USAGE OF CLEAN CULTURES AND INDUSTRIAL PREPARATIONS FROM LACTIC-ACID BACTERIA FOR MODIFICATION OF SECONDARY MEAT RAW MATERIALS

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Background

Recently scientists from many countries direct their efforts to manufacture of compound meat products combining traditional consumers' properties, in whose formula enter high-quality biologically valuable raw materials and different kinds of protein-containing raw material, in particular, 2nd-grade by-products. However, usage of such raw materials in the meat-processing production is complicated because of their low technological and functional characteristics.

Meat with a high content of connective tissue, including by-product mucosas, whose protein content is characterized by availability of collagen and elastin active in their effect on digestion as they stimulate juice extraction and motor function of stomach and intestine, is a valuable raw material for manufacture of new meat products with a high food and biological value.

One of the most effective ways of usage of such raw material is processing by bactericidal preparations for improvement of functional-technological properties of raw materials and quality of finished products due to increase of biological value [1, 2].

Objectives

The objective of the work was in grounded selection of clean cultures and bactericidal preparations from lactic-acid bacteria produced by the industry for processing of connective tissue wastes from meat production and utilization of the manufactured product as a food additive in the meat product technology.

Methods

Cicatrix and nuchal ligament were chosen as an object of investigations of collagen-containing raw material, as mass share of collagen and elastin in them came to 70-90% from the total protein amount, and they were processed by lactic-acid bacteria: clean culture *Lactobacterium casei* and "Uglich-4" bactericidal preparation (specific composition of the preparation: *Str. Lactis, Str. Diacetilactis, Str. Cremoris, Leuc. Citrovorum).* To provide carbohydrate feeding, wheat flour at the rate of 5 % from the mass of basic raw material was added to comminuted raw materials [3, 4].

Cattle cicatrix and nuchal ligament were comminuted to d > 3-5 mm.

Lactic-acid bacteria cultures were prepared using sterilized nonfat milk, in which bacterial preparation at the rate of 0.1% from the milk mass was introduced, and temperature-controlled during 24-36 hours at 37 °C.

Cultures were introduced in the amount of 5-7% from the mass of raw material being fermented. Fermentation was carried out at 5 °C.

During investigations standard procedures of determination of water-soluble protein mass share, amine nitrogen, environment pH and rheological properties of compositions were used.

The results obtained were processed by the least squares method.

Results and discussion

Investigations carried out earlier proved positive changes in functional-technological and organoleptic characteristics of muscular tissue during fermentation by lactic-acid bacteria preparations. In this connection studying the possibility and effectiveness of microbial fermentation of collagen- and elastin-containing raw materials for their deep processing and preparation for further production is of interest. About the depth of the process of raw material fermentative hydrolysis by the selected bactericidal preparations judged by accumulation of matabolism products, in particular, water-soluble protein and amine nitrogen. The data are given in Figs 1 and 2.

Analysis of the obtained results confirms correctness of the chosen raw material processing method, as during fermentation splitting of the connective tissue proteins – collagen and elastin - takes place, free amino acids and polypeptides are accumulated, about what increase in mass share of water-soluble proteins and amine nitrogen in obtained compositions with cicatrix and nuchal ligament testifies.

Increase of water-soluble protein during 24 hours of fermentation, in composition with a bactericidal preparation, amounted to: with cicatrix – 20%, with nuchal ligament – 77.5%; in composition with a clean culture : with cicatrix – 17%, with nuchal ligament – 15%.

Increase of amine nitrogen during the same period of time was 84.5% and 72.2%, respectively, for compositions with a bactericidal preparation; 58% and 44%, respectively, for compositions with a clean culture.

Microbial biomass accumulated in the process of fermentation is characterized by a high content of protein rich in essential amino acids. That is why share of essential amino acids in collagen-containing raw materials being fermented increases: methionine – by 2.1-4.3% to the protein mass, tryptophan – by 1.1-1.5%, what also promotes increase in food and biological value of raw materials being processed.

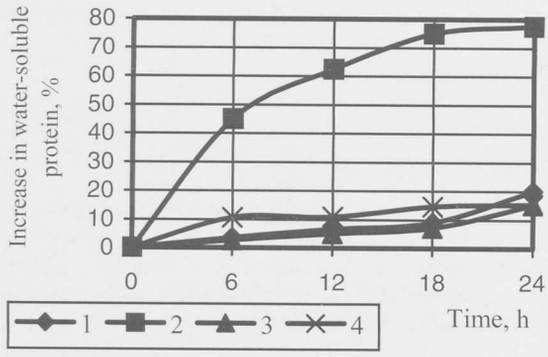
Change in the content of lactic acid characterizes the process of growth and development of lactic-acid bacteria accompanied by exudation of lactic acid (Fig. 3) in all compositions under investigation.

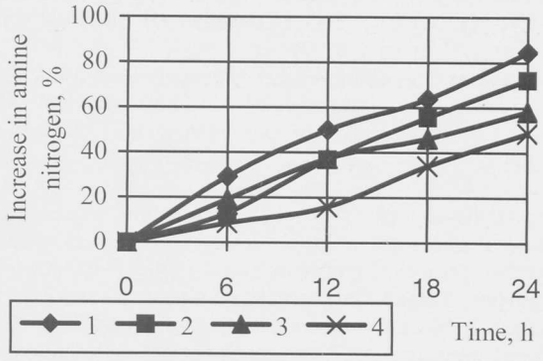
Simultaneously microbial fermentation is accompanied by change in pH to the acid side in all compositions due to formation, mainly, of lactic acid in the process of hydrocarbon exchange of lactic-acid microorganisms. Just at pH values close to 5.2-5.6 swelling of collagen, hydrolysis of low-molecular ties and activation of cell enzymes take place. Due to low values of hydrogen index activity of cell enzymes also increases, especially that of some cathepsins, what positively tells on functional-technological properties of collagen-containing raw materials being processed.

In the process of fermentation growth of critical shear stress (CSS) of systems by 25-30% due to saturation of the dispersion medium with biomodification products is observed. It testifies to hydrolysis of connective tissue proteins precisely by bactericidal preparation complexes. For comparison, should wheat flour proteins be hydrolyzed, composition would become more heterogeneous, dispersion medium – less viscous and, as a result, CSS would decrease.

Conclusion

The results of carried out investigations of the formula and functional properties of compositions based on cicatrix and nuchal ligament showed the outlook of processing of collagen- and elastin-containing raw materials by lactic-acid bacteria of *Lactobacterium* and





1- cicatrix processed by bactericidal preparation 2 - nuchal ligament processed by bactericidal preparation; 3 - cicatrix processed by clean culture; 4 - nuchal ligament processed by clean culture

Fig. 1. Dynamics of water-soluble protein accumulation during fermentation

Fig. 2. Dynamics of amine nitrogen accumulation during fermentation

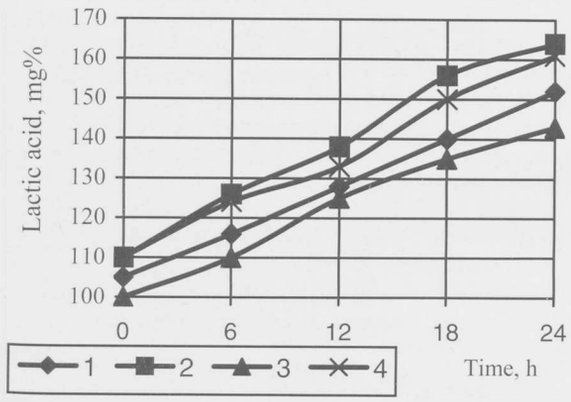


Fig. 3. Dynamics of lactic acid accumulation during fermentation:
1- cicatrix processed by bactericidal preparation 2 - nuchal ligament processed by bactericidal preparation; 3 - cicatrix processed by clean culture; 4 - nuchal ligament processed by clean culture

Streptococcus families. Due to hydrolytic effect on collagen and elastin of their enzyme complex, as well as lactic and other organic acids that appeared in the process of fermentation, deep processing of raw materials, which provides loosening and swelling of collagen and elastin fibres, is achieved. It promotes extension of perspectives of usage of the above kind of raw materials in manufacture of genera- and prophylactic-purpose foodstuffs.

Lactic-acid bacteria also promote delay in growth of undesirable microflora, providing sanitary-hygienic safety of production, and create optimal conditions for further usage of the treated product.

Pertinent literature

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