PHYSICOCHEMICAL PROPERTY AND SENSORY EVALUATION OF DRY-AGED BEEF FROM HANWOO COW WITH DIFFERNET CUTS AND AGING METHODS

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Abstract – The objective of this study was to analyze physicochemical property and sensory evaluation of dry-aged beef from Hanwoo cow with different cuts and aging methods. Different aging methods [professional dry-aging (PD), simplified dry-aging (SD), simplified dry-aging with a bag (SDB)] were applied for butt, loin, and rump of Hanwoo cow beef (approximately 48-month-old and quality grade 2) and analysis of aging and trimming losses, total aerobic bacteria, and sensory evaluation were carried out. There are no significant differences in aging and trimming losses of butt compared to those of loin in all types of aging group. SD group tended to produce the highest aging loss than those from PD and SDB group, however, using the bag alleviated the differences between butt and loin. No noticeable microbial contamination was counted with different cuts and aging methods ($p<0.05$). Sensory property of butt and loin had significantly higher score than rump in PD and SD group and no significant differences were found with different aging methods. Considering the results of this study, butt of Hanwoo cow beef seems to have a potential in simplified dry-aging with/without a bag for small-scale business owners.

Key Words – Butt, loin, and rump, Korean native cattle, Simplified dry-aging

I. INTRODUCTION

Postmortem aging is a main cause controlling eating quality attributes, which are categorized as tenderness, flavor, and juiciness of meat [1]. During postmortem aging, tenderness is improved with the various proteolytic enzymes, such as calpains, lysosomal cathepsins, and proteasomes, and the others [2]. Reducing sugar, free amino acids, free fatty acids, and nucleotide compounds are representative flavor precursors which develop flavor formation of meat during aging and the Maillard reaction [3].

There are 2 types of aging methods, wet- and dry-aging, and wet-aging by vacuum-packaging is prevailing as it is convenient and causes low aging loss, maintaining advantages of aging. However, as consumers' preference varies with increased interest in the meat quality attributes, traditional dry-aging has been resurfaced. Dry-aging suggests unpackaged and exposed meat in controlled condition, especially, air, humidity, and temperature. It causes unique flavor, however, it is costly due to high loss of water, resulting in low yield. And further, its concern on microbial contamination is high as meat is directly exposed to outside. Therefore, to minimize the disadvantages, a dry-aging bag is recently applied. However, dry-aging is still difficult to apply for small-scale business owners because of facilities and technical limitations.

Hanwoo, Korean native cattle, is the most preferred beef cattle to Korean consumers. Its tenderness and flavor are outstanding due to high marbling [5]. However, as a pattern of meat consumption in Korea is more focused on grilling and roasting, cuts with low fat contents, like butt and rump, are not preferred. In addition, as Hanwoo cow is usually slaughtered at older age than steer, tenderness is a major concern of Hanwoo cow beef [6]. In this circumstance, aging, especially dry-aging, would be one of the solutions which overcome the limitations of less-preferred Hanwoo cow.

Therefore, the objective of this study was to analyze physicochemical property and sensory evaluation of dry-aged beef from Hanwoo cow with different cuts and aging methods.

II. MATERIALS AND METHODS

Sample preparation

A total 48 Hanwoo cows were slaughtered at approximately 48-month-old and graded as quality grade 2 based on the Korean carcass grading system [7]. For the experiment, butt, loin, and rump were collected after 2 days. The samples were transferred in an iced condition (4°C) to Korea Institute for Animal Products Quality Evaluation (Sejong, Korea) and dry-aged for 28 days with different aging methods: 1) professional dry-aging (PD; air, 2~7 m/sec; temperature, 1 ± 1°C; humidity, 85 ± 10%) in a specialized facilities, 2) simplified dry-aging (SD) in an ordinary refrigerator with a built-in temperature and humidity controller (temperature, 2 ± 1°C; humidity, 75 ± 10%), and 3) simplified dry-aging with a highly water vapor permeable bag (SDB, Drybagsteak LLC, Minneapolis, MN, USA) at the same condition as SD group. SDB group was vacuum-packed to attach the bag onto the surface.

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.

Total aerobic bacteria

The samples (5 g) were blended with sterile saline (45 mL, 0.85% NaCl) for 2 min using the Stomacher BagMixer® 400 (Interscience Co., St Nom, France) and then serially diluted in sterile saline. Each diluent (100 μL) was spread on the tryptic soy agar (Difco Laboratories, Detroit, MI, USA) and the agar plates were incubated at 37 °C for 48 h. The microbial counts were expressed as log CFU/g.

Sensory evaluation

Each sample was cut into pieces in the same size ($20 \times 40 \times 7$ mm), cooked until the internal temperature was reached 72°C, and served to the sensory panel. 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

There is no significant difference in aging loss of butt compared to that of loin in all types of aging group (Table 1). Aging loss of rump was lower than the other cuts in PD group ($p<0.05$), and further, it also resulted in significant lower aging loss than loin in SDB group whereas there no differences in SD group. Different dry-aging methods caused different aging loss in all cuts. SD group tended to produce the highest aging loss than those from PD and SDB groups, however, using the bag alleviated the differences in butt and loin. On the one hand, the differences in aging loss of different cuts could be affected with moisture contents of the samples. Remaining moisture contents in PD group were 65.29%, 63.81%, and 69.99% for butt, loin, and rump, respectively, while 65.72% of butt, 62.17% of loin, and 68.72% of rump in SDB group was reported (data not shown). SD group did not show significant difference in moisture contents between different cuts (data not shown). On the other hand, lower reduction of aging loss with different dry-aging methods may be due to facilities and technical limitations. Furthermore, rump caused less trimming loss in PD group ($p < 0.05$) whereas trimming loss was not changed with different cuts in all type of dry-aging (Table 1).

Total aerobic bacteria

Even though total aerobic bacteria is a major concern for dry-aging [8], no significance was detected between different dry-aging methods (Table 1). In addition, our results suggest no noticeable microbial contamination with different cuts ($p<0.05$). However, more than 28 days of dry-aging should be in caution as microbial population was almost researched at approximately 7 log CFU/g.

Sensory evaluation

Sensory property of butt and loin had significantly higher score than rump in PD and SD groups whereas only tenderness resulted in a similar tendency in SDB group (Table 2).

Table 1. Aging, trimming losses, and number of total aerobic bacteria of dry-aged beef from Hanwoo cow with different cuts and aging methods after 28 days

	Aging[1]	Cuts			SEM[2]
		Butt	Loin	Rump	
Aging loss (%)	PD	32.76^{ay}	33.53^{ay}	26.38^{by}	1.788
	SD	40.25^{abx}	47.20^{ax}	37.38^{bx}	2.634
	SDB	35.90^{xy}	36.69^{y}	36.19^{x}	1.457
	SEM[3]	1.593	1.829	1.736	
Trimming loss (%)	PD	15.57	19.54^{y}	13.70^{y}	1.883
	SD	18.53	26.31^{x}	19.29^{x}	2.741
	SDB	18.21	18.16^{y}	19.97^{x}	1.518
	SEM[3]	1.759	2.088	1.489	
Total aerobic bacteria (log CFU/g)	PD	6.81	6.58	6.66	0.285
	SD	6.68	6.18	7.38	0.354
	SDB	7.02	7.01	7.16	0.233
	SEM[3]	0.366	0.307	0.332	

[1]PD, professional dry-aging in a specialized facilities; SD, simplified dry-aging in an ordinary refrigerator; SDB, simplified dry-aging with a highly water vapor permeable bag.
[2]Standard error of the means (n=12), [3](n=9).
[a,b]The means with different superscripts within the same row were significantly different ($p<0.05$).
[x,y]The means with different superscripts within the same column were differ significantly ($p<0.05$).

Higher tenderness of butt and loin is possibly due to higher amounts of remaining fat contents after aging and trimming. Butt and loin had significantly higher fat contents than rump mostly in all type of dry-aging (data not shown). No significant differences of all sensory parameters were found with different aging methods, meaning that SD and SDB groups can provide similar sensory property to PD group.

IV. CONCLUSION

Considering the results of this study, butt seems to have a potential compared to rump. Dry-aging has shown a new possibility to improve non-preferred cuts of Hanwoo and simplified dry-aging with/without a bag for small-scale business owners. However, a future study on exogenous and endogenous control of simplified dry-aging and its change before/after aging should be preceded in advance.

Table 2. The sensory evaluation of dry-aged beef from Hanwoo cow with different cuts and aging methods after 28 days

	Aging[1]	Cuts			SEM[2]
		Butt	Loin	Rump	
Juiciness	PD	4.19^{a}	3.76^{a}	2.78^{b}	0.258
	SD	4.18^{a}	4.61^{a}	2.94^{b}	0.285
	SDB	3.81	3.99	3.29	0.320
	SEM[3]	0.285	0.228	0.307	
Tenderness	PD	4.22^{a}	4.03^{ay}	3.13^{b}	0.202
	SD	4.43^{a}	4.99^{ax}	3.45^{b}	0.224
	SDB	4.24^{a}	4.66^{axy}	3.54^{b}	0.231
	SEM[3]	0.216	0.217	0.249	
Flavor	PD	4.04^{a}	4.10^{a}	3.04^{b}	0.179
	SD	4.13^{a}	4.53^{a}	3.37^{b}	0.181
	SDB	3.84	4.20	3.61	0.195
	SEM[3]	0.227	0.180	0.178	
Overall acceptance	PD	3.97^{a}	3.95^{a}	3.02^{b}	0.216
	SD	4.01^{a}	4.66^{a}	3.15^{b}	0.193
	SDB	3.80^{ab}	4.27^{a}	3.24^{b}	0.249
	SEM[3]	0.216	0.249	0.193	

[1]PD, professional dry-aging in a specialized facilities; SD, simplified dry-aging in an ordinary refrigerator; SDB, simplified dry-aging with a highly water vapor permeable bag.
[2]Standard error of the means (n=12), [3](n=9).
[a,b]The means with different superscripts within the same row were significantly different ($p<0.05$).
[x,y]The means with different superscripts within the same column were differ significantly ($p<0.05$).

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