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# Feedlot and Carcass Characteristics Of

# Bulls vs. Steers



# For Beef Production

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## SUMMARY

*This study consisted of 3 trials conducted over a 3-year period (1971-73). Short scrotum (SS) bulls, normal bulls and steers were compared for feedlot performance, carcass characteristics including retail cutout and acceptability using consumer surveys. Measured by palatability, no statistically significant differences were found between SS and normal bulls in performance, cutability or acceptability. However, intact males — SS and normal — gained 15% more in the feedlot on 10% less feed than steers. There were no differences in dressing percent. Steers graded average choice while intact males graded high good. Steers were more tender, measured by Warner-Bratzler tenderness tests, but the intact males were still acceptable to the consumers.*

*The intact males were far superior to the steers in cutability — yield grade 1.9 for bulls and 3.5 for the steers — and their carcasses yielded 15% more retail cuts. Rib-eye areas averaged 2 square inches larger and their carcasses contained less than half the internal and external fat of steers.*

*Future work is needed to determine how to reduce the variation in tenderness among intact males, and more consumer surveys are needed to determine acceptability using normal retail channels. A strong potential exists for increased production of acceptable quality beef from intact males if a suitable market classification system can be established.*


# Feedlot and Carcass Characteristics Of Bulls vs. Steers For Beef Production


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Castration of young bull calves has been a traditional practice in the U.S. because of these advantages: (1) increased ability to fatten, (2) more docile animals and (3) delayed maturation resulting in more tender beef at older ages. There are disadvantages: (1) reduced growth rate, (2) reduced feed efficiency and (3) overfat carcasses.

Because of increasing populations with inadequate meat supplies, most European countries are now slaughtering a high percentage of intact males. The U.S. is one of the few countries where castration is still a common practice. For the past decade the emphasis has been on producing leaner meat of high quality. Overfinished beef is a loss to the producer, packer, retailer and consumer. Yield grade 4 and 5 cattle brought as much as 7¢ a pound less than yield grade 2 and 3 cattle in the Midwest in 1973. Since feed grains are becoming more expensive, production of fat in the future will likely no longer be economically feasible. Twice to 3 times as much feed energy is needed to produce a pound of fat as is required for a pound of lean meat (3).

Because of these factors, use of intact males for increased efficiency in meat production has been given increased attention in recent years. Numerous authors have reported superior performance and carcass yield of bulls compared with steers and heifers (2, 4, 12, 16). As a result of these and other studies, the USDA (1973) established a new grade for carcasses from young bulls. However, it stipulated that bull beef be identified as "bullock beef." If this "bullock beef" gains consumer acceptance, the "bullock" designation may possibly be dropped altogether. Primary problem in the production of bull beef is a lack of uniform tenderness.

Recent work suggests that scrotal ablation (short scrotum) in bull calves may increase rate of gain, feed efficiency and cutability and carcass quality may be superior to that of normal bull carcasses (15). Studies at the USDA's Meat Animal Research Center found similar results when short scrotum bulls (SS) were compared with normal bulls and steers (6).

The purpose of this study was to evaluate bulls, SS bulls and steers for feedlot performance, carcass characteristics and consumer acceptability. A further objective was to determine if SS bulls differ from normal bulls in fertility and production of male hormones (testosterone).

### Procedure

In Trial I (1971), 6 Hereford, 3 Angus and 2 Shorthorn bull calves were short scrotumed at weaning (6-8 months of age) by pushing the testes against the abdominal cavity and placing 2 elastrator rings as high as possible around the scrotum (13). A second group of 6 Hereford, 3 Angus and 2 Shorthorn bull calves was castrated and a third group of 3 Herefords and 1 Shorthorn was retained as normal bulls.

Trial II (1972), included 39 Angus-Hereford crossbred calves; Trial III (1973), 36 Angus calves. In both trials, the calves were randomly divided into equal lots of castrated, short scrotumed and normal bulls. Castrations and short scrotum operations were per-

Table 1. Finishing rations.

| Ingredient | Trial I (Pelleted)[a] | Trial II (Pelleted)[a] | Trial III (Ground)[b] |
|---|---|---|---|
| Barley | 16.00% | 30.0% | 73.0% |
| Wheat | 43.25 | 30.0 | - |
| Corn | - | - | - |
| Beet pulp | 30.00 | 20.0 | 25.0 |
| Alfalfa (sun cured) | 8.00 | 17.0 | - |
| Soybean oil meal | 1.00 | - | - |
| Urea | - | 1.0 | 1.0 |
| NaCl | 1.00 | 1.0 | 1.0 |
| Limestone | 0.50 | - | - |
| Dicalcium phosphate | 0.25 | 1.0 | - |
| Total | 100.00% | 100.0% | 100.0% |
| Crude protein, % | 11.30 | 13.9 | 13.0 |
| Energy level, Mcal/lb | 1.27 | 1.23 | 1.26 |

[a] Ration was supplemented with 3 lb. per head/day of mixed hay.
[b] Ration was supplemented with 2 lb. per head/day of mixed hay.

Table 2. Least squares means and standard errors for feedlot traits in Trial I*.

| Traits studied | Bulls (n = 4) Mean | S.E. | SS Bulls (n = 11) Mean | S.E. | Steers (n = 11) Mean | S.E. |
|---|---|---|---|---|---|---|
| Ave. daily gain, lb. | 2.02 [a] | 0.09 | 2.24 [b] | 0.04 | 1.98 [a] | 0.04 |
| Feed/lb. gain, lb.[c] | 6.14 | 0.33 | 5.50 [a] | 0.18 | 6.05 [b] | 0.18 |
| Day of age at slaughter | 503 | 21 | 505 | 11.5 | 521 | 11.5 |
| Days on finishing ration | 88 | --- | 77 | --- | 107 | --- |
| Slaughter wt., lb. (24-hr. shrink) | 901 | 15 | 920 | 8.4 | 929 | 8.4 |
| Live wt./day age, lb. | 1.80 | 0.07 | 1.83 | 0.04 | 1.78 | 0.04 |

* A "least squares mean" is an adjusted average for unequal numbers. The S.E., or standard error, is a measure of the deviation from the average.

[a b] Values on the same line with different superscripts are significantly different ($P < .05$).

[c] Feed efficiency was computed on a dry-matter basis.

Table 3. Least squares means and standard errors for feedlot traits in Trial II*.

| Traits studied | Bulls (n = 13) Mean | S.E. | SS Bulls (n = 13) Mean | S.E. | Steers (n = 13) Mean | S.E. |
|---|---|---|---|---|---|---|
| Ave. daily gain, lb. | 2.57 [a] | 0.07 | 2.62 [a] | 0.07 | 2.24 [b] | 0.07 |
| Feed/lb. gain, lb.[c] | 6.60 [a] | 0.23 | 6.50 [a] | 0.23 | 7.37 [b] | 0.23 |
| Days of age at slaughter | 458 [a] | 6.62 | 459 [a] | 6.62 | 499 [b] | 6.62 |
| Days on finishing ration | 118 [a] | 6.90 | 121 [a] | 6.90 | 165 [b] | 6.90 |
| Slaughter wt., lb. | 1027 | 22.0 | 1016 | 22.0 | 1006 | 22.0 |
| Live wt./day age, lb. | 2.24 | | 2.21 | | 2.02 | |

* A "least squares mean" is an adjusted average for unequal numbers. The S.E., or standard error, is a measure of the deviation from the average.

[a b] Values on the same line with different superscripts are significantly different ($P < .05$).

[c] Feed efficiency was computed on a dry-matter basis.

formed at birth in Trial II and at branding time (2-3 months of age) in Trial III.

In trials I and II all calves after weaning were fed a growing ration until they reached a body weight of approximately 750 lb. and then were fed the finishing ration (Table 1). In Trial III, all calves were fed the finishing ration at weaning (approximately 500 lb.). Feed intake and growth rates were recorded at regular intervals.

Blood samples were collected every 30 days to determine plasma testosterone levels. Testosterone analysis was a modification of radioimmunoassay (5).

All animals were slaughtered at the University of Idaho meat laboratory, and complete carcass data were collected on each carcass (1). Carcasses were graded according to the USDA standards (17). All retail cuts were trimmed to not more than ¼ inch fat thickness. One rib steak 1¼ inch thick was removed from the loin end of the rib for Warner-Bratzler shear tests for tenderness. After collection of the carcass data, each carcass was divided into 4 mixed quarters. Each quarter was sold to a separate customer who completed and returned an evaluation form after sampling steaks and roasts. The consumer scored steaks and roasts for flavor, juiciness, tenderness and overall satisfaction. Each category was divided into very acceptable, average and poor or unacceptable. Scores were assigned numbers based on a 9-point Hedonic rating scale, with the range (9) like extremely, (5) average to (1) dislike extremely. Average ratings of less than 5.0 were considered undesirable while those of 6.0 or more were considered desirable in palatability.

Least squares analysis for data with unequal subclass numbers were used (11). In those tables where data were combined for all 3 trials, there were no statistical analyses. Those data are simply "weighted" means for comparison purposes.

## Results and Discussion

In Trial I, the SS bulls had significantly higher rates of gain and greater feed efficiency than steers (Table 2). Since only 4 normal bulls were used in the trial, no valid comparisons among all 3 groups could be made. In Trial II (Table 3) equal numbers were used for all 3 groups. There were no differences between normal and SS bulls in feedlot performance. The intact males gained 16% faster on 12% less feed than the steers. They reached slaughter weight 6 weeks earlier than the steers.

In Trial III (Table 4), the feeding program was changed. In the previous trials all animals were fed a growing ration until they reached an average weight of 750 lb. but in Trial III all calves received the finishing ration from weaning.

Under this intensive feeding program the normal bulls averaged 2.65 lb., the SS bulls 2.38 lb. and the steers averaged 2.11 lb. Although the gains were not as high as predicted, these animals were subjected to handling (bleeding, weighing, etc.) which may reduce growth rates. Normal bulls were superior to SS bulls and steers in rate of gain and efficiency. They reached significantly heavier slaughter weights 30 days earlier than the SS bulls and steers.

The Trial III data are probably the most significant of the 3 trials since all calves were halfsibs. The cows were bred AI from the same sire.

Feedlot data pooled in Table 5 indicated that normal bulls were superior to either SS bulls or steers in rate of gain and there were no differences in feed efficiency between normal and SS bulls. Although some sources have warned of management problems with feedlot bulls, no problems were experienced so long as bulls were kept away from cows and heifers. Normal and SS bulls were similar in sexual behavior, tending to go off feed in the presence of females. Otherwise, all intact males were docile in nature. Most problems occur when feeding bulls more than 18 months of age.

Carcass traits for cattle slaughtered in Trial I are presented in Table 6. Normal bulls graded high good compared to low choice for the SS bulls and steers. Intact males had significantly higher yield grades and their carcasses yielded approximately 15% more retail cuts than steers. In Trial II (Table 7), all intact males graded lower than steers, high good vs. low choice, but had significantly higher yield grades

**Table 4. Least squares means and standard errors for feedlot traits in Trial III*.**

| Traits studied | Bulls (n = 11) Mean | S.E. | SS Bulls (n = 12 Mean | S.E. | Steers (n = 12) Mean | S.E. |
|---|---|---|---|---|---|---|
| Ave. daily gain, lb. | 2.65 [a] | 0.07 | 2.38 [b] | 0.07 | 2.11 [c] | 0.07 |
| Feed/lb. gain, lb [d] | 6.30 [a] | 0.24 | 7.10 [b] | 0.23 | 7.50 [b] | 0.07 |
| Days of age at slaughter | 444 [a] | 6.40 | 473 [b] | 6.10 | 4.74 [b] | 6.10 |
| Total days on feed | 223 [a] | 6.90 | 250 [b] | 6.60 | 253 [b] | 6.60 |
| Slaughter wt., lb. | 1076 [a] | 12.3 | 1029 [b] | 11.7 | 954 [c] | 11.7 |
| Live wt./day age, lb. | 2.42 [a] | 0.05 | 2.17 [b] | 0.04 | 2.01 [c] | 0.04 |

* A "least squares mean" is an adjusted average for unequal numbers. The S.E. or standard error is a measure of the deviation from the average.

abc Values on the same line with different superscripts are significantly different ($P < .05$).

d Feed efficiency was computed on a dry-matter basis.

**Table 5. Overall means for feedlot traits.**

| Traits studied | Bulls (n = 28) | SS Bulls (n = 36) | Steers (n = 36) |
|---|---|---|---|
| Ave. daily gain, lb. | 2.52 | 2.37 | 2.12 |
| Feed/lb. gain, lb. | 6.40 | 6.40 | 7.00 |
| Days of age | 459 | 478 | 498 |
| Slaughter wt., lb. | 1028 | 991 | 965 |
| Live wt./day age, lb. | 2.25 | 2.08 | 1.94 |

**Table 6. Least squares means and standard errors for carcass traits in Trial I.**

| Item | Bulls (n = 4) Mean | S.E. | SS Bulls (n = 11) Mean | S.E. | Steers (n = 11) Mean | S.E. |
|---|---|---|---|---|---|---|
| Dressing % | 62.36 | 0.61 | 61.11 | 0.34 | 61.44 | 0.34 |
| Cold wt., lb. | 551 | 11.5 | 552 | 6.5 | 561 | 14.4 |
| Conformation [c] | 14.0 | 0.43 | 14.2 | 0.24 | 13.9 | 0.24 |
| Marbling [d] | 5.26 | 0.56 | 6.02 | 0.31 | 6.59 | 0.31 |
| Quality grade [c] | 11.4 | 0.59 | 12.0 | 0.33 | 12.8 | 0.33 |
| Fat thickness, in. | 0.18 [a] | 0.07 | 0.25 [a] | 0.04 | 0.53 [b] | 0.04 |
| % internal fat | 1.93 [a] | 0.38 | 1.94 [a] | 0.21 | 3.21 [b] | 0.21 |
| Rib eye area, sq. in. | 11.3 [a] | 0.57 | 11.7 [a] | 0.32 | 10.2 [b] | 0.32 |
| Yield grade | 2.00 [a] | 0.32 | 1.93 [a] | 0.18 | 3.36 [b] | 0.18 |
| % steaks and roasts [e] | 53.9 [a] | 1.32 | 54.9 [a] | 0.73 | 48.0 [b] | 0.73 |
| % total lean trim [e] | 22.5 | 1.67 | 21.9 | 0.92 | 18.3 | 0.92 |
| % total retail cuts [e] | 76.3 [a] | 2.52 | 76.8 [a] | 1.40 | 66.3 [b] | 1.40 |

a b Values on the same line with different superscripts are significantly different at the 0.05 level.

c 15 = low prime, 9 = low good.

d 10 = abundant, 1 = devoid.

e Expressed as % of cold carcass weight.

Table 7. Least squares means and standard errors for carcass traits in Trial II.

| Traits studied | Bulls (n = 13) | | SS Bulls (n = 13) | | Steers (n = 13) | |
|---|---|---|---|---|---|---|
| | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| Dressing % | 61.18 | 0.37 | 61.78 | 0.37 | 62.31 | 0.37 |
| Cold wt., lb. | 628 | 15.3 | 628 | 15.3 | 627 | 15.3 |
| Conformation [c] | 14.5 | 0.20 | 14.6 | 0.20 | 14.0 | 0.20 |
| Marbling [d] | 4.79 [a] | 0.23 | 4.96 [a] | 0.23 | 6.39 [b] | 0.23 |
| Quality grade [c] | 11.3 [a] | 0.24 | 11.2 [a] | 0.24 | 12.7 [b] | 0.24 |
| Fat thickness, in. | 0.24 [a] | 0.04 | 0.25 [a] | 0.04 | 0.71 [b] | 0.04 |
| % internal fat | 2.19 [a] | 0.17 | 2.12 [a] | 0.17 | 3.77 [b] | 0.17 |
| Rib eye area, sq. in. | 13.7 [a] | 0.26 | 13.5 [a] | 0.26 | 11.1 [b] | 0.26 |
| Yield grade | 1.67 [a] | 0.17 | 1.69 [a] | 0.17 | 3.89 [b] | 0.17 |
| % steaks & roasts [e] | 53.5 [a] | 0.58 | 52.0 [a] | 0.58 | 46.3 [b] | 0.58 |
| % total lean trim [e] | 22.4 [a] | 0.46 | 23.2 [a] | 0.46 | 17.4 [b] | 0.46 |
| % brisket | 4.02 | 0.17 | 4.25 | 0.17 | 3.73 | 0.17 |
| % lean (brisket) | 59.2 [a] | 1.43 | 58.9 [a] | 1.43 | 41.5 [b] | 1.43 |
| % plate | 6.96 [a] | 0.17 | 7.30 [a] | 0.17 | 8.22 [b] | 0.17 |
| % lean (plate) | 67.2 [a] | 2.01 | 63.2 [a] | 2.01 | 44.2 [b] | 2.01 |
| % flank | 5.67 [a] | 0.17 | 5.80 [a] | 0.17 | 6.91 [b] | 0.17 |
| % lean (flank) | 53.0 [a] | 2.94 | 60.7 [a] | 2.94 | 36.3 [b] | 2.94 |
| % total retail cuts [e] | 75.9 [a] | 0.83 | 75.2 [a] | 0.83 | 63.7 [b] | 0.83 |

a b **Value on the same line with different superscripts are significantly different at the 0.05 level.**

c **15 = low prime, 9 = low good.**

d **10 = abundant, 1 = devoid**

e **Expressed as % of cold carcass weight.**

Table 8. Least squares means and standard errors for carcass traits in Trial III.

| Traits studied | Bulls (n = 11) | | SS Bulls (n = 12) | | Steers (n = 13) | |
|---|---|---|---|---|---|---|
| | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| Dressing % | 63.0 | 0.31 | 62.8 | 0.30 | 62.9 | 0.30 |
| Cold wt., lb. | 678 [a] | 7.21 | 645 [b] | 6.90 | 600 [c] | 6.90 |
| Cold wt./day age | 1.54 [a] | 0.03 | 1.38 [b] | 0.03 | 1.27 [c] | 0.03 |
| Conformation [d] | 14.6 [a] | 0.17 | 14.6 [a] | 0.16 | 13.9 [b] | 0.16 |
| Marbling [e] | 5.34 [a] | 0.24 | 6.29 [b] | 0.23 | 7.42 [c] | 0.23 |
| Quality grade | 12.0 [a] | 0.23 | 12.8 [b] | 0.22 | 13.8 [c] | 0.22 |
| Fat thickness, in. | 0.25 [a] | 0.03 | 0.28 [a] | 0.03 | 0.46 [b] | 0.03 |
| Rib eye area, sq. in. | 13.2 [a] | 0.35 | 12.7 [a] | 0.33 | 11.3 [b] | 0.33 |
| % internal fat | 2.65 [a] | 0.17 | 2.69 [a] | 0.17 | 4.29 [b] | 0.17 |
| Yield grade | 2.00 [a] | 0.17 | 2.13 [a] | 0.16 | 3.17 [b] | 0.16 |
| % steaks & roasts [b] | 53.1 [a] | 0.51 | 52.5 [a] | 0.49 | 47.6 [b] | 0.49 |
| % total lean trim [f] | 22.9 [a] | 0.30 | 22.4 [a] | 0.29 | 19.1 [b] | 0.29 |
| % total retail cuts [f] | 75.6 [a] | 0.62 | 75.1 [a] | 0.59 | 66.6 [b] | 0.59 |

abc **Values on the same line with different superscripts are significantly different at the 0.05 level.**

d **15 = low prime, 9 = low good.**

e **10 = abundant, 1 = devoid.**

f **Expressed as % of cold carcass weight.**

(1.68 vs. 3.89). Holding steers on the finishing ration 6 weeks longer than the intact males may have resulted in the low grades. Carcasses from the intact males yielded 19% more retail cuts than the steers and intact males yielded approximately 50% more lean meat from the brisket, plate and flank. Steers tended to deposit heavy amounts of fat in these minor wholesale cuts.

Carcass data for Trial III (Table 8) were very similar to Trial II except the intact males graded low choice. Feeding the finishing ration longer increased the quality grades of the intact males, but grades were not as high as for steers. Intact males produced carcasses which yielded 13% more retail cuts than steers.

In all 3 trials normal and SS males had similar carcass composition and carcasses from intact males yielded a significantly higher percentage (16%) of retail cuts than steers (Table 9). The only difference was the SS bull carcass graded slightly higher than normal bulls. The steer carcasses graded higher than either intact male group. Intact males had approximately 2 square inches larger rib-eyes than steers and carcasses from intact males contained about half as much internal and external fat as steer carcasses.

There were no significant palatability differences in Trial I (Table 10) among the 3 treatments. The SS bulls were intermediate in tenderness, as measured by the shear device, and the normal bulls approached the 20 lb. measurement, which is usually considered unacceptable in tenderness.

In Trial II (Table 11), the intact males were significantly less tender than steers. This group of intact males was on the finishing ration 6 weeks less than the steers which could have been the most critical factor in determining if young intact males will be acceptable in tenderness. Despite the shear values, meat from the intact males received fairly high ratings from consumers. They rated the SS bulls lowest in tenderness (7.50) but still rated the meat more tender than average (5.0).

Shear values were higher for intact males in Trial III than in Trial II (Table 12). All animals were on feed longer and graded higher than in Trial II. The SS bulls had the highest shear values (20.79 lb.). The high standard deviation of 5.2 indicated some SS bulls were considerably less tender. Normal bulls and steers were very acceptable in tenderness. Although the steers received the highest ratings from consumers, there were no complaints and all meat received very acceptable ratings.

The palatability averages for the 3 trials clearly show steers were more tender than intact males, although consumer scores indicated meat from intact males were acceptable (Table 13). More research is needed to determine acceptability of meat from intact males and how to produce carcasses from intact males that will be uniform in tenderness.

Testes from normal bulls were approximately 3 times heavier than those from SS bulls (Table 14). These weight differences indicate that scrotal ablation caused some testicular tissue to atrophy. Although there were no differences in adrenal gland weights in Trial I, the SS bulls in Trial II had significantly heavier adrenals than steers. Seminal vesicle weights in Trial II varied significantly among bulls, SS bulls and steers.

Plasma testosterone assays were conducted in Trial II (Table 15), indicating testosterone production in normal and SS bulls was quite similar and intact males produced about 30 times more testosterone than steers (8). Results also indicate testosterone levels vary greatly among individual animals. Some steers had levels too low for detection. Although more research is needed on endogenous hormones and their role in meat production, testosterone apparently stimulates more rapid and efficient growth among intact males than among castrates (7). Testosterone is protein anabolic, meaning that it promotes muscle growth (10). This may explain why intact males have larger rib-eyes and higher yields of red meat, but it may also cause increased growth of connective tissue resulting in less tender meat. Meat from mature bulls contains more connective tissue.

The short scrotum technique offers no apparent advantage except those animals are rendered infertile according to sperm counts on semen obtained by electroejaculation. Few live spermatozoa were found in semen from SS bulls. Normal bulls had higher

**Table 9. Overall means for carcass traits.**

| Traits studied | Bulls (n = 28) | SS Bulls (n = 36) | Steers (n = 36) |
|---|---|---|---|
| Dressing % | 62.1 | 61.9 | 62.0 |
| Cold wt., lb. | 637 | 610 | 598 |
| Cold wt./day age | 1.41 | 1.28 | 1.21 |
| Conformation | low prime | low prime | high choice |
| Marbling | small | small + | modest |
| Quality grade | high good | low choice | ave. choice |
| Fat thickness, in. | 0.24 | 0.26 | 0.57. |
| Rib eye area, sq. in. | 13.2 | 12.7 | 10.9 |
| % internal fat | 2.4 | 2.2 | 3.8 |
| Yield grade | 1.9 | 1.9 | 3.5 |
| Total % retail cuts | 75.8 | 75.7 | 65.5 |

**Table 10. Least squares means and standard errors for palatability traits in Trial 1[a].**

| | Bulls (n = 4) | | SS Bulls (n = 11) | | Steers (n = 11) | |
|---|---|---|---|---|---|---|
| Traits studied | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| Shear value, lb. [b] | 19.01 | 1.58 | 18.04 | 0.88 | 17.25 | 0.88 |
| Flavor | 8.88 | 0.58 | 8.64 | 0.32 | 8.50 | 0.32 |
| Juiciness | 7.76 | 0.69 | 7.72 | 0.38 | 8.06 | 0.38 |
| Tenderness | 8.08 | 0.68 | 7.83 | 0.38 | 8.03 | 0.38 |
| Overall satisfaction | 8.56 | 0.64 | 8.44 | 0.35 | 8.31 | 0.35 |

[a] **Mean differences were not significantly different at the 0.05 level.**

[b] **Pounds of force required to shear a 1 inch core of cooked meat using a Warner-Bratzler shear device.**

**Table II. Least squares means and standard errors for palatability traits in Trial II.**

| | Bulls (n = 13) | | SS Bulls (n = 13) | | Steers (n = 13) | |
|---|---|---|---|---|---|---|
| Traits studied | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| Shear value, lb. | 23.34[a] | 1.56 | 21.27[a] | 1.54 | 16.85[b] | 1.54 |
| Flavor (n = 52)[c] | 8.24 | 0.16 | 8.61 | 0.16 | 8.45 | 0.16 |
| Juiciness (n = 52)[c] | 7.94 | 0.27 | 7.97 | 0.27 | 8.16 | 0.27 |
| Tenderness (n = 52)[c] | 7.85[ab] | 0.27 | 7.50[c] | 0.27 | 8.45[b] | 0.27 |
| Overall satisfaction (n = 52)[c] | 8.20 | 0.19 | 8.25 | 0.19 | 8.40 | 0.19 |

[ab] **Values on the same line with different superscripts are significantly different at the 0.05 level.**

[c] **n = Number of consumer ratings per treatment. Each carcass received 4 ratings.**

**Table 12. Means and standard deviations for palatability traits in Trial III.**

| | Bulls (n = 11) | | SS Bulls (n = 12) | | Steers (n = 12) | |
|---|---|---|---|---|---|---|
| Traits studied | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| Shear value, lb. | 17.43[a] | 1.62 | 20.79[b] | 5.20 | 16.81[a] | 1.92 |
| Flavor | 8.59 | 0.58 | 8.75 | 0.50 | 9.00 | 0.00 |
| Juiciness | 7.91 | 0.77 | 7.88 | 0.53 | 8.42 | 0.79 |
| Tenderness | 7.50 | 1.28 | 7.63 | 0.53 | 8.33 | 0.72 |
| Overall satisfaction | 8.55 | 0.83 | 8.58 | 0.60 | 8.92 | 0.29 |

[ab] **Values on the same line with different superscripts are significantly different at the 0.05 level.**

Table 13. Overall means for palatability traits.

| Traits studied | Bulls (n = 28) | SS Bulls. (n = 36) | Steers (n = 36) |
|---|---|---|---|
| Shear value, lb. | 20.35 | 20.14 | 16.96 |
| Flavor | 8.47 | 8.67 | 8.67 |
| Juiciness | 7.90 | 7.86 | 8.22 |
| Tenderness | 7.75 | 7.64 | 8.28 |
| Overall satisfaction | 8.39 | 8.42 | 8.55 |

Table 14. Lease squares means and standard errors for weights of testes, adrenals and seminal vesicles.

| Traits studied | Bulls | | SS Bulls | | Steers | |
|---|---|---|---|---|---|---|
| | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| Testes wt., g. (Trial I) | 547.3 [a] | 17.4 | 152.4 [b] | 9.6 | - | - |
| Testes wt., g. (Trial II) | 605.2 [a] | 13.4 | 202.3 [b] | 13.4 | - | - |
| Adrenal wt., g. (Trial I) | 14.84 | 2.67 | 15.02 | 1.48 | 16.19 | 1.48 |
| Adrenal wt., g. (Trial II) | 15.92 [a b] | 1.07 | 18.08 [a] | 1.07 | 13.05 [b] | 1.07 |
| Seminal vesicle wt., g. (Trial II) | 89.43 [a] | 4.31 | 72.12 [b] | 4.31 | 3.55 [c] | 4.31 |

a b c Values on the same line with different superscripts were significantly different at the 0.05 level.

Table 15. Plasma testosterone levels (pg/ml) in bulls, SS bulls and steers (Trial II)

| Treatment | Age of animals at time of bleeding | | | | |
|---|---|---|---|---|---|
| | 10 months | 12 months | 14 months | 15 months | 16 months |
| Bulls | 1148 ± 252 (13) [b] | 1224 ± 457 (13) | 1191 ± 268 (13) | 1330 ± 257 (9) | 1527 ± 332 (4) |
| SS Bulls | 1164 ± 296 (13) | 1301 ± 265 (13) | 1311 ± 265 (13) | 1300 ± 341 (10) | 1146 ± 259 (6) |
| Steers [c] | 32 ± 10 (2/13) [d] | 43 ± 27 (2/13) | 27 ± 3 (3/13) | 33 ± 9 (2/13) | 28 ± 9 (2/13) |

[a] Plasma levels of testosterone were adjusted by an analysis of variance program to remove variability between assays.

[b] Number in parentheses represents animals from which blood was collected for that month.

[c] Steers were significantly lower ($P < .05$) in plasma testosterone for all ages.

[d] Blood was collected from 13 steers at each collection. Fraction in parentheses indicates animals showing detectable testosterone levels in 1 ml of plasma assayed.

numbers of live spermatozoa. Microscopic studies of histological samples taken from the testes after slaughter revealed no spermatozoa in the tissues from SS bulls. The testicles of SS bulls had functional interstitial cells which are the source of male hormones. These results agree with previous research (9, 14). Apparently the SS technique renders the animal infertile by impairing spermatogenesis. This probably resulted from pushing the testicles against the body, subjecting them to body heat.

One major problem with the SS technique is the danger of losses from tetanus, particularly in warm, wet weather. Four calves were lost from tetanus in the spring of 1973, dying about 2 weeks after they were short-scrotumed. The tetanus organisms apparently entered through small abrasions beneath the elastrator bands. Since there appears to be no real advantage in using SS bulls compared to normal bulls, future studies will be conducted primarily with normal bulls and steers.


## The Authors

John A. Jacobs, T. L. Gregory, R. G. Sasser, S. R. Gortsema, R. C. Bull and Morris Hemstrom were all members of the Department of Animal Industries, University of Idaho, when this research was conducted.

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