# COMPARISON OF YIELD AND FLAVOR-RELATED COMPOUNDS OF HANWOO LOIN FROM DIFFERENT SEX AND AGING METHODS

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**Abstract – The objective of current study was to compare edible yield, flavor-related compounds, and sensory quality of aged Hanwoo loin by different sex and aging methods. Hanwoo loin from cow (average 48 mon) and steer (average 28 mon) aged with dry- or wet-aging method for 28 days. Then, we analyzed aging and trimming losses, shear force, flavor-related compounds, and sensory evaluation. Aging and trimming losses showed no difference by sex in each aging group and dry-aged group resulted in much higher losses ($p<0.05$). Shear force, inosine monophosphate (IMP), glutamic acid, and aspartic acid had no noticeable changes with different sex or aging. In sensory evaluation, steer had higher tenderness than cow in dry-aged group, however, juiciness, flavor, and overall acceptance did not show difference between cow and steer by aging methods. From the results, Hanwoo loin from cow, which was much older age than steer, can be value-added using proper aging process.**

**Key Words – Aging method, Age, Korean native cattle**

## I. INTRODUCTION

Hanwoo, Korean native cattle, is the most popular beef cattle in Korea as consumers prefer the flavor of Hanwoo beef to others [1]. The market portion of Hanwoo composed of cow (45.04%), steer (34.53%), and bull (22.46%) [1]. In general, steer has better intramuscular fat, texture, fat- and meat-color, and fatty acid composition [2]. Cho *et al*. [3] reported that chemical composition and meat quality of cow beef are varied by age. Compared to steer (consumed around 30 month old), it is recommended to slaughter cow less than 5-year-old age [3]. As age and sex are the most important intrinsic factors determining meat quality attributes [4], cow with older age may have inferior quality characteristics to steer in the market.

Fresh beef are occasionally aged to improve its flavor and tenderness [5, 6] and dry- and wet-aging are the most common for postmortem aging. Meat should be vacuum-packed for wet-aging at refrigerated temperature while dry-aging is directly exposed to outside without packaging and control of air flow, temperature, and humidity are critical points to determine dry-aging effect. Dry-aging of beef provides unique and concentrated flavors with beefy and brown/roasted, which leads to consumers' overall acceptance [7]. Lee *et al*. [8] reported that dry-aged beef loin increased protein components and improved sensory quality.

However, there are limited studies available in Hanwoo beef with different aging methods, especially for cow with old age. Therefore, the objective of this study was to compare yield, flavor-related compounds, and sensory quality of Hanwoo loin by different sex and aging methods.

## II. MATERIALS AND METHODS

*Sample preparation*

Cows (average 48 month) and steers (average 28 month) were slaughtered and graded in a local slaughter house. Each 8 loins (oval shape, 25×15 cm) from cows and steers graded as 'quality grade 2' was obtained after 2 days postmortem. The samples were aged for 28 days with different aging methods: dry-aging (air velocity, 2~7 m/sec; temperature, 1±1°C; humidity, 85±10%) and wet-aging (temperature, 2±1°C). A half of the samples were packed in an oxygen-impermeable nylon

bags (2 mL $O_2/m^2$/24 h at 0°C, 0.09 mm thickness; Sunkyung Co. Ltd., Seoul, Korea) for wet-aging.

*Aging and trimming losses*

Aging and trimming losses were determined as the percentage weight loss of each sample after aging or trimming (removing the non-edible surface). Fat contents were excluded before/after aging for more accurate calculation of the losses with lean meat.

$$\text{Aging loss (\%)} = \frac{\textit{Weight before aging} - \textit{Weight after aging}}{\textit{Weight before aging}} \times 100$$

$$\text{Trimming loss (\%)} = \frac{\textit{Weight before trimming} - \textit{Weight after trimming}}{\textit{Weight before trimming}} \times 100$$

*Shear force*

Meat samples (30 g) were vacuum-packed, heated in a water-bath until a core temperature of 72°C was reached, and cooled in iced water. Cooked sample was cut into a 10 × 10 × 30 mm to measure shear force. The value was measured according to Lee *et al.* [9]

*Flavor-related compounds.*

Inosine 5'-monophosphate (IMP), aspartic acid, and glutamic acid were analyzed as flavor-related compounds according to Jayasena *et al*. [10].

*Sensory evaluation*

The sensorial quality was evaluated by 11-member panelist. Each sample was cut into a similar size pieces and served. The scoring of each sample was done on a single sheet using a 7-point hedonic scale (1 = extremely dislike, 7 = extremely like). The sensory parameters scored were juiciness, tenderness, flavor, and overall acceptance.

*Statistical analysis*

Statistical analysis was performed by one-way analysis of variance. When significant differences were detected, the differences among the mean values were determined by the Student-Newman-Keul's multiple comparison test at a confidence level of $p<0.05$.

## III. RESULTS AND DISCUSSION

Aging and trimming losses showed no difference by sex and different aging methods (Table 1). Dry-aged groups resulted in much more aging and trimming losses than those in wet-aged groups ($p<0.05$) due to water evaporation which could be occurred during aging period. High amount of water loss is one of the characteristics of dry-aged meat [2]. High trimming loss of dry-aged group was found as the results of removing non-edible hard surface after aging, however, no difference was detected between cow and steer. Shear force was not different by both sex and aging methods.

Table 1. Aging and trimming loss and shear force of Hanwoo loin with different sex and aging methods after 28 days of aging period

| Item[1] | Method | Sex | | SEM[2] |
|---|---|---|---|---|
| | | Cow | Steer | |
| AL | Dry | 33.53[a] | 37.81[a] | 1.718 |
| | Wet | 1.40[b] | 1.89[b] | 1.870 |
| | SEM[3] | 1.173 | 1.447 | |
| TL | Dry | 19.54[a] | 20.10[a] | 1.870 |
| | Wet | 0.20[b] | 0.26[b] | 0.095 |
| | SEM[4] | 1.545 | 1.093 | |
| SF | Dry | 3.80 | 2.84 | 0.328 |
| | Wet | 3.83 | 2.51 | 0.443 |
| | SEM[5] | 0.475 | 0.158 | |

[1]AL = aging loss (%), TL = trimming loss (%), SF = Shear force (kg).
[2]Standard error of the mean (n=8), [3](n=8), [4](n=8), [5](n=8).
[a-b]Values with different superscripts within the same sex was significantly different ($p<0.05$).

Representative flavor-related compounds of beef including IMP, aspartic acid, and glutamic acid were determined (Table 2). IMP, aspartic acid, and glutamic acid were not different by both aging- and different aging-methods.

Table 2. The flavor-related compounds of Hanwoo loin different sex and aging methods after 28 days of aging period

| Item[1] | Method | Sex | | SEM[2] |
|---|---|---|---|---|
| | | Cow | Steer | |
| IMP | Dry | 67.67 | 75.58 | 6.853 |
| | Wet | 58.67 | 58.97 | 7.719 |

| | | | | |
|---|---|---|---|---|
| | SEM[3] | 6.187 | 8.574 | |
| | Dry | 2.74 | 3.29 | 0.359 |
| Asp | Wet | 3.64 | 5.22 | 0.921 |
| | SEM[4] | 0.314 | 0.957 | |
| | Dry | 18.25 | 25.60 | 3.450 |
| Glu | Wet | 21.88 | 37.30 | 9.25 |
| | SEM[5] | 2.405 | 9.952 | |

[1]IMP = inosine mono phosphate (mg/100 g), Asp = aspartic acid (mg/100 g), Glu = glutamic acid (mg/100 g).
[2]Standard error of the mean (n=8), [3](n=8), [4](n=8), [5](n=8).

Juiciness, flavor, and preference of beef loin were not different by sex and aging-methods (Table 3). However, Hanwoo loin from steer scored higher tenderness than cow in dry-aged group. Dry-aged steer showed the highest score for all sensory parameters even though there was no significance except for tenderness.

Table 3. The sensory evaluation of Hanwoo loin with different sex and aging methods after 28 days of aging period

| Item[1] | Method | Sex | | SEM[2] |
|---|---|---|---|---|
| | | Cow | Steer | |
| | Dry | 3.76 | 4.28 | 0.223 |
| Jiuciness | Wet | 4.14 | 4.08 | 0.214 |
| | SEM[3] | 0.220 | 0.206 | |
| | Dry | 4.04[y] | 4.64[x] | 0.177 |
| Tender | Wet | 4.25 | 4.44 | 0.233 |
| | SEM[4] | 0.269 | 0.185 | |
| | Dry | 4.10 | 4.20 | 0.215 |
| Flavor | Wet | 3.94 | 4.06 | 0.157 |
| | SEM[5] | 0.172 | 0.196 | |
| | Dry | 3.95 | 4.15 | 0.211 |
| OA | Wet | 4.00 | 4.06 | 0.174 |
| | SEM[6] | 0.180 | 0.199 | |

[1]Tender = tenderness, OA = overall acceptance.
[2]Standard error of the mean (n=8), [3](n=8), [4](n=8), [5](n=8).
[x,y]Values with different superscripts within the same aging method was significantly different ($p<0.05$).

## IV. CONCLUSION

Sex did not cause noticeable difference in Hanwoo loin regardless aging methods. The present study is meaningful to see the possibility of using cow with older age as a value-added beef by aging process, especially dry-aging, without any inferior quality compared with steer. In-depth studies in optimum condition of dry-aging for cow will be beneficial for industry.

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## REFERENCES

1. Cho, S. H., Kim, J., Park, B. Y., Seong, P. N., Kang, G. H., Kim, J, H., Jung, S. G., Im, S. G., & Kim, D. H. (2010). Assessment of meat quality properties and development of a palatability prediction model for Korean Hanwoo steer beef. Meat Science 86: 236-242.
2. Lee, J. M., Choi, J. H., Oh, M. H., Kim, Y. S., Cheon, D. W., Seo, S. C., Hwang, K. S., & Jang, A (2010). Effect of sex on quality grade factors, physiochemical and sensory traits of longissimus dorsi in Hanwoo. Korean Journal for Food Science of Animal Resources 30(2): 321-327.
3. Cho, S, H., Seong, P., Kang, G., Choi, S., Chang, S., Kang, S. M., Park, K. M., Kim, Y., Hong, S., & Park, B. Y. (2012). Effect of age on chemical composition and meat quality for loin and top round of Hanwoo cow beef. Korean Journal for Food Science of Animal Resources 32(6): 810-819.
4. Dashdorj, D., Amna, T., & Hwang, I. (2015). Influence of specific taste-active components on meat flavor as affected by intrinsic and extrinsic factors: an overview. European Food Research and Technology 241(2): 157-171.
5. Campbell, R. E., Hunt, M. C., Levis, P., & Chambers, E. (2001). Dry-Aging Effects on Palatability of Beef Longissimus Muscle. Journal of Food Science 66(2):196-199.
6. Smith, R. D., Nicholson, K. L., Nicholson, J. D. W., Harris, K. B., Miller, R. K., Griffin, D. B., & Savell, J. W. (2008). Dry versus wet aging of beef: Retail cutting yields and consumer palatability evaluations of steaks from US Choice and US Select short loins. Meat science 79(4): 631-639.
7. Khan, M. I.., Jung, S., Nam, K. C., & Jo, C. (2016) Postmortem aging of beef with a special refrence to the dry aging. Korean Journal for Food Science of Animal Resources 36(2):160-170.
8. Lee, C. W., Lee, S. H., Min, Y., Lee, S. Jo, C., & Jung, S. (2015). Quality improvement of strip loin from Hanwoo with low quality grade by dry Aging. Korean Journal of Food and Nutrition 28(3): 415-421.
9. Lee, H. J., Jayasena, D. D., Kim, S. H., Kim, H. J., Heo, K. N., Song, J. E., & Jo, C. (2015). Comparison of bioactive compounds and quality traits of breast meat from Korean native ducks and

commercial ducks. Korean Journal for Food Science of Animal Resources *35*(1): 114-120.
10. Jayasena, D. D., Nam, K. C., Kim, J. J., Ahn, H., & Jo, C. (2015). Association of carcass weight with quality and functional properties of beef from Hanwoo steers. Animal Production Science 55(5): 680-690.