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Improving Tenderness of Forage-Finished Beef Using a Mechanical Tenderizer

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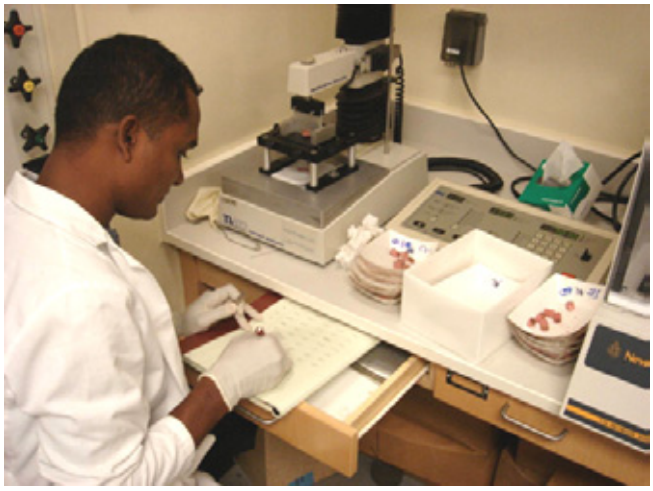
The tenderness of beef is an important part of the experience of eating it. Ranchers employ various management methods to influence meat quality and tenderness, including breed selection, nutrition, animal age, handling, and transportation. Consumers' meat-eating experience is most significantly affected by tenderness. Once animals are delivered to the slaughter facility, other methods can be incorporated to enhance tenderness. Decreasing stress during pre-slaughter handling, electrical stimulation during slaughter process, and an appropriate post-slaughter aging period are proven ways to improve meat tenderness. Mechanical tenderization, calcium solution infusion, use of proteolytic enzymes, and marination are also used to improve meat tenderness.

We conducted a study on the use of a mechanical blade tenderizer to improve the tenderness of forage-finished beef. Ten forage-finished cattle raised on the island of Hawaii were slaughtered at a commercial slaughterhouse and subjected to low-voltage electrical stimulation during slaughter, then dry-aged for 21 days in a cold room at 37°F. Two 1-inch thick rib-eye steaks were removed from each carcass. One steak was retained as a control while the other was subjected to treatment with a commercial blade tenderizer (Ross Industries, Inc., Midland, Virginia). The samples were sealed in air-tight plastic bags and transported to the Department of Human Nutrition, Food and Animal Sciences, University of Hawaii at Manoa, for shear force measurement. Sealed steak samples were cooked in a water bath at 160°F for one hour, cooled at room temperature for one hour, unwrapped, gently dried, and five core samples of ¼ -inch diameter were taken from each steak. Each core sample was cut with a Warner-Bratzler blade attachment using a TA.XT2 Texture Analyzer (Texture Technologies Group, Scarsdale, New York) at a speed of 240 mm/min. The data were analyzed by paired *t*-test using the MINITAB program.

The shear force required to cut the cooked, blade-tenderized rib steaks was significantly lower ($P < 0.01$) than that required to cut the control steaks. The improvement of tenderness by the mechanical tenderizer was about 20 percent. It was noticed that the improvement was variable among steak samples, ranging from 2 to 37 percent.

Our recent study shows that the shear force value of forage-finished beef produced on the island of Hawaii ranged from 2.29 kg to 9.72 kg with a mean value of 5.30 kg (Figure 1). According to Miller et al. (2001), shear force values of 3.4, 4.0, and 4.3 kg would result in 99, 94, and 86 percent consumer satisfaction for beef tenderness. If we use shear value of 4.3 kg as a measure of providing a certain level of beef tenderness, only 35%



Shear force being measured in a UH-CTAHR laboratory.

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Table 1. Effect of a mechanical blade tenderizer on the shear force value* of cooked rib steak from forage-finished cattle.

	Minimum tenderness	Maximum tenderness	Average** tenderness	Percent improvement
No treatment	6.36	3.67	5.36 ± 0.95	
Blade tenderized	6.26	3.53	4.32 ± 1.09	19.3

*Shear force is expressed in kilograms; a lower amount of force indicates greater tenderness.
**Mean ± standard deviation.

of the forage-finished rib steaks produced in Hawaii would provide enough tenderness for consumer satisfaction (Figure 1). Given that mechanical blade tenderization improves meat tenderness by 20%, after blade tenderization, shear value of 5.2 kg would reduce to 4.3 kg. If the results are being extrapolated, after mechanical blade tenderization, nearly 63 percent of the forage-finished beef would meet consumer satisfaction for tenderness (Figure 1), a significant improvement from the current 35% consumer satisfaction. In conclusion, mechanical blade tenderization appears to be a potential method to enhance consumer satisfaction of eating forage-finished beef produced in Hawaii by improving the tenderness of forage-finished beef with marginal tenderness.

Reference

Miller, M.F., M.A. Carr, C.B. Ramsey, K.L. Crockett, and L.C. Hoover. 2001. Consumer thresholds for establishing the value of beef tenderness. Journal of Animal Science 79:3062–3068.

Acknowledgement

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Table 2. Shear force values of some common produce items of the same core size.

Food	Shear force value*
Carrot	13.77
Pineapple, core	13.00
Pear, 'Bartlett'	3.41
Apple, 'Red Delicious'	2.92
Grape, 'Thompson Seedless'	2.61
Pineapple, cross-section	1.17
Banana	0.29

*Shear force is expressed in kilograms; a lower amount of force indicates greater tenderness.

Figure 1. Distribution of shear force value of forage-finish beef in Hawaii and the effects of mechanical tenderization on consumer satisfaction, based on tenderness value of 4.3 kg as a satisfaction threshold.