PE7.05 Changes of meat quality in *longissimus muscle* from twenty-four to thirty months of age using Japanese black steers 53.00

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Abstract— the aim of this study was to investigate the changes of meat quality in longissimus muscle (LM) from 24 to 30 mo of age using identical twins of Japanese Black steers. LMs sampled from animals, which were fattened from 10 to 24 mo of age or 30 mo of age for each pair of identical twins (four sets: 8 heads), were used in this study. Cooking loss at 30 mo of age was lower than at 24 mo of age ($p<0.05$), and WHC at 30 mo of age was greater than at 24 mo of age ($p<0.05$). Collagen solubility (%) of 24 mo of age was two times greater than at 30 mo of age. There was no significant difference of WBSF between the groups, but the value at 24 mo of age was lower than at 30 mo of age. In fatty acid composition of LM, some unsaturated fatty acids at 30 mo of age tended to be greater than at 24 mo of age, and the melting point of 30 mo of age was lower than that of 24 mo of age ($p<0.01$). Total FAA, dipeptides and IMP at 24 and 30 mo of age were not significantly different. These results demonstrated that the additional fattening period of 6 mo from 24 to 30 mo of age affects the meat quality of LM in Japanese Black steers.

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Index Terms— fattening period (age), Japanese Black steers, longissimus muscle, meat quality.

I. INTRODUCTION

Meat quality is important in beef cattle production, and its improvement in physico-chemical traits which affects meat quality including palatability is becoming increasingly important. Many researchers report that fattening methods in feedlot influence physico-chemical traits of beef (Lengyel, Husveth, Polgar, Szabo, and Magyar, 2003; Westering and Hedrick, 1979; Melton, Amiri, Davis, and Backus,1982; Mandell, Bchanan-Smith, and Campbell, 1998). In these methods, the fattening period of cattle is one important factor.

We reported that intramuscular fat content (IMF) in principal muscles including longissimus muscle (LM) continues to increase in the late fattening stage (Okumura et al. 2007). The relationships between the fattening period and other chemical traits were related in fatty acid composition（Lengel et al. 2003, Mitsuhashi, Mistumoto, Yamashita, and Ozawa, 1988）, collagen and Warner-Bratzler shear force (WBSF)（Nishimura, Hattori, and Takahashi, 1999). However, a study of meat quality except IMF at different ages using cattle that have identical genotypes has not been done.

The object of this study was to investigate the changes of meat quality in LM in Japanese Black steer identical twins from 24 to 30 mo of age.

II. MATERIALS AND METHODS

A. Samples

LMs sampled from animals, which were fattened from 10 to 24 mo of age or 30 mo of age of each pair of identical twins (four sets: 8 heads), were used in this study. Feeding, management, growth of animals and intramuscular fat deposition in principal muscles are described previously (Okumura et al. 2007).

B. Physico-chemical analyses

LMs at 7-8th thoracic vertebrae were analyzed to determine its cooking loss, WBSF, water holding capacity (WHC), fatty acid composition, melting point, free amino acid (FAA) and inosine 5'-monophosphate (IMP) content. Then the data of its moisture, crude fat and crude protein that were analyzed previously were used (Okumura et al. 2007).

Samples for FAA and IMP content analysis were aged 9 days postmortem, 2℃. Aged samples were frozen at -30℃ and stored until analyzed. Cooking loss was calculated as; cooking loss = { (raw weight approximately 50 g (A) － cooked weight at 70℃ for 1 h) ÷ (A) } × 100

WBSF was analyzed using samples of at least 4 cakes of muscles that had already been analyzed for cooking loss and were cut (vertical cross section 1×1cm2) parallel to the long axis of the muscle fibers (SALTAR, Zenken, Tokyo, Japan). WHC was analyzed by following the Wierbiki and

Deatherage (1958) method. Approximately 500 mg triplicate samples of muscle were placed in a filter-press device and compressed at 35 kgf / cm2 for 1 min.

In fatty acid composition, intramuscular fat was extracted by means of a modification of the Folch, Lees, and Stanley (1957) method using chloroform/methanol (2 / 1; v / v). Fatty acids were determined as methyl esters with a gas chromatograph (Detector FID, model GC380, GL Science, Tokyo, Japan) using a capillary column CP-Sil 88 W-cot 0.25mm×50M (GL Science, Tokyo, Japan).

For FAA and dipeptides contents, the minced samples, to which were added ultra pure water, were homogenized with norleucine as an internal standard. And then we obtained samples for FAA and dipeptides after taking off fat and protein using Hexane and Acetonitrile respectively. The samples were analyzed by a HPLC (Waters 2487: Detector UV, Waters, USA), using a column for FAA (picotag 3.9 i.d. × 300mm, Waters, USA). IMP was analyzed using samples for FAA and dipeptides by the HPLC, using a column (Atlantis 4.6 i.d. × 150mm, Waters, USA).

C. Statistical analysis

All data are presented as the means±standard error of the mean. The statistical significance of the data between the two groups was analyzed using two-sides paired t test.

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III: RESULTS AND DISCUSSION

Cooking loss, WHC and WBSF in LM at 24 mo of age and 30 mo of age are shown in Figure 1, 2 and 3, respectively. Cooking loss of 30 mo of age was lower than 24 mo of age ($p<0.05$). WHC at 30 mo of age was greater than at 24 mo of age ($p<0.05$). Although WBSF had no significant difference between the groups, the value at 24 mo of age was lower than at 30 mo of age. Total collagen content and insoluble collagen content of LM at 24 and 30 mo of age had no significant differences, but soluble collagen content at 24 mo of age tended to be lower than at 30 mo. In addition, soluble collagen (%) of 24 mo of age was two times greater than at 30 mo of age (data not shown).

In the fatty acid composition of the LM, the proportions of C14:1 and C16:1 at 30 mo of age were greater than at 24 mo of age ($p<0.05$), and the melting point of 30 mo of age was lower than that of 24 mo of age ($p<0.01$) (data not shown). As we already reported, IMF at 24 and 30 mo of age are 37.0 % and 42.4%, respectively ($p<0.05$), and moisture and crude protein at 30 mo of age are lower than at 24 mo of age (Okumura et al. 2007).

FAA, dipeptides and IMP contents of LM are shown in Table 1. Taurine and methionine at 30 mo of age were lower than at 24 mo of age ($p<0.05$). Total FAA content at 24 and 30 mo of age were 13.7 and 11.4 μmol/g respectively, but significant difference was not observed. The dipeptides and IMP at 24 and 30 mo of age had no significant difference, respectively. FAA content were recalculated on the basis of protein at 24 and 30 mo of age were similar except for methionine. These results indicated that the decrease of protein in LM caused by the increase of intramuscular fat decreases some kinds of FAA content.

According to previous study, Ozawa et al. (2000) reported that there is a high negative correlation between cooking loss and intramuscular fat in LM of Japanese Black steers. Also, in general, it is thought that collagen content is affected by the fattening periods. Regarding the quality of fat, melting points of fat in subcutaneous, intermuscular and perinephric adipose tissue from Japanese Black steers markedly decrease with the advancement of animal age (Mitsuhashi et al.1988).

This study indicated that the increase of intramuscular fat, which is caused by additional fattening periods, results in the decrease of cooking loss, which improves WHC. Moreover, collagen composition and fatty acid composition are affected by the additional fattening period from 24 to 30 mo of age.

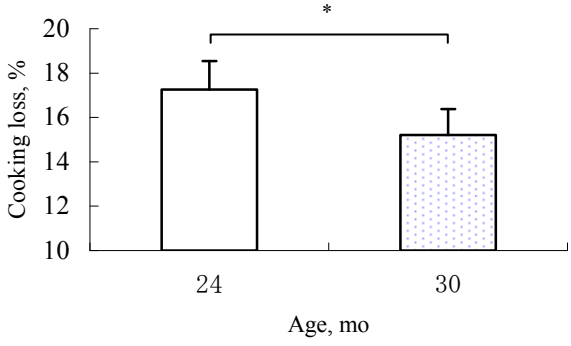

Figure 1. Cooking loss in longissimus muscle at 24 and 30 mo of age

*:p < 0.05

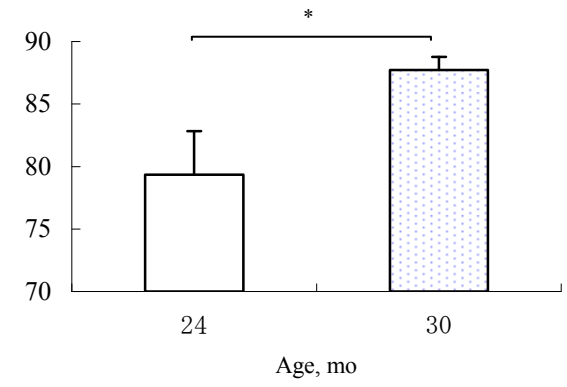

Figure 2. Water holding capacity in longissimus muscle at 24 and 30 mo of age

*:p < 0.05

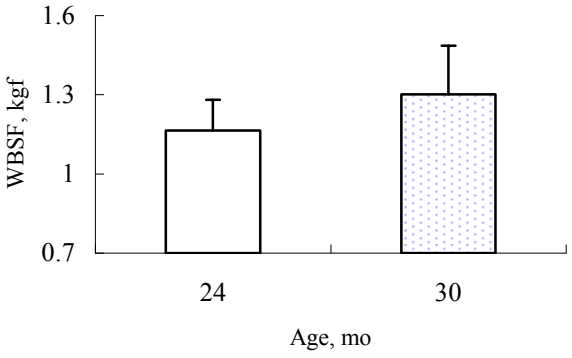

Figure 3. Warner-Bratzler shear force in longissimus muscle at 24 and 30 mo of age

IV. Conclusion

These results demonstrate that the additional fattening period of 6 mo from 24 to 30 mo of age affects the meat quality of LM in Japanese Black steers.

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