

EFFECTS OF BACKGROUNDING VS GRAIN FEEDING ON GROWTH PERFORMANCE, CARCASS CHARACTERISTICS, PALATABILITY ATTRIBUTES AND FATTY ACID COMPOSITION OF FINISHING STEERS

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Summary

Crossbred steers were used to evaluate the effect of management strategy on growth performance, carcass characteristics, palatability attributes, and fatty acid composition of finished cattle. Management strategies included 1) high-grain finishing with a 75% corn diet fed at maximum intakes from weaning to slaughter; and 2) backgrounding where a 100% alfalfa silage diet was fed at 1.9% of bodyweight for 112 days followed by feeding the high-grain diet at maximum intakes until slaughter. Comparisons were performed at 10 mm of grade fat.

Backgrounding increased time on feed and feed required per pound of weight gain, but decreased time on grain, dry matter intake, average daily gain, and rib eye area as compared to steers directly placed on the high-grain diet. Weight at slaughter, lean yield, subjective marbling score, and intramuscular fat percentage were not affected by management strategy. Management strategy did not affect palatability attributes (tenderness, juiciness, flavor) for rib eye steaks.

Rib eye steaks were analyzed for fatty acid composition to determine the effects of management strategy on altering deposition of desirable and undesirable fatty acids pertaining to human health. Backgrounding decreased the levels of undesirable fatty acids including saturated fatty acids and polyunsaturated, omega-6 fatty acids when compared to steers fed the high-grain diet from weaning to slaughter. For desirable fatty acids, backgrounding increased monounsaturated fatty acids, conjugated linoleic acid, and omega-3 polyunsaturated fatty acids as compared to cattle fed the high-grain strategy.

Introduction

Beef consumption has been steadily declining over

the last two decades while poultry consumption has dramatically increased. The decline in beef consumption can be mainly associated to problems with consistency of quality (i.e., tenderness), perceived healthfulness (i.e., lipid amount and composition), and food safety (i.e., *E. coli*, BSE). Health-related concerns about beef are partially due to its relatively high concentration of undesirable, cholesterol-raising saturated fatty acids and low concentration of desirable, cholesterol-lowering polyunsaturated fatty acids.

Current dietary recommendations for humans make a distinction between omega-6 and omega-3 fatty acids because a balance between these two families of essential polyunsaturated fatty acids is recognized to be fundamental for normal growth and overall health. There is evidence of beneficial effects of omega-3 fatty acids in the prevention of cardiovascular disease and cancer, in contrast to opposite effects indicated for some omega-6 fatty acids. Furthermore, specific conjugated linoleic acids exhibit anticarcinogenic effects at very low dietary concentrations. While desirable conjugated linoleic acids are more abundant in ruminant versus monogastric depot lipids, grass-fed cattle deposit greater amounts of those fatty acids in muscle than grain-fed cattle.

Diet is an important factor affecting fat composition in beef muscle, although fatty acid deposition is extensively regulated by the activity of rumen microorganisms. Therefore, the purpose of this study was to compare the effects of management strategy (backgrounding vs high grain feeding) on growth performance traits, carcass characteristics, palatability attributes, and fatty acid composition of finished steers.

Materials and Methods

One hundred and thirty-six steer calves from the University of Guelph's Maternal-Terminal Line

Project were used in the trial. All steers were finished at the Elora Beef Research Centre. Cattle were randomly allotted to one of two management strategies: 1) weaned cattle, directly placed on a high-grain diet (75.1% high moisture corn, 17.7% alfalfa silage, 3.6% soybean meal) and fed at maximum intakes; and 2) cattle fed 100% alfalfa silage at 1.9% of bodyweight for 112 days, followed by feeding the high-grain diet until slaughter.

Cattle were selected for slaughter based on attaining 8-10 mm of backfat determined using ultrasound. Finished steers were slaughtered at the University of Guelph Meat Laboratory abattoir. Hot carcass weights were recorded prior to overnight chilling at 1°C. The left-hand side of each carcass was graded by Canadian Beef Grading Agency graders. An experienced carcass evaluator assessed carcass measurements at the 12th to 13th rib interface, including grade fat (mm), rib eye area (square inches), and subjective marbling score. For each carcass, rib eye steaks were prepared for determination of intramuscular fat content (%), fatty acid concentrations (% of total fat), and taste panel evaluation of palatability attributes (tenderness, juiciness, flavor).

Crossbreeding data were adjusted to a constant level of backfat thickness (10 mm grade fat).

Results and Discussion

Backgrounded steers required 64 more days on feed but 47 fewer days on grain to finish than steers on the high-grain regime (Table 1). Backgrounding decreased average daily gain and rib eye area as compared with steers directly placed on the high-grain diet. Steers on the backgrounding strategy gained 1.08 lb/d on the alfalfa silage, followed by a compensatory gain of 4.85 lb/d on the high-grain diet. Slaughter weight, carcass weight, lean yield, subjective marbling score, and intramuscular fat percentage were not affected by management strategy.

Management strategy affected the fatty acid composition of rib eye steaks (Table 2). Backgrounding decreased concentrations of undesirable, saturated fatty acids, with less myristic acid and stearic acid than steers on the high-grain regime. Desirable, monounsaturated fatty acids

increased with backgrounding, as compared to high-grain feeding. Backgrounded steers had less undesirable, omega-6 polyunsaturated fatty acids, including less linoleic acid and arachidonic acid, than steers on the high-grain diet. In contrast, backgrounded steers had more desirable, omega-3 polyunsaturated fatty acids, including linolenic acid, eicosapentaenoic acid, and docosahexaenoic acid than steers on the high-grain strategy. Concentrations of desirable conjugated linoleic acids were also greater in backgrounded steers.

These results suggest that backgrounding may alter fatty acid composition of beef with more desirable omega-3 polyunsaturated fatty acids and conjugated linoleic acids, and less of the undesirable saturated and omega-6 polyunsaturated fatty acids, in line with current dietary recommendations for humans.

Significance to the Industry

Backgrounding with high quality forages may be a practical management strategy for finishing cattle. Backgrounding did not affect carcass traits including slaughter weight, carcass weight, lean yield, intramuscular fat deposition, and palatability attributes when compared with grain finishing at a constant backfat finish.

Backgrounding alters intramuscular fatty acid deposition in cattle, which may be beneficial to human health. Less saturated fat and more unsaturated fat including omega-3 polyunsaturated fatty acids and conjugated linoleic acids are deposited in backgrounded cattle as compared to cattle directly placed on a high grain diet after weaning. Incorporation of backgrounding in management strategies for finishing cattle requires considerations of differential costs among diets, lower efficiencies in converting feed to gain, and longer periods of time required for backgrounded steers to finish as compared to cattle on a high-grain regime.

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Table 1. Estimated management strategy effects on growth performance, carcass characteristics, and palatability attributes of finishing steers

Item	Management Strategy		Pr > t
	High-Grain	Backgrounding	
Growth performance			
Days on feed ^a	160.0	224.3	< 0.001
Days on grain	160.0	113.3	< 0.001
Slaughter weight, lb	1317	1294	0.362
Average daily gain, lb/d	4.21	3.04	< 0.001
Dry matter intake, lb/d	21.30	18.45	< 0.001
Feed/Gain ratio, lb/lb	5.10	6.12	< 0.001
Carcass characteristics			
Hot carcass weight, lb	794	768	0.110
Rib eye area, square inches	13.5	12.6	0.010
Lean yield, % ^b	54.0	54.3	0.532
Marbling score ^c	5.20	5.35	0.293
Intramuscular fat, %	5.12	5.46	0.214
Palatability attributes			
Tenderness ^d	6.89	7.20	0.287
Juiciness ^e	7.31	7.11	0.255
Beef flavor ^f	8.00	8.04	0.707

^a Days from the start of the trial to slaughter.

^b Yield data based on percentage lean in the 9th to 11th rib section.

^c Rib eye scored subjectively for marbling using a 10-point scale (4 = slight; 5 = small; 6 = modest).

^d Subjective assessment of the force required to chew the sample, scored from 1 = no force to 15 = extreme force.

^e Scored subjectively from 1 = no juiciness to 15 = extreme juiciness.

^f Scored subjectively from 1 = no beef flavor to 15 = extreme beef flavor.

Table 2. Estimated management strategy effects on fatty acid composition in rib eye steaks from finishing steers

Fatty acids ^a	Management Strategy		Pr > t
	High-Grain	Backgrounding	
Saturated	46.32	45.37	0.023
Monounsaturated	46.48	47.35	0.044
Polyunsaturated	5.66	5.59	0.715
Omega-6	4.32	3.92	0.011
Omega-3	0.99	1.29	< 0.001
Conjugated linoleic acid	0.32	0.35	0.050

^a Reported as normalized percentages (g / 100 g of total fatty acids).