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Effects of Oxidative Cross-Linking of its Myofibrillar Protein on Texture during the Processing of Air-Dried Yak Meat

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Objectives

This study aimed to examine the mechanism of cross-linking of myofibrillar protein and its influence on texture during the processing of air-dried yak meat.

Materials and Methods

The semimembranosus of 9 healthy and disease-free male yaks when they were 3 to 4-yr-old under natural grazing was selected for 20 kg, and these yaks are all from Gannan Prefecture, Gansu Province, China. The fascia and fat on the surface of the raw meat were removed and cut into strips with a cross-section of 2 cm × 2 cm in a freeze-dried room away from direct sunlight and naturally ventilated (room temperature –10 ~ –15°C, relative humidity 50 ~ 75%). The meat was hung on the wire, and the distance between adjacent 2 meats was maintained at 1 to 2 cm. Samples were collected during natural air-drying for 60 d. Carbonyl content, total thiol concentration, disulfide bond content, SDS-PAGE, dimeric tyrosine content, the surface hydrophobicity, histological characteristics and texture were measured, respectively. All of the experiments were conducted in triplicate for each sample, and the final results from the mean of 3 independent experimental replications. Dimeric tyrosine content, the surface hydrophobicity, histological characteristics and texture were measured, respectively. All of the experiments were conducted in triplicate for each sample, and the final results from the mean of 3 independent experimental replications.

Results

The carbonyl content of raw meat is 2.63 nmol/mg, and increased by 6.35 nmol/mg in 60 d. With the increase of protein oxidation, the proportion of protein α helices decreases while β sheets increase, and β-turns and random coils remain basically unchanged. The lost sulfhydryl group is cross-linked in the form of disulfide bonds, significant difference between 4 and 50 d ($P < 0.05$). Through SDS-PSGE experiments found that the cross-linking of myosin heavy chain formed macromolecules to stay on the top of the separation glue, fully verified this point (Fig. 6). The sensitive amino acid tyrosine was cross-linked by dimerization of dimeric tyrosine and changed significantly from 0 to 30 d ($P < 0.05$). Changes in the surface hydrophobicity of the protein can be obtained, and the aggregation of the protein is greater than that of the structure during processing from 4 to 60 d. These changes cause contraction of myofibrils in both the transverse and longitudinal directions, which in turn leads to hardness, cohesiveness, gumminess and chewiness were significantly increased ($P < 0.05$) in air-dried yak meat, springiness and resilience decreased significantly ($P < 0.05$) during processing.These changes cause contraction of myofibrils in both the transverse and longitudinal directions, which in turn leads to hardness, cohesiveness, gumminess and chewiness were significantly increased ($P < 0.05$) in air-dried yak meat, springiness and resilience decreased significantly ($P < 0.05$) during processing.

Conclusion

With the increase of protein oxidation of yak meat during non-artificial freeze-drying, myofibrillin molecules crosslink and aggregate in the form of disulfide bond and dimeric tyrosine. These changes cause the muscle fibers to contract both horizontally and vertically, which in turn leads to hardness, cohesiveness, gumminess and chewiness were increased significantly, and result in decreased springiness and resilience ultimately.

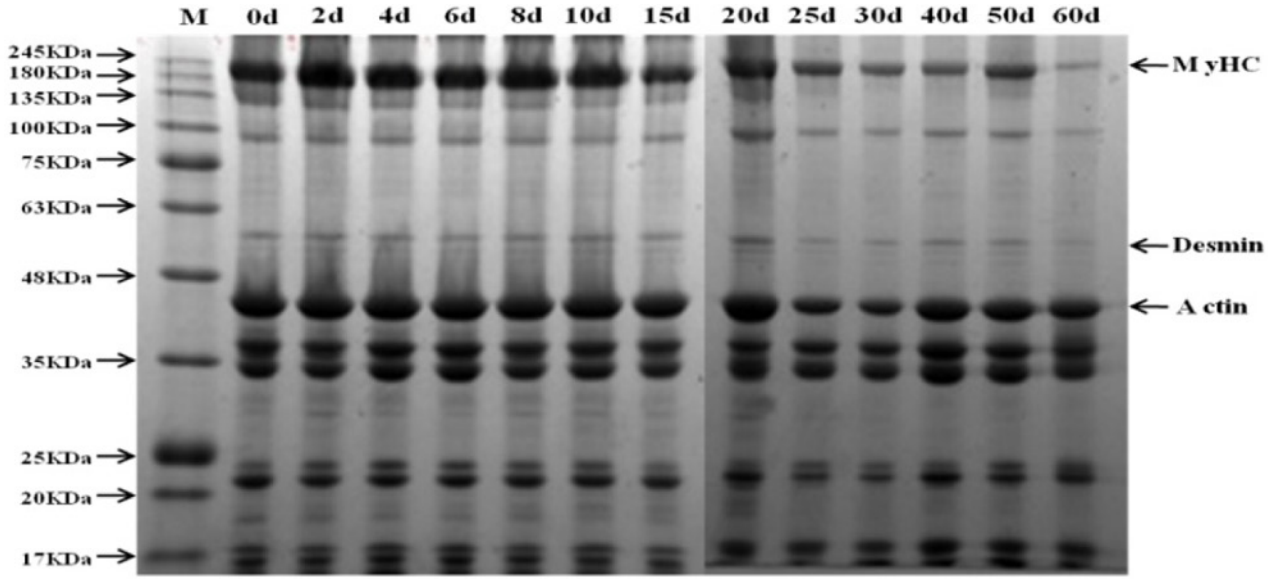

Fig. 6. Myofibrillar protien SDS-PAGE of dried yak meat.