Study of Physical and Chemical and Biochemical Indicators Lamb

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Abstract: The main sources of animal protein are meat, milk, eggs and fish. Meat and meat products contain half of the protein a person needs, as well as all the fats, carbohydrates, hormones and other biologically active substances necessary for his life. Meat is the optimal supplier of trace elements such as iron, zinc and selenium.

The aim of the work is the need to conduct research on the development of promising methods for processing raw meat and expanding the range, preparing it for the manufacture of high-quality meat products.

The presented article is aimed at the development of scientifically-based solutions necessary for the implementation of the technology for the production of combined products through a combination of meat and vegetable raw materials.

Keywords: Trace elements, semi-finished product, microstructure, biologically active substances, concentration level.

INTRODUCTION

In the Republic of Kazakhstan, meat production is traditionally considered to be one of the main and priority areas in agriculture. At the same time, the main national traditional source of raw meat is lamb and horse meat.

Currently, the share of lamb in the Republic of Kazakhstan accounts for 25% of meat produced in the country. The number of sheep by the beginning of 2004 was about 12 million heads. In the Republic, more than 20 breeds and breed groups of sheep are bred, well adapted to different climatic zones. Mutton production is carried out mainly due to the slaughter and processing of adult sheep, and about 10% - due to the processing of young animals under the age of one year. Young lamb, and especially lamb, contains physiologically active peptides that help regulate the body's biological activity.

Analysis of the current state and potential of the meat processing industry has shown that in recent years, positive trends have emerged in the production of meat products: the product range is expanded and the quality of products is improved, production is updated and modernized, new technologies and rational methods of processing livestock raw materials are being introduced. In addition to traditional products, domestic manufacturers began to produce new products and semi-finished products of varying degrees of readiness, including vacuum-packed.

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In Kazakhstan, part of the harvested lamb is sold to the population in the form of meat or is used primarily for the manufacture of second courses in the system of mass food. In the off-season period, when processing enterprises lack other raw materials, a small portion of mutton is used to produce sausage and food products and canned food, whose assortment is significantly inferior to other countries with developed sheep breeding.

All this testifies to the need for scientific research on the development of promising methods for processing lamb, preparing it for the manufacture of high-quality gourmet salted, sausage and culinary products and canned meat.

MATERIALS AND METHODS

Determining the chemical composition gives an opportunity to get an idea about the quality of meat and meat products, their nutritional value, depending on the quantitative ratio of moisture, protein, fat and minerals. The determination of the total chemical composition was made by the method of a single sample of the test sample.

Determination of the pH of the Meat

To measure the pH of the medium, a potentiometric method was used; the pH of the medium was determined in an aqueous extract prepared in a ratio of 1:10 on a pH – 150 potentiometer.

Determination of the Solubility of Muscle Proteins

The solubility of proteins in aqueous systems is due to the interaction of the surface of macromolecules with

water molecules. An important factor determining the solubility of proteins in the post-slaughter period is the temperature of the meat and the final pH value.

Determination of the Digestibility of the Product (for Tyrosine)

The attack of mutton and horse meat proteins, products from them by proteolytic enzymes *in vitro* is determined on the instrument A. A. Pokrovsky. and Ertanova I.D. The rate of protein digestion is determined by the accumulation of protein hydrolysis products in dialysates with an hourly interval for 3 hours. When determining the content of hydrolysis products, a standard curve is constructed.

The amount of tyrosine was calculated by the following formula:

$$X = \frac{Y\,0{,}001\,V_1\,1000}{mV_2}\ мг/г \qquad (1)$$

where Y is the relative quantity of tyrosine,

0,001 - the amount of tyrosine, mg,

V1 is the total volume of dialysate, ml

V2 - the amount of dialysate taken for research, ml.

Determination of Moisture Binding Ability

Meat compositions and finished products were carried out using the pressing method developed by R. Grau and R. Ham, modifications by V. Volovinsky and B. Kelman; Grau, R. (1964). Meat and meat products, Food industry, M. (VZS).

Microstructural Studies of Muscle Tissue

The method of histological examination is an important addition to the overall picture of meat changes during processing.

Meat samples with a size of 1.5x5x0.5 mm are fixed in a 20% aqueous solution of neutral formalin, then celloidin blocks are made from them and sections of 7-10 microns thick are cut, which are stained with hematoxylin-eosin (Skalinsky E.I., Belousov A. A.,) (VNIKIMP).

RESULTS AND DISCUSSION

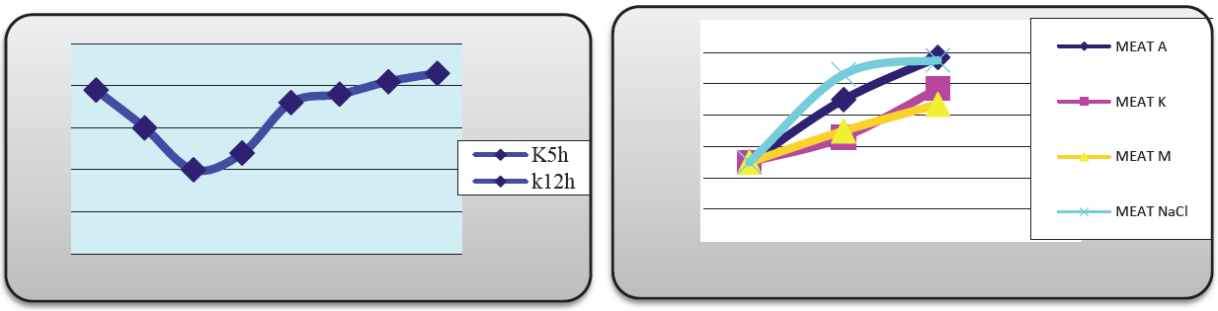
In order to determine the chemical composition, studies were carried out to determine the physicochemical parameters of lamb meat.

After cessation of oxygen in the tissue, anaerobic hydrolytic decomposition of glycogen occurs with the formation of lactic acid. After the cessation of the formation of lactic acid, a certain pH value of the medium is established, which is usually characterized as final. The level of concentration of hydrogen ions determines a number of physico-chemical parameters that determine the technological and commercial properties of meat.

Changes in the pH level of the muscle tissue of mutton are shown in *Figure **1a** and **b**.*

Proceeding from this, and also considering that not only the pH value, but also the state in which the muscle proteins are located, significantly affects the moisture binding capacity.

The nature of changes in the pH of both lamb and other types of meat has its own characteristics. For the muscle tissue of mutton, the pH decrease is the same as for beef and pork and reaches almost the minimum value by 24-48 hours of storage. By this time, almost all glycogen is hydrolyzed to form lactic acid. After the cessation of the life of the animal, biochemical transformations in the protein system are most pronounced. An indicator of the depth of changes in protein macromolecules that occur during maturation is



(**a**) (**b**)

Figure 1: (**a**) pH Meat lamb control. (**b**) pH Mutton meat experiment.

Table 1: Changes in the Solubility of Sarcoplasmic and Myofibrillary Proteins During Autolysis (in% to Total Nitrogen)

Kind of meat	Duration of autolysis, h					
	0	24	48	72	96	120
Mutton	Sarcoplasmic proteins					
	25,6 ±1,3	25,9 ±1,2	26,1 ±1,3	26,2 ±1,2	26,3 ±1,2	26,4 ±1,4
	Myofibrillary proteins					
	15,9 ±1,3	12,3 ±1,4	12,6 ±1,2	13,5 ±1,4	13,8 ±1,6	14,3 ±1,3

their solubility. Table **1** shows data on the solubility of the sarcoplasmic and myofibrillary mutton proteins.

According to the data obtained, the solubility of sarcoplasmic proteins of mutton meat varies slightly depending on the depth of autolysis.

One of the main indicators determining the biological value of food is the degree of protein digestion in the gastrointestinal tract by proteolytic enzymes. The results of determining the digestibility of proteins by digestive enzymes *in vitro* make it possible to predict the degree of utilization of proteins by the body.

The results obtained in the determination of the digestibility index of the samples under study are presented in Table **2**.

Analyzing the data in Table **2**, it should be noted that the test samples are characterized by lower values of digestibility with both pepsin and trypsin compared with the control sample.

This circumstance is explained by the very well-known fact of the presence of protease inhibitors of the gastrointestinal tract in soybean.

The magnitude of the digestibility of the test sample is closer in value to the corresponding characteristic of the control sample.

Thus, a comparative analysis of the experimental data on the digestibility of the samples studied suggests that the process of limited proteolysis of soy proteins leads to an improvement not only of the functional and technological properties of the raw material, but also of the digestibility of objects by enzymes of the gastrointestinal tract, which is apparently due to the binding protease inhibitors contained in soybean seeds during the modification process.

Figure **2** shows the changes in water-binding capacity (BCC) indices of the muscle tissue of lamb during autolysis. During the autolysis of the BCC, the mutton decreases and reaches the minimum value by 48 hours (56.47 ± 0.47%), later on as the resolution of the rigor mortis, BCC increases. Modifications of the biochemical direction in the protein system during meat ripening entail a change in the structural-mechanical parameters characterizing by its tenderness.

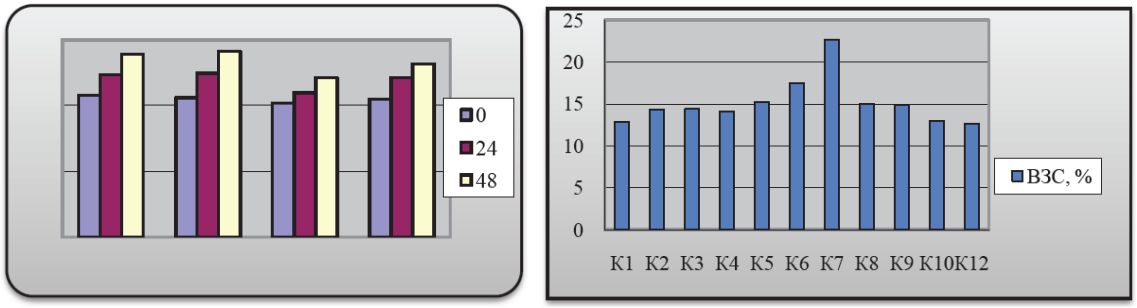
The moisture content, and first of all the moisture-binding capacity, determine the main economic indicator - the yield of the finished product. High moisture content, characteristic of meat of higher fatness, will affect the mass fraction of sodium chloride in the finished product.

The results of the experiments showed that the decisive factor in the strength properties of sheep's muscular tissue is the nature, depth of development of autolytic processes, and not least the structure of tissues. Thus, the peculiarities of the autolithic processes of mutton affect the strength characteristics depending on the exposure time.

In the absence of a pronounced technological impact on meat, it is possible to determine the degree of freshness of raw meat (GOST 19496-93) by the

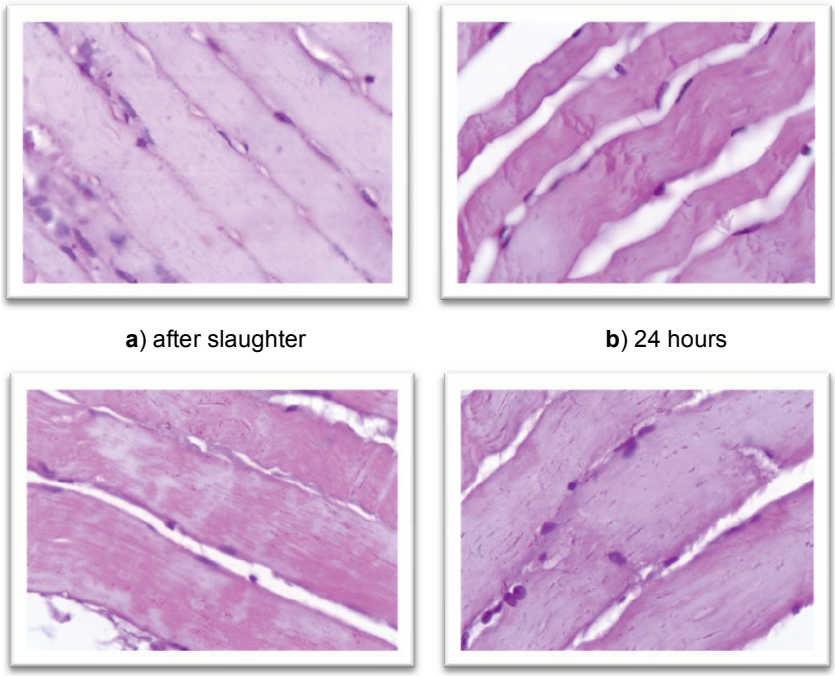
Table 2: The Digestibility of the Samples

Digestibility of samples, mg of tyrosine per 100 g of protein	Samples of semi-finished products	
	control	experience
I. Pepsin	14,35±0,13	13,95±0,11
2. Trypsin	15,21±0,04	14,77±0,05
3. Total digestibility	29,56±0,17	28,72±0,16



(**a**) (**b**)

Figure 2: (**a**) BCCMutton Mutton Experiment. (**b**) ARIA Meat lamb control.



a) after slaughter **b**) 24 hours

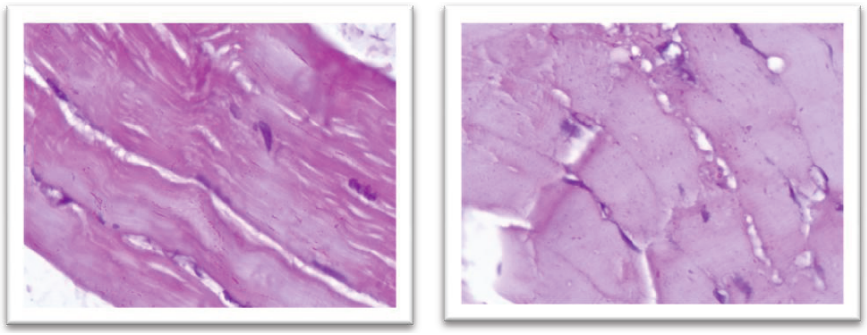
c) 48 hours **d**) 72 hours

Figure 3: Control samples of lamb meat.

state of the myofibrillary apparatus and cell nuclei. Depending on the degree of development of destructive autolytic processes in muscle tissue, according to this document there are 1) fresh meat, 2) fresh meat that cannot be stored for a long time, 3) meat of doubtful freshness, 4) stale meat. Also, microstructural analysis allows us to assess how much raw meat is covered by spoilage processes and to determine the depth of penetration of bacterial microflora into the muscle mass.

Microscopic examination of sections made from control samples of the product revealed the following. Muscle fibers in pieces of meat are straight, swollen and tight to each other (Figure **3**). The transverse striation in them is predominantly either not detected at all, or is located disordered. However, in certain parts of the muscle fibers, it can remain quite distinct. The degree of destruction of muscle fibers is quite high and manifests itself in the form of microcracks, transverse gaps and their fragmentation. In this case, the discrepancy between the formed fiber ends in these areas is insignificant. Sarcolemma is very often detached from sarcoplasm. Cell nuclei are located on the periphery of the muscle fibers and have a characteristic rounded or oval shape.

The microstructure of muscle tissue in a product made from raw meat is characterized as follows. Muscle fibers have a curved shape, quite swollen enough often fragmented or they have multiple transversely slit-like integrity. The nuclei retain their oval shape, but are stained worse than in raw materials. As a result of meat ripening in the salting



a) 24 hours **b**) 48 hours

Figure 4: Prototypes.

and subsequent heat treatment, a sufficiently large amount of fine-grained protein mass is formed from the structural elements of muscle fibers, which is located between the particles of the meal components.

CONCLUSION

Thus, microstructural histological, ultrastructural (scanning and transmission electron microscopy) studies have demonstrated the peculiarities of the fine structure of the muscle of the longest and semi-tendinous muscles of sheep, as well as the characteristics of the structure of meat products obtained from these muscles.

The information obtained as a result of the performed research gives grounds to recommend the use of lamb meat for the production of semi-finished products in the early stages of autolysis.

Studies have found that the nature of changes in protein substances in the process of autolysis is determined by the pH of the meat and the intensity of glycolysis.

Studies of the moisture-binding capacity of lamb during post-mortem storage are consistent with the results of studies of the solubility of myofibrillary proteins.

On the basis of the comprehensive studies, a technological scheme has been developed for the production of semi-finished lamb products.

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