Testing a noninvasive beef tenderness test

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Completed: *In Progress. Results expected in May 2022.*

Project Title:

Validation of rapid evaporative ionization mass spectrometry (REIMS) for tenderness prediction

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Background

Tenderness is one of the beef industry's biggest quality challenges. Beef is costly, so customers are understandably annoyed when a high-priced steak is tough, or when the tenderness differs between two packages of the same cut and grade of beef.

A major obstacle to identifying tenderness is that measuring tenderness is a time consuming and costly process. Traditional methods of evaluating tenderness involve slicing, shearing, or chewing. These are destructive processes, so no value can be recovered after the beef has been tested. Genetic tests have been developed, but they aren't always accurate and are too slow for routine sorting in packing plants. Efforts to provide consumers with consistently tender beef or identify superior genetics would benefit from a rapid, accurate, cost-effective method of measuring tenderness at line-speed.

Rapid evaporative ion mass spectrometry" (REIMS) is a medical technology used tumor removal. Essentially, this technology is a "smart" scalpel that burns as it cuts. This procedure gives off gases which indicate what type of tissue is being cut. The scalpel analyzes these gases and tells the operator whether tumor cells are present (which means it's cutting through the tumor) or not (cutting around the tumor).

The fact that this technology can identify biological tissue based on its chemical composition means that it may also be able to identify differences in tenderness, flavor and juiciness in meat. There is some evidence that it can identify tough vs. tender beef at least as accurately as other technologies.

Objectives

- evaluate the use of rapid evaporative ionization mass spectrometry (REIMS) for prediction of beef tenderness as assessed by slice-shear force analysis.
- determine the capabilities of REIMS to assess collagen and proteolytic enzyme activity

What they will do

They will collect 2" steaks from 750 AA and 750 AAA at Cargill plants in Alberta and Ontario over the course of a year. Samples will be aged for 14 or 21 d, frozen, shipped to Texas, thawed, and tested with the REIMS technology. The steaks will then be cooked, tested for slice shear force (tenderness), and separated into tough, intermediate and tender categories. Predicted (REIMS) and actual (shear force) results will be compared. Subsamples will also be sent to the University of Alberta for collagen analysis (beef with more collagen is tougher) and the University of Guelph to measure desmin, troponin-T and calpain (proteins and enzymes that are related to beef tenderness.

Implications

Current REIMS technology is too large to be portable, so the beef needs to go to the machine in Texas. But the first step to see if it has potential for non-destructive tenderness testing. Down the road, if the technology is miniaturized for use in human medicine, it could become a reality for commercial beef grading as well.

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