University of Nebraska - Lincoln Digital Commons@University of Nebraska - Lincoln

Roman L. Hruska U.S. Meat Animal Research Center

USDA Agricultural Research Service -- Lincoln, Nebraska

1-1-1985

Muscle Fiber Studies Comparing Bos Indicus and Bos Taurus Cattle

Steven C. Seideman MARC

Follow this and additional works at: http://digitalcommons.unl.edu/hruskareports



Part of the Animal Sciences Commons

Seideman, Steven C., "Muscle Fiber Studies Comparing Bos Indicus and Bos Taurus Cattle" (1985). Roman L. Hruska U.S. Meat Animal Research Center. Paper 60.

http://digitalcommons.unl.edu/hruskareports/60

This Article is brought to you for free and open access by the USDA Agricultural Research Service --Lincoln, Nebraska at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Roman L. Hruska U.S. Meat Animal Research Center by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

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.

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.

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

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.

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

Muscle fiber characteristic	Bos taurus				Bos indicus			
	Hereford- or Angus-X		Pinzgauer-X		Brahman-X		Sahiwal-X	
	Ave.	SD	Ave.	SD	Ave.	SD	Ave.	SD
Fiber area		hotson No						
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 fiber	S							
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 Adjusted ave. fiber	2335.1	388.9	2467.9	385.4	2799.1	548.2	2658.0	351.1
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.

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

bCross-sectional area of the three muscle fibers adjusted for their percentage