

A STUDY ON THE MEAT QUALITY OF HANWOO(KOREAN NATIVE CATTLE) BEEF IN RELATION TO SEX AND KOREAN MEAT QUALITY GRADE

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Keywords : Hanwoo beef, meat quality, Korean beef grading standard, shear force

Background : The Hanwoo cattle is one of Korean native breeds. Consumption of Hanwoo beef meat is very high in Korea. Quality of meat is defined differently in different countries(Dikeman, 1993). The major quality attributes of beef are pH, color, tenderness and marbling. Many factors, such as age, sex and breed, are known to influence these factors(Ramsey *et al.*, 1963; Crouse *et al.*, 1989). Marbling score is generally used to classify beef quality grade. Higher levels of marbling have been associated with improved tenderness and with reduced variation in tenderness of cooked beef. Also, Marbling score has been shown to be related to beef palatability(Smith *et al.*, 1984). Hanwoo beef quality grades are characterized by considerable marbling, as subjectively evaluated in the longissimus muscle at 13th rib interface. Korean carcasses are graded for meat quality into one of three grades(1, 2 and 3) and carcass yield grade is classified into one of three grades(A, B and C). The overall grade of a carcasses is assigned from one of 9 classes according to its yield and quality grade(KAIA, 1991). It is very important to give the consumers in Korea accurate and reliable information on Hanwoo meat quality. However, There is very little information about the characteristics of the Hanwoo beef quality being reported.

Objective : The objective of this study was to evaluate carcass and meat quality characteristics of Hanwoo beef in relation to sex and meat quality grade.

Materials and Methods : The study were conducted with 58carcasses(30bulls and 28cows). Hanwoo cattle were slaughtered in commercial abattoir. After chilling for 24hours, The left carcass side splitted at korean grade site(between 13th rib and 1st lumbar vertebrae) to expose the dorsal muscle. Carcasses were evaluated by trained meat grade evaluators for hot carcass weight, fat thickness, lion eye area, marbling degree(1=devoid to 5=abundant marbling), lean colour, fat colour, lean firmness and carcass maturity according to the Korean beef grading standards. Samples for analyses were collected from *longissimus dorsi*(LD) muscle from the right carcass side of each carcass, 24hr postmortem(p.m.), after chilling. Selected cuts were packaged and stored at 4°C. pH, colour, total pigment and sarcomere length using a laser technique(Voyle, 1971) were measured at 24hr postmortem. CIE L, a, b was determined by Minolta chromameter. Chroma(C) and hue-angle(h) were calculated by following formulas; $C = (a^2 + b^2)^{1/2}$, $h = \tan^{-1}(b/a)$. Drip loss were taken at aging time. To measure shear force, loins were cooked in a vacuum pack by immersion in water bath held at 75°C for 30minutes. Each sample was then cooled to room temperature. Five cores were removed parallel to the muscle fiber. Each core was sheared using a Instron universal testing machine. Cooking loss were measured at 75°C. All carcass and meat quality traits data were statistically analyzed using model which contained independent variables of sex and quality grade.

Results and Discussion : Table 1 shows yield and quality grade traits evaluated from the carcasses. Hanwoo bull beef showed thinner backfat, larger rib-eye area and heavier carcass weight compared to Hanwoo cow beef($p < 0.05$), but the yield grade was not different between bulls and cows. In meat quality grading score, marbling score and maturity of cows were higher than those of bulls($p < 0.05$). Also, cows showed darker meat colour than muscle from bull carcasses. Table 2 shows physico-chemical characteristics of LD muscles in Hanwoo bull and cow beef. pH, shear force and L-value did not differ($p > 0.05$) between cows and bulls. However, the a, b, C and h-value of cow LD muscles were lower than those of bulls. Cows had lower cooking loss, higher total pigment and longer sarcomere length than bull LD muscles. The pH, colour value, sarcomere length and total pigment of the LD muscle of Hanwoo beef for each quality grade are listed in Table 3. 1st quality grade cow LD muscles had the highest ultimate the pH value(5.52). 1st quality grade bull and 3rd quality grade cow had lower pH value(5.44 and 5.42, respectively) the all other LD muscles. Within cows and bulls, there were no significant difference among the quality grade groups on L-values($p > 0.05$). 1st and 3rd quality grade cow LD muscles had longer sarcomere length(1.90 and 1.94 μ m, respectively) than other LD muscles. 1st quality grade bull LD muscles also had the shortest sarcomere length(1.64 μ m). 1st quality grade bull LD muscles had lower drip loss than other LD muscles(Fig. 1), but there were no significant difference among all meat quality grade groups. In both bull and cow, cooking loss of 1st quality grade groups were lower than those of any other quality grade groups(Fig. 2). In addition, shear force value of 3rd quality grade bull and cow LD muscles were higher than those of 1st and 2nd quality grade bull and cow(Fig. 3).

Quality Grade	pH		L-value		Cooking loss (%)		Drip loss (%)		Sarcomere length (μ m)	
	Bull	Cow	Bull	Cow	Bull	Cow	Bull	Cow	Bull	Cow
1st	5.44	5.52	1.90	1.94	1.64	1.64	1.64	1.64	1.64	1.64
2nd	5.48	5.48	1.80	1.80	1.70	1.70	1.70	1.70	1.70	1.70
3rd	5.42	5.42	1.70	1.70	1.80	1.80	1.80	1.80	1.80	1.80



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Table 1. Carcass yield and grade traits measured by Korean beef grading standard in Hanwoo bull and cow beef

Measurements	Hanwoo beef	
	Bull (n=30)	Cow (n=28)
Backfat thickness, cm	0.52 ± 0.26 ¹⁾	0.71 ± 0.35 ^a
Loin-eye area, cm ²	79.63 ± 9.45 ^a	71.54 ± 5.73 ^b
Carcass weight, kg	379.5 ± 34.3 ^a	301.6 ± 30.2 ^b
Yield grade ²⁾	1.94 ± 0.35 ^a	1.86 ± 0.52 ^a
Marbling score ³⁾	2.03 ± 1.25 ^b	3.89 ± 1.29 ^a
Meat colour ⁴⁾	3.87 ± 0.94 ^b	4.96 ± 0.84 ^a
Fat colour ⁵⁾	2.91 ± 0.73 ^a	2.96 ± 0.64 ^a
Firmness ⁶⁾	2.29 ± 0.33 ^a	2.05 ± 0.32 ^b
Maturity ⁷⁾	1.23 ± 0.13 ^b	2.44 ± 0.53 ^a
Quality grade ⁸⁾	2.50 ± 0.67 ^a	1.61 ± 0.74 ^b

- ¹⁾ Mean ± S.D. ²⁾ 1=A grade; 2=B grade; 3=C grade.
³⁾ 5=abundant; 1=devoid. ⁴⁾ 1=bright red; 7=dark red.
⁵⁾ 1=light; 7=yellowish. ⁶⁾ 1=firm; 3=soft.
⁷⁾ 1=youthful; 3=mature. ⁸⁾ 1=1st grade; 2=2nd grade; 3=3rd grade.
^{ab} Means in the same row bearing different superscripts are different (P<0.05).

Table 2. Physico-chemical characteristics of LD muscles of Hanwoo bull and cow beef at 24hr postmortem

Measurements	Hanwoo beef	
	Bull (n=30)	Cow (n=28)
pH	5.49 ± 0.07 ^a	5.50 ± 0.06 ^a
Lightness(L)	38.83 ± 1.27 ^a	38.69 ± 1.00 ^a
Redness(a)	16.74 ± 1.46 ^a	14.84 ± 1.08 ^b
Yellowness(b)	3.80 ± 0.50 ^a	3.12 ± 0.35 ^b
Chroma(C)	17.14 ± 1.48 ^a	15.14 ± 1.07 ^b
Hue-angle(h)	12.73 ± 1.37 ^a	11.91 ± 1.32 ^b
Cooking loss(%)	24.87 ± 2.80 ^a	23.31 ± 2.17 ^b
Shear force(kg)	6.80 ± 1.22 ^a	6.62 ± 1.31 ^a
Total pigment(ppm)	254.6 ± 33.6 ^b	290.8 ± 48.4 ^a
Sarcomere length(μm)	1.70 ± 0.16 ^b	1.86 ± 0.20 ^a

- ^{ab} Means in the same row bearing different superscripts are different (P<0.05).

Table 3. pH, colour value and sarcomere length of LD muscles of Hanwoo bull and cow beef in each meat quality graded by Korean beef grading standard

	Bull			Cow		
	Meat quality grade			Meat quality grade		
	1st (n=3)	2nd (n=9)	3rd (n=18)	1st (n=15)	2nd (n=9)	3rd (n=4)
pH	5.44 ± 0.05 ^d	5.49 ± 0.09 ^{ab}	5.49 ± 0.07 ^{ab}	5.52 ± 0.06 ^a	5.49 ± 0.04 ^{ab}	5.42 ± 0.02 ^b
Lightness(L)	38.72 ± 1.51 ^a	39.49 ± 1.49 ^a	38.49 ± 1.03 ^a	38.70 ± 1.17 ^a	38.55 ± 0.88 ^a	38.96 ± 0.55 ^a
Redness(a)	16.83 ± 0.53 ^a	17.22 ± 1.35 ^a	16.47 ± 1.59 ^{ab}	14.89 ± 0.86 ^c	14.64 ± 1.50 ^c	15.12 ± 0.89 ^{bc}
Yellowness(b)	3.95 ± 0.80 ^{ab}	4.02 ± 0.39 ^a	3.65 ± 0.47 ^{ab}	3.10 ± 0.24 ^{cd}	2.99 ± 0.45 ^d	3.51 ± 0.05 ^{bc}
Chroma(C)	17.15 ± 0.45 ^a	17.68 ± 1.35 ^a	16.85 ± 1.61 ^{ab}	15.15 ± 0.82 ^c	14.94 ± 1.51 ^c	15.52 ± 0.88 ^{bc}
Hue-angle(h)	13.13 ± 2.15 ^a	13.11 ± 1.24 ^a	12.47 ± 1.32 ^a	11.78 ± 1.07 ^a	11.58 ± 1.68 ^a	13.12 ± 0.61 ^a
Sarcomere length(μm)	1.64 ± 0.19 ^c	1.74 ± 0.16 ^{abc}	1.69 ± 0.21 ^{bc}	1.90 ± 0.18 ^{ab}	1.75 ± 0.13 ^{abc}	1.94 ± 0.33 ^a

- ^{abc} Values with different superscripts within a same row are significant difference (P<0.05) by Duncan's multiple range test

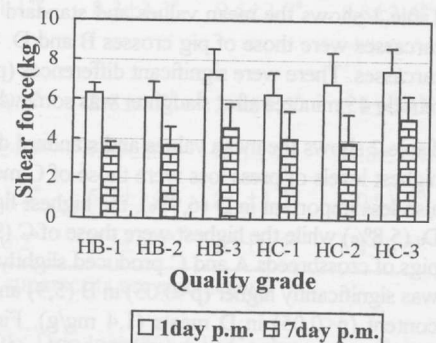
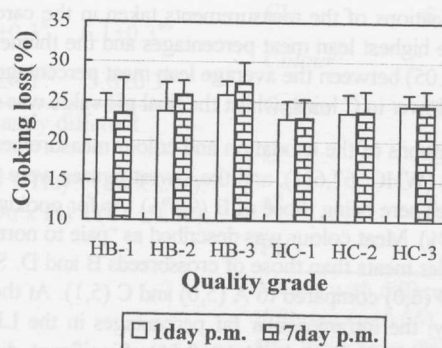
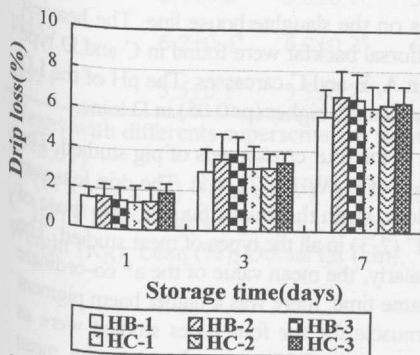


Fig. 1. Drip loss of LD muscles in Hanwoo bull and cow beef

Fig. 2. Cooking loss of LD muscles in Hanwoo bull and cow beef

Fig. 3. Shear force of LD muscles in Hanwoo bull and cow beef

- HB-1; Hanwoo bull beef, 1st meat quality grade, HB-2; Hanwoo bull beef, 2nd meat quality grade, HB-3; Hanwoo bull beef, 3rd quality grade
 HC-1; Hanwoo cow beef, 1st meat quality grade, HB-2; Hanwoo cow beef, 2nd meat quality grade, HB-3; Hanwoo cow beef, 3rd quality grade