Carcass Characteristics, Palatability, and Shelf Life of Beef Finished on Selected Feeding Regimes

D. M. Allen, M. C. Hunt, C. L. Kastner, D. H. Kropf, V. Chen, O. Corte, G. H. Gutowski, A. R. Harrison, C. Kuntapanit, J. D. Thomas, and M. E. (Smith) McCurry

This report terminates a 3-year study and includes data from this past year. Previous results were reported in the 1976 and '77 Cattlemen's Day Reports (Allen et al., 1976 and Allen et al., 1977).

Summary

Cattle were finished on four feeding regimes: grass-fed, short- and long-fed (80% concentrate and 20% forage for 49 and 98 days, respectively), and forage-fed (60% forage and 40% concentrate for 98 days).

Quality grade averaged U.S. Good for the grass and short feds and U.S. Choice for the long- and forage-fed groups.

The taste panel tended to favor cattle fed longer; however, Warner-Bratzler shear force and consumer panel responses did not differ among treatments.

Steers finished for 98 days had the lowest percentage total collagen (connective tissue) and the greatest percentage of collagen in the salt soluble (most tender) state.

Grass feds had the lowest fat rancidity, as indicated by the lowest TBA (thiobarbituric acid) number, and highest percentage total poly-unsaturated fatty acids (expressed as percentage of fatty acids in the fat).

Muscle samples from the various feeding treatments were vacuum aged (21 days at 0-1°C) and then displayed (2-3 days at 3°C) without adversely affecting color stability.

Vacuum aging improved taste panel responses, but flavor of vacuum-aged cuts decreased after 5 days' display. Vacuum aging also decreased the slightly yellow fat color observed in steaks from grass-fed cattle before vacuum aging. The slightly yellow fat color should not affect marketability.

Carcass half conditioning at 13°C until 8 hr. postmortem did not consistently improve tenderness when compared with conventional chilling at 3°C until 48 hr. postmortem.

All bacterial numbers after carcass conditioning and vacuum aging were acceptable.

Introduction

Fluctuating feed prices have generated considerable interest in feeding practices for beef that differ from traditional finishing programs.

Changes in feeding practices raise questions about acceptability of the end product, and its response to current processing practices.

Alternative feeding regimes were evaluated for carcass traits and palatability, and shelf life characteristics of the product subjected to current processing practices.

Experimental Procedure

Thirty-eight calves from the Meat Animal Research Center, Clay Center, Nebraska, were castrated at birth and remained on bromegrass and bluestem pasture with their dams until they were weaned at six months of age. For the next 75 days, they received a growing ration (65% corn silage, 15% alfalfa haylage, and 20% cracked corn) and then Ralgro (36 mg. zeranol) was implanted. All steers received a wintering ration (48% corn silage, 50% alfalfa haylage, and 2% soybean meal) for the next 134 days before being grazed on bromegrass and bluestem for 133 days.

Ten steers (grass-fed) were slaughtered at the end of the grazing period. The remaining 28 steers were randomly assigned to either a short-, long-, or forage-fed finishing program in drylot. The short- (10 steers) and long-fed (8 steers) groups were fed 75% cracked corn, 5% soybean meal, and 20% alfalfa haylage for 49 and 98 days, respectively. The forage-fed group (10 steers) was fed 36% cracked corn, 4% soybean meal, 20% alfalfa haylage, and 40% corn silage for 98 days. Steers were slaughtered at approximately 18-23 months.

Approximately 1 hr. postmortem the right half of each carcass was chilled conventionally at 3°C until 48 hr. Left halves were conditioned at 13°C until 8 hr., then chilled at 3°C until carcass fabrication at 48 hr. postmortem.

Longissimus (loin eye), semitendinosus (eye of round), semimembranosus (top round), and biceps femoris (bottom round) muscles were removed from each carcass half at 48 hr. postmortem. Each muscle was sampled before and after vacuum storage at 0-1°C for 21 days and evaluated before, during, and after 5 days' display in polyvinylchloride film at 3°C under 100 foot candles of General Electric Deluxe Warm White Light. Inside chuck and gluteus medius (top sirloin) samples were used in some comparisons.

Results and Discussion

Carcass and Eating Quality Characteristics

Longer feeding increased carcass weight, fat thickness, rib eye area, internal fat, and numerical yield grade and reduced cooler shrinkage. Higher marbling scores, quality grade, and whiter external fat resulted from increased feeding. Lean texture tended to be finer in longer fed cattle. Bone maturity increased slightly over the 98-day feeding period

but remained well within the A maturity range. Quality grade averaged Good for the grass and short feds and Choice for the long- and forage-fed groups.

All taste panel responses (tenderness, flavor of lean and fat, and juiciness) to longissimus samples favored cattle fed longer. Grass-fed cattle, however, were rated slightly juicy and desirable. Generally, feeding regime did not affect tenderness measurements of the longissimus, semitendinosus, and semimembranosus steaks; however, some differences in Warner-Bratzler shear force were noted in the biceps femoris comparisons. A 61-member consumer panel did not prefer gluteus medius samples from any one feeding regime over another.

Connective tissue was studied to determine its effect on tenderness. Longissimus steaks from steers finished on a high plane of nutrition for 98 days had the lowest proportion of total collagen (connective tissue), highest yield of salt soluble collagen, and most-preferred taste panel ratings. A higher nutritional plane will improve taste panel ratings perhaps by decreasing total collagen percentage in the longissimus muscle, by increasing the percentage of collagen in the salt soluble state, or both.

Total cooking and drip losses were generally lowest in steaks from grass-fed cattle. Drip loss from the longissimus muscle increased with increasing time on feed, possibly due to the increased fat content in longer-fed cattle.

Vacuum aging improved taste panel tenderness, juiciness, flavor scores, and objective tenderness measurements. Vacuum aging, however, decreased taste panel flavor scores of steaks displayed 5 days; whereas, tenderness increased during display.

Conditioning carcass halves at 13°C as opposed to chilling counterparts at 3°C failed to consistently improve tenderness evaluated by Warner-Bratzler shear force and taste panel. Conditioning only improved taste panel tenderness evaluated for grass-fed steaks. This was true even though all halves had less than 1.27 cm. fat over the 12th rib; pH values greater than 6 prior to cold application; and, in grass-fed halves chilled at 3°C, deep tissue (internal round) that chilled at 1.3°C per hour for the first 6 hr. postmortem. All these factors met or approximated conditions (previously established by other workers) that could encourage cold shortening, which can decrease tenderness.

Shelf Life Characteristics

TBA (thiobarbituric acid) number (fat rancidity measure) for samples from carcass halves conditioned at 13°C did not differ from counterparts chilled at 3°C.

At all sampling periods, grass-fed longissimus samples had the lowest TBA numbers. Vacuum packaging and display increased TBA number in longissimus and subcutaneous fat samples. TBA number did not differ between feeding regimes for subcutaneous fat samples or between subcutaneous layers, regardless of feeding regime. All TBA numbers were

low, and normally less than those reported by other workers as being detectable by taste panels. Grass feds had the highest mean total poly-unsaturated fatty acid composition (expressed as percentage of fatty acids in fat) even though nutritional regimes did not differ for percentage saturated and unsaturated fatty acid composition.

For steaks displayed continously (24 hr. a day), longissimus steaks from grass- and short-fed cattle approached visual rejection by the fifth day. Semitendinosus steaks from all feeding regimes retained an acceptable visual score throughout display, but biceps femoris and semimembranosus steaks from grass-, short-, and long-fed cattle approached or surpassed visual rejection by the third day.

All test steaks from carcasses in this study were vacuum aged for 21 days and then displayed for 48 to 72 hr. without adversely affecting color stability. Vacuum aging decreased the slightly yellow fat color observed in steaks from grass-fed cattle evaluated before vacuum aging. The slightly yellow fat color should not affect marketability.

Carcass halves chilled at $3^{o}C$ had lower total psychrotrophic and mesophilic bacterial numbers than did corresponding halves conditioned at $13^{o}C$. Total aerobic and anaerobic bacterial numbers tended to remain constant or decrease slightly during vacuum storage. Vacuum-stored cuts from carcasses of grass-fed steers had significantly higher aerobic and anaerobic numbers than those of other feeding regimes. All carcass and resultant cut bacterial numbers were acceptable, before and after carcass conditioning, vacuum aging, or both.