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Effect of Marbling on Variation and Change in Beef Tenderness in *Bos Taurus* and *Bos Indicus* Crosses

Robert M. Koch, John D. Crouse, Michael E. Dikeman, Larry V. Cundiff, and Keith E. Gregory¹

Introduction

Today's diet conscious consumers continue to desire flavorful, tender meat, but increasingly avoid excess fat. Differences in USDA quality grades within similar aged cattle are determined primarily by differences in marbling scores which tend to be associated with overall fatness in beef carcasses. Previous studies (Cundiff et al., 1988) demonstrated an antagonism between lean yield in carcasses and degree of marbling associated with higher quality grades. Breeds that rank highest for retail product percentage rank lowest for marbling. High negative genetic correlations have been found within breeds between marbling and retail product percentage. Thus, only limited opportunity exists for genetically increasing marbling without increasing fat trim and reducing retail product percentage. Nevertheless, there is a large amount of variation in palatability characteristics among animals with the same degree of marbling, suggesting the importance of factors other than marbling have a large impact on eating qualities. Concern with the antagonism between marbling and retail product percentage is justified to the extent that a certain amount of marbling is required to ensure palatability of the retail product. This report summarizes the sensory tenderness evaluations associated with marbling scores from steer carcasses produced in the Germplasm Evaluation Program at the U.S. Meat Animal Research Center.

Procedure

Sensory panel tenderness scores (SPT) from 1221 animals produced by 16 breeds of sire mated to Angus and Hereford cows in Cycles I, II and III were analyzed. Sire breeds were grouped by species; 1) *Bos taurus* (Angus, Brown Swiss, Charolais, Chianina, Gelbvieh, Hereford, Jersey, Limousin, Maine Anjou, Pinzgauer, Red Poll, Simmental, South Devon and Tarentaise) or 2) *Bos indicus* (Brahman and Sahiwal).

Steers were slaughtered at a commercial packing plant. After a 48-hr chill, carcasses were evaluated for conformation and maturity. Marbling, lean color, texture and firmness were evaluated in the longissimus muscle interface. USDA quality grade (USDA, 1975) was determined by representatives of the U.S. Meat Animal Research Center, of the Standardization Branch, Agricultural Marketing Service, USDA, and of Kansas State University. The right side of each carcass was transported to Kansas State University for detailed cutout and taste panel evaluation. Steaks from the longissimus muscle at the 10th rib were cooked at 177 C to an internal temperature of 65 C and evaluated by an experienced taste panel for tenderness, flavor and juiciness. Sensory scores ranged from 9 = extremely tender, 5 = acceptable, 1 = extremely tough. Longissimus muscle fat percentage was determined by chemical analyses of the 12th rib steak.

Results

Average values of longissimus muscle fat percentage, sensory panel tenderness and standard deviations of sensory panel scores within each degree of marbling for *Bos taurus* and *Bos indicus* groups are shown in Table 1. Trends are illustrated in Figure 1. Average taste panel scores improved as marbling increased when comparisons were at the same age, but the change was relatively small. Variation as measured by the standard deviation within marbling degrees tended to be greater at low levels of marbling than at higher levels. This in turn increased the risk of at least some steaks having less than acceptable tenderness (see SPT < 5, Table 1 and Figure 1). In *Bos taurus* sired cattle with a slight degree of marbling (USDA Select), 3% of the steaks were scored as less than acceptable in tenderness. In *Bos taurus* sired cattle with moderate or greater degrees of marbling (USDA High Choice or Prime), 0% of the steaks were scored as less than acceptable (i.e., 100% with scores > 5). Sensory panel scores for steaks from *Bos indicus* sired steers were lower for tenderness and the percentage less than acceptable was higher than for those from *Bos taurus* sired steers, even at the same degree of marbling.

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Table 1—Sensory panel tenderness and marbling scores^a

Marbling	<i>Bos taurus</i> sired					<i>Bos indicus</i> sired			
	LMF%	No.	SPT	SD	SPT<5	N	SPT	SD	SPT<5
P. devoid	2.1	3	5.1	1.2	66.7				
Traces	2.7	68	6.7	1.1	10.3	20	5.7	1.1	15.0
Slight	3.7	362	7.0	.9	3.0	61	5.8	1.3	24.6
Small	5.0	389	.3	.8	1.3	50	6.5	1.2	10.0
Modest	6.6	161	7.4	.8	1.9	10	6.5	1.0	10.0
Moderate	8.0	59	7.7	.6	0				
Sl. abundant	9.0	24	7.8	.5	0	1	7.7	0	0
Md. abundant	11.1	8	7.4	.8	0				
Abundant	13.6	5	8.1	.5	0				

^a LMF% = longissimus muscle fat percentage; SPT = sensory panel tenderness scores with 9 = extremely tender, 5 = acceptable, and 1 = extremely tough; SD = standard deviation with marbling degree; SPT<5 = percentage sensory scores less than acceptable.

Figure 1. Effects of marbling on mean sensory panel tenderness scores in *Bos taurus* and *Bos indicus* crosses.

