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Duration of Exposure to a High-Concentrate Diet Prior to Pasture-Finishing Affects Fatty Acid Composition and Volatile Compounds of Beef Strip Loin Steaks

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Objectives

The objective of the present study was to determine the effects of exposure to a high-concentrate diet prior to pasture-finishing on fatty acid composition and volatile flavor compounds produced during cooking of beef strip loin steaks.

Materials and Methods

Angus-cross steers (*n* = 48 [12 head/treatment]) were provided a high-concentrate cracked corn-based diet for 0 d (0D), 40 d (40D), 80 d (80D), or 120 d (120D) prior to pasture-finishing on high-quality forages (non-toxic tall fescue, rye/ryegrass, oats, alfalfa) to a target final BW (487 kg). Carcass data were recorded and strip loins removed 24 h postmortem. Eight strip loins (USDA Select) were selected per treatment for further analyses; 8 additional process-verified grass-fed strip loins were selected from a commercial processing facility in New Zealand (NZ) by trained personnel targeting USDA Select quality grade to be used as a baseline comparison. All subprimals were aged under vacuum for 21 d postmortem at 4°C then frozen (–20°C). Strip loins were fabricated frozen into 2.54 cm steaks, and a single steak from each strip loin was used for fatty acid analysis and volatile compound analysis. Fatty acids were quantified from fatty acid methyl esters and volatile flavor compounds were evaluated on cooked samples using gas chromatography. Data were analyzed using a one-way ANOVA with animal serving as the experimental unit.

Results

Total fatty acids (g/100g) were greatest in NZ (3.23 g/100 g; $P < 0.05$) and least in 0D (1.53 g/100 g; $P < 0.05$). Concentration of saturated fatty acids was decreased ($P < 0.05$) and concentration of monounsaturated fatty acids was increased ($P < 0.05$) in NZ compared to all other treatments. Odd-chain fatty acids were greater in 40D, 80D, and 120D than NZ and 0D ($P < 0.05$). Trans-vaccenic acid and conjugated linoleic acid concentrations were greater in 40D, 80D, and 120D than NZ ($P < 0.05$), with 0D intermediate ($P > 0.05$) for trans-vaccenic acid. Concentration of n-6 polyunsaturated fatty acids was greater in 80D and 120D than all other treatments ($P < 0.05$), and concentration of n-3 polyunsaturated fatty acids was greater in 0D than all other treatments ($P < 0.05$). Consequently, the ratio of n-6:n-3 polyunsaturated fatty acids was greater in 80D and 120D than all other treatments ($P < 0.05$). Non-enzymatic browning-derived ketones (2,3-butanedione and 3-hydroxy-2-butanone) were increased in NZ compared to all other treatments ($P < 0.05$). Differences among treatments in lipid-derived volatile compounds were primarily of alcohols and aldehydes. In particular, 1-penten-3-ol was greater in NZ than all other treatments ($P > 0.05$), and 1-octanol was greater in NZ than all treatments ($P < 0.05$) except 40D ($P > 0.05$) and lesser in 120D than NZ and 40D ($P < 0.05$). Hexanal was greater in NZ than all other treatments ($P < 0.05$) except 80D ($P > 0.05$), and octanal was greater in NZ than 80D and 120D ($P < 0.05$). Additionally, 2-pentylfuran was greater in NZ than all other treatments ($P < 0.05$).

Conclusion

Concentrations of fatty acids and quantity of volatile compounds produced during cooking are affected by exposure to grain prior to pasture-finishing. Additionally, beef produced in NZ chemically differs from that produced through pasture-finishing systems in the United States. Changes in fatty acid composition affect lipid oxidation products in cooked beef.

