Fatty Acid Composition and Mineral Content Variation in Florida Crossbred Cattle

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Synopsis

This study analyzed the fatty acid composition and mineral content variation in beef from Florida crossbred cattle and determined the relationship of these beef nutritional attributes with breed type.

Summary

Carcass data and steak samples were collected from 230 head of cattle. The breed type of the population ranged from 100% Angus to 100% Brahman. All 230 samples were analyzed for fatty acid composition and 150 were tested for mineral content. There is a correlation between the fatty acid content and breed type. A wide range of variation was found in terms of mineral content, specifically iron, which implies there is opportunity for selection of cattle with a desirable phenotype: in this case the desirable phenotype is beef of higher mineral content.

Introduction

Seven factors have been identified as consequential for driving beef demand. Ranked in the order of their relevance to consumers these factors are: price, food safety, product quality, health, nutrition, social aspects, and sustainability. Since Florida beef producers cannot control price, they should focus on the safety, quality, healthfulness, and nutritional value of beef products to best meet the desires of the consumer.

One of the greatest selling points of beef is that it provides a superior eating experience/taste over other protein sources. Over and above this eating experience, beef is a nutrient rich foodstuff. However, it also is considered to have an unhealthful fatty acid composition. Nutrient profiles are not uniform across cattle, and variations in fatty acid composition and mineral content is partially attributable to genetic factors. If beef producers could select cattle that have more healthy fatty acid profiles or higher iron and zinc content, they could enhance the nutritional and health value of beef. Beef perceived as more healthy could increase profit to producers because consumers may likely be willing to pay a premium for beef that consistently has an improved nutritional and health value. In addition, this nutritionally-enhanced beef could increase overall demand for beef and lead to continued growth of the beef industry.

The goal of this study was to characterize the amount of natural variation in fatty acid and mineral content and determine the relationship between the nutritional and healthfulness value and breed composition.

Materials and Methods

Population and phenotypic data collection

The cattle in this study are part of the University of Florida multibreed herd of cattle that range from 100% Angus to 100% Brahman. All cattle in this study have full pedigree records defining their exact breed composition. Cattle were classified into six different groups based on their expected Angus and Brahman breed composition. Based on the Angus composition, the grouping was as follows: 1 = 100 to 80%; 2 = 79-65%; 3 = 62.5% (Brangus); 4 = 59 to 40%; 5 = 39 to 20%; 6 = 19 to 0%. .Steers were fed a high-grain diet to reach a predetermined finishing end-point. When steers reached 0.5 inch of backfat over the ribeye, they were transported to a commercial packing plant and harvested using established USDA-FSIS procedures. A 1-inch steak removed from the 12th/13th rib was sampled per animal from the *Longissimus dorsi* muscle interface. Steaks were transported to the Meat Science laboratory of the Department of Animal Sciences at University of Florida, vacuum packaged, aged for 14 d from the harvest date at 36°F and frozen at -4°F. A thin shaving of each steak trimmed of external fat and

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connective tissue, was powdered, and analyzed at Iowa State University for fatty acid and mineral composition.

Statistical Analysis

Fatty acid composition was calculated on a percentage basis by using the peak areas. All fatty acid components were used to calculate total percentage of saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA), omega-3 PUFA, and omega-6 PUFA. Additionally, the atherogenic index was calculated as described by Ulbricht and Southgate (1991) by using the ratio of palmitic and myristic acids to total unsaturated fatty acid.

All statistical analyses were performed using SAS (SAS Inst. Inc., Cary, NC). The MEANS procedure was used to produce descriptive statistics for fatty acid and mineral composition data. Least squares means estimating the effect of breed were obtained from the PROC GLM procedure of SAS using a fixed effects model which had breed and birth year. Least squares means were separated using the PDIFF option of GLM in SAS.

Results

Saturated fatty acids are known to have a negative effect on human health, while polyunsaturated fatty acids are known to have a positive effect. There was no significant difference ($P>0.05$) in the amount of MUFA among the different breed groups (ranging for 44.2% to 45.8%). However, a beneficial trend was found in both the SFA and PUFA, with SFA declining from 51.3% to 47.5% and the PUFA increasing from 4.3% to 6.9% as the percentage of Brahman increased from 0 to 100%, as shown in Figure 1.

The mean iron concentration in *Bos indicus* influenced cattle was 14.50 µg/g muscle. However, there was variation in iron concentration; in beef from *Bos indicus* influenced cattle, as shown in Figure 2. The maximum iron concentration in this study was 27.44 µg/g muscle; which represents between 15 and 34% of the recommended daily allowance for iron depending on gender and age. The variation in iron content provides an opportunity for genetic selection of cattle with a superior phenotype, or nutritional value.

Conclusion

Genomic selection provides an opportunity to change nutritive value and healthfulness of Florida beef in a desirable direction with substantial positive consequences for human health and wellbeing. We anticipate that genomic tools for implementing genetic marker-assisted selection will soon be available and will open up opportunities for the breeding of Florida beef with improved nutritional and healthfulness value. Additionally, we anticipate consumers will be willing to pay a premium for more nutritious and healthier beef. Future work will clarify how large these economic returns may be and how the premium would impact Florida beef producers.

Acknowledgements

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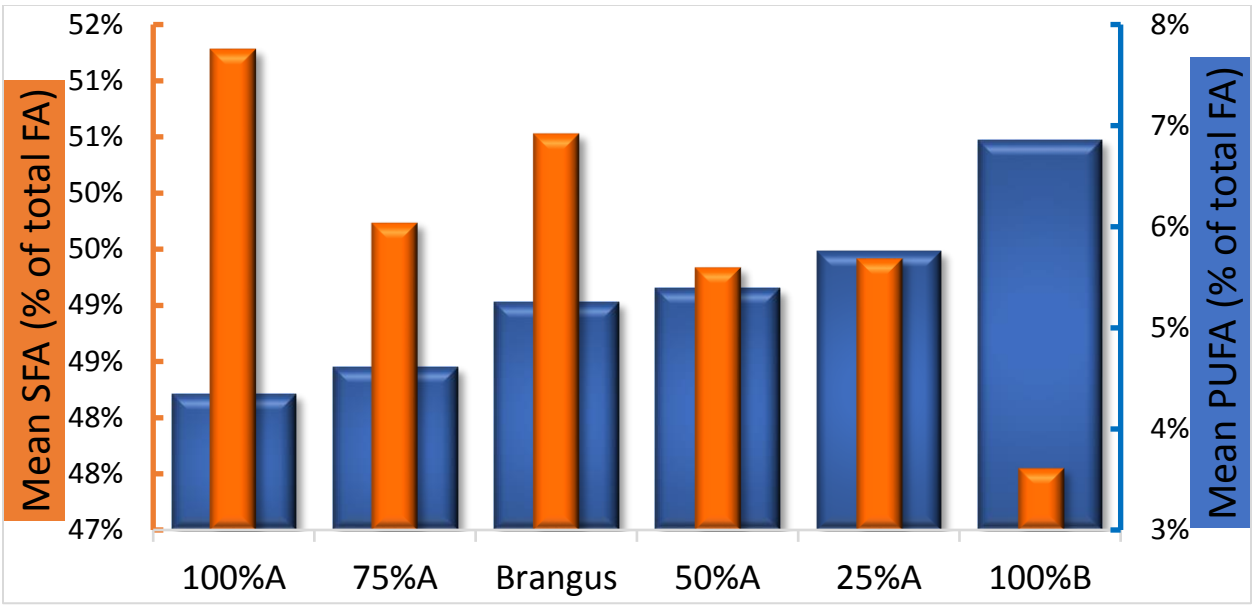

Figure 1. Effect of breed type on saturated fatty acids (SFA) vs polyunsaturated fatty acids (PUFA) as a proportion of total fatty acid (FA) in cattle harvested after finishing on a high-grain diet. Angus = A, Brahman = B.

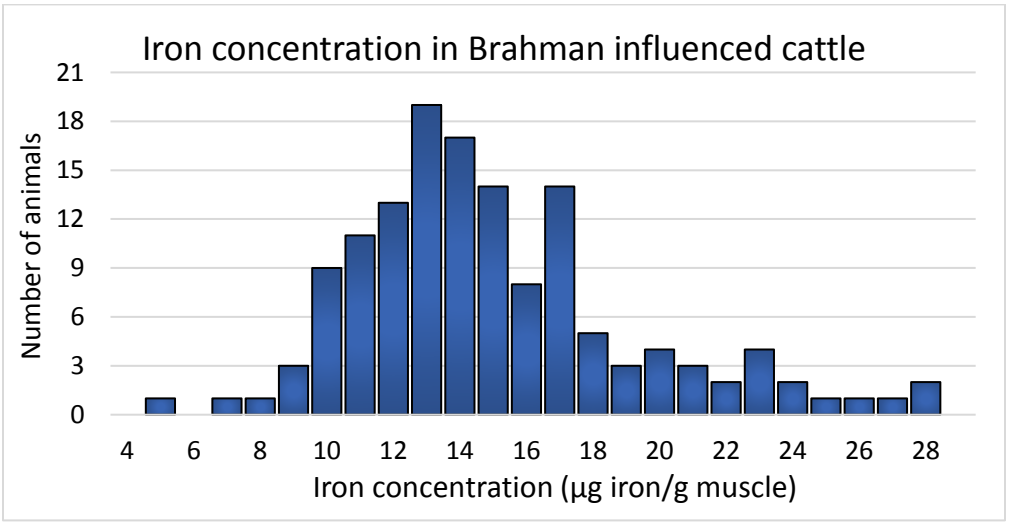

Figure 2. Distribution of iron concentration in Brahman-influenced cattle harvested after finishing on a high-grain diet.