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Biochemical Properties of Intramuscular Connective Tissue of Wuzhumuqin Sheep During Postnatal Development (#260)

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Introduction

Concerning meat quality and biological value, not only collagen content but also age-related cross-linkages must be considered. So-called background toughness attributable to the connective tissue present, mainly composed of collagen and various amount of elastin and proteoglycans, which surround each unit of muscle organization. In which the endomysium and the perimysium are mainly related to meat quality (Annabelle Dubost et al, 2013) . In general, the older the animal gets the tougher its meat becomes. The one of reason for this decrease in the textural quality of the meat is the collagen in the muscle connective tissue becomes progressively tougher, more rigid, resistant and less easily denatured. In order to clarify the correlation of factors related to meat production and meat tenderness, it is necessary to analyze the way of skeletal muscle changes with animals' growth. It is crucial to control these factors efficiently in meat production. Wuzhumuqin sheep, a type of Mongolian sheep was employed in the study. In general, Wuzhumuqin sheep are accustomed to voluntary movements and a high amount of free-feeding (also called natural grazing) for their entire lifespan. There have been few studies of the characteristic of intramuscular connective tissue during development of Wuzhumuqin sheep in natural grazing. The objective of the present study was to investigate the content of collagen, heat denaturation, content of pyridinoline and proteoglycan of collagen obtained from naturally grazing Wuzhumuqin sheep during postnatal development.

Methods

Materials: Wuzhumuqin sheep aged at 1, 6, 9, 12 and 18 months old were selected from the Original Breeding Farm of Wuzhumuqin Sheep in East Wuzhumuqin, Inner Mongolia. Semitendinosus muscle was collected and the samples were stored at -20°C. Before used, it was thawed under 4 , and the fat was removed.

Isolation of intramuscular connective tissue: The intramuscular connective tissues are isolated by the methods of Fujii et al. (1982). Endomysium and perimysium are isolated by the methods described by Light et al. (1985).

Differential Scanning Calorimeter (DSC) analysis of intramuscular connective tissue: Weigh 30 mg samples in sample cell, seal the sample cell and put on the specimen holder of differential scanning calorimeter. Using alumina as reference compound, heating velocity as 1℃, temperature range as 20 ~ 100 ℃.

Content of pyridinoline and Uronic acid of intramuscular connective tissue: The content of pyridinoline of intramuscular connective tissue was used the methods described by Pan et al. (2002) .The content of uronic acid in proteoglycans is measured by the methods described by Bitter and Muir (1962).

Results

Collagen content in intramuscular connective tissue

The content of collagen in total connective tissue, endomysium and perimysium were shown respectively in Table 1. The amount of collagen in connective tissue, endomysium and perimysium were decreased during the growth of sheep, and the changes were significantly different ($P<0.05$). Moreover, Amount of collagen in perimysium was significantly lower than that of endomysium.

Temperature of thermal denaturation in intramuscular connective tissue

Temperature of thermal denaturation in total connective tissue, endomysium and perimysium were shown respectively in Table 2. Thermal denaturation temperature in total connective tissue and endomysium were increased gradually during the growth of sheep. However thermal denaturation temperature in perimysium was decreased during growth of sheep, which may be caused by the increasing of depots intramuscular fat between muscle bundle, to destroyed the arrangement and stability structure of collagen, and/or decreasing the stability of their cross-linking. The denaturation temperature in total connective tissue was higher than that of endomysium and perimysium. Especially for 18 months, denaturation temperature in connective tissue was 66.1 , in endomysium and perimysium were 48.1 and 36.6 , respectively.

Quantitative of pyridinoline and Uronic acid content in connective tissue

The amount of pyridinoline and uronic acid in connective tissue of different aged sheep were shown in Table 3. The contents of pyridinoline and uronic acid in connective tissue increased during growth of sheep. But the content of pyridinoline in connective tissue was increased quicker in the 12 months. The changes of pyridinoline and uronic acid in connective tissue from different ages were significantly different ($P<0.05$).

Conclusion

The content of total connective tissue, endomysium and perimysium was

Notes

decreased significantly, and the collagen content in endomysium was higher than that of perimysium. Thermal denaturation temperature of total connective tissue and endomysium were increased, but the denaturation temperature of perimysium was decreased. Contents of Pyridinoline and uronic acid in intramuscular connective tissue were increased with the growth of sheep.

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Table 2 Thermal denaturation temperature in connective tissue, endomysium and perimysium Td（℃）

	1 months	6 months	9 months	12 months	18 months
Connective tissue	48.1	48.5	51.3	54.2	66.1
Endomysium	42.1	42.2	43.4	45.3	48.1
Perimysium	48.5	45.1	45.7	42.1	36.6

Table 2
Thermal denaturation temperature in connective tissue, endomysium and perimysium Td (℃)

Table 3 Amount of pyridinoline in intramuscular connective tissue (%)

	1 month	6 months	9 months	12 months	18 months
Pyridinoline	$0.1124^{a}\pm0.0002$	$0.1254^{b}\pm0.0010$	$0.1354^{c}\pm0.0007$	$0.1502^{d}\pm0.0015$	$0.3011^{e}\pm0.0019$
Uronic acid	$5.4008^{a}\pm0.3092$	$9.1308^{b}\pm0.2700$	$17.8399^{c}\pm0.5498$	$21.9281^{d}\pm0.4246$	$38.8833^{e}\pm0.6791$

Note: Different characters mean significant difference ($P < 0.05$).

Table 3
Amount of pyridinoline in intramuscular connective tissue (%)

Notes

Table 1 Total amount of collagen in connective tissue, endomysium and perimysium（mg/g）

	1 month	6 months	9 months	12 months	18 months
Connective tissue	$32.91^{A}\pm1.51$	$28.58^{B}\pm1.72$	$27.99^{B}\pm1.20$	$26.21^{C}\pm2.04$	$25.33^{C}\pm1.02$
Endomysium	$22.41^{A}\pm0.37$	$21.68^{A}\pm1.44$	$21.56^{A}\pm1.02$	$19.55^{B}\pm0.72$	$19.14^{B}\pm0.77$
Perimysium	$6.34^{A}\pm0.31$	$6.00^{B}\pm0.19$	$5.59^{C}\pm0.31$	$5.55^{C}\pm0.13$	$5.20^{D}\pm0.32$

Note: Different characters mean significant difference ($P < 0.05$).

Table 1
Total amount of collagen in connective tissue, endomysium and perimysium (mg/g)

Notes