MOISTURE ABSORBERS AND MECHANICAL TENDERIZATION FOR AGED BEEF PRODUCTION

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I. INTRODUCTION

During post-mortem storage, several biochemical changes occur in the skeletal muscle due to the complex system of enzymes involved in proteolysis. These changes not only improve tenderness but can also contribute to the formation and concentration of flavor compounds (Dransfield, 1993). The most common method for achieving concentration is through dry aging, which involves water evaporation loss. However, the formation of a dry crust on the surface of the meat leads to its removal and subsequent yield losses for producers (Dashdorj et al., 2016). To address this issue, the development of an aging system that allows for dehydration and concentration of flavor compounds without the crust formation could be a game-changer for the industry. This experiment tested two techniques to achieve this: mechanical tenderization, which creates channels in the meat for better water escape during aging, and the use of moisture absorbers (meat pads) that come into contact with the meat and trap the water removed.

II. MATERIALS AND METHODS

The study used forty-eight striploins of Nellore bulls, Longissimus thoracis et lumborum muscle (10th thoracic vertebrae to 6th lumbar vertebrae), which were randomly assigned to one of four treatments: Dry-aged (Dry), Wet-aged (Wet), Wet-aged with moisture absorbers (Wet+Abs), and Mechanical Tenderized meat wet-aged with moisture absorbers (Wet+Abs+Mt). The vacuum packaging used was Sealed Air Corporation's Cryovac® BB6050 from the USA, and moisture absorbers were from McAirlaid's in Germany (M6175S). Tenderization was performed using a Jaccard manual tenderizer with 32 blades of 2 mm thickness. Aging was carried out for 28 days in a chamber that maintained a regulated temperature of 2°C, 55% relative humidity, and 2.5 m/s air velocity. After aging, yield indicators were evaluated, and pH, moisture content, and water activity were measured on the surface (crust) and inner region of the samples. The aged samples were then analyzed for instrumental tenderness by shear force. The data were analyzed using Statistica 7.0 software by One Way Analysis of Variance. The averages were compared by Tukey's test with a significance level of 5%.

III. RESULTS AND DISCUSSION

Dry-aged samples had significantly higher weight loss values ($P<0.05$) due to evaporation/purge compared to the vacuum-packed samples (Table 1). Among the vacuum-aged samples, those treated with moisture absorbers showed higher ($P<0.05$) values of liquid loss, while the tenderized samples showed a tendency ($P<0.12$) towards greater dehydration compared to the non-tenderized samples. During cooking, the vacuum-aged samples exhibited higher ($P<0.05$) weight loss values compared to the other treatments, which did not differ from each other ($P>0.05$). The type of aging did not have effect on shear force values ($P>0.05$).

As shown in Table 2, the pH and water activity values of the dry-aged meat surface samples were significantly lower ($P<0.05$) than the other treatments, and were also lower ($P<0.05$) than the inner region samples. In the other treatments, there was no significant difference ($P>0.05$) in the pH value and water activity between the surface and inner regions.

The moisture contents, evaluated on the surface or in the inner region of the samples, were lower (P<0.05) in the dry-aged samples compared to the other treatments, which did not differ from each other (P>0.05). For all treatments, the superficial regions showed lower (P<0.05) moisture content compared to the inner regions, with the dry-aged samples showing the most pronounced difference (Table 2).

Table 1. Means of weight loss values during aging, trimming, cooking losses, and shear force of aged samples (n = 48).

Trait	Dry	Wet	Wet+Abs	Wet+Abs+Mt	*SEM*	*P value*
AL, %	27.70^{a}	4.30^{c}	10.70^{b}	12.00^{b}	1.77	<0.001
Trimming, %	22.00	-	-	-	2.55	-
Total L, %	49.70^{a}	4.30^{c}	10.70^{b}	12.00^{b}	1.93	<0.001
CL, %	17.20^{b}	19.50^{a}	17.90^{b}	17.70^{b}	2.64	0.024
WBSF, kg	2.70^{a}	2.50^{a}	2.70^{a}	2.50^{a}	0.50	0.727

^{a,b}Different letters on the same line indicate a significant difference (P < 0.05); AL – Aging loss (evaporation + purge); CL – Cooking loss; Total L – Total loss (AL + Trimming); Dry (Dry-aged), Wet (Wet-aged), Wet+Abs (Wet-aged with moisture absorbers), Wet+Abs+Mt (Mechanical Tenderized meat wet-aged with moisture absorbers).

Table 2. Means of the moisture, water activity and pH values of the superficial, and central portions of the aged samples (n = 48).

Trait	Region	Dry	Wet	Wet+Abs	Wet+Abs+Mt	*SEM*	*P value*
Moisture, %	*Surface*	33.80^{Bb}	-	70.70^{Ba}	70.40^{Ba}	1.73	<0.001
	Inner	71.80^{Aa}	74.00^{a}	73.80^{Aa}	73.90^{Aa}	0.93	0.366
pH	*Surface*	5.40^{Bb}	-	5.70^{Aa}	5.70^{Aa}	0.05	<0.001
	Inner	5.60^{Aa}	5.70^{a}	5.60^{Aa}	5.60^{Aa}	0.04	0.431
Aw	*Surface*	0.93^{Bb}	-	0.99^{Aa}	0.98^{Aa}	0.005	<0.001
	Inner	0.98^{Aa}	0.99^{a}	0.99^{Aa}	0.98^{Aa}	0.001	0.782

^{a,b}Different letters on the same line indicate a significant difference (P < 0.05); ^{A,B}Different letters in the same column indicate a significant difference (P < 0.05); Dry (Dry-aged); Wet (Wet-aged); Wet+Abs (Wet-aged with moisture absorbers); Wet+Abs+Mt (Mechanical Tenderized meat wet-aged with moisture absorbers).

IV. CONCLUSION

In conclusion, the results suggest that incorporating moisture absorbers in vacuum-packed meat can enhance the dehydration process, albeit not reaching the level of dry-aged meat. Nevertheless, this approach yielded higher dehydration values than traditional vacuum-packing methods, making it a viable option for those seeking to concentrate flavor compounds without developing a crust on the meat's surface. Conversely, our findings showed that the use of mechanical tenderization did not result in significant dehydration improvement, indicating that its use may not be necessary.

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