COMPARISON OF TENDERNESS AND MOISTURE LOSS OF DRY AGED BEEF

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Background

Consumers consider tenderness to be the single most important component when purchasing meat and are willing to pay more for higher quality (Savell and Shackleford, 1992). To ensure tenderness, methods such as dry aging, Tendercut™, Tenderstretch, electrical stimulation, or calcium chloride injection can be employed. As intramuscular fat content and aging time increase, beef tenderness improves (Miller, 1994). Depending on the physiological age of the beef carcass, the tenderization process can vary from a few days to several weeks to improve meat palatability (Pearson, 1987).

If beef is inherently tender, dry aging beyond the initial 14 d may not increase the tenderness sufficiently to increase its acceptability. If this were true, aging beyond 14 d would decrease profits through more required storage space, slowed production time, and increased moisture loss.

Objective

The objective of this study was to determine if it is more economical for producers to age U.S. Choice beef for 14 or 21 d. This objective was achieved through evaluating tenderness, percentage moisture loss, lean tissue, and fatty tissue for carcasses aged for 14 and 21 d.

Material and Methods

Slaughter Procedures

Five Angus heifers were slaughtered at Virginia Polytechnic Institute and State University in Blacksburg, Virginia. Once split, the hot carcass sides (n=10) were weighed. Each side of the carcass was randomly designated either A or B to ensure accuracy of moisture loss throughout the study. After the initial weighing of the hot carcasses, the Tendercut™ process (Wang et al., 1994) was applied to each carcass with a cut between the 12th and 13th ribs to expose the *longissimus* muscles of each side. On 1,2,3,4,5,7, and 10 days postmortem, each individual side was weighed at the same time to determine moisture loss. All of the carcasses graded U.S. Choice.

Yield Determination

At 14 d postmortem, side A of each carcass was weighed and fabricated into retail cuts. The lean tissue, fatty tissue, and bone for each carcass were weighed separately in order to designate the composition of the carcass. On day 21 the companion side of each carcass was weighed and fabricated into similar retail portions and individual lean tissue, fatty tissue, and bone percentages were calculated. All retail portions were individually vacuum packaged, weighed, and boxed for sale.

Warner-Bratzler Shear (kg)

Upon fabrication of each side, 2.54 cm steaks from the *longissimus* and *semimembranosus* muscles were frozen to later determine Warner-Bratzler shear values. Frozen steaks were thawed (0-2 C, 24 h) and then cooked to an internal temperature of 70C according to AMSA guidelines (1995). Cores (12.7 mm diameter) were removed from each of the samples. Warner-Bratzler shear force of these samples was determined with a computer interfaced Instron Universal Testing Machine (Model 1011, Instron Corp., Canton, Mass.) equipped with a 50-kg load cell with a crosshead speed of 200 mm/min and 10% load range.

Statistical Analysis

The experimental design was a completely randomized design with 5 replications. A paired t-test (SAS, 1998) was utilized to identify differences ($p<0.05$) in Warner-Bratzler Shear values, individual lean tissue, fatty tissue, and bone percentages.

Results and Discussion

No difference ($p>0.05$) was observed in shear values for *longissimus* and *semimembranosus* muscles from carcasses aged 14 and 21 d (Table 1). Carcasses hung for a 14-day aging time were able to achieve shear force values less then 4.60 kg. According to Shackleford et al. (1991), this would equate to acceptability in tenderness by the consumer. The lack of difference in tenderness could be highly attributable to the large amount of marbling and youth of the animals. A large variation in tenderness that was not present in carcasses aged 21 d was apparent in the *semimembranosus* muscle aged for 14 d (Table 1). This result could be due partially to testing only 4 samples instead of 5, but it also demonstrates that increasing aging time past 14 d has the potential to decrease variability in tenderness for cuts of beef that are inherently less tender. Although the *semimembranosus* muscle had acceptable tenderness, it is typically less tender (Aberle et. al, 2001). This observation would explain the wide variation in tenderness that existed in the beef *semimembranosus* aged for 14 d.

No difference ($p>0.05$) was observed in percentage moisture, lean tissue, and fatty tissue loss from days 14 and 21 (Table 2). The carcasses aged for 14 d had a lower ($p<0.05$) percentage of bone than those aged for 21 d. This observation occurred because of variation in fatty tissue and trim loss between carcasses aged for 14 and 21 d. This variation was detected in percentage bone because it makes up a smaller percentage of the carcass composition than fatty tissue. These results demonstrate that aging time did not affect carcass composition enough to warrant using one aging time over the other.

Table 1: Comparison of shear force values (kg) for *longissimus* and *semimembranosus* muscles from beef carcasses dry aged for 14 and 21 d.

Treatment	*Longissimus*		*Semimembranosus*	
	Mean	Std. Dev.	Mean	Std. Dev.
14 d	2.37[a] kg	0.74 kg	*3.01[a] kg	*1.52 kg
21 d	2.40[a] kg	0.55 kg	2.60[a] kg	0.35 kg

*only contained 4 samples
[a]means within columns with the same letter are not different ($p<0.05$)

Table 2: Comparison of Cutting test values for *longissimus* and *semimembranosus* muscles from beef carcasses dry aged for 14 and 21 d.

Treatment	% Moisture Loss		% Lean Tissue		% Fatty Tissue		% Bone	
	Mean	Std. Dev.	Mean.	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
14d	2.56[a]	0.34	57.0[a]	2.35	27.4[a]	3.65	15.0[a]	1.22
21d	2.52[a]	0.37	57.0[a]	2.86	26.2[a]	2.68	16.2[b]	1.64

Conclusion

After 14 days, the *longissimus* and *semimembranosus* muscles were acceptable in tenderness. The percentage lean tissue for each carcass did not decrease with a longer aging period. Therefore, when raising beef animals that grade U.S.Choice, it would be more economical to age the carcasses for 14 than 21 d due to decreased storage space and production time.

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