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Development of Ham Technology using Starter Cultures

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***Abstract*: The decrease in the number of raw meat and the deterioration of its quality, requires manufacturers of meat products to introduce advanced technologies. The development of biotechnology has given an impetus to the development and implementation of new technologies aimed at intensifying the complex of complex biochemical transformations that occur in meat raw materials in the production of sausages. The paper presents the results of a study of the effect of starter crops on raw meat in relation to the production of ham. The results of the main functional and technological properties of raw meat subjected to biomodification are presented.**

***Keywords*: functional and technological properties, ham, starter cultures, microorganisms.**

I. INTRODUCTION

The development of market relations mobilizes researchers and industrialists to search for new technological solutions that can improve the efficiency of the use of animal raw materials of various kinds by creating products with extraordinary organoleptic properties. One of the promising areas for the development of such technologies is the creation and use in the production of meat products of biologically active substances based on the vital products of microorganisms [1, 2]. Such preparations are known as bacterial starter cultures (bacterial starter cultures). Today, it is important to create technologies to reduce the cost of production of meat products (replacing part of the premium grade raw materials with lower grade raw materials, which is significantly cheaper at the cost), while guaranteeing the manufacturer to maintain the specified quality standards and process stability [3, 4]. With the development of biotechnology, it has become possible to develop and introduce new technologies aimed at intensifying the complex of complex biochemical transformations that occur in meat raw materials in the production of sausages.

Bacterial starter cultures make it possible to hydrolyze the connective tissue of raw meat, due to which its moisture-binding ability, water-holding ability increases, stiffness decreases, and the nutritional value and yield of the finished product increase [5, 6].

Many scientists [7, 8] have shown the promise of using starter cultures consisting of specially selected strains of microorganisms that purposefully act to shorten the technological process and obtain stable quality indicators of products based on meat raw materials and vegetable [9, 10].

In the fermentation process, bacterial starter cultures synthesize various exo- and endoenzymes. Due to their proteolytic activity, many bacterial starter cultures are involved in improving the consistency of meat products. Forming collagenases and elastases, they improve the value and tenderness of raw meat with a high content of connective tissue proteins [11]. Thus, the biosynthesis of lactic and other organic acids by bacteria (especially the family of lactobacilli and micrococks) helps to increase the tenderness and juiciness of meat, as they cause collagen swelling and, thereby, contribute to loosening of the tissue and hydrolysis of low molecular weight bonds. An important role is also played by the hydrogen index (pH) of the feed. Due to low pH values, the activity of intracellular cathepsin enzymes also increases, the optimal pH for which is 4.5-3.8 [5, 6].

The use of bacterial starter cultures, consisting of specially selected strains of microorganisms, provides a reduction in the technological process and stable quality indicators of the product.

In production, such strains of microorganisms as Staphylococcus carnosus, Staphylococcus xylosys, Lactobacillus curvatus, Debaryomyceshansenii, Pediococcus pentosaceus [5] are used.

Staphylococcus carnosus and Staphylococcus xylosys belong to the genus Staphylococcus. In the production of ham, these crops are used to form the aroma and enhance the taste of the finished product.

Staphylococci are arranged in clusters, singly or in pairs. They have a spherical shape in diameter from 0.5 to 1.5 microns. They do not form a spore and develop in all planes. Staphylococci tolerate the effects of temperature, light, chemical agents and drying are resistant to high levels of sodium chloride. Reduce nitrates to nitrites. The optimum temperature for the development of staphylococci is 30-37 ºC.

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Lactobacillus curvatus is a genus of gram-positive facultatively anaerobic or microaerophilic bacteria.
One of the most important in the group of lactic acid bacteria that convert lactose and other carbohydrates into lactic acid. In most cases, they are non-pathogenic; many species play a positive role in human nutrition. In humans, they are constantly present in the intestine, where they are symbionts and make up a significant part of the intestinal microflora. Many species are involved in the decomposition of plant debris. They produce lactic acid, and an acidic medium inhibits the growth of many pathogenic bacteria and fungi [4, 6].

The shape of the cells is rod-shaped 0.5 - 1.2 and 1.0-10.0 microns. As a rule, the shape is single elongated, sometimes in the form of short cocciform chains. Cell division occurs in one plane.

Debaryomyceshansenii belong to the genus yeast. They are characterized by good resistance to high salt concentrations. Ways to enhance proteolysis and lipolysis and prevent the development of unwanted microflora. They can develop well on protein media [12].

The budding cells are usually round in shape, less often oval or elongated, usually pointed on one side. Budding occurs on a narrow basis in different directions. Askeys are formed from vegetative cells, without conjugation. In asuka, as a rule, 1–4 scoria-shaped astroscopes are formed.

Pediococcus pentosaceus belongs to the genus Cocci - gram-positive, motionless, not spore-forming. Pediococcus pentosaceus in anaerobic conditions ferment sugar to lactic acid. The optimum temperature for the development of Pediococcus pentosaceus 25 - 35 ° C, die at temperatures above 50 ° C. Cells divide in two perpendicular directions in one plane [13, 14].

The aim of the study is to study the influence of starter cultures on model stuffing from low-grade meat raw materials.

II. MATERIAL AND METHODS

The object of the study is the influence of consortia of microorganisms on raw meat. The cultivation of microorganisms was carried out by a surface method. This method consists in the fact that microorganisms are grown on the surface of solid or liquid nutrient media. Solid glucose-based nutrient media were used for this study. The prepared media was poured onto Petri dishes, then the cultures were seeded on a sterile nutrient medium and the plates were placed in a thermostat at a temperature of 37 ° C [15].

The studies presented in the work were carried out in accordance with the recommendations and methods of their implementation according to “Methods for the study of meat and meat products” [15]. Experimental studies were carried out in the laboratories of the departments: technology for storage and processing of livestock products; biotechnology, biochemistry, biophysics of the Kuban State Agrarian University named after I. T. Trubilin (KubSAU), the testing center "Argus".

In the course of the study, experiments were conducted to determine the growth of microorganisms on raw meat, and the ability to modify connective proteins with their help.

To study the growth of microorganisms on raw meat, model minced meat was created consisting of 50% second-class beef and 50% bold pork, into which the studied microorganisms were introduced.

The activation of the cultures was carried out in a microbiological box, in accordance with the Instruction for microbiological control. The experiment was conducted within 24 hours.

Determination of pH was carried out on a potentiometer pH-340 according to GOST R 51478-99 [16]. The pH of the hydrolyzate solutions was determined by the potentiometric method on a universal pH-150M ionometer.

The water-binding ability (BCC) of the feed was determined by the Grau-Hamm method [15].

The number of mesophilic aerobic and facultative anaerobic microorganisms was determined in accordance with GOST 10444.15-94 [17].

Mass changes in raw materials were determined by weighing on a balance and in a ratio in% to the mass of the feedstock. The mass fraction of moisture was determined in accordance with GOST 9793-74 by drying the sample to constant weight at a temperature of 105 ° C [15]. The moisture-holding ability (HUS) of the minced meat was calculated as the difference between the mass fraction of moisture in the minced meat and the amount of moisture separated during the heat treatment [15].

Mathematical data processing was carried out in the STATISTICA program in modules: descriptive statistics, correlation analysis, and experimental design.

III. RESULTS AND DISCUSSION

The cultures that were most actively manifesting their properties in the production of raw smoked sausages Staphylococcus carnosus, Staphylococcus xylosys, Lactobacillus curvatus, Debaryomyces hansenii, Pediococcus pentosaceus are one of the most important indicators for starting crops is the change in physico-chemical and meat functional parameters. For the production of sausages, the most important of these raw material indicators are the water-binding capacity (BCC), the water-holding capacity of meat raw materials and changes in the pH of minced meat [18]. These indicators primarily affect the output and organoleptic characteristics of the finished product.

The decrease in pH of the minced meat is presented in Figure 1.

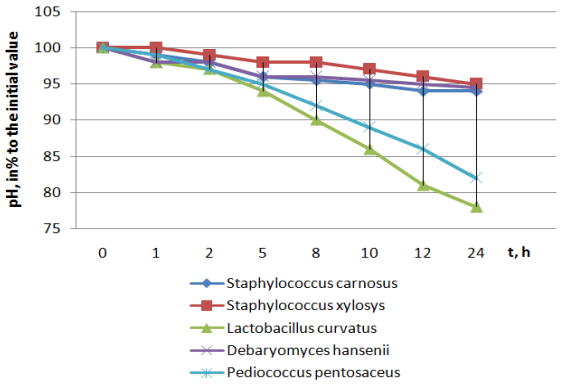

Fig. 1. Changing the pH of the minced meat

A study of the pH of the minced meat showed that the growth of cultures of Lactobacilluscurvatus, Pediococcus pentosaceus is accompanied by a significant decrease in the pH of the minced meat. A decrease in pH is associated with the formation of lactic acid microorganisms during the life of the organism. Lactic acid is used in the production of meat and meat products due to its high diffusion properties, antimicrobial action, the ability to plasticize proteins, accelerate the maturation of meat, loosen collagen bundles, adjust the pH and taste of the finished product.

Due to the lack of acid-forming ability, a decrease in the pH of model minced meat with cultures of Debaryomyces hansenii, Staphylococcus carnosus, and Staphylococcus xylosys occurred slightly.

As is known, muscle tissue proteins have a higher SCD than connective tissue proteins; the moisture-binding ability of veined meat decreases with decreasing meat grade [19].

The results of the change in the moisture-binding ability of model minced meat are presented in Figure 2.

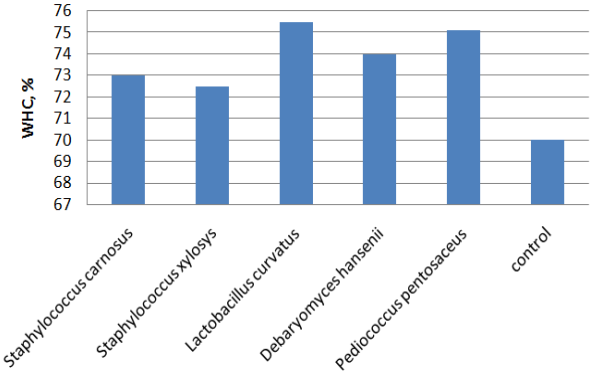

Fig. 2. Change WBC minced meat

From the presented data it can be seen that the control sample of the model stuffing without adding the studied cultures for moisture-binding ability is lower than the experimental samples of model stuffing. When using low-grade raw materials, an important indicator is the softening of collagen and, as a result, its more complete absorption. At the same time, the moisture-binding ability of biomodified collagen increases.

The moisture-retaining ability of raw materials is characterized by the ability of raw materials to retain moisture during the heat treatment. This indicator provides the yield of the finished product and is the most important technological indicator [6, 18].

The results of the change in the water holding capacity of the model minced meat are presented in Figure 3.

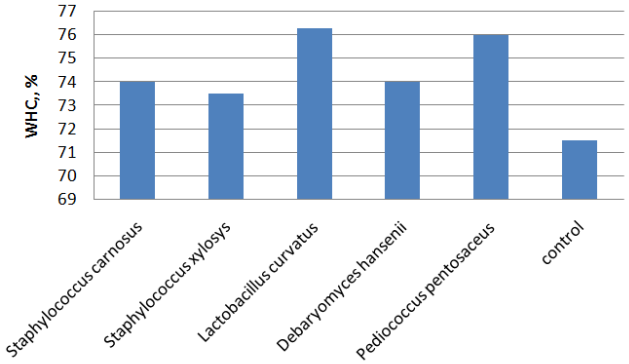

Fig. 3. Modified WHC minced meat

The presented results indicate that when introducing the studied cultures into the model stuffing, a tendency to an increase in the WCS is observed, which is most pronounced in the acid-forming microorganisms Lactobacillus curvatus, Pediococcus pentosaceus.

IV. CONCLUSION

Investigations of starter cultures were conducted on model minced meat from low-value meat raw materials. The introduction of cultures of Lactobacillus curvatus, Pediococcus pentosaceus leads to a shift in the pH of the model stuffing to the acid side, increases the moisture-binding and water-holding ability of the model stuffing. The introduction of cultures of Debaryomyces hansenii, Staphylococcus carnosus, Staphylococcus xylosys does not significantly change the pH, BCC, and the WCS of the model mincemeat. We believe that the introduction of these crops into the ham recipe will contribute to significant changes in the functional and technical properties of low-grade meat raw materials.

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