EFFECT OF A BACTERIAL ENZYME PREPARATION ON THE TECHNOLOGICAL PROPERTIES OF LOW-FUNCTIONAL MUSCLES

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SUMMARY: The possibility to use enzymatically modified low-functional muscular tissue in the production of sausages with reduced salt content was studied. Three model systems with identical enzyme concentrations and different salt percentages (2.2, 0.8, no salt) were tested. The changes in protein solubility, meat emulsifying ability and yields were followed. It was established that protein solubility increased and meat emulsifying ability improved resulting in higher yields: Experiment I - from 72.81% to 85.78%; Experiment II - from 79.91% to 86.13%; Experiment III - from 83.80% to 89.65%. The enzymatic modification of meat with "Mezenterin 11-11" made possible the production of meat products with significantly reduced salt content.

INTRODUCTION: The necessity for more efficient utilization of meat as well as for reduction of salt in meat products calls forth methods that will improve their technological properties at lower salt levels. The water-holding capacity is a basic factor for the production of cooked sausages with acceptable organoleptic properties (Bouton et al., 1972; Locker et al., 1984; Wirth, 1986; Gaulf, 1985). Some researchers use diphosphate additives, e.g. the analogues of the adenosine triphosphoric acid (Trout et al., 1987), alongside with salt in order to improve the hydrophilic properties of meat. Others use the enzymatic modification of meat to cause partial hydrolysis and thus improve its water-holding capacity (Brekke et al., 1981).

The aim of the present work was to study the possibility to use a bacterial proteolytic enzyme preparation in order to obtain better technological properties in beef hearts at reduced salt additions.

MATERIALS AND METHODS: The enzyme preparation used in our studies called "Mezenterin 11-11" was of microbial origin with proteolytic activity of 210 PU/g, temperature optimum 55°-60°C and pH optimum 6.5. Beef hearts were refrigerated to +4°C and were then ground through a 2 mm plate. After that 0.02% of the enzyme preparation were added to the meat filling. Thirty percent of the enzymatically modified beef hearts were added to 70% pork. The material was then fine ground. Three model systems were prepared in this way with additions of 25% ice, and salt as follows: Model I - no salt; Model II - 0.8%; Model III - 2.2%. Control samples with identical salt contents but without addition of enzyme were prepared by analogy for each model Three model systems from 100% pork without enzyme preparation were tested where Control I had 0% salt, Control II - 0.8% salt, and Control III - 2.2% salt. The model systems were tested at 15, 30, 60 and 120 minute intervals.

The changes in protein solubility were analyzed by mixing 2 g of the meat emulsions with 8 cm^3 0.1 M NaCl buffer, 0.05 M potassium phosphate, and correction of pH to 7.0. Ten ml of protein suspension were centrifuged at a speed of 10 000 for 15 min. The protein in the supernatant was determined by Kjeldahl's method and was correlated to the total protein in the meat emulsion.

Amounts of 40 g were taken from the model systems and were packed in 35 x 110 mm glass ampules. The samples were heated for 30 min in a water bath at 78°C. After the heat treatment the meat packing was taken out and weighed. The water exuded during the heat treatment was poured into a volumetric flask, and the water-to-fat ratio was determined. The finished product yield after the heat treatment was calculated. The results obtained were analyzed by the variation statistical method (Gerasimovich et al., 1978) and (Dedenko et al., 1977).

RESULTS AND DISCUSSION: The results from the total protein solubility study are given on Figures 1,2 and 3. There is significant increase in protein solubility in the enzymatically modified samples. Thus for example, protein solubility in 0% salt model controls (i.e. non-modified enzymatically) increased from 31.79% to 48.31% while in enzymatically modified sa-

mples it increased from 31.79% to 55.82% for 120 minute enzymatic modification. The increase observed owes to the proteolysis caused by "Mezenterin 11-11" and with time of its action becomes more extended. The addition of higher salt levels (Models II and III) is accompanied by increased solubility resulting from the joint effect of the enzyme and salt.

The results in Table 1 indicate that the amount of fat in the water exuded during the heat treatment tends to decrease with prolonged time of enzyme action on the meat in all model experiments. This fact is in favour of the improved emulsifying ability of the enzymaticall modified samples. The increased protein solubility and the better emulsifying ability of enzymaticall modified meat entail the following changes in the finished product yield.

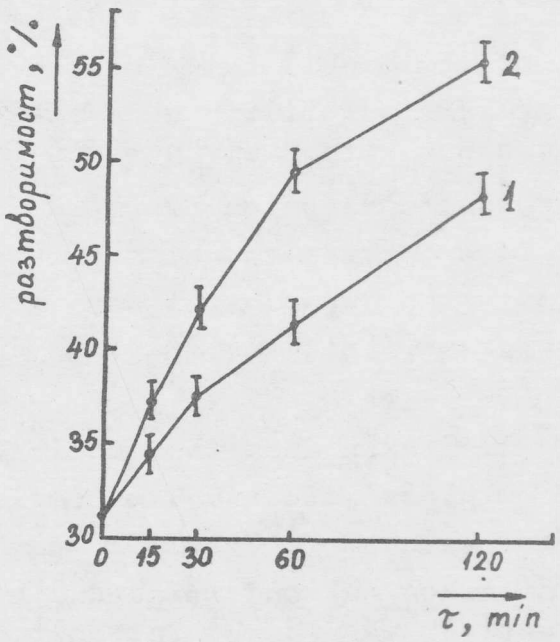

Fig.1. Changes in the protein solubility in model experiments with 0% salt: 1 - control sample (no enzyme); 2 - test sample (0.02% enzyme).

Control samples (enzymaticall non-modified) with 0%, 0.8% and 2.2% salt additions, respectively, gave lower yields compared to 100% pork control samples (Table 1). This indicates that beef hearts have low functional properties. Following the heat treatment, the yields in Model I (0.02% enzyme, 0% salt)

increased from 72.81% to 84.62% and 85.78% for 60 and 120 min. treatment, respectively, while in Model III (0.02% enzyme, 2.2 % salt) from 83.80% to 89.60% for 120 min. treatment.

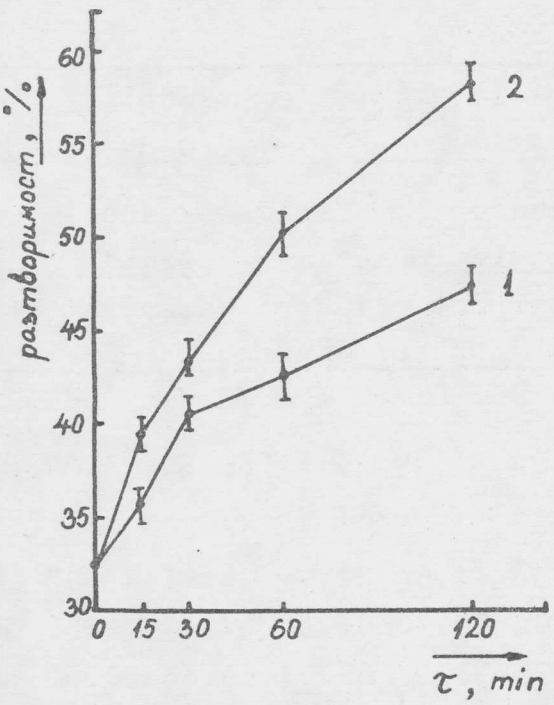

Fig.2. Changes in the protein solubility in model experiments with 0.8% salt: 1 - control sample (no enzyme) 2 - test sample (0.02% enzyme).

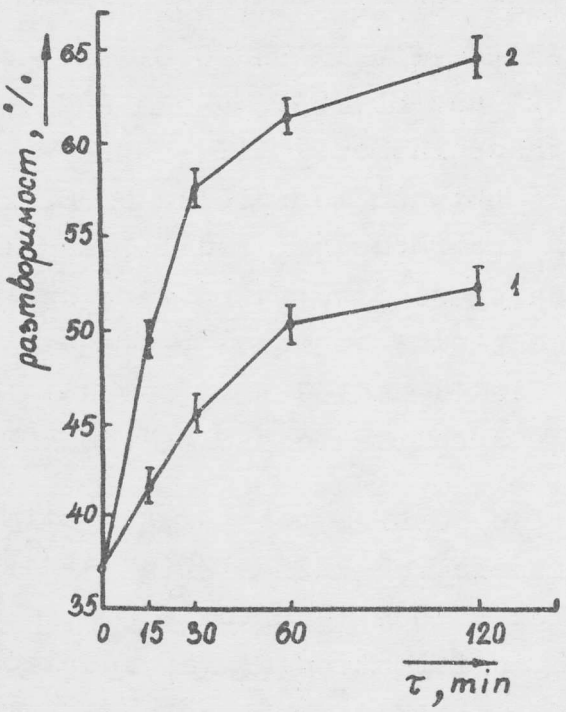

Fig.3. Changes in the protein solubility in model experiments with 2.2% salt: 1 - control sample (no enzyme) 2 - test sample (0.02% enzyme).

Table 1. Changes in the amounts of water and fat exuded during heat treatment, and finished product yields in the model experiments.

Sample	Model I (0% salt)			Model II (0.8% salt)			Model III (2.2% salt		
	Yield	Exuded Liquid		Yield	Exuded Liquid		Yield	Exuded Liquid	
		Water	Fat		Water	Fat		Water	Fat
	%	%	%	%	%	%	%	%	%
100% pork	79.93	61.82	38.18	85.31	65.63	34.37	87.38	66.61	33.39
30/70%:									
control	72.81	55.36	44.64	79.91	56.87	43.13	83.80	59.89	40.11
:15 min	78.54	61.04	38.96	84.35	67.50	32.50	86.64	68.43	31.57
:30 min	82.39	63.78	36.22	85.04	69.44	30.56	84.07	72.70	27.27
:60 min	84.62	67.65	32.35	86.51	70.59	29.41	88.72	76.58	23.42
:120 min	85.78	67.13	32.87	86.13	72.43	27.57	89.65	78.22	21.78

It can be seen that samples with 60 and 120 min enzymatically treated beef hearts with 0% and 0.8% salt contents have higher yields: 84.62% and 85.78%; 86.51% and 86.13%, respectively, compared to those in Model III - 83.80%. There is no significant difference between the yields of 60 min enzymatically modified samples from Models I and II, and the respective 100% pork control samples. Also there were no significant differences between the yields of model beef heart samples enzymatically modified for 15 and 30 min from all three model experiments, and the respective controls from 100% pork.

CONCLUSIONS: 1. The partial proteolysis stimulated by the bacterial enzyme preparation "Mezenterin 11-11" improves the functional properties of beef hearts.

2. The enzymatic modification of low functional beef hearts makes possible their utilization in cooked sausages.

3. The proteolytic enzyme preparation "Mezenterin 11-11" provides technological possibility to use enzymatic modifica-

tion of meat as a potential substitute of salt and thus to produce law-salt meat products.

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