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## Introduction

It is now widely recognized that consumers do not accept meat with excessive quantities of fat. To make cuts of meat acceptable to the consumer, packers and retailers are forced to trim much of the subcutaneous fat. If this consumer demand persists, the meat industry will be forced to change its production system to produce leaner cattle.

Subcutaneous fat cover is thought to act as an insulator, retarding rapid temperature decline and consequently preventing cold-induced toughness. Cold-induced toughening is a phenomenon observed when prerigor excised muscles are exposed to cold (< 50°F) temperatures. However, there is no conclusive evidence that cold-induced toughening actually happens under current meat industry practices of slaughtering and carcass handling. The objectives of these experiments were to examine the effect of the removal of subcutaneous fat and high temperature conditioning on beef tenderness. High temperature conditioning (HTC) — storage of carcasses at high temperatures (e.g. 78°F) for 3 to 6 hr after slaughter — was included to attempt prevention of cold-induced toughness in defatted carcasses.

## Procedure

*Animals.* Eight Hereford x Angus and eight Brahman crossbred steers (2 groups each: 4 Hereford x Angus and 4 Brahman-cross) were used to examine the effect of HTC and subcutaneous fat cover on the tenderness in bovine longissimus muscle.

Immediately after slaughter, the first group of carcasses were split. One side was transferred to a 30°F cooler, and the other side was held at 78°F for 6 hr HTC. Carcasses from the second group of steers were split and subcutaneous fat cover over the longissimus muscle completely removed; individual sides were stored as with the first group. After 6 hr, HTC sides from both groups were transferred to the 30°F cooler, and after 24 hr, all sides were transferred to a 34°F cooler, where they remained for the duration of the experiment. Table 1 describes carcasses from the animals used in this study.

*Temperature Decline.* Temperature and pH were determined at 6, 9, 12, and 24 hr postmortem. Temperature was measured with a fluke (Model 8020A) digital multimeter and temperature probe (Model 80T-150).

*Shear force.* Shear force of cooked steaks was measured after 1, 3, 8, and 14 days of postmortem aging. Cores (1 in) from cooked steaks were sheared on an Instron Universal Testing machine equipped with a Warner-Bratzler shear device.

## Results

Temperature decline data for treatments groups are reported in Table 1. These results clearly indicate that the subcutaneous fat indeed acts as an insulator. At 30°F, the defatted sides had an internal temperature of 51.4°, and the control sides, 60.1°. The data also indicates that the HTC treatment maintained the desired temperature for the 6 hr treatment period. Shear force data are reported in Table 2. These results demonstrate that shear force values were not affected by the treatments and suggest that the presence of subcutaneous fat is not necessary to ensure meat quality. It must be emphasized that data from this study cannot be used to conclude that producing cattle with low backfat would or would not adversely affect beef quality. Therefore, studies of production systems which produce lean animals are necessary to determine their effects on beef quality.

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**Table 1—Effect of subcutaneous fat and high temperature conditioning on temperature decline (least-squares means)**

| | Hours postmortem (temperature, °F) | | | |
|---|---|---|---|---|
| Treatment | 6 | 9 | 12 | 24 |
| P > F of interaction | .001 | .065 | .101 | .573 |
| With subcutaneous fat at 30°F | 60.1[a] | 50.0 | 42.7 | 34.7 |
| With subcutaneous fat at 78°F | 74.4[b] | 59.0 | 47.21 | 34.5 |
| Without subcutaneous fat at 30°F | 51.4[c] | 42.71 | 38.05 | 34.2 |
| Without subcutaneous fat at 78°F | 70.6[d] | 52.63 | 41.61 | 34.0 |
| High temperature conditioning: | | | | |
| 30°F | 55.8[a] | 46.36[a] | 40.35[a] | 34.4[a] |
| 78°F | 72.5[b] | 55.81[b] | 44.40[b] | 34.2[b] |
| Subcutaneous fat: | | | | |
| With | 67.3[a] | 12.50[a] | 44.94[a] | 34.6 |
| Without | 53.0[b] | 47.7[b] | 39.8[b] | 34.1 |
| Residual standard deviation | .65 | .37 | .44 | .15 |

[abcd]Values within a column within interaction or main effect with different superscripts differ (P < .05).

**Table 2—Effect of subcutaneous fat and high temperature conditioning on shear force (least-squares means)**

| Treatment | Days postmortem (lb force) 1 | 3 | 8 | 14 |
|---|---|---|---|---|
| P > F of interaction | .062 | .643 | .277 | .536 |
| With subcutaneous fat at 30°F | 18.2 | 14.9 | 12.4 | 12.5 |
| With subcutaneous fat at 78°F | 18.74 | 15.22 | 13.93 | 12.4 |
| Without subcutaneous fat at 30°F | 22.3 | 14.6 | 12.1 | 9.9 |
| Without subcutaneous fat at 78°F | 19.0 | 14.3 | 12.1 | 10.7 |
| High temperature conditioning: | | | | |
| 30°F | 20.2 | 14.7 | 12.2 | 10.4[a] |
| 78°F | 18.9 | 14.7 | 13.0 | 11.5[b] |
| Subcutaneous fat: | | | | |
| With | 18.5 | 15.0 | 13.1 | 11.7 |
| Without | 20.70 | 14.4 | 12.1 | 10.3 |
| Residual standard deviation | 1.17 | .93 | .86 | .61 |

[ab]Values within a column within interaction or main effect with different superscripts differ ($P < .05$).