

INVESTIGATION INTO STRUCTURAL AND FUNCTIONAL PROPERTIES OF MUSCULAR AND CONNECTIVE TISSUE OF DIFFERENT BOVINE MUSCLES

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Resume: The results of the investigations of muscular and connective tissue quality of 3 different bovine muscles are presented. Differences in physico-chemical (pH value, moisture content, water-holding capacity) and thermophysical (form of contours of heat absorption, temperature of maxima and enthalpy of denaturation) characteristics of muscular (without visible fat and connective tissue) and connective tissue are determined. This points out to the necessity of taking into account peculiarities in structural organization of contractile mechanism of muscles in carrying out similar technological processes, as they may account for essential differences in ready product quality.

Introduction. At the present time the classification of meat into different sorts is carried out according to amounts of muscular, fatty and connective tissue, i.e. morphological composition of muscles. In this case the muscles, depending upon the assortment of products, are classified into relatively uniform groups, according to their quality. To increase the productivity of labour and yields of meat without visible fatty and connective tissue (muscular tissue) the choppers-trimmers are used in the industry. It is considered, that muscular tissue, regardless of from what muscle it is obtained is uniform in its quality characteristics.

However, there is evidence about peculiarities in structural organization of contractile mechanism of myofibrills and connective tissue of different muscles (1). Therefore, it can be supposed that structural peculiarities will account for reactions with different responses to similar technological processes, which finally can influence qualitative and quantitative characteristics of ready product.

The aim of this work was the investigation of qualitative characteristics of muscular and connective tissue, taken from different muscles of the cattle.

Materials and methods. Quality characteristics of muscular (MT) and connective tissue (CT) were investigated on samples taken from the muscles: M. longissimus dorsi (MLD), M. triceps brachii (MTB), M. rhomboidens cervicas (MRC) of the chilled sides (72 h) of beef (young cattle). From these muscles, superficial fascia, muscular tissue without visible fatty and connective tissue and intramuscular connective tissue (endomysium) of MLD were obtained by method of preparation. In the prepared samples the following was determined: pH value on the potentiometer of type pH-340; water-holding capacity (WHC) by method of pressing; moisture content - by drying; weight losses during heating on Q-derivatograph by method, as modified by Oreshkin E.F. et al. (2).

Results and discussion. Analysis of data obtained shows, that the quality of MT varies in investigated samples (Fig. 1). Thus, MLD contains less moisture, has lower pH value and WHC as compared to MT, taken from MTB and MRC.

Thermogravimetric investigations of MT and CT have shown that the nature and extent of weight losses are also determined by type of muscle and temperature of heating (Fig. 2, 3). Beginning of juice exudation from the sample MT MRC occurs at reaching 32°C and from the sample MRC and MLD at about 45°C. The largest weight losses of MT from MRC and MTB are observed at temperature > 60°C and 65°C, respectively (0.39 and 0.34% /°C), and in MT from MLD - at > 55°C.

At heating CT the least weight losses are observed in the sample from MLD and MTB, the greatest weight losses are observed at temperatures higher than 82°C (0.41%/°C).

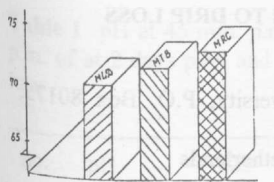


Fig. 1.
WHC of muscular tissue of different bovine muscles

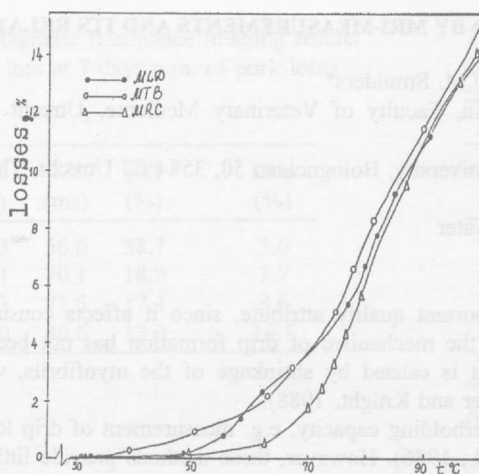


Fig. 2.
Weight losses changes during heating of muscular tissue taken from different bovine muscles

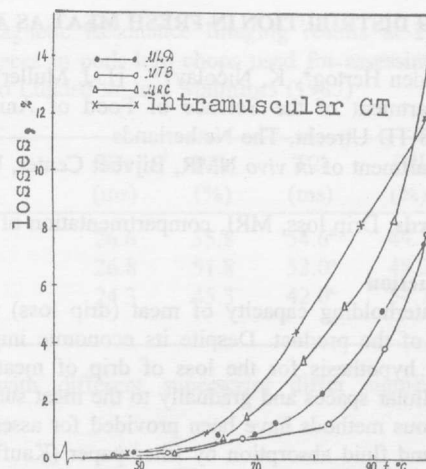


Fig. 3
Weight losses changes during heating of connective tissue taken from different bovine muscles

The level of heat absorption in the samples of MT at 45-75°C depends upon the type of the sample, but at > 75°C doesn't depend (Fig. 4, 5). Comparison of muscular tissue levels of enthalpies of MT of MLD, MTB and MRC results in relation 5:3:1. Similar results were obtained for samples of connective tissue of the muscles. The thermograms of fascia are distinguished by shape of contours of heat absorption, temperatures of maxima and enthalpies of denaturation (Fig. 5). In all the cases the contour is asymmetric with pronounced shoulder in the region (73-75)°C, with wide transition at (75-82)°C. Maxima of heat absorption are grouped at the range (64.5-66.5)°C with the exception of intramuscular CT of MLD.

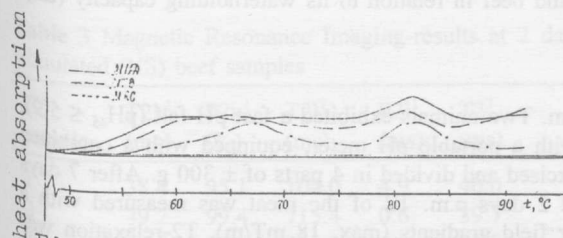


Fig. 4. Temperature dependences (superposed) of surplus specific heat of muscular tissue of different bovine muscles

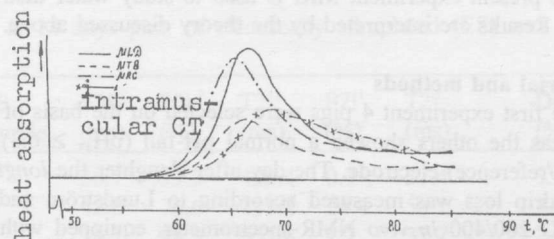


Fig. 5. Temperature dependences (superposed) of surplus specific heat of connective tissue of different bovine muscles

One should note significant differences, more than two-fold, in the values of enthalpies of denaturation CT of MTB, as compared to CT of MLD. Based on the investigations carried out, differences in physico-chemical, structural and thermophysical characteristics of MT of similar kinds of muscles were revealed. The ratio of enthalpies of muscular tissue samples denaturation of MLD, MTB and MRC is equal to 5:3:1. Thermogravimetric investigations of weight losses also confirmed differences in the properties of muscle bundles of meat of relatively similar quality. Dynamics of thermal losses of fascia of different muscles and intramuscular connective tissue is shown. Fascia of MRC proved less heat stable, the fascia of MLD and MTB - are more heat stable.

Conclusion: The results of changes of pH value, WHC, moisture, weight losses, levels of specific heat absorption of contractile and stromal components of the investigated muscles point out to the necessity of taking into account the level and character of these changes in carrying out similar technological treatments of meat raw materials.

References: 1. Oreshkin E.F. et al. Fleischwirtschaft, 1989, 69, N° 4
2. Oreshkin E.F., Borisova M.A. Thermogravimetric investigations of warm beef weight losses. Myasnaya Industria SSR, 1, 1986, pp. 40-42.