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INFLUENCE OF CHILLING TEMPERATURE OF DIFFERENT QUALITY GROUPS OF PORK ON CATHEPSINS D AND B + L ACTIVITY AND ON ACTOMYOSIN COMPLEX PROTEIN STRUCTURE STATE

M.A. BORISOVA, A.B. LISITSYN, G.E. LIMONOV, R.A. KHROMOVA, B.Z. KRAKOVA
All-Russian Meat Research Institute, Talalikhina 26, 109316 Moscow, Russia
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The problem of meat tenderization is without any doubt one of the most important and far from being solved issues of meat industry. In scientific literature there are conflicting interpretations of the role of endogenous enzymes of proteolysis (proteinases) in this process, and until the present time our ideas in this field are vague (1, 2, 3, 4, 5, 6). It is known that the temperature of meat chilling after slaughter has an essential influence on development of rigor mortis and on post-rigor period, as well as on activity of two main groups of proteinases: calpains and cathepsins, and on meat tenderness. The causes of many phenomena are still not known, for example, there are controversial opinions about the influence of these two groups of proteinases on meat ageing on the whole, and on individual groups of meat proteins of these two groups of proteinases.

In the present work we tried to trace the influence of the activity of cathepsins D and B + L on structure state of actomyosin complex proteins in the course of ageing up to 96 hours. The investigations were carried out on two quality groups of pork: N and PSE as influenced by different chilling tempeartures of meat after slaughter of the animals.

Materials and methods: The object of investigations was M. longissimus dorsi of pork, trimmed from visible connective and fatty tissue. pH value at the first hour after slaughter was: for PSE meat - 5.45, for N meat - 6.30. The meat was chilled at 0, 4, 10 and 20°C during the first 24 hours, then it was stored at 4°C. The activity of cathepsin D was determined by method of Anson (7). The activity of cathepsins B + L was determined by method of Kirschke (8). The state of the proteins of actomyosin complex was judged by maximum temperature at which the processes of "loosening" in their structure prevailed, which was determined by the method of own protein fluorescence (9). To determine the activity of cathepsins B + L in relation to collagen of intermuscular connective tissue, the meat was prepared by trimming, perimysium was separated, and the determinations were made.

Results and discussion: The investigations have shown that the activity of cathepsin D of both N and PSE meat is the greatest at 4°C of meat chilling. This pattern is maintained during the whole period of meat ageing up to 96 hours, but this proteinasa prossesses the maximum activity at 48 hours after slaughter of the animal (Fig. 1 a, b). In PSE meat the total level of activity of cathepsin D is much greater than in meat N. The activity of cathepsins B + L in the intact muscle for both groups of meat (N and PSE) is rather high (~18 un./g) and is almost the same, with the maximum being observed at 48 hours of ageing after chilling at 4°C. At 96 hours of ageing the activity of cathepsins B + L is the lowest and practically doesn't depend upon meat chilling temperature (Fig. 2 a). The activity of cathepsins B + L of the isolated perimysium in general level is significantly lower (~3.0 un./g) than in the intact muscle, its dependence on chilling temperature and time of ageing is expressed more vividly. The connective tissue possesses maximum activity at 48 h of ageing after chilling at 4°C. In PSE meat it is slightly higher, than in N meat (Fig. 2 b). The maximum temperature (T_{max}), at which the process of "loosening" of actomyosin complex protein structure is prevailing during heat denaturation for PSE meat actually doesn't depend upon temperature of chilling, and for N meat this value very slowly and slightly rises, as the chilling temperature rises from 0° to 10°C. Although at 48 hours of ageing both kinds of meat show a slight increase in T_{max}, further correlation with the activity of the investigated proteinases was not observed (Fig. 3 a, b)

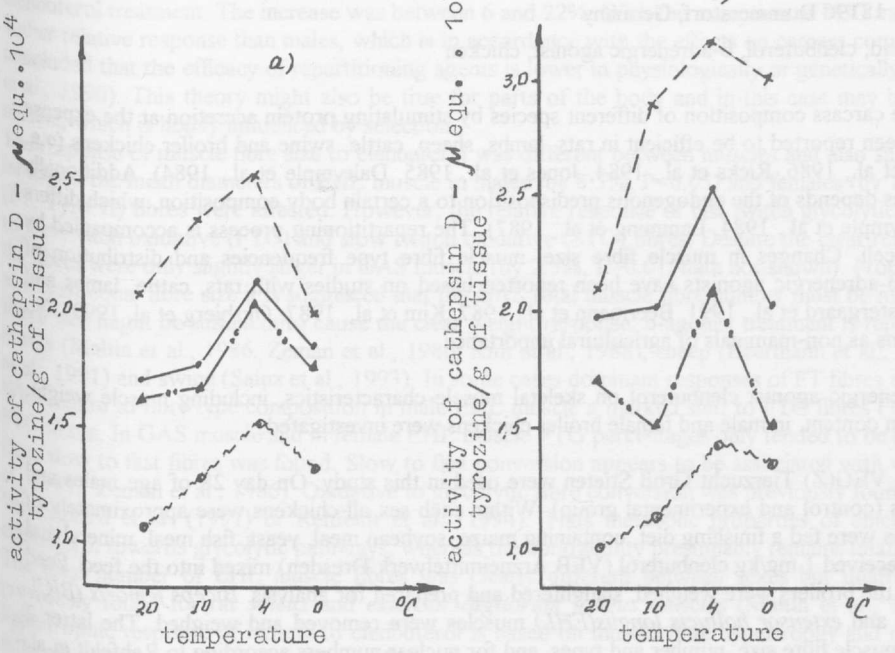

Fig. 1 a, b:
Dependence of cathepsin D activity on meat chilling temperature at the first day after slaughter of the animal, in the course of ageing up to 96 hours; pork N (a), pork PSE (b)

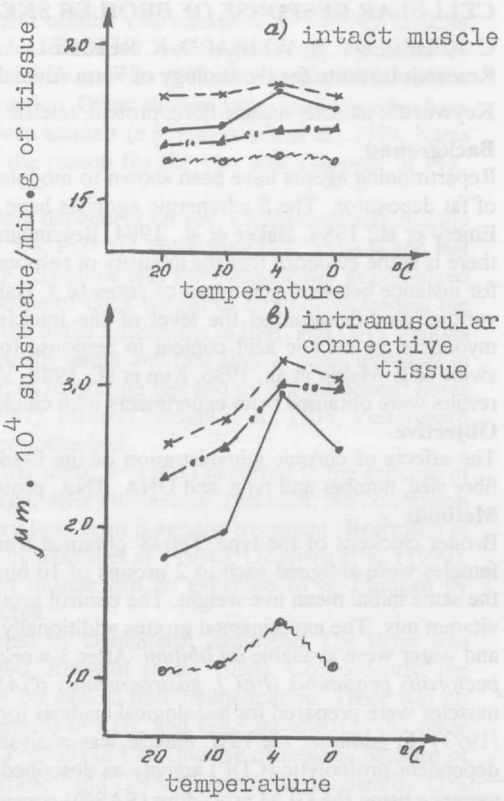

Fig. 2 a, b:
Dependence of cathepsins B + L activity on chilling of PSE pork at the first day after slaughter in the course of ageing up to 96 h

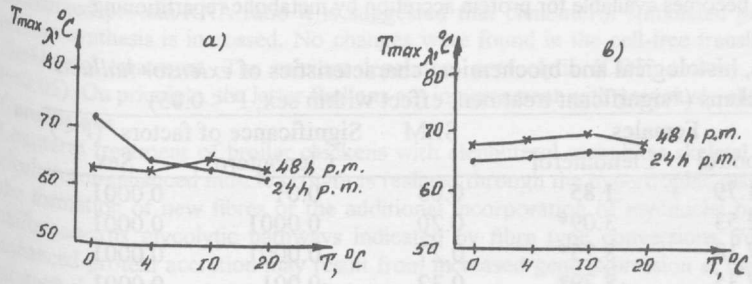

Fig. 3 a, b:
Dependence of maximum temperature of "loosening" of miofibrillar protein structure (T_{max}) on temperature of meat chilling after salughter
(a - PSE, b - N)

Therefore it can be with the certain degree of confidence argumented, that the cathepsins D, and B + L don't have direct effect on the state of proteins structure of actomyosin complex. A similar conclusion can be drawn with regards to collagen of intermuscular connective tissue, as according to literature and our own data, in meat of the animals at 48 h after slaughter, no maximum increase in the fraction of soluble collagen, nor maximum in parameters of thermal denaturation of this protein were observed. But a tenderizing effect of proteinases on meat is well known. Therefore, one can suppose that it is mainly directed to the proteins of cytoskeleton, the role of which in meat toughness is yet to be determined.

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