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Muscle Fiber Studies Comparing *Bos Indicus* and *Bos Taurus* Cattle

Steven C. Seideman¹

Introduction

Beef cattle can be classified as either *Bos taurus* or *Bos indicus*. *Bos taurus* breeds of cattle are those originating from Europe, whereas *Bos indicus* are those breeds originating from India and southeast Asia to include such breeds as Brahman, Sahiwal, Boran, etc. Because of the heat and disease resistance of *Bos indicus* breeds of cattle, they have been used intensively in the southern U.S. However, some studies have shown *Bos indicus* breeds of cattle to produce carcasses with less marbling and less tender meat than *Bos taurus* breeds. Since carcass and meat characteristics are a reflection of the muscle fiber present in the meat, a study was conducted to examine the fiber type characteristics of *Bos taurus* and *Bos indicus* breeds of cattle.

Procedure

A total of 124 *Bos taurus* x *Bos indicus* steers (1/4, 1/2, 3/4 Hereford, Angus, Pinzgauer, Brahman, and Sahiwal) were slaughtered at either 16 or 17 months of age. All steers were fed and treated alike.

After slaughter, a section of the longissimus muscle was removed from the 13th rib region at one-third the distance from the lateral end of the ribeye. The sections were wrapped in aluminum foil, frozen in liquid nitrogen, and stored in an ultralow freezer (-94°F). Transverse sections were cut 10µm thick using a cryostat and stained for alkali-stable ATPase. Stained sections were later photographed and enlarged. From the photographs, fibers were counted and classified as red, intermediate, or white muscle fibers based on staining intensity.

The area of ten fibers of each type was then determined.

Results

Muscle fiber characteristics of *Bos taurus* and *Bos indicus* cross cattle are shown in Table 1. The cross-sectional areas of all muscle fibers from muscle of *Bos indicus* cattle were generally substantially larger than the areas of muscle fibers from *Bos taurus* cattle. In addition, the standard deviations of white fibers from *Bos indicus* breeds of cattle were substantially larger than the standard deviation of muscle from *Bos taurus* breeds of cattle.

The percentages of white, intermediate, and red muscle fibers (Table 1) ranged from 46.4 to 49.0 percent, 23.0 to 24.9 percent, and 27.8 to 30.3 percent, respectively. These percentages did not appear to be substantially different for any breed.

Average fiber size and adjusted fiber size (Table 1) indicate that muscle from *Bos indicus* cross cattle has larger muscle fibers than muscle from *Bos taurus* breeds of cattle.

This study has shown that muscle from *Bos indicus* cross cattle (Brahman and Sahiwal) tended to have larger muscle fibers than muscle from *Bos taurus* cross cattle (Hereford, Angus, and Pinzgauer). In this study, it was observed that muscle from cattle having large muscle fibers tended to have less marbling and produced less tender meat as opposed to muscle from cattle having small muscle fibers. This relationship of small muscle fibers to tender meat represents an important link between the cellular structure of meat and its tenderness. Further development of this concept is being pursued and may lead to an improvement in the USDA beef grading system.

¹Seideman is a research food technologist, Meats Unit, MARC.

Table 1.—Muscle fiber characteristics of *Bos taurus* and *Bos indicus* cattle

Muscle fiber characteristic	<i>Bos taurus</i>				<i>Bos indicus</i>			
	Hereford-or Angus-X		Pinzgauer-X		Brahman-X		Sahiwal-X	
	Ave.	SD	Ave.	SD	Ave.	SD	Ave.	SD
Fiber area								
White	3257.7	650.7	3446.5	591.1	4127.4	1023.9	3867.5	773.5
Intermediate	1979.9	428.7	2145.0	452.3	2332.5	468.9	2093.1	309.0
Red	1767.6	374.8	1812.3	370.4	1937.4	377.4	2013.5	320.6
Percentage of fibers								
White	49.0	6.2	47.3	5.1	46.4	5.9	48.3	6.6
Intermediate	23.0	5.0	24.9	5.8	23.3	4.9	23.4	4.9
Red	28.0	5.2	27.8	5.4	30.3	6.4	28.3	5.4
Ave. fiber size ^a	2335.1	388.9	2467.9	385.4	2799.1	548.2	2658.0	351.1
Adjusted ave. fiber size ^b	1273.5	219.2	1323.6	210.6	1461.2	266.0	1456.6	195.1

^aCross-sectional area of white, intermediate and red muscle fibers divided by 3.
^bCross-sectional area of the three muscle fibers adjusted for their percentage.