

A Study on the Influence of a Bacterial Proteolytic Enzyme Preparation on the Structural and Mechanical Properties of Mutton

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Introduction

The structural and mechanical properties of meat have a considerable effect upon its organoleptical and technological qualities. It is assumed that a number of factors modifying the fibrillar structure of the muscular tissue, such as natural maturation, mechanical handling, enzyme treatment, irradiation, etc., resulted in the improvement of its structural and mechanical properties. One of the methods being more largely used in the industry to increase the tenderness of meat proved to be the application of proteolytic enzymes of vegetable and microbial origin (1, 2, 3, 4). The technological and economical advantages of the microbial enzymes contributed to their increasing utilization in the meat industry (5, 6, 7). As a result of this, we made it our task to investigate the effect of the bacterial proteolytic enzyme preparation Mesenterine 11-11 obtained from *Bacillus mesentericus* - strain 11-11(8,12) on the structural and mechanical properties of mutton.

Material and Methods

The present studies were carried out on the sacral part of *m. longissimus* taken from sheep's carcasses in warm condition (2 hours after slaughtering) and after chilling and storage at +4°C (48 hours after slaughtering). The muscle from the right side of the animal carcass used as the test sample was injected with 0.35% enzyme solution in 2% sodium chloride solution at a ratio of 10% to the sample weight. The left parts of the muscle being used as controls were injected with 2% sodium chloride solution only, in the same proportion to the sample weight. The test samples and the controls were packed in polyethylene bags and stored at a temperature of +2° to +4°C. The indices such as tenderness of muscular tissue after Grau (9), and structural and preparation firmness (10, 11) were used to determine the effect of the bacterial enzyme preparation Mesenterine 11-11 on the structural and mechanical properties of meat. Samples to be tested were taken from meat injected in warm condition on 2, 48, 72 and 144 hours postmortem, as well as from meat injected in chilled condition on 72, 96 and 144 hours postmortem. The trials were carried out in triplicate while 9-30 measurements were made on various indices and the average values of the corresponding number of measurements were stated in the diagrams enclosed.

Results and Discussion

The experimental results and their analysis showed that the bacterial enzyme preparation Mesenterine 11-11 had a considerable effect upon the structural and mechanical properties of mutton treated either in warm or chilled condition. For instance, upon determining the tenderness after Grau it was established that the values reported in the test samples for this index showed an apparent trend to increase since the tenderness of enzyme-treated meat has already raised on 48 hours postmortem to 132% as compared to the initial value. The process of improving the tenderness of the muscular tissue continued and on 144 h postmortem reached to an increase of 155% in relation to the initial value. Meanwhile, within the initial 48 hours after slaughtering a process of worsening of the tenderness was observed in the untreated samp-

les which corresponded to the occurrence of the rigor mortis process, then a slow process of increasing the tenderness was initiated and reached just about on 144 h postmortem the initial value.

The results obtained from the determination of the structural firmness of the muscular tissue indicated that the structural firmness was considerably increased in the controls on 48 h after yielding of meat and then a process of decrease in the values for this index occurred but these values, however, remained higher than the initial ones on 144 h postmortem as well. A continuous, although comparatively slightly pronounced trend to decrease in the structural firmness of the muscular tissue was observed in the enzyme-treated samples.

The values for the index of plastic firmness revealed the same important difference between the test samples and the controls. The plastic firmness continuously decreased in the test samples while a drastic increase occurred in the controls on 48 h postmortem followed by a process of lowering in the plastic firmness; however, on 144 h after yielding of meat the untreated samples maintained considerably higher values for this index as compared to these of the enzyme-treated muscular tissue. Upon comparing the action of the enzyme preparation applied to warm and chilled meat it was established that the changes occurring in the structural and mechanical properties of the meat material treated in chilled condition were identical in character to these reported for the samples treated in warm condition. In the case of application of the enzyme preparation to warm meat, however, a considerably more accelerated process of improving its structural and mechanical properties was observed. In conclusion it should be suggested that an intensive increase in the tenderness and decrease in the structural and plastic firmness of the muscular tissue were completed using the bacterial proteolytic enzyme preparation Mesenterine 11-11. From the practical standpoint, it appears more expedient to apply the enzyme preparation to warm meat thus creating conditions for accelerated running of the processes improving the structural and mechanical properties and opportunities for savings in coldstores and energy consumption.

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