THE ROLE OF MOISTURE EVAPORATION ON FLAVOR PRECURSORS AND TASTE OF DRY-AGED BEEF

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I. INTRODUCTION

Dry aging is one of the aging methods, which exposes raw meat to controlled conditions (temperature, RH, and air flow) to improve its tenderness, flavor, and juiciness [1]. It is a traditional aging method used prior to the introduction of vacuum packaging. However, the low efficiency in processing and loss in salable yield resulted in decreased market value of dry-aged beef since 1980's [2]. In recent years, the demand for dry-aged beef has been increasing with a premium value owing to its characteristic flavor (beefy and roasted). This may be attributed to the concentrated flavor precursors by moisture evaporation during dry aging process [3]. However, there is little scientific evidence published for this hypothesis. Therefore, we investigated the effect of moisture content on flavor precursors and taste of dry-aged beef to determine the role of moisture evaporation on flavor of dry-aged beef.

II. MATERIALS AND METHODS

A total of thirty sirloins (*Longissimus lumborum*, Holstein steer) were aged either dry for 0, 7, 14, 21, 28 days (temperature, 4°C; relative humidity , 75%; air velocity, 2.5 m/s) or wet (temperature, 4°C; relative humidity, 75); n=3 for each aging days. After aging process, crust of dry-aged beef was trimmed off and both dry- and wet-aged beef were analyzed for moisture content and water-soluble flavor precursors [free amino acid (FAA) and reducing sugar], based on the methods from Lee *et al*. [1]. Pattern discrimination index of dry- and wet-aged beef was determined using an electronic tongue (Astree, Alpha MOS, Toulouse, France). For statistical analysis, the general linear model was performed using SAS 9.4 (SAS Institute Inc., Cary, NC, USA) on the basis of the Tukey's multiple comparison test at a level of $P<0.05$.

III. RESULTS AND DISCUSSION

Moisture content of dry-aged beef was lower than that of wet-aged beef after 28 days of aging process ($P<0.05$, Figure 1).

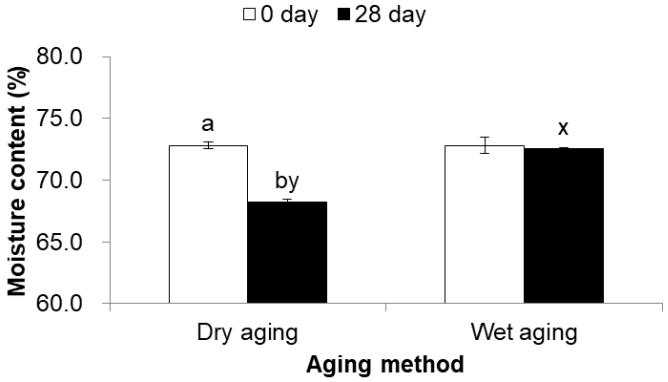

Figure 1. Moisture content (%) of dry- and wet-aged beef before/after 28 days of aging (mean±standard deviation). [a,b]Different letter indicates significant difference within the same aging method ($P<0.05$). [x,y]Different letter indicates significant difference within the same aging days ($P<0.05$).

Different pattern of changes in water-soluble flavor precursors were observed between dry- and wet-aged beef during 28 days of aging (Table 1). After aging process, both FAA and reducing sugar contents were significantly higher in dry-aged beef compared to that in wet-aged one as dry aging continually increased their contents (P<0.05), whereas wet aging decreased from day 21 to 28. From that, we found a stronger correlation between moisture content and the amounts of water-soluble flavor precursors in dry-aged beef (-0.9 for FAA and reducing sugar) than that in wet-aged beef (-0.5 and -0.8 for FAA and reducing sugar, respectively) (data not shown), meaning that moisture evaporation could concentrate water-soluble flavor precursors in dry-aged beef.

Table 1. Water-soluble flavor precursors of dry- and wet-aged beef with different aging days

Traits	Method	Aging days					SEM[1]
		0	7	14	21	28	
Free amino acids (mg/100 g)	Dry	86.23^{e}	197.39^{d}	231.44^{c}	331.64^{bx}	373.44^{ax}	4.258
	Wet	86.23^{e}	191.54^{d}	224.68^{c}	294.59^{ay}	275.62^{by}	3.327
	SEM[2]	0.172	3.327	4.210	5.942	5.758	
Reducing sugar (mM)	Dry	9.05^{d}	10.84^{cy}	11.71^{bc}	12.91^{ab}	14.37^{ax}	0.328
	Wet	9.05^{b}	13.22^{ax}	11.80^{a}	13.06^{a}	10.16^{by}	0.330
	SEM[2]	0.340	0.412	0.216	0.451	0.063	

[1]Standard error of means (n= 15), [2](n=6).
$^{a-d}$Means within the same row with different superscript differ significantly (P<0.05).
^{x,y}Means within the same column with different superscript differ significantly (P<0.05).

However, moisture evaporation may not fully explain taste properties of dry- and wet-aged beef. We analyzed taste properties of dry- and wet-aged beef and found that they were fully discriminable from day 14 (> 73.17%, data not shown), when moisture content of dry-aged beef was not significantly lower than that of wet-aged beef. Therefore, there could be other factors affecting flavor of dry-aged beef although moisture content had a significant correlation to the concentration of water-soluble flavor precursors in dry-aged beef.

IV. CONCLUSION

The characteristic flavor of dry-aged beef is attributed to moisture evaporation during dry aging process by concentrating water-soluble flavor precursors. However, there should be other factors affecting flavor development of dry-aged beef as the difference in moisture content could not explain all differences in flavor of dry-aged beef.

ACKNOWLEDGEMENTS

This study was supported by “High Value-added Food Technology Development Program (Project No. 316048),” Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry and Fisheries

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