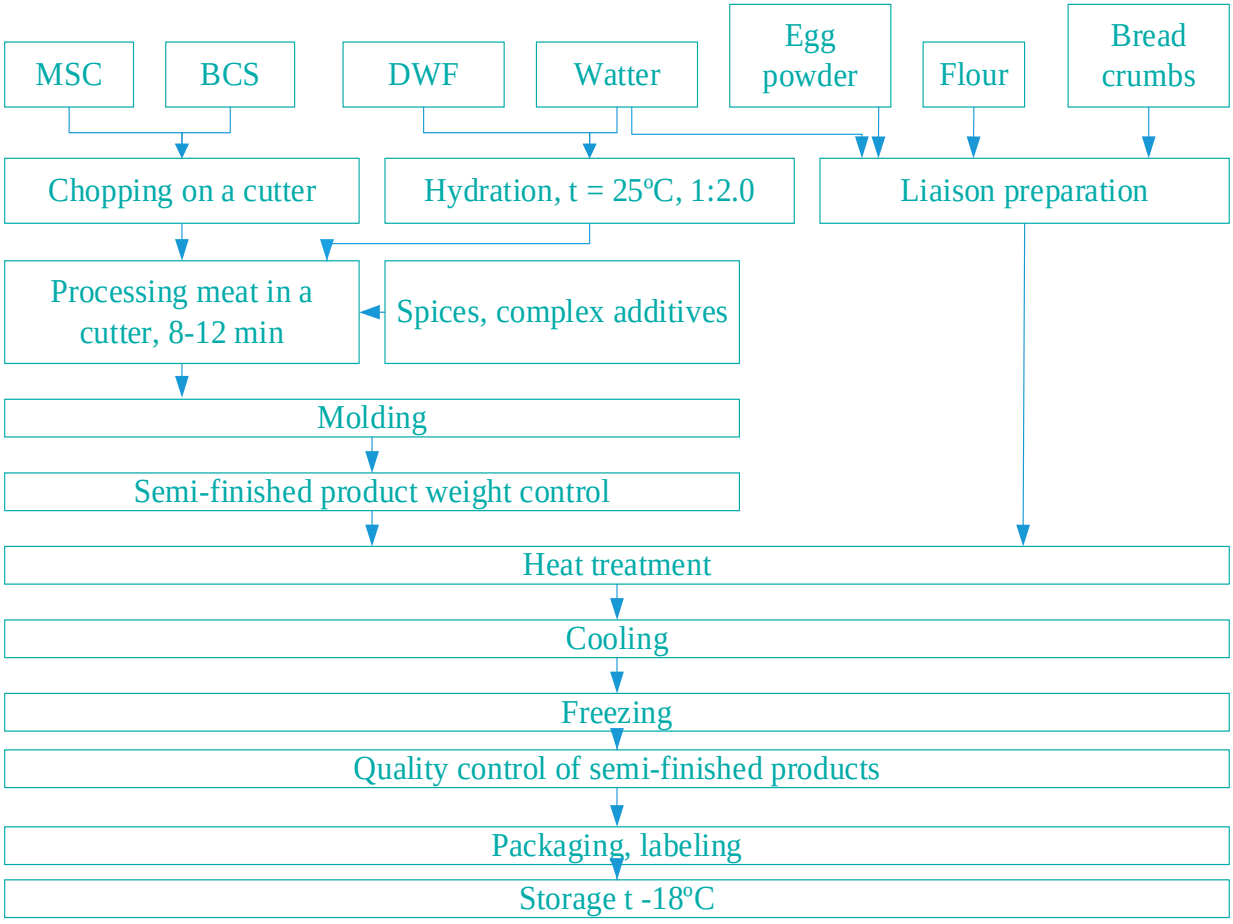

Figure 2: Scheme of chicken nuggets production with dietary wheat fiber

The minced meat preparation began with the processing of MSC on a cutter for 5-8 min. At the first stage of cuttering in the first 2-3 minutes, mechanical destruction of the cellular structure of tissues predominates. Muscle fibers are destroying, and proteins are extracting into the aqueous phase. The optimum temperature of cutting, which ensures the best extraction of salt-soluble proteins in the first phase is 0-2°C. With further grinding, muscle proteins begin to swell intensively, binding the added moisture, secondary structure formation of proteins occurs among themselves with the formation of an emulsion matrix.

At the second stage of cuttering, had been adding broiler chicken skin, and at the end of cuttering, hydrated 1:2 DWF. The introduction of fat-containing raw materials in the second stage is because it has a softer structure and requires less time for dispersion. With the continuous grinding of the raw material, the fat is partially dispersed with the formation of finely dispersed fat globules, which combine with the protein framework, consisting of water-salt-soluble muscle proteins, an emulsion is formed.

The optimum temperature of minced meat after cutting should be in the range from 10°C to 12°C. The finished minced meat forward to molding in a drum-type molding machine, forming the nuggets in the beans form (see Figure 3). After molding, semi-finished products are weighed and sent for au gratin.

Figure 3: The nuggets in the beans form

The au gratin of semi-finished products was in two stages: at the first stage, a liaiso was applied, and then bread crumbs. The liaison was cooking from egg powder, premium flour, and water, mixing them in a certain proportion (see Table 2).

Table 2: Recipe for liaison for nuggets

Name	Quantity
Wheat flour of the highest grade	6.60
Egg powder	0.80
Water	19.60
Bread weight	27.00

This mixture has been whipped until a homogeneous, liquid, slightly viscous mass. The liaison is not subject to storage and must be sent to the manufacture of semi-finished products no later than 30 minutes later.

When breading, portioned semi-finished products were rolled in breadcrumbs. To remove large lumps formed from drops of liaison and grains of bread crumbs, the latter were periodically sieved. The finished semi-finished products were placed in one row in trays and sent to the freezer, the freezing temperature was -18°C. The freezing was until the temperature inside the product was not higher than -10°C.

3 Results and Discussions

For determining the quality indicators of chopped semi-finished products, physical and chemical studies of the product were carried out before and after heat treatment. One of the main physical and chemical indicators of raw meat is the pH value. The results of the study of the pH value of raw minced meat and the finished product, presented in Figure 4, allow to conclude that with the introduction of complex additives, an increase in pH is observed both in semi-finished in finished products.

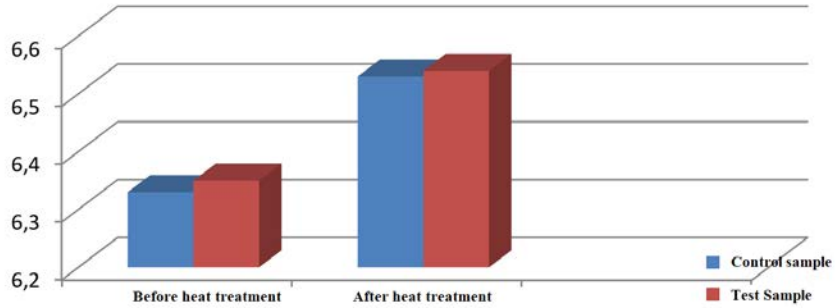

Figure 4: pH indicator dependence of semi-finished products and finished products with DWF

The increase in pH is due to the introduction of complex additives (Chicken Aroma, Gluton universal) into the formulation of chopped semi-finished products, which add some cations to the system. As a result, after heat treatment, the pH of the test sample increases by 1% compared to the control.

Determination of moisture (see Figure 5) shows that when added to the DWF recipe, its level in experimental samples of semi-finished products after heat treatment is higher than in the control sample.

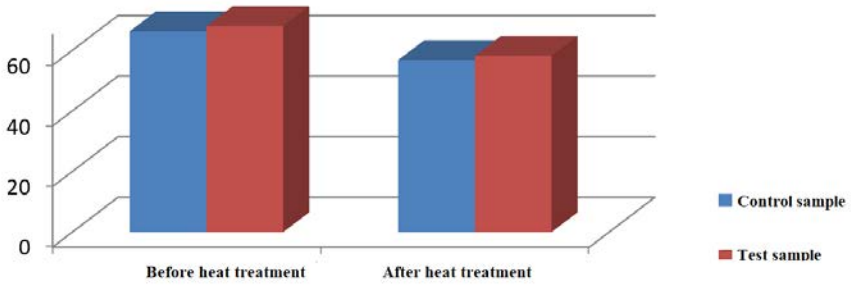

Figure 5: The moisture content indicator dependence of semi-finished products and finished products with DWF

It may be because, in the test sample, water molecules interact with hydrophilic, polar groups of DWF, forming strong bonds, which, along with the forces of capillary interaction, are responsible for limiting the mobility of water. The ability of DWF to retain moisture determines a

decrease in the weight loss of finished products, and as a result, it contributes to an increase in the yield of finished products. It is noted that the yield of products with DWF increases relative to the control and amounts to 108%. The control and test samples' water and fat-holding capacities indicators and the losses during heat treatment are in Figure 6.

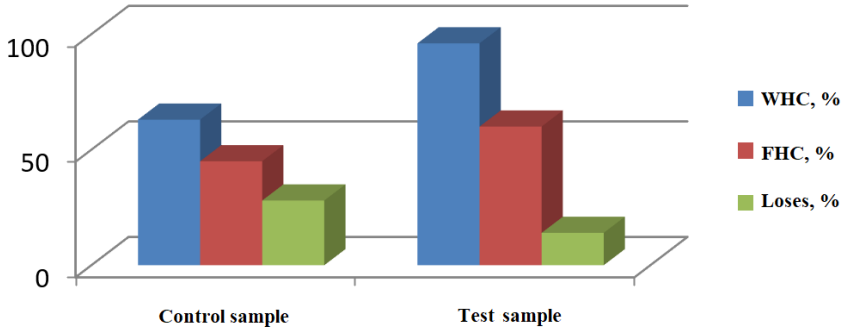

Figure 6: Dependence of the indicators of WHC, FHC and losses of the test and control samples

The study results revealed that introducing wheat fiber into semi-finished meat products increases the moisture-binding and fat-holding capacity and decreases losses during heat treatment by 12%.

In ready-made chicken nuggets with DWF, made by the developed recipe, the physicochemical parameters were determined by the requirements of GOST 32589-2013 Culinary products from poultry meat. General specifications (see Table 3).

Table 3: Physical and chemical indicators of chicken nuggets with DWF

Indicator	Standard according to GOST 31936-2012	Control sample	Test sample
Protein mass fraction,% not less	8	18.7±1.8	19±
Mass fraction of fat,% no more	40	6.5±0.4	4±0.3
Mass fraction of sodium chloride,% no more	1.8	1.5±0.5	1.5±0.5
Mass fraction of introduced phosphorus in terms of P_2O_5,% no more	0.4	0.35±0.1	0.35±0.1
Total acidity, °T, no more	4.0	1.2±0.3	1.2±0.3
Mass fraction of au gratin, % no more	According to the recipe	7.5	7.5

From the data presented in Table 3, it had found that all the physicochemical indicators of the developed minced chicken nuggets comply with the requirements of the regulatory document.

Thus, introducing DWF into the nugget recipe improves the consistency and juiciness of the finished product, reduces weight loss during frying by 30-40%, prevents the formation of large ice crystals during freezing, which contributes to improving the quality of the finished product.

The research results significantly impact the economic performance of production, including a decrease in the consumption of meat raw materials due to the high moisture-binding capacity of meat systems with DWF. The organoleptic assessment of nuggets had carried out according to a five-point system. Taste, smell, color, juiciness, and appearance were taken into account. The profileogram of the organoleptic evaluation of nuggets is in Figure 7

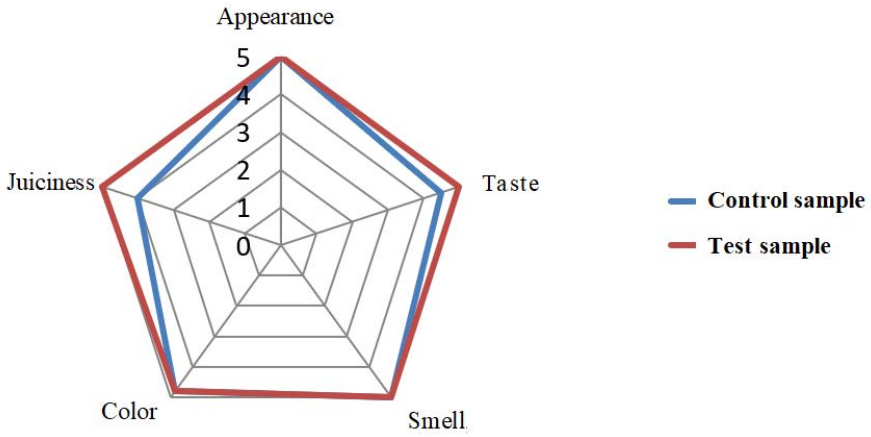

Figure 7: Profileogram of nuggets: 4.6-5.0 points - the quality of the product is excellent; 3.6-4.5 - good; 2.6-3.5 - satisfactory; 2.5 and below is bad

Nuggets with DWF had distinguished by the highest organoleptic characteristics. The test sample had a juicy and soft and elastic consistency, pleasant taste.

4 Conclusion

The above research results indicate the feasibility of introducing DWF since their introduction makes it possible to reduce the economic performance of production, including reducing the consumption of raw meat due to the high moisture-binding capacity of meat systems with DWF. Thus, the introduction of DWF into the nugget formulation improves the consistency and juiciness of the finished product, reduces weight loss during frying by 30-40%, prevents the formation of large ice crystals during freezing, contributing to an increase in the quality of the finished product. The highest organoleptic characteristics distinguished nuggets with DVF. The test sample had a juicy and soft-elastic consistency, pleasant taste.

5 Availability of Data and Material

Data can be made available by contacting the corresponding author.

6 References

Balestra, F., Bianchi, M., Petracci, M. (2019). Applications in meat products. In *Dietary Fiber: Properties, Recovery, and Applications*. DOI: 10.1016/B978-0-12-816495-2.00010-1

Cortez-Vega, W. R., Fonseca, G. G., Prentice, C. (2013). Effects of soybean protein, potato starch and pig lard on the properties of frankfurters formulated from mechanically separated chicken meat surimi-like material. *Food Science and Technology International, 19*(5). DOI: 10.1177/1082013212457667

GOST. (2012). *Mechanically deboned poultry meat as appropriate. Technical conditions.* GOST 31490-2012. https://docs.cntd.ru/document/1200095720

GOST. (2013). *Culinary products from poultry meat. General specifications.* GOST 32589-2013. https://docs.cntd.ru/document/1200109733

Grubor, B., Kalenjuk, B., Radivojša, M., Ćirić, M. (2020). *Functional food: Supply and demand in a modern society*. Zbornik Radova Departmana Za Geografiju, Turizam i Hotelijerstvo, (49–2). DOI: 10.5937/zbdght2002195g

Karre, L., Lopez, K., Getty, K. J. K. (2013). Natural antioxidants in meat and poultry products. *Meat Science*. DOI: 10.1016/j.meatsci.2013.01.007

Miller, D. K., Acevedo, N. C., Lonergan, S. M., Sebranek, J. G., Tarté, R. (2020). Rheological characteristics of mechanically separated chicken and chicken breast trim myofibril solutions during thermal gelation. *Food Chemistry*, 307. DOI: 10.1016/j.foodchem.2019.125557

Obeid, R., Heil, S. G., Verhoeven, M. M. A., van den Heuvel, E. G. H. M., de Groot, L. C. P. G. M., Eussen, S. J. P. M. (2019). Vitamin B12 intake from animal foods, biomarkers, and health aspects. *Frontiers in Nutrition*, 6. DOI: 10.3389/fnut.2019.00093

Okolie, U. V., Ehiemere, I. O. (2009). Use of Soy Bean Products as Cheap Sources of Protein in Child-Nutrition in Akpuoga Nike Community, in Enugu State South East, Nigeria. *Pakistan Journal of Nutrition, 8*(4). DOI: 10.3923/pjn.2009.491.494

Petracci, M., Bianchi, M., Mudalal, S., Cavani, C. (2013). Functional ingredients for poultry meat products. *Trends in Food Science and Technology*. DOI: 10.1016/j.tifs.2013.06.004

Samal, S. K. (2019). *Avian Virology: Current Research and Future Trends*. DOI: 10.21775/9781912530106

Schmidt, M. M., da Fontoura, A. M., Vidal, A. R., Dornelles, R. C. P., Kubota, E. H., Mello, R. de O., … de OLIVEIRA, C. S. (2020). Characterization of hydrolysates of collagen from mechanically separated chicken meat residue. *Food Science and Technology*, 40. DOI: 10.1590/fst.14819

Singh, R. B. (2019). Role of tryptophan in health and disease: systematic review of the anti-oxidant, anti-inflammation, and nutritional aspects of tryptophan and its metabolites. *World Heart Journal*, *11*(2), 161-178.

Szymandera-Buszka, K., Waszkowiak, K., Kaczmarek, A., Zaremba, A. (2021). Wheat dietary fibre and soy protein as new carriers of iodine compounds for food fortification – The effect of storage conditions on the stability of potassium iodide and potassium iodate. LWT, 137. DOI: 10.1016/j.lwt.2020.110424

Vasyleva, N. S., Slozhenkina, M. I., Khramova, V. N., Shinkareva, S. V., Chekhova, E. A., Knyazhechenko, O. A. (2021). Research of the effect of spinach on the quality indicators of chopped poultry semi-finished products. In *IOP Conference Series: Earth and Environmental Science* (Vol. 677). DOI: 10.1088/1755-1315/677/3/032004

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