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Proteomic Analysis of Bovine Skeletal Muscle: Changes in Soluble Proteins with Minerals during Storage

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Summary

It is well-known that meat quality is improved during postmortem aging, which results in increase in its tenderness, and in the improvement of its taste and aroma. Although their influence on the texture and taste of the meat is still not clear, it is well documented that fragmentation of myofibrils takes place during aging of meat. Troponin T is well-known as one of the myofibrillar proteins to be easily degraded during postmortem aging of meat. However the profile of soluble protein changes during storage has not been fully understood. The intracellular protelytic system of muscle cells is considered to play an important role in improving the texture and taste of meat. The proteases such as cathepsins and calpain and minerals such as calcium are responsible for protein degradation in muscle tissue. This study was performed to examine the changes in total, soluble and insoluble proteins of bovine skeletal muscle during meat aging conditioning of vacuum-packed beef. Bovine meat samples were taken from the biceps femoris muscle after slaughter. The meat samples were stored at 4ºC for 1, 10, 15, 23, and 30 days. We tested the technique of proteomic analysis using SDS-PAGE, two-dimensional polyacrylamide gel electrophoresis (2D-PAGE) and Western blotting analysis. The results of 2D-PAGE patterns showed that the spots (MW 38 kDa, Ip 7.8 - 9.5) were gradually decreased in soluble fraction of beef meat for 10 days, and completely decreased after 15 days of storage. The SDS-PAGE profile and Western blotting analysis showed that the band (38 kDa) was identified as glyceraldehydes-3-phosphate dehydrogenase (GAPDH). Moreover, bovine muscle was buffered, homogenized and stored (10 d) for SDS-PAGE and Western blotting analysis. The degradation of GAPDH was observed not only in meat during aging but also in the homogenate of meat during storage. These results suggested the system using the homogenate of meat could be useful for the model of meat aging. To investigate the mechanism of meat aging, we next examined that effect of protease inhibitors and minerals on soluble proteins of beef during storage. The results showed that Pepstatin A, Calpain inhibitor II and TLCK inhibited the degradation of GAPDH at high concentrations, suggesting that cathepsin D, calpain II and serine protease might be related to the its degradation during storage. Moreover, the SDS-PAGE profile and Western blotting analysis suggested that NaCl, $MgCl_2$ and $CaCl_2$ promote the GAPDH degradation, whereas that KCl inhibited the degradation. By analyzing the complete proteome of foods, specific markers can be found to predict the quality of the end-product.