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Effects of aging on mRNA expressions of the factors affecting meat quality or quantity in Japanese Black cows: PPAR γ 2, leptin, IGF-I, IGF-I receptor, myostatin, PGC-1 α



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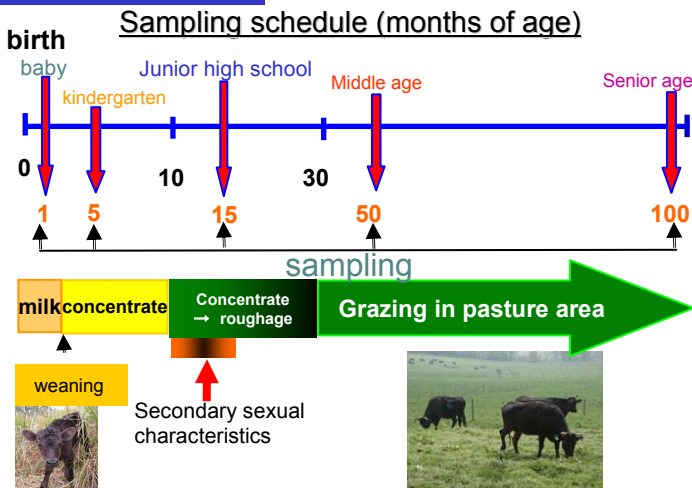
Introduction

In Japan, the present beef production system mainly depends on imported concentrate; however, it has many problems like some infectious diseases such as BSE or environmental pollutions. We propose the new environmentally-friendly and sustainable system makes better use of domestic grass resources by fatty type cattle of Japanese Black. For the purpose of producing high quality and the large quantity beef through roughage feeding, at first we investigated when the factors affecting meat quality or quantity are expressed in the aging process of skeletal muscle from 1 to 100 months (mo) of age in grazing cattle in the pasture area.

Conclusions

The result of this study indicated that the changes of meat quality and quantity in longissimus muscle (LM) could be observed for the long term from 1 to 100 mo of age, while the changes in biceps femoris muscle (BFM) were remarkable in the first few months after birth, after which changes were gradual. In beef production using roughage as feed, the cattle fattened slowly and the fattening periods needed to be longer than the present beef production system using concentrate as feed. If the more efficient system of raising cattle is used, meat quality in LT can be improved more than in BF.

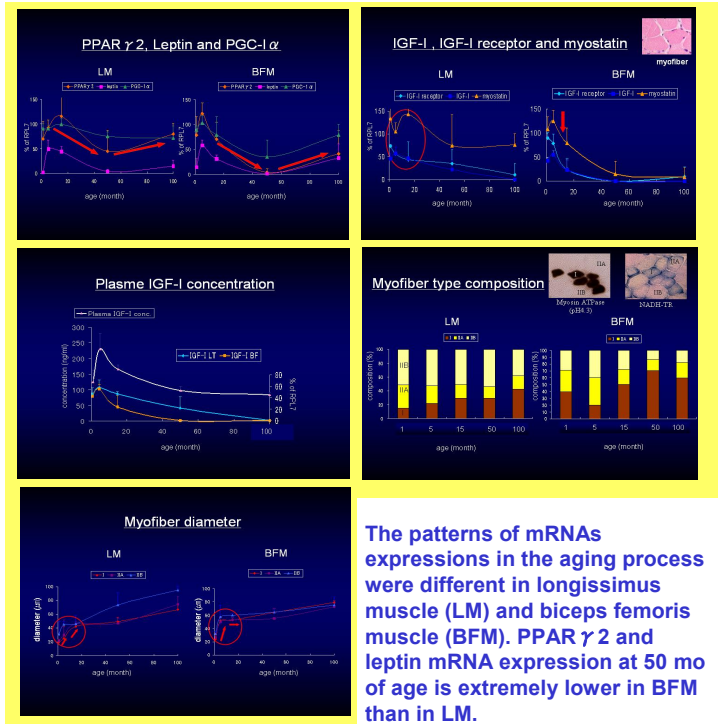
Materials and Methods



Analysis

1. semi-quantitative RT-PCR: expression of mRNA
 - 1) peroxisomal proliferating activated receptor gamma 2 :PPAR γ 2
 - 2) leptin
 - 3) Insulin-like growth factor I: IGF-I
 - 4) IGF-I receptor
 - 5) myostatin
 - 6) PPAR γ 2 co-activator 1alpha: PGC-I α
2. RIA: IGF-I concentration in blood plasma
3. Enzyme histochemistry: myofiber type composition, myofiber diameter

Results and Discussion



The patterns of mRNAs expressions in the aging process were different in longissimus muscle (LM) and biceps femoris muscle (BFM). PPAR γ 2 and leptin mRNA expression at 50 mo of age is extremely lower in BFM than in LM.

Biopsy

Needle biopsy (1 and 5 months of age)

Shot biopsy (15, 50 and 100 months of age) longissimus muscle (LM)

biceps femoris muscle (BFM)

LM **BFM**

Needle biopsy: About 10 samples were taken from each muscle. Size: 1.5-2.0 cm length and 2 mm width

shot biopsy: About 2 samples were taken from each muscle. Size: 2.5-3.0 cm length and 5 mm width

This suggests that the differentiations to adipocytes in LM happen longer than in BFM. PGC-1 α mRNA expressed highly in LM at all ages, so the mitochondrial biogenesis happened actively. The energy metabolism in LM may be more active than in BFM. IGF-I in LM and the receptor expressions remained high until 15 mo of age, while in BFM these reached a peak at 5 mo of age and thereafter decreased rapidly. On the other hand, Myostatin expressed similar to the pattern of IGF-I. Myostatin may play a role of inhibiting excess growth in the early life of cattle. These mRNAs expressions induced morphological changes of the myofibers. The rapid increase in the size of the myofibers in LT continued until 15 months of age, while in BF the changes were gradual after 5 months of age. The above results showed that the growth and mature patterns may be different.