Evaluating the Nutrient Profile of Beef

It is possible to genetically change the nutrient profile of beef. The question is: Should we?

*by **Kasey Brown,** associate editor*

For many years, nutritionists have told consumers to decrease their intake of red meat to decrease the amount of saturated fat in the diet, with the goal of preventing heart disease. New research is shedding light that reducing red meat intake may not prevent heart disease.

"In this context, reducing the intake of red meat would only result in reducing the intake of a food with the highest nutritional value per unit of energy, which is nutritional density, as well as many bioactive components with important health-promoting properties," Raluca Mateescu, associate professor of animal science at the University of Florida, told attendees of the 2014 Beef Improvement Federation (BIF) Annual Meeting & Research Symposium in Lincoln, Neb., June 18-21, 2014.

On the other hand, there is potential to increase some of the nutritional benefits of beef through genetic selection. The nutrient profile can be changed genetically in beef due to the heritability of mineral and micronutrient contents of the muscle, Mateescu reported.

Beef benefits

Consumers indicated in the 2014 Food and Health survey that healthfulness is the third main reason in determining their food purchases, and it is rapidly approaching price in importance, she said. Many in the United States have an issue with being overweight and undernourished.

Obesity prevalence in the United States has been increasing quickly. The Centers for Disease Control and Prevention reports that no state in the United States has less than 20% obesity prevalence. They chart adults with a body mass index (BMI) of 30 or greater, which is approximately 30 pounds (lb.) overweight for a person who is 5 feet, 4 inches tall, Mateescu explained.

In addition, despite being overweight, many Americans are not getting the recommended daily amount of several nutrients. Of those, daily requirements for iron, zinc, vitamin B_6 and vitamin B_{12} — nutrients readily provided by beef — are not being met by more than 30% of the population, Mateescu noted. Iron deficiency is especially prevalent in certain population segments, like women and the elderly.

PHOTO BY TROY SMITH

►Raluca Mateescu, University of Florida, says the nutrient profile of beef can be altered genetically.

"Among all diet components, meat has the unique status of providing, per unit of energy, a high amount of high-quality protein, along with many nutritive factors and other components important for human health," she added.

Red meat provides high-quality protein, essential amino acids, essential fatty acids, E

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and B-complex vitamins and minerals, Mateescu added. It also provides bioactive components with health-promoting qualities such as peptides, conjugated linoleic acid (CLA), iron, zinc and selenium.

The nutrient profile of beef

Genetics can influence beef's nutritional value, she said, referencing findings of the Beef Healthfulness Project. This research followed three Angus herds in Iowa, Oklahoma and California and encompassed 2,285 head of cattle. The project looked at growth, carcass quality and meat quality, as well as nutritional value and healthfulness of the beef. All animals were genotyped with the Illumina Bovine SNP50K Bead Chip.

Mateescu explained that the steaks from these animals were vacuum-packaged, aged for 14 days from the harvest date and frozen. Steaks were cooked and subjected to a Warner-Bratzler shear force test and sensory analysis at the Oklahoma State University Food and Agricultural Products Center. Composition analysis for nutrient and bioactive compounds was conducted at Iowa State University.

Heritabilities were found in the mineral composition of beef; most notable were iron at 0.54, zinc at 0.09, magnesium at 0.06, and sodium 0.18 (see Table 1). A recommended 3.5-ounce (oz.) serving of beef now provides 8%-18% of the recommended daily allowance of iron, 26% of zinc, 10% of potassium and 28% of phosphorus. There is a strong and positive genetic correlation between iron and zinc, she added.

Mateescu said that high heritabilities were also found in the micronutrient content of beef, with creatine at 0.43, carnosine at 0.38 and anserine at 0.53. Additionally, beef is one of the best dietary sources of carnitine, which is an essential nutrient in fatty-acid oxidation and has beneficial effects on exercise capacity. Creatine is important to muscle energy metabolism and can enhance muscle performance. Carnosine has significant antioxidant properties, and anserine is believed to be a possible antioxidant.

Using a Manhattan plot, she showed research that had identified SNPs and chromosomal regions associated with mineral concentration. She suggested that the industry develop the genetic or management tools needed to increase the components with positive health consequences and reduce those with negative health consequences.

Should we change the nutrient profile?

Beef is already a healthy component to the human diet, Mateescu emphasized. While it is possible to genetically change the nutrient profile of beef, should we? There is, after all, a cost to pursuing a trait, as well as a risk associated with consumer sensitivity to genetic modification.

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►Mineral composition in beef can be highly heritable, notably in iron, zinc, magnesium and sodium.

Mateescu recommended increasing the iron concentration in beef. Iron deficiency is one of the most common and widespread nutritional disorders in the world, affecting both developing and industrialized nations, she said. It particularly affects pregnant women, female athletes and infants in lower socioeconomic groups.

Increased iron concentration could also help aging adults fight the risk of sarcopenia related to iron and zinc deficiency. The beef industry could benefit from the increase in iron concentration through improved color stability and shelf life at the retail display. There is also a significant positive genetic correlation to improving beef flavor.

People get their nutrition, physical activity and weight-loss information from health professionals, according to the 2014 Food and Health Survey. Mateescu said this is good news because health professionals are generally receptive to research documenting the meat consumption/health relationship. She recommended that the beef industry focus on research designed to document the relationship between meat consumption and specific health benefits, and to develop consumer-education programs to promote the health and nutritional benefits of beef.

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Editor's Note: *To listen to this presentation, review the proceedings or see the accompanying PowerPoint, visit the newsroom at* www.bifconference.com, Angus Journal's *event coverage site providing comprehensive coverage of the 2014 BIF Meeting in Lincoln, Neb.*

Table 1: Mineral composition and heritability

Mineral	N	Mean ± SD (µg/g meat)	% of RDV*	Heritability
Calcium	2,260	38.7 ± 19.8	<0.1	0.00 ± 0.02
Copper	1,980	0.78 ± 0.9	4-8	0.00 ± 0.03
Iron	2,259	14.4 ± 3.0	8-18	0.54 ± 0.09
Zinc	2,261	38.9 ± 7.9	26	0.09 ± 0.04
Magnesium	2,274	254.6 ± 43.1	6.4-8.5	0.06 ± 0.04
Manganese	2,000	0.07± 0.04	<0.1	0.01 ± 0.03
Potassium	2,225	3,433.5 ± 494.3	10	0.04 ± 0.03
Phosphorus	2,271	1,965.9 ± 278.4	28	0.03 ± 0.03
Sodium	2,273	489.4 ± 92.9	3.4	0.18 ± 0.06

*RDV = recommended daily value.

Source: Genetic parameters for concentrations of minerals in longissimus muscle and their associations with palatability traits in Angus cattle. Mateescu et al., 2013.