COMPARISON OF QUALITY AND FUCTIONAL TRAITS OF HANWOO STEER BEEF BY THE QUALITY GRADE

Dong-Gyun Lim[1], Cheorun Jo[2], Kyung Haeng Lee[3] and Ki-Chang Nam[4]

[1]Department of Health Administration and Food Hygiene, Jinju Health College, Jinju, South Korea

[2]Department of Animal Science and Biotechnology, Chungnam National University, Daejeon, South Korea

[3]Department of Food and Nutrition, Korea National University of Transportation, Jeungpyeong, South Korea

[4]Department of Animal Science and Technology, Sunchon National University, Suncheon, South Korea

Abstract – Effects of quality grade (QG) on quality and functional properties of M. *Longissimus dorsi* of Hanwoo (Korean native cattle) steers were investigated. A total of 250 Hanwoo carcasses were categorized into four QG groups (1++, 1+, 1, and 2). QG 1++ had the highest fat content and lightness (L*) values. Except inosine monophosphate, there was little significant difference of nucleotide compounds among QG groups. QG 2 had greater amounts of antioxidative dipeptides (anserine and carnosine) than the others. QG 1++ and QG 1+ had higher percentage of oleic acid (C18:1) and total unsaturated fatty acids than the QG 2. The amounts of conjugated linoleic acids were not significantly different by QG. High QG (1++ and 1+) groups were highly ranked in the sensory evaluation. It is concluded that QG affected mainly the eating quality of Hanwoo beef rather than the health-related functional compounds.

Key Words – Eating quality, Health-related compounds, Quality grade

- INTRODUCTION

Marbling is a prime theme in Korean beef industry, as consumers judge meat quality on the basis of the content of intramuscular fat and they are willing to pay premium for highly marbled product [1]. The beef quality grade in Korea has five possible values (1++, 1+, 1, 2, and 3), which is primarily determined by the marbling score [2]. It has been reported that the quality grade of Hanwoo can be improved by extending the feeding period [3], which results in the increase of beef price. Although consumer preferred beef with high quality grade, there is little information on the detailed meat quality, functional traits, and micro compounds. The objective of this study was to investigate the effect of quality grade on the physicochemical, functional, and sensory traits of M. *Longissimus dorsi* of Hanwoo steers with different quality grades.

- MATERIALS AND METHODS

A total of 250 Hanwoo steers (27-30 months old) were categorized into four quality grade (QG) groups: QG 1++ (n=35), QG 1+ (n=53), QG 1 (n=120), and QG 2 (n=42), according to the Korean carcass grading procedure [4]. After *Longissimus dorsi* (LD) muscles between the 9th-13th ribs were removed and aged at 4°C for 7 days, the LD muscles were trimmed of all subcutaneous and intermuscular fat and visible connective tissue. The proximate composition, pH, water-holding capacity, drip loss, and cooking loss of each LD muscle were determined. CIE color values on the surface of samples and maximum shear force were measured. After extracting lipids from meat samples, fatty acid and cholesterol contents were determined by the methods of Jung [5]. Free amino acid composition was analyzed using the method described by Hughes [6] with modification. Dipeptide and nucleotide contents of the meat samples were determined according to the methods of Mora [7] and Jung [8], respectively. During the sensory evaluation, 8 panelists recorded their preferences for cooked Hanwoo beef using a 9-point hedonic scale.

- RESULTS AND DISCUSSION

Moisture and protein contents significantly decreased with increasing QG from 2 to 1++, while fat content was increased ($p<0.05$), which is understandable because the most predominating parameter to determine the QG is intramuscular fat content (marbling) in Korean beef carcass grade system [3]. Cholesterol for LD muscles did not differ among the four quality grade groups.

Drip loss of high QG group (1++) was significantly lower than that of low group (QG 2) ($p<0.05$) and similar findings were obtained by [9]. It was reported that cooking loss of Japanese black steer meat was significantly lower for samples with the highest marbling score [10]. Shear force values among the QG groups did not significantly differ.

Table 1 Composition, physicochemical traits, and micro-compounds of Hanwoo beef with different QG

QG	1++	1+	1	2	SEM[e]
Moisture[1]	55.79[d]	62.06[c]	64.84[b]	70.92[a]	0.31
Fat[1]	24.25[a]	17.44[b]	14.05[c]	7.09[d]	0.32
Cholesterol[2]	61.67	60.88	60.33	61.45	0.37
Drip loss[1]	17.92[b]	18.00[b]	18.60[ab]	19.22[a]	0.16
Cooking loss	21.28[ab]	22.33[a]	21.46[ab]	20.34[b]	0.19
L* value	40.70[a]	39.84[ab]	39.05[b]	37.46[c]	0.18
IMP[2]	90.3[bc]	82.5[c]	121.1[a]	106.7[ab]	3.24
Histidine[2]	95.1[b]	101.9[b]	102.4[b]	125.0[a]	2.43
Anserine[2]	107.1[b]	114.9[ab]	120.6[ab]	137.8[a]	3.44
Carnosine[2]	706.8[ab]	706.8[ab]	675.0[b]	751.6[a]	8.97
Oleic acid[1]	44.59[a]	44.58[a]	43.39[ab]	42.77[b]	0.20

[1] Standard error of means
[2] Unit: %; [3] Unit: mg/100g
[a-d] Means with different superscript within the same row differ significantly ($P<0.05$)

Among analyzed nucleotide-related compounds, inosine monophosphate (IMP) were more detected in QG 1 compared with the other groups ($p<0.05$). IMP is generally considered as the major nucleotide in muscle that imparts flavor to the meat [11]. In case of free amino acids, QG

2 had more alanine, arginine, histidine, proline, and threonine than the other groups ($p<0.05$), which can be attributed to the high content of protein in QG 2. For analyzed dipeptides, QG 2 had more anserine and carnosine content than the others ($p<0.05$). Dipeptides including carnosine, anserine, and creatine are considered as functional/bioactive components in meat because they can provide health benefits, including prevention and treatment of a disease [12].

For the composition of fatty acids, Oleic acid (C18:1) was the predominant fatty acid found followed by palmitic (C16:0) acid. QG 2 had more C15:0, C17:0, C17:1, C20:3, C20:4, and C24:1 than the others ($p<0.05$). Oleic acid (C18:1) makes up the largest proportion of the monounsaturated fatty acid (MUFA) in Hanwoo beef. QG 1++ and 1+ had higher percentage of oleic acid (C18:1) and unsaturated fatty acid (UFA) contents than QG 2 ($p<0.05$). Similar findings were obtained by [13] who found out UFA were higher in loin of 1++ quality grade.

Marbling often has been regarded as a contributing factor to beef palatability and is used as the most important factor in evaluating the beef quality. According to the sensory evaluation, flavor attribute did not differ significantly among the four groups. QG 1++ and 1+ had higher scores of tenderness, juiciness and acceptance than the others ($p<0.05$). Many authors have proven tenderness and juiciness are positively related to intramuscular fat content [14].

- CONCLUSION

There were only a few different traits among QG in terms of functional compounds such as nucleic acids, amino acids, and dipeptides, although there were remarkable differences of Hanwoo LD muscles in fat content and preference. The results of this study will give information on the objective comparison of the quality and functional compositions depending on the beef QG.

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