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Stukalska N.[1] Ph.D., Associate Professor, Kuzmin O.[1] Doctor of Engineering Sciences, Professor, Dudarev I.[2] Doctor of Engineering Sciences, Professor
1 – National University of Food Technologies (NUFT) Kyiv, Ukraine
2 – Lutsk National Technical University Lutsk, Ukraine

INFLUENCE OF CHICKEN MEAT GRINDING PROCESS CONDITIONS ON ITS STRUCTURAL AND MECHANICAL CHARACTERISTICS

In recent years, the consumer basket of the majority of our country's population has been dominated by chicken compared to pork and cattle due to the low cost and palatability of chicken.

The widespread use of chicken meat instead of beef and pork forces manufacturers to satisfy consumer demand for traditional products, which are, in particular, sliced meat products.

Meat processing is carried out on existing equipment, the work of which is designed to use a material flow with certain physico-chemical and structural-mechanical characteristics. Since poultry meat has different properties from beef and pork, the operational parameters of the equipment will differ from those previously determined and taken into account in the design of shredding machines. In order to process «new» products on the existing equipment, it is necessary to know their properties, first of all – structural and mechanical, on which the quality of finished products depends.

One of the important and main structural and mechanical characteristics is a group of shear characteristics. They are most sensitive to technological and mechanical changes in the product better reveal and characterize changes in the structure inside the product than surface and compression ones, characterize the consistency of the product and the degree of its processing during the action of various processes.

The rheological (structural-mechanical) properties of meat raw materials were studied by scientists: Kosoy [1–2], Gorbatov [3], Sukhenko [4–6], Yachneva [7], Krzywdzińska-Bartkowiak [8] and others. In their opinion, the study of the structural and mechanical characteristics of meat products is a necessary element in the study of their consistency, which allows taking certain steps to solve the problems of its regulation.

One of the important tasks of food technology is to give products a given shape and structure. The type of structure and mechanical properties of food products determine their consistency as one of the quality indicators.

For the production of products of a given and stable quality, the modern meat industry needs: information on the chemical composition of raw materials, consistency control, rational and optimal parameters of the technological process from the point of view of impact on consistency.

The use of technological techniques that allow for purposeful action in the processing process on the structural and mechanical characteristics of raw materials contributes to the effective management of quality indicators, in particular the consistency of finished products.

One of the important indicators of the quality of minced meat products, which characterizes the consistency, is the deformation behavior of the product, which reflects the structural and mechanical characteristics of food systems under the action of stress that does not exceed the elastic limit.

According to research, the peculiarities of the chemical composition and morphological structure of muscle tissue in different parts of the carcass are determined by physico-chemical (moisture-retaining capacity, pH indicators and others) and structural-mechanical properties (structure, content of muscle tissue, content and structure of collagen) of meat, which, in turn, determine the degree of tenderness and juiciness of culinary products.

An objective indicator that characterizes the consistency of meat products is their structural and mechanical properties, which determine the maximum forces of destruction in various ways of applying the load (tearing, cutting). Changing the values of indicators of structural and mechanical

properties (connective tissue content) for meat products made from natural muscle tissue has a favorable effect on their consistency (the products are more tender and juicy). There is a close correlation between the morphological structure of muscle and connective tissues of meat, the degree of destruction of its structure during tenderization and heat treatment, and the values of structural and mechanical characteristics [5–6].

The quality and yield of the finished product depend significantly on the conditions under which the grinding process is carried out.

All of the above data confirm the influence of the physicochemical properties of chicken meat and the design parameters of meat grinders on the quality of the grinding process and the rheological properties of minced meat. But during the grinding process, other parameters of the working organs of the meat grinder can be used. Based on the analysis of scientific and technical literature, the theory is followed that different degrees of grinding of meat raw materials are used for the production of various types of meat products of the chopped group.

So, in order to find the optimal conditions of the grinding process, under which the rheological properties of minced meat will acquire the best values, we showed interest in expanding the range of use of design parameters and studying their influence on the structural-mechanical, physico-chemical properties of minced chicken meat and technological parameters of the process grinding.

The aim of the work is to study the kinetics of deformation of minced chicken meat when using different diameters of the lattice holes during grinding, which will reveal the mechanism of product behavior under stress in the working chamber of mechanical equipment and subsequent restoration of the product structure.

Analyzing the scientific and technical literature, it was established that in most cases the process of grinding raw meat is carried out under the following conditions: the diameter of the grate holes, $4.5 \cdot 10^{-3}$ m knife at the angle of the knife blade of 60 degrees and the rotation frequency of the drive shaft 110 rpm.

Interest has been expressed in expanding the range of use of design parameters and studying their influence on the structural and mechanical properties of minced chicken and the technological parameters of the grinding process. We studied minced meat from white meat (breast), red meat (shin) and a mixture of white and red meat in the ratio of 1:1 percent.

Studies of the deformation of minced meat were carried out at a temperature of +12 °C. To create the required temperature of minced meat, the external fixed cylinder of the rheotest was thermostated. The thermostating temperature was maintained with an accuracy of ±0.1 °C.

Previous studies have shown that in minced chicken, the period of structure destruction ranges from 450 to 500 Pa, depending on the type of meat. Based on this, the research was carried out for 120 s under a stress of 50 Pa. In order to identify the influence of the diameter of the grid holes on the deformation kinetics of minced chicken meat, studies were conducted, the results of which are shown in Table 1.

Analyzing the obtained results of the deformation behavior of minced chicken meat depending on the use of grates with different hole diameters, it can be stated that all types of minced chicken deform the least when using grates with hole diameters of $6 \cdot 10^{-3}$ m. This is due to the size of the obtained minced meat particles . During the action of voltage on the minced meat in the measuring system of the rheotest – a cylinder in a cylinder, the particles shift in the plane. During movement, the particles of minced meat rub against each other, which is due to an increase in temperature in the thickness of the minced meat. With a large content of small particles in minced meat, the temperature rises faster, this leads to a violation of the structure and denaturation of the protein, which leads to an increase in the deformation of the minced meat structure.

Conclusion. The greatest degree of destruction of the structure is observed in minced leg meat when using all types of grates. This is explained by the structure of the fabric and its chemical composition. An increase in moisture by 1.60 % and a decrease in fat by 1.74 % and protein by 0.95 %

leads to the fact that under the influence of tension in pieces of minced meat, regardless of size, there is a faster loss of asthma-related moisture. Moisture under the influence of tension heats up and partially melts the fat droplets in the minced meat, which is due to faster protein denaturation and an increase in the deformation state of the minced meat.

Table 1 – **Deformation indicators of minced meat, %**

The diameter of the grid holes, mm	Stress on minced meat, 50 Pas				
	Conditionally instantaneous true elastic deformation γ_0	Elastic deformation γ_e	Elastic deformation $\gamma_{пр}$	Permanent deformation γ_η	General deformation γ_m
From chicken fillet					
3.0	1.40±0.12	3.10±0.10	4.50±0.13	7.85±0.11	12.35±0.10
4.5	1.40±0.10	1.72±0.10	3.12±0.11	8.21±0.11	11.33±0.12
6.0	0.93±0.10	1.50±0.12	2.43±0.11	4.48±0.11	6.94±0.11
From the meat of chicken legs					
3.0	2.03±0.10	2.31±0.11	4.34±0.13	10.97±0.10	15.31±0.15
4.5	2.025±0.110	2.28±0.11	4.301±0.110	9.50±0.13	13.80±0.12
6.0	1.52±0.11	1.98±0.10	3.50±0.11	5.77±0.10	9.27±0.11
From a mixture of fillet + leg meat in a ratio of 1:1					
3.0	1.74±0.11	2.12±0.12	3.87±0.11	10.77±0.11	14.57±0.12
4.5	2.01±0.11	2.20±0.12	4.21±0.11	8.08±0.13	12.29±0.12
6.0	0.90±0.11	1.29±0.13	2.19±0.12	2.25±0.12	4.44±0.11

The obtained results prove the significant influence of the diameter of the grid holes on the deformation behavior of minced meat from different types of chicken meat.

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