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# Meeting the Demand for high-quality, tender beef

## Project Title:

Postmortem Intervention Strategies to Enhance Tenderness of Underutilized Beef Cuts

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## Researchers:

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Tenderness is consistently identified as the most important trait affecting beef quality and consumer satisfaction. It has been estimated that the inconsistencies associated with beef tenderness potentially cost the Canadian beef industry $21 million annually. Cuts such as the beef round and chuck represent about half of the weight of the carcass but are generally underutilized and sold either as roasts or ground beef at about half the price of cuts from the middle meats, due to their variable tenderness and/or lack of convenience.

Conventional technologies, such as ageing, work well to improve tenderness in the primal cuts but not so well in these underutilized cuts. Improving the tenderness and palatability (taste) of underutilized cuts of beef will increase the value of the carcass which will result in higher returns for the beef producer.

Meat tenderness is generally associated with myofibrillar and connective tissue proteins. Connective tissue is dominated by collagen, of which the insoluble portion contributes to meat toughness. Elastin is also an extremely stable connective tissue. Therefore, commercially applicable methods to degrade collagen and elastin to an extent which produces the desired tenderness and texture would add value to cuts high in connective tissue.

Proteolytic enzymes (or proteases) derived from tropical plants, such as papain, bromelin and ficin, have often been tested and used to break down connective tissues to enhance tenderness. However, it is important that, in the process of reducing the amount of detectable connective tissues, there is not extensive degradation of muscle fibres.

The three-phase study Postmortem Intervention Strategies to Enhance Tenderness and Underutilized Beef Cuts was undertaken to:

- establish guidelines for application of selected proteolytic enzymes to improvepalatability and textural characteristics of several beef muscles
- examine the combined effects of moisture enhancement, mechanical tenderization and controlled proteolysis by exogenous enzymes on tenderness of underutilized beef cuts
- recommend a commercially applicable strategy to ensure a consistently tender product

The first phase of the study focused on sourcing enzymes and defining the optimal levels and conditions of their use. Three

enzymes were tested: Pancreatin from porcine pancreas, protease from Bacillus subtilis and protease from Aspergillus oryzae. All have the specific affinity to break down elastin and collagen in muscle but do not degrade fresh, uncooked and refrigerated product and are inactivated by heat during cooking. Other, more traditional proteases, such as papain, do not have these attributes.

Enzymes were injected into the semimembranosus muscle (the top round) and the semitendinosus muscle (the eye of round). Shear force was measured immediately after cooking and over a storage period up to 14 days. Shear force refers to the amount of force it takes to cut the meat and is a method of measuring tenderness. The results indicated that the enzyme-treated meat showed a gradual reduction in shear force with an increase of enzyme concentration. Storage period had no effect on shear force.

It was found that individual muscles responded differently to the enzymes tested therefore, to optimize results, it is important to apply musclespecific intervention strategies to ensure a consistently tender product. Enzyme treatments were evaluated in conjunction with moisture enhancement and mechanical tenderization. Pancreatin injected into semitendinosus steaks reduced shear force and improved overall tenderness but it was not able to significantly reduce the amount of detectable connective tissue. Moisture enhancement and mechanical tenderization did improve tenderness. Bacillus and Aspergillus proteases injected into the semimembranosus muscles improved tenderness and juiciness and was as effective as moisture enhancement and mechanical tenderization indicating that it may provide substantial benefit to the beef industry.

Cooking method was also observed to affect the outcome of enzyme treatment in this study. Shear force was significantly affected by enzyme level when the meat was grilled but was not affected by enzyme level when the meat was cooked in a convection oven. The study then evaluated dry and moist cooking of semimembranosus muscle in a conventional oven. Tenderization of beef occurred at only 5 ppm protease under moist conditions whereas it required 15 ppm protease for tenderization under dry conditions.

From this study, it was concluded that the single most important factor to improve tenderness of beef is the individualized tailoring of enzyme levels to complement enzyme type and cooking method. Further research is required to find enzymes that will enhance tenderness of muscles that are high in connective tissue.

## Proudly Funded By:

The Beef Cattle Research Council, a division of the Canadian Cattlemen's Association, sponsors research and technology development and adoption in support of the Canadian beef industry's vision to be recognized as a preferred supplier of healthy, high quality beef, cattle and genetics.

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