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Effects of Post-Weaning Exposure to a High-Concentrate Based Diet vs. Pasture on Carcass Characteristics, Meat Quality, and Lipogenic Gene Expression of Early Harvested Steers

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Objectives

High-concentrate based diets fed during the finishing phase promotes marbling deposition in cattle. However, little has been reported that examines early exposure to high-concentrate diets during the post-weaning phase and the ability to accelerate marbling deposition. Our objective was to evaluate marbling deposition, meat quality, and lipogenic gene expression of post-weaned steers when started on a high-concentrate based diet or grazing high-quality forages.

Materials and Methods

Steers ($n = 20$; initial BW = 261 ± 21.5 kg) were randomly assigned to 1 of 2 feeding treatments: high-concentrate based diet (cracked corn, corn gluten feed, and chopped hay [F]) or grazing high-quality pasture (winter annuals, alfalfa, and non-toxic fescue [P]) for 127-d. Steers were harvested at a commercial abattoir where subcutaneous (SC) adipose tissue was collected and flash frozen for total RNA isolation, and flash frozen in optimal cutting temperature compound for histology. On d 2 post-harvest, carcass characteristics and the 6 to 12 rib section of each carcass was collected for further analysis. RefFinder was used to evaluate reference gene candidates and data was analyzed with Proc Mixed of SAS 9.3 (SAS Inst. Inc., Cary, NC).

Results

Steers consuming grain had a greater overall ADG (1.36- vs. 0.68-kg/d for F and P, respectively; $P < 0.01$) resulting in heavier final BW and HCW, and greater dressing percentage ($P < 0.01$). Steers consuming grain had larger ribeye area ($P < 0.01$) and more fat at the 12th–rib ($P < 0.01$) than steers on forages, whereas there were no differences for KPH and calculated yield grade ($P > 0.22$). Grain consumption resulted in greater marbling scores than grazing pasture ($P < 0.01$; 448 vs. 240, respectively). Despite the increased marbling, longissimus muscle (LM) b* was not different ($P > 0.95$), whereas LM from F were brighter and more red ($P < 0.01$). Both SC L* and b* were not different between treatments ($P > 0.20$), whereas SC a* was greater for F than P ($P < 0.01$). Fat cell sizes of SC tissue were larger in perimeter and area for F ($P < 0.01$) whereas P had a greater fat cell number ($P < 0.01$). Steers on F had greater LM total lipid ($P < 0.01$), whereas P resulted in greater moisture, nitrogen and ash ($P < 0.01$). There were no differences in SFA or PUFA n-6 in LM ($P > 0.49$) whereas F had greater MUFA ($P < 0.01$) and P had greater PUFA and PUFA n-3 ($P < 0.01$) resulting in a more desirable PUFA n-6/PUFA n-3 ratio ($P > 0.01$; 1.46 v 7.35 for P and F, respectively). Furthermore, while Warner-Bratzler Shear Force (WBS) mean ± SD values were all well below 5 kg, and there was not an interaction between treatment and days aged ($P = 0.106$), there tended to be a higher shear force value for steers on F compared to P ($P < 0.08$; 2.99- vs. 2.75-kg, respectively) while WBS values decreased as steaks were aged 2-, 7-, and 14-d ($P < 0.01$). Fatty acid synthase and stearoyl CoA desaturase-9 were upregulated by 16 and 81 fold, respectively for steers on F when compared to P ($P < 0.01$). Additionally, F steers had a 42-fold increase in mRNA of elongase-5 compared to P steers ($P < 0.01$) and threefold more expression of lipoprotein lipase ($P = 0.01$).

Conclusion

These data suggest that exposure to high-concentrate based diets during early post-weaning results in increased carcass quality, lipid deposition, and expression of key lipogenic genes.