MEAT QUALITY AND SENSORY PROPERTIES OF 8 BOVINE MUSCLES IN LONGISSIMUS AND FEMORIS OF HANWOO BEEF

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Introduction

FEW STUDIES have been conducted to evaluate the differences in meat quality and other sensory properties among different beef muscles. Ramsbottom et al. (1945) compared 25 major muscles from three "U.S. Good" heifer carcasses and found significant differences in tenderness and Warner-Bratzler shear force (WBS) among many muscles. Different bovine muscles have different function to contribute their various quality traits. Jeremiah et al. (1971) reported that muscles from the same animal differed widely in tenderness characteristics. Detailed information regarding those factors which are responsible for differences in tenderness among muscles from an anatomical location should provide evidence for characterizing differences in meat quality among animals. Sensory property is an important component of meat palatability. In fact, the National Consumer Retail Beef Study (Savell *et al*., 1987, 1989) clearly revealed the importance of flavor, tenderness, and juiciness traits to the consumer in the purchasing-decision process. Carmack et al.(1995) reported the sensory evaluation of beef-flavor-intensity, tenderness, and juiciness for 12 major muscles. Therefore, the objective of this study was to investigate the meat quality and sensory properties of eight bovine muscles located in longissiums and femoris muscles of Hanwoo beef.

Materials and methods

A total of 12 Korean Hanwoo steers (approximately 550-650 kg of live weight) were slaughtered and divided by quality grade level of the Prime grade (Korea grade 1^{++}) and Standard grade (Korea grade 3) for this experiment. On the following day of slaughter, eight muscles were dissected from Longissimus muscle (lumborum, thoracis, articular part) and Bicep femoris muscle (rump part, thigh part, rectus femoris, vastus lateralis, vastus medialis) and frozen until analysis. Intermuscular fat was determined by Food scan^{TM}Lab (FOSS, USA). WB-shear force (WBS) was measured on cooked steaks (25-mm thick) according to the method described by Wheeler et al. 2000). Water-holding capacity (WHC) was determined by centrifugation method (Kristensen and Purslow, 2001). WHC was expressed as a percentage of weight loss of sample tissue during the centrifugation. For sensory evaluation, five trained sensory panelists scored the sensory characteristics of tenderness, juiciness and flavor intensity on a six-point scale. The panelists were asked to score from one point for extremely dislike to six point for extremely like. Thin sliced samples (50 x 70 x 40 mm in size) were cooked by placing on the tin plate (ca. 245-255□) with turning at the first pooling of liquid on the surface of the strip, or at the start of shrinkage. The cooked strip was immediately served to each panelist for evaluation. Data were analyzed by using the SAS program (1996) and means were separated by the Student-Newman-Keuls' test ($p<0.05$).

Results and Discussion

Intramuscular fat contents, WBS and WHC of 8 muscles in longissimus and femoris muscle were shown in Table 1. There were significantly differences in the intramuscular fat contents and WBS values among the muscles or between the quality grade levels ($p<0.05$). However, there was significantly different in WHC between two quality grades only for longissimus articular part, bicep femoris rump and thigh part ($p>0.05$), although most other muscles had higher WHC in muscles from prime grade (1++) than the Standard(3) grade. The Intramuscular fat contents were significantly lower and WBS force was significantly higher for the muscles which were located at upper site and more exercised when they were compared to the others ($p<0.05$).

Table 2. Intramuscular fat contents, WBS and WHC of 8 muscles in Longissimus and Femoris muscles of Hanwoo beef among different muscle locations and between the Quality grades.

Muscles	Intermuscular fat(%)		Warner-Bratzler shear force(WBS) (kg/0.5inch^2)		Water Holding Capacity(WHC)	
	1^{++}	3	1^{++}	3	1^{++}	3
Longissimus lumborum muscle	26.0 ± 4.5^{aA}	3.98 ± 1.14^{bAB}	3.42 ± 0.57^{cAB}	7.85± 2.23^{dA}	55.98 ± 1.32	52.79 ± 2.07
Longissimus thoracis muscle	23.6 ± 1.9^{aA}	3.15 ± 0.63^{bB}	2.72 ± 0.59^{cA}	7.40± 2.04^{dA}	55.50 ± 0.64	53.77 ± 1.70
Longissimus muscle – Articular part	24.0 ± 1.5^{aA}	5.28 ± 1.52^{bA}	2.12 ± 0.48^{cA}	5.56± 0.30^{dB}	55.59 ± 2.05^{e}	53.06 ± 0.13^{f}
Biceps femoris muscle – Rump part	24.5 ± 6.7^{aA}	3.74 ± 1.34^{bB}	3.24 ± 1.19^{cAB}	5.63± 0.73^{dAB}	56.21 ± 1.31^{e}	52.19 ± 0.64^{f}

Biceps femoris muscle – Thigh part	10.5 ± 1.5 ^{aB}	1.38 ± 0.06 ^{bC}	4.36 ± 0.93 ^{cB}	6.73± 1.22 ^{dAB}	55.84 ± 1.66 ^{e}	52.78 ± 0.74 ^{f}
Quadriceps femoris muscle – Rectus femoris muscle	11.5 ± 1.5 ^{aB}	2.80 ± 0.86 ^{bBC}	4.55 ± 1.12 ^{cB}	4.38± 0.91 ^{dB}	53.61 ± 2.30	53.12 ± 2.59
Quadriceps femoris muscle – Vastus lateralis muscle	10.2 ± 1.9 ^{aB}	1.78 ± 0.55 ^{bC}	4.88 ± 1.19 ^{cB}	7.50± 1.44 ^{dA}	53.63 ± 1.10	53.07 ± 1.15
Quadriceps femoris muscle – Vastus medialis muscle	11.5 ± 0.7 ^{aB}	5.43 ± 1.74 ^{bAB}	3.58 ± 1.18 ^{cAB}	5.25± 2.18 ^{dAB}	54.11 ± 2.44	52.19 ± 3.26

^{a,bcdef,} Means in the same row with different superscripts are significantly different (P<0.05)
^{ABC} Means in the same column with different superscripts are significantly different (P<0.05)

The sensory scores for 8 different muscles located in longissimus and femoris muscles were shown in Table 2. There were significant differences in the overall sensory testing scores among 8 muscles in the same Quality grade or between two Quality grade (p>0. 05). The 8 muscles separated from the Prime grade (1^{++}) carcasses contained high intramuscular fat contents and they had relatively high sensory scores in tenderness, juiciness and flavor when compared to those from the others (1^{++}). In each main muscle group (Longissimus and Femoris) of the same Quality grade, the sensory scores were not significantly different in tenderness, juiciness and flavor by different muscle location (P<0.05).

Table 3. Sensory scores 8 muscles in Longissimus and Femoris muscles of Hanwoo beef among different muscle locations and between the Quality grades.

Muscles	Sensory panel score(Point/6Point)					
	Tenderness		Juiciness		Flavor	
	1^{++}	3	1^{++}	3	1^{++}	3
Longissimus lumborum muscle	5.64 ± 0.17 ^{aA}	3.58 ± 0.68 ^{b}	5.70 ± 0.23 ^{aA}	3.62 ± 0.69 ^{b}	5.42 ± 0.10 ^{aA}	4.16 ± 0.34 ^{b}
Longissimus thoracis muscle	5.64 ± 0.23 ^{aA}	3.67 ± 0.12 ^{b}	5.52 ± 0.20 ^{aA}	4.23 ± 0.37 ^{b}	5.32 ± 0.10 ^{aA}	4.40 ± 0.22 ^{b}
Longissimus muscle – Articular part	5.60 ± 0.34 ^{aA}	4.07 ± 0.76 ^{b}	5.68 ± 0.25 ^{aA}	4.47 ± 0.61 ^{b}	5.40 ± 0.20 ^{aA}	4.50 ± 0.36 ^{b}
Biceps femoris muscle – Rump part	5.22 ± 0.59 ^{aA}	3.32 ± 0.31 ^{b}	5.42 ± 0.28 ^{aA}	3.92 ± 0.71 ^{b}	5.02 ± 0.43 ^{aAB}	3.82 ± 0.70 ^{b}
Biceps femoris muscle – Thigh part	3.96 ± 0.15 ^{aC}	3.25 ± 0.05 ^{b}	4.72 ± 0.12 ^{aB}	3.85 ± 0.15 ^{b}	4.46 ± 0.22 ^{aB}	4.10 ± 0.10 ^{b}
Quadriceps femoris muscle – Rectus femoris muscle	4.62 ± 0.26 ^{aB}	3.76 ± 0.48 ^{b}	4.88 ± 0.35 ^{aB}	3.86 ± 0.52 ^{b}	4.74 ± 0.22 ^{aB}	4.12 ± 0.49 ^{b}
Quadriceps femoris muscle – Vastus lateralis muscle	4.24 ± 0.35 ^{aBC}	3.20 ± 0.41 ^{b}	4.80 ± 0.36 ^{aB}	4.10 ± 0.29 ^{b}	4.78 ± 0.51 ^{aB}	4.10 ± 0.29 ^{b}
Quadriceps femoris muscle – Vastus medialis muscle	4.90 ± 0.44 ^{aB}	4.03 ± 0.90 ^{b}	5.10 ± 0.33 ^{aAB}	4.43 ± 0.42 ^{b}	4.86 ± 0.34 ^{aAB}	4.17 ± 0.24 ^{b}

^{a,b} Means in the same row with different superscripts are significantly different (P<0.05)
^{ABC} Means in the same column with different superscripts are significantly different (P<0.05)

Conclusion

There were not significantly different in intramuscular fat contents, WBS and sensory scores depending upon the small muscle location in two main muscle groups (Longissimus and Femoris) of the same quality grade (p<0.05). The muscles exposed to more exercise had low intramuscular fat contents and high WBS(P<0.05). The bovine 8 muscles dissected from the Prime grade (1^{++}) had significantly higher sensory scores in tenderness, juiciness and flavor when compared to those dissected from the Standard grade(3)(P<0.05). In each main muscle group of the same Quality grade, the sensory scores were not significantly different in tenderness, juiciness and flavor by different muscle location (P<0.05).

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