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THE SUBSTANTIATION OF THE USE OF RAW MEAT AS RELATED TO THE EXTENT AND NATURE OF AUTOLYSIS

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SUMMARY

Results of a study into free catheptic activity, pH and water-binding capacity during autolysis of DFD-, PSE- and normal meat, are presented. Acid phosphatase in fresh warm DFD-meat and in normal meat was detected histochemically, the data obtained confirming the biochemical results of the determination of cathepsin D activity. The experiments performed allowed to substantiate the use of raw meat as related to autolysis extent and nature.

INTRODUCTION

One of the conditions of manufacturing high-quality meat products is a differentiated use of raw meat with account for the extent and nature of its autolytic changes. Of importance in meat ageing are tissue proteases - cathepsins. The conversions of the protein components under catheptic catalytic effect pre-determine many meat properties during storage and processing. The purpose of this work was to study the activity of muscle proteases (as exemplified with cathepsin D) depending on the nature and extent of meat autolysis, and, on the basis of the results obtained, to substantiate meat ageing time.

MATERIALS AND METHODS

As a test object the l.dorsi m. was used - dissected from beef sides within $2.7 \cdot 10^5$ - $3.6 \cdot 10^2$ s from slaughter. During meat auto-

lysis pH was recorded potentiometrically, WHC - by means of centrifugation. The free activity of cathepsin D was determined according to Caldwell and Grosjan (1) with a slight modification (the lysosomal fraction was isolated from muscle with a Teflon homogenizer according to Sragni and de Bernard (2)). Protein concentration in the test solutions was measured by the modified Whiteker and Granum method (3). The acid phosphatase, the basic enzymic marker of lysosomes was detected histochemically by the Gomori method (4). The experiments were performed in 3-5 replicates. The experimental results were processed with mathematical statistical methods.

RESULTS AND DISCUSSION

The experimental results (Fig.1) indicated that the release and free activity of cathepsins were connected with the course of the autolytic conversions of meat components. Changes in the catheptic activity are most pronounced in the meat characterized with a normal autolysis course (Normal meat) (Curve 3). However, irrespective of the autolysis nature, a common regularity in proteolytic activity is observed: first, cathepsins release from lysosomes and changes in the proteolytic activity prevail, then the activity is falling down. For DFD- and PSE-meat a high proteolytic activity is typical at the initial stage of autolysis, as compared to Normal meat. The above results evidence changes in the functional activity of lysosomal enzymes, which is connected with the state of lysosomal membranes. Thus, Afanasyev & Nozdin (5) believe that the number of primary lysosomes in a cell is decreased at the stage of anxiety, this may be due to damages of the membrane structures of cells. An indirect proof of a higher initial activity of cathepsins in DFD-meat is the results of histochemical detection of acid phosphatase (Fig. 2). According to the data on fresh warm Normal meat, a low phosphatase activity is observed, which is exhibited as single agglomerations and scattered small granules in the muscle fiber. In fresh warm DFD-meat

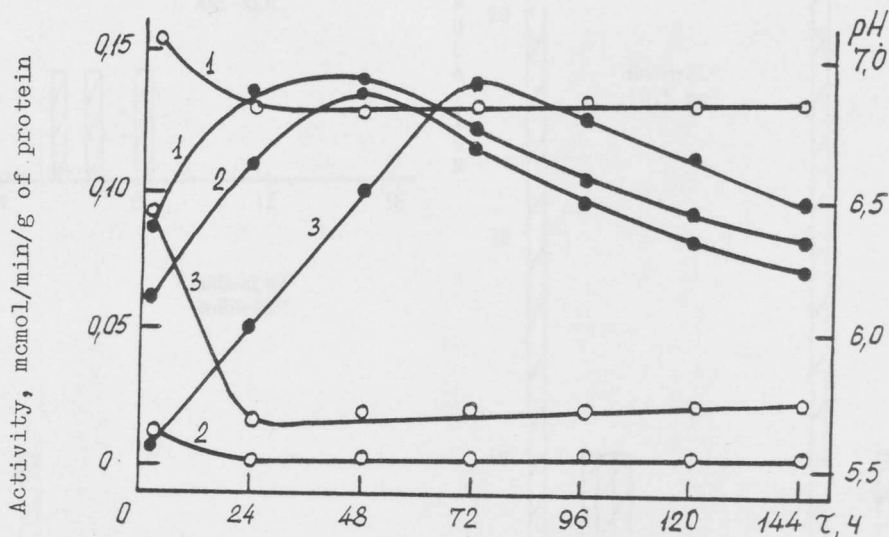


Fig.1. Changes of pH and cathepsin D activity in the process of meat autolysis: 1 - DFD, 2 - PSE, 3 - Normal; o - pH, • - activity.

a higher acid phosphatase activity is found histochemically as compared to Normal meat. The enzyme is localized in the muscle sarcoplasm as clear dark-brown grains. By comparing histochemical results on the activity of acid phosphatase and biochemical data on the activity of cathepsin D in the muscle tissue, it can be assumed that tissue protease activity in DFD-meat is a consequence of the metabolic stress in the live animals, which destabilizes considerably the lysosomal membranes and releases higher amounts of enzymes from lysosomes. The conclusions drawn agree with Pokrovsky and Tutelyan's (6) and Laborit et al.'s (7) data. Glycolytic and proteolytic processes occurring under tissue meat properties, including WHC. The dynamics of WHC is similar to changes of pH values. In DFD-meat, a high level of muscle protein hydration is maintained throughout the test period of autolysis. Hence, a relatively high proteolytic activity of cathepsins at the initial stage of autolysis in DFD-meat, a fast rate of attaining the maximum enzymic activity and stable processing characteristics (pH and WHC), as compared to Normal meat, allow to process DFD-meat at the early stages of autolysis (1-24 hr). By cathepsin D activity, pH and WHC, it is rational to process Normal meat at the third day of autolysis.

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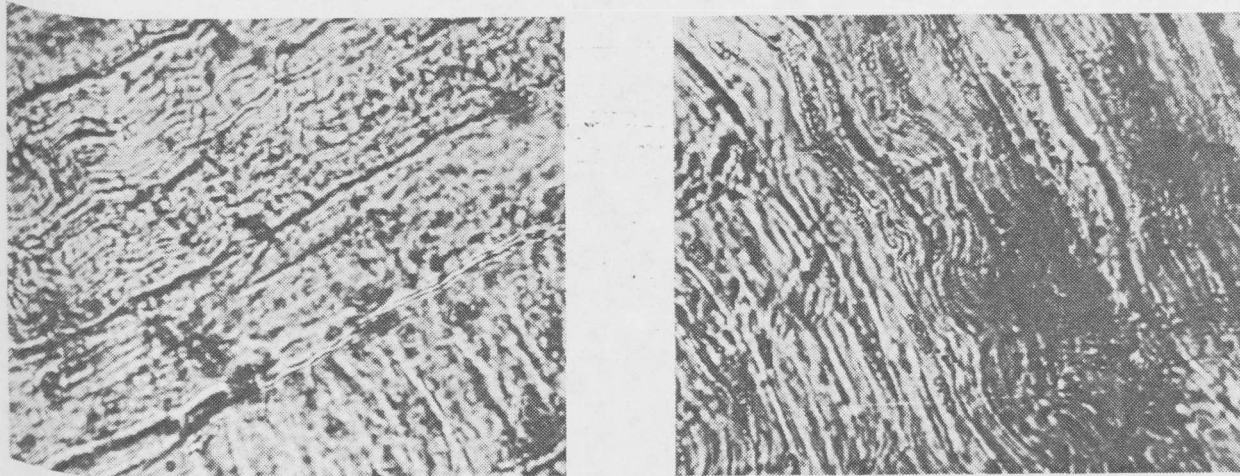


Fig. 2. Acid phosphatase distribution in the muscle tissue of fresh warm beef (X480):
a - Normal, b - DFD