EFFECTS OF SEX DIFFERENCES IN BEEF CARCASSES RELATIVE TO CUTABILITY AND PALATABILITY

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Reports of this kind frequently are appraised in two ways by the hearers or readers. One school of thought, "Too cursory to be of value;" the other, "The detail is confusing." Therefore, the approach will be to please all the people all the time - and probably will be about as successful as that famous old verse would indicate it might. If, on the other hand, it serves to focus attention on trends and to provoke thought the purpose of the speaker will have been fulfilled.

The data of many research workers and their thoughts have been woven into this story. It is hoped that proper interpretation has been made and due credit acknowledged. Without doubt important data has been unavailable or overlooked. This can appropriately be introduced in the discussion to follow and entered on the printed record.

Because carcasses are dependent upon animal growth, feedlot investigations deserve a place in this report. Comparisons of steer and heifer performance are familiar stories and the results of a 1954-55 experiment using Hereford calves sired by bulls of Montana Line 1 and Nebraska Line 1 breeding appear to be typical (8). The data in table 1 indicate steers gain more rapidly and use feed more efficiently than heifers.

Table 1. Feedlot Performance of Steers and Heifers Sired by Bulls from Different Lines of Breeding.

	Montana[1]		Nebraska[1]	
	Heifers	Steers	Heifers	Steers
Initial Weight	406	400	419	410
A D G	1.93	2.27	1.96	2.21
Feed cost cwt. gain	$16.31	$15.03	$16.60	$14.61

[1]Breeding of Sire

Heifer carcasses have proportionately heavier hindquarters than steers but much of this advantage is lost with fat trim. Analysis of carcasses (4) from steers and heifers on feed 200 days showed a yield of 54.8% and 51.0% lean, respectively. Based on a large number of steers and heifers highly significant differences in retail cut yield were found in favor of steer carcasses. (3). Another report (10) indicated edible portion of 69.1 percent from steer carcasses and 67.7 percent from heifer carcasses. As a result of this advantage in muscle-fat ratio, steer carcasses yield a greater quantity of nutrients. (6).

A comparison (9) of heifer, cow and steer carcasses indicated increasing percentages in that order of trimmed boneless beef and bone. Fat

percentage decreased in the same order. The boneless beef to bone ratio was higher in heifers than in steers - an indication that careful marketing management of heifers might very well increase the value of heifer carcasses. In another project (12), the ratio of total edible portion to bone was 4.7 to 1 for steer carcasses and 4.9 to 1 for bull carcasses.

Although interest in heifer and steer comparisons has been expressed by livestock and meat personnel for many decades, interest in bulls as block beef producers has evolved comparatively recently. It is recorded that the early queens desired big, but gentle, docile and somewhat passive bearers. Perhaps this idea of the eunuch was transplanted to cattle production and no doubt is very effective when two and three years are required to get cattle to market. The plan may now be subject to critical review. A contemporary pioneer studying the effect of castration was the Arizona Station which reported the work in 1946 (14). Many other stations have pursued projects on steer, bull and hormone investigations.

As most of us would expect, the bulls gain more rapidly as evidenced by several trials summarized in table 2 (7) and table 3 (2).

Table 2. Daily Gains and Carcass Grades of Bulls, Steers and Late Castrated Steers.[1]

Trial	Bulls	Steers	
		Early Castrates[2]	Late Castrates[3]
	Average Daily Gain		
1	2.23	2.00	2.00
2	2.43	1.94	1.96
3	2.36	2.03	
4	2.76		2.31
5	2.60		2.06
	Carcass Grade[4]		
1	8.5	12.0	12.5
2	6.8	10.9	10.9
3	9.0	11.2	
4	7.8		10.9
5	9.1		11.5

[1]73 bulls, 38 steers and 43 late castrate steers.

[2]Castrated at approximately 1 month of age.

[3]Castrated at approximately 7 months.

[4]Prime = 15, 14, 13 Choice = 12, 11, 10, etc.

Table 3. Effect of Sex on Production and Carcass Traits of Half Sibs.

	Bulls	Steers	Heifers
Initial Weight	461	383	319
A D G	2.19	1.82	1.52
Carcass Grade[1]	7.0	9.4	9.2
Trimmed Boneless Yield from Thick Cuts	57.4	53.9	52.0

[1]15, 14, 13 = Prime, 12, 11, 10 = Choice, 9, 8, 7 = Good, etc.

In every one of these comparisons the feed requirement per unit gain was least for the bulls, next for steers and most for heifers. In the trials reported in table 2, bulls yielded the lowest dressing percentage - significant at the 5 percent level. Bull carcasses consistantly carried a lesser degree of finish and marbling which explains in large measure the lower carcass grade as compared with steers (2) and (5). On the other hand, the percent yield of trimmed boneless major cuts and the percent edible portion in the carcasses favored the bulls and was least in heifers (table 3 and table 4).

Table 4. Percent Edible Portion of Bull & Steer Carcasses

Trial	Bulls	Steers	
		Late Castrates	Early Castrates
1	77.7[1]	74.1	73.7
2	77.5[1]	74.4	74.1
3	77.1[1]	73.2	
4	76.1[1]		69.9

[1]Significant at .01

Based on other data (7) additional observations from a comparison of steer and bull carcasses are as follows: The steer carcasses had significantly heavier hindquarters, kidney knobs and flanks. Removal of the kidney knobs accounted for more than one-half the variance due to differences in percent of hindquarter between the lots. These results indicated that there was very little difference between the steers and bulls in proportion of preferred edible meat in the hindquarter. The percentage chuck in bull carcasses was greater than in steers, percentage of short loin was greater in steers - both comparisons significant at the one percent level.

There was no significant differences observed in any of the slaughter or carcass determinations between steers castrated at approximately one month of age and those castrated at approximately seven months of age (7).

Longissimus dorsi areas of half sib heifers, steers and bulls of similar ages measured 9.5, 9.8 and 11.1 sq. in. respectively. (2) Another

comparison (5) showed 2.02 sq. in. of longissimus area per hundred pounds of steer carcass and 2.33 sq. in. for bulls.

Unavoidable is the question: "If there are sex related variations in quantity of edible meat, what differences exist with reference to palatability? The few available reports on tenderness indicate that the bull beef is less tender than steer and heifer beef with little difference existing between the latter two. Warner-Bratzler shear readings on 1 inch cores of steers, heifers and bulls were 9.8, 11.0 and 12.3 lbs. respectively. (1) Taste panel scores in other data have average 6.92 and 6.91 for steers and heifers and in another trial 6.97 and 7.07 for steers and heifers. In still two other experiments (7), the taste panel scored the steers, 8.10 and 7.60, more tender than bulls, 7.60 and 6.90. Also, difference in tenderness between bulls and steers was less at 15 days post mortem than at 3 days post mortem (5) (7). It is commonplace for the range of tenderness scores to be wider within a sex grouping than it is between sexes, and for considerable overlapping of the extremes. Furthermore, data on Hereford bulls indicate that age beyond 14 months probably has a pronounced depressing effect on tenderness.

Chemical determination of intramuscular fat confirms the familiar visual observation that the longissimus dorsi muscle of steers has a higher degree of marbling than bulls. Data would indicate a difference in the magnitude of approximately 5.5 percent in steers as opposed to 2.2 percent in bulls. A study (11) of intramuscular fat from the lumbar region indicated the iodine numbers for steers were markedly higher than for young bulls at a given percentage of fat. A high moisture content for the bull meat is the antithesis. Slightly higher amounts of hydroxyproline have been found in bull muscle. Pilot attempts to determine and relate viscosity, specific gravity and refractive index of the meat extracts, cyanometmyoglobin and total N to palatability characteristics were not conclusive (13).

A few summary statements can be constructed from the sparse and varied data available to the writer. Bull calves surpass steers and steers surpass heifers in feed efficiency and rate of gain in the race to produce carcasses. Heifer carcasses normally are most highly finished; bull carcasses have a low degree of finish. Dressing percent follows no consistant pattern with respect to sex. Bull carcasses yield the greatest area of longissimus dorsi muscle per unit of weight. The yield of trimmed boneless cuts, influenced by degree of finish, indicate bulls have approximately a 6 percent advantage over steers and a 10% advantage over heifer carcasses. The trimmed boneless beef to bone ratio is greatest in bulls, usually intermediate in heifers and lowest in steers.

Chemical analyses show the least intra-muscular fat and most moisture in bull muscle, the most intra-muscular fat and least moisture in heifer beef and intermediate data from steer muscle. Range within class is wide. Connective tissue is most prevalent in bull muscle.

Steer and heifer beef is approximately one-half point (on a 10 point scale) more tender than bull beef derived from young, well fed bulls. The range of degrees of tenderness is moderately wide within sex groups. Although no objectionable flavors are inherent in these kinds of beef, apparently there has been little success in detailed flavor evaluation.

These observations concerning the sex associated differences were not particularly well received twelve years ago or even two years ago. Growing interest in bull production and carcass traits during the last two years is now reaching a high pitch. The current dilemma of the fed beef industry coupled with the coy rebuffs received by ambitious ambassadors seeking foreign markets for well finished beef are potent catalysts. Perhaps, after all, there is another way to protect our queen - the beef business.

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DR. KING: Thank you, Vern. To summarize and lead the discussion is one who needs no introduction for the majority of this group, but for those new members present, he is Dr. O. D. Butler, Head of the Department of Animal Science at Texas A. & M. University and my boss.

DR. BUTLER: Thank you, Gene. Since we are right now at the point when we should be ending this discussion, we will get into it very quickly. I have a few points to make by way of summary.

If it is the purpose of a grading system to identify the value of carcasses, we cannot avoid using the quantitative knowledge that we have at present. This is inescapable. The evidence is overwhelming, and it isn't perfect. Bob Bray brought this out real well. But it certainly is usable and superior to the present system.

Conformation is an issue which in my opinion can be resolved very easily. Conformation in beef cattle can do two things for you. It can improve the production or improve the cutability. Each one of these traits can be measured directly. So it seems very obvious that if we measure production directly and then let conformation go where it will among those that produce fast, and if we measure cutability directly and let conformation drift within those and select those that have the best cutability, then we will have conformation directly associated with the traits that are important. So we can simply change the definition of superior conformation and have it exactly related to the points that we are interested in. Quality of beef is an area of uncertainty. Personally, I wouldn't favor very much change until we have more factual information. I believe we have the factual information on the quantitative aspects. For quality we need objective measurements. We know that if the packers would give us enough time and let us sample carcasses we could array them rather exactly based upon their palatability. But this is impractical at the present time.