

EVALUATING SHELF LIFE OF BEEF STEAKS OF CATTLE RAISED FROM DIFFERENT GRASS AND GRAIN FEEDING SYSTEMS

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I. OBJECTIVES

Current consumer perceptions commonly view grass-fed beef to be healthier and more environmentally sustainable compared to conventional grain-fed beef. Consumer and retailer trends indicate that shelf life is an important factor in making purchasing decisions. The objective of this study was to compare the shelf life of beef steaks from different grass and grain feeding systems. The 4 treatments include (1) conventional grain-fed beef (CON, $n = 12$), (2) 20-mo grass-fed beef (20GF, $n = 12$), (3) 25-mo grass-fed beef (25GF, $n = 12$), and (4) 20-mo grass-fed + 45-d grain-fed beef (45CON, $n = 9$).

II. MATERIALS AND METHODS

After the slaughter, the strip loins were aged for 14 d in vacuum packages at 5.5°C, then cut into steaks. Immediately, the steaks were wrapped into the oxygen-permeable film and placed under a retail display for 6 d at 4°C–6°C. During the retail display, color of lean muscle and external fat surfaces of each steak (L^* , a^* , and b^*) were measured at 3 positions every 12 h daily for 6 d. Bacterial counts for total aerobic mesophilic bacteria, aerobic psychrotrophic bacteria (APB), and lactic acid bacteria for steaks from each strip loin were assessed on days 0, 3, and 6 of retail display. The pH of the same steak samples for microbial analysis was also measured. Data were analyzed using R version 3.6.1 for Windows. Packages analysis of variance, emmeans, and Cld were used. Two-way analysis of variance was conducted for each variable to investigate treatment effects, display time effect, and corresponding interactive effect.

III. RESULTS

Steaks from 20GF and 25GF treatment groups had lower ($P < 0.05$) L^* values than steaks from the CON treatment group, while L^* values of steaks from CON and 45CON were not significantly different. The a^* values of 20GF and 45CON treatment group steaks were lower ($P < 0.05$) than those of CON and 25GF treatment group steaks. However, external fat L^* values of steaks from CON and 45CON treatment groups were significantly lower ($P < 0.05$) than those of the 20GF and 25GF treatment groups. The b^* values of external fat were significantly higher ($P < 0.05$) in the steaks from CON and 20GF treatment groups than in the steaks from 25GF and 45CON. The aerobic mesophilic bacteria counts were significantly higher ($P < 0.05$) in steaks from 20GF and 45CON treatment groups than in beef muscle from CON and 25GF treatment groups, while APB and lactic acid bacteria were significantly higher ($P < 0.05$) in steaks from grass-fed treatment groups than in steaks from grain-fed and 45CON treatment groups. Initial counts for APB were between 4.80 and 5.85 on day 0 in the steaks from all the treatments. However, on day 3, APB counts for the steaks from grass-fed steers approached the indicative spoilage level (7 log CFU/g). On day 6, APB counts for all the treatments exceeded spoilage level. The thiobarbituric acid reactive substances values were significantly higher ($P < 0.05$) in the steaks from 20GF and CON treatment groups than 25GF and 45CON treatment groups. On day 6, thiobarbituric acid reactive substances values were 4.71 mg/kg for CON, 3.47 mg/kg for 20GF, and 2.84 mg/kg for 45CON and 25GF treatment

groups, respectively, indicating the spoilage of the steaks due to lipid oxidation. There was no significant difference in muscle pH among treatments.

IV. CONCLUSION

The results indicated that the shelf life of the steaks from the grass feeding system might be shorter due to the appearance and faster microbial spoilage rate than the steaks from cattle raised on grain-incorporated feeding systems.

Keywords: shelf life, beef steaks, feeding systems, grass-fed beef, grain-fed beef