COMPARISON OF PHYSICO-CHEMICAL AND SENSORY PROPERTIES OF HANWOO COW BEEF BY MATURITY LEVEL

Soohyun Cho[1*], Geunho Kang, Pilnam Seong, Sunmoon Kang, Kyungmi Park,

Changwan Sun[2], Kisik Yoon[2], Youngchun Kim and Beomyoung Park

[1]Animal Products Research and Development Division, National Institute of Animal Science, Suwon 441-706, Korea

[2]Korean Animal Products Evaluation, Kunpo, 424-6, Korea

Abstract – This study was performed to investigate the physic-chemical and sensory properties of striploin muscles from Hanwoo cow beef by different maturity levels. The protein contents of striploin muscles from maturity level 4 and 5 groups were significantly higher than those of maturity level 9 group ($p<0.05$). There were not significantly different in fat, moisture and collagen contents among different maturity levels ($p>0.05$). The striploin muscles from 4, 5 and 6 groups were significantly lower in Warner-Bratzler shear force (WBS), whereas water holding capacity (WHC) were significantly higher than those of maturity level 8 and 9 groups ($p<0.05$). There were no significant differences in cooking loss (%) among the maturity level groups ($p>0.05$). In color properties, *L values of striploin muscle from maturity level 4 group were significantly different from those of maturity level 9 group ($p<0.05$). Results from the sensory evaluation, the striploin muscles for maturity level 4-6 groups had significantly higher tenderness and overall-likeness scores than maturity level 9 group ($p<0.05$).**

Key Words – Hanwoo cow beef, Maturity, Meat quality, Sensory property

- INTRODUCTION

Meat quality of breeds was mostly concentrated on age, length of fattening periods and weight of animals. Total of 718,256 Hanwoo cattle were slaughtered in Korea [1]. The quality grading system in Korea is primarily determined by marbling score and additionally adjusted by other carcass traits such as meat color, fat color, texture and maturity [2]. The frequencies of > Quality grade 1 (QG 1) were 40.9% which decreased by 5.7% when compared to those in 2009 for Hanwoo cows [1]. Although the quality grade of carcasses was largely determined by marbling [3], the meat quality of cow carcasses was affected more by marbling, maturity and their interaction [4]. It is also known that beef from older cull animals was tougher [5] and higher incidence of yellow colored fat as maturity level increased [4]. Moon et al. [2] reported that mature carcasses had more yellow fat, coarser texture, a larger *longissimus* muscle area and lower quality grade and marbling scores when cows were divided by 3 maturity groups. However, there were few studies regarding the relationship of meat quality with different maturity levels for Hanwoo cows within the same quality grade groups. Therefore, the objective of this study was to investigate the physic-chemical and sensory properties of striploin from Hanwoo cow beef by different maturity levels.

- MATERIALS AND METHODS

Sample preparation :

A total of 90 striploin muscle samples were obtained from Hanwoo cow beef on the following days of the slaughter within the 1+ Quality grading animals at the Slaughtering and Processing Plant of Naju Agricultural Cooperatives in Korea (Table 1). The quality grade

(QG) has five possible values (1^{++}, 1^{+}, 1, 2, 3) and the QG is based on marbling score, lean meat color, fat color, firmness and texture of lean meat, and maturity of the exposed *longissimus dorsi (LD)* muscle at the thirteenth rib interface [6]. For this experiment, the samples were collected form QG 1+ to exclude the meat quality difference from the quality grading factors such as marbling scores. The maturity of the carcass was determined by evaluating the color, shape and ossification of the bones and cartilages (1=very young; 9 =very old)

Analytical methods :

Chemical compositions were analyzed by using methods of Association of Official Analytical Chemists [7]. Water-holding capacity (WHC) was measured by using the method of [8]. Warner Bratzler-shear force (WBS) was measured on cooked steaks (25-mm thick) according to the method described by Wheeler et al. [9]. Cooking loss was calculated as a percent for the weight changes during cooking for WBS measurement. Color values on freshly cut surface of the WBS block were measured by a chroma meter (Minolta Co. CR 301) for lightness (*L**), redness (*a**) and yellowness (*b**) of CIE after a 30-min blooming at 1□. For sensory evaluation, the beef strips (75 x 20 x 4 mm) were cooked by placing these on the tin plate equipped with a water jacket (ca. 245-255°C). The cooked strips were imme- diately served to each panelist for evaluation of tenderness, juiciness, flavor, and overall liking scores.

Statistical analysis :

Data were analyzed by using the SAS program [10] and means were separated by the Student-Newman-Keuls' test. The level of significance was $p<0.05$.

- RESULTS AND DISCUSSION

In chemical compositions, the striploin of maturity level 4 and 5 groups had significantly higher protein contents than those of maturity level 9 ($p<0.05$) (Table 2). The intramuscular fat contents of the striploin for QG 1^{+} were 14.30-15.56%. The maturity level 4 group had numerically higher intramuscular fat contents than those of the other maturity groups, but there was no significant difference among the maturity groups ($p>0.05$). There were not significantly different in moisture and collagen contents among different maturity levels ($p>0.05$). The striploin muscles from 4, 5 and 6 groups were significantly lower in Warner-Bratzler shear force (WBS), whereas water holding capacity(WHC) were significantly higher than those of maturity level 8-9 groups ($p<0.05$)(Table 3). Wulf et al. [11] reported that beef tenderness decreased as the cattle age increased Also, Hilton et al. [4] reported that meat quality especially for Warner-Bratzler shear force and tenderness were possibly affected by maturity score. However, the overall WBS values were considerably low in this experiment and it might be because they had the intramuscular fat contents >14% even for the high maturity level group. In color properties, *L** values of striploin muscle from maturity 4 group were significantly different from those of maturity 9 group ($p<0.05$) (Table 3). Meat color was a further important factor of the visual appearance of meat. However, there were not significant differences in cooking loss (%) among the maturity groups ($p>0.05$). Chambaz et al. [12] reported that lightness was inversely correlated to heme iron content and heme iron contents of muscle increases with age especially up to 24 month of age and then remains relatively stable. However, *a** and *b** values had no significant differences among these maturity groups ($p>0.05$). Results from the sensory evaluation, the striploin muscles for maturity 4-6 level groups had significantly higher tenderness and overall-likeness scores than maturity level 9 group ($p<0.05$) (Table 4).

Table 1 Distribution of analysis sample numbers for experiment (n=90)

Maturity level

	4	5	6	7	8	9
Heads of animals	15	15	15	15	15	15

Table 2 Comparison of chemical composition for striploin muscles of Hanwoo cow beef by different maturity level.

Maturity level	Moisture (%)	Protein (%)	Fat (%)	Collagen (%)
4	63.35 ±0.27	20.59 ±0.14[a]	15.56 ±0.28	1.95 ±0.08
5	63.87 ±0.27	20.72 ±0.16[a]	14.37 ±0.33	1.89 ±0.03
6	63.21 ±0.28	20.28 ±0.09[ab]	14.91 ±0.31	1.93 ±0.03
7	63.94 ±0.28	20.31 ±0.10[ab]	14.30 ±0.30	1.96 ±0.03
8	63.96 ±0.29	20.45 ±0.15[ab]	14.70 ±0.34	1.91 ±0.03
9	63.74 ±0.39	20.05 ±0.15[b]	14.73 ±0.43[a]	2.01 ±0.04

*Mean ± S.E.
[a-b]Means in the same row within the same category with different letters are significantly different ($p<0.05$).

Table 3 Comparison of Warner-Bratzler shear force(WBS), water holding capacity(WHC), cooking loss (%), and meat color for striploin muscles of Hanwoo cow beef by different maturity level

Maturity level	WHC (%)	WBS (Kg)	CL (%)	Meat color		
				*L**	*a**	*b**
4	55.99± 0.91[a]	3.14± 0.17[b]	24.32± 0.71	38.14 ±0.51[a]	20.50 ±0.36	9.81 ±0.15

5	56.97± 0.68[a]	3.37± 0.20[b]	24.75± 0.35	36.79 ±0.51[ab]	19.80 ±0.42	9.97 ±0.31
6	56.79± 0.86[a]	3.33± 0.13[b]	24.60± 0.47	36.72 ±0.55[ab]	19.08 ±0.42	9.53 ±0.31
7	55.15± 0.34[ab]	3.93± 0.09[a]	25.51± 0.29	36.47 ±0.45[ab]	19.87 ±0.38	10.21 ±0.22
8	53.08± 1.40[b]	4.19± 0.13[a]	25.55± 0.26	35.64 ±0.52[b]	19.74 ±0.33	10.00 ±0.28
9	52.67± 0.56[b]	4.13± 0.21[a]	25.89± 0.26	35.99 ±0.51[b]	19.86 ±0.36	9.97 ±0.26

Mean ± S.E.
[a-b]Means in the same column within the same category with different letters are significantly different ($p<0.05$).

Table 4 Comparison of sensory properties for striploin muscle of Hanwoo cow beef by different maturity level

Maturity level	Tenderness	Juiciness	Flavor-likeness	Overall likeness
4	73.37 ±2.04[a]	78.75 ±1.66	74.57 ±1.79	72.89 ±1.95[a]
5	73.07 ±2.04[a]	78.95 ±1.57	77.49 ±1.47	72.79 ±1.85[a]
6	73.02 ±1.87[a]	77.85 ±1.62	76.05 ±1.59	72.54 ±1.86[a]
7	69.84 ±1.69[ab]	76.67 ±1.30	75.79 ±1.21	69.42 ±1.67[ab]
8	68.93 ±1.76[ab]	75.76 ±1.41	73.92 ±1.45	69.57 ±1.53[ab]
9	65.36 ±2.00[b]	75.57 ±1.38	71.58 ±1.51	66.77 ±1.73[b]

Mean ± S.E.
[a-b]Means in the same column within the same category with different letters are significantly different ($p<0.05$).

- CONCLUSION

Overall meat quality and sensory properties decreased as the maturity level increased for Hanwoo cow beef QG 1^{+} contained 14.3-15.5% intramuscular fat contents. Therefore, the maturity level can be used as an indicator of meat quality for the marbled beef.

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