2019 Reciprocal Meat Conference– Meat and Poultry Quality and Composition-Measurement and Prediction

Meat and Muscle Biology™

Fatty Acid Composition of New Zealand Forage Finished Beef Compared to US Grain Fed Beef

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Keywords: fatty acid, feeding, fodder beet
Meat and Muscle Biology 3(2):127

Objectives

The objective of this study was to evaluate differences in fatty acid (FA) composition of NZ beef finished on fodder beet (Beta vulgaris subsp. vulgaris L.; FB) or traditional grass diets and US grain-finished beef.

Materials and Methods

Strip loins (n = 240) were selected from a commercial abattoir in NZ representing two feeding treatments (FB, non-FB) and expected low and high eating quality (primarily based on marbling) following a nationwide feeding trial to finish beef steers using FB. Selection resulted in four treatments: FB low quality (FBL), FB high quality (FBH), non-FB low quality (NFBL), and non-FB high quality (NFBH). Additionally, sides of beef (n = 120) representing USDA Top Choice (TCH) and Select (SEL) were sourced from a commercial abattoir in the US. Loins were fabricated prior to 21 d postmortem to isolate the longissimus lumborum (LL); these were sliced into 2.5 cm steaks, vacuum packaged, and stored at 2–4°C until 21 d or 35 d postmortem and frozen on the appropriate day. Lipids were extracted from a subset of samples via chloroform: methanol extraction then separated into polar and neutral fractions. Fatty acid methyl esters were evaluated using GC-FID. Data were analyzed with a 2-way ANOVA at a significance level of $\alpha = 0.05$ and treatment, aging, and the respective interaction as fixed effects.

Results

Aging influenced percent saturated FA (%SFA; $P < 0.01$), monounsaturated FA (%MUFA; $P < 0.01$), and polyunsaturated FA (%PUFA; $P = 0.01$). An increase in %MUFA and %PUFA at 35 d compared with 21 d ($P < 0.01$) corresponded with a decrease in %SFA at 35 d ($P < 0.01$). Treatment also influenced %PUFA ($P < 0.01$). NFBL contained the greatest %PUFA ($P < 0.05$). TCH and FBH contained less %PUFA than all treatments except SEL ($P > 0.05$). Treatment and aging also affected palmitic and stearic acids ($P < 0.01$), which make up the greatest portion of SFA. The proportion of palmitic acid was least in SEL ($P < 0.05$) and greater in FBH than NFBH and TC ($P < 0.05$). The US treatments had lower proportions of stearic acid than NZ treatments ($P < 0.05$). Both palmitic and stearic acids were of greater proportions in 35 d samples than 21 d samples ($P < 0.05$). Oleic acid contributes largely to total FA and was affected by the interaction of treatment and aging ($P = 0.04$). At 35 d, NZ treatments had greater proportions of oleic acid than at 21 d ($P < 0.05$). The proportion of oleic acid was least in SEL at both aging times. Of the PUFA, linoleic was affected by treatment ($P < 0.05$) and was greatest in SEL and TC ($P < 0.05$); FB treatments had the lowest proportion of linoleic acid ($P < 0.05$). Treatment and aging affected α-linolenic acid ($P < 0.01$). NFBL and NFBH had a greater proportion than both FB and US treatments ($P < 0.05$); both FB treatments had greater proportions of α-linolenic than US treatments ($P < 0.05$). Proportion of α-linolenic acid was elevated with 35 d aging ($P < 0.05$). Treatment affected proportions of long chain PUFA ($P < 0.05$) with TCH and SEL having lower proportions than NZ treatments ($P < 0.05$). Low quality NZ treatments had the greatest proportions of long chain PUFA ($P < 0.05$).

Conclusion

While finishing diet does affect fatty acid composition of beef strip steaks, finishing on FB produces a similar FA composition to non-FB grass. Total lipid content is also responsible for variation in FA composition. As lipids oxidize during aging, a shift toward more unsaturated FA occurs, leading to a decrease in %SFA.