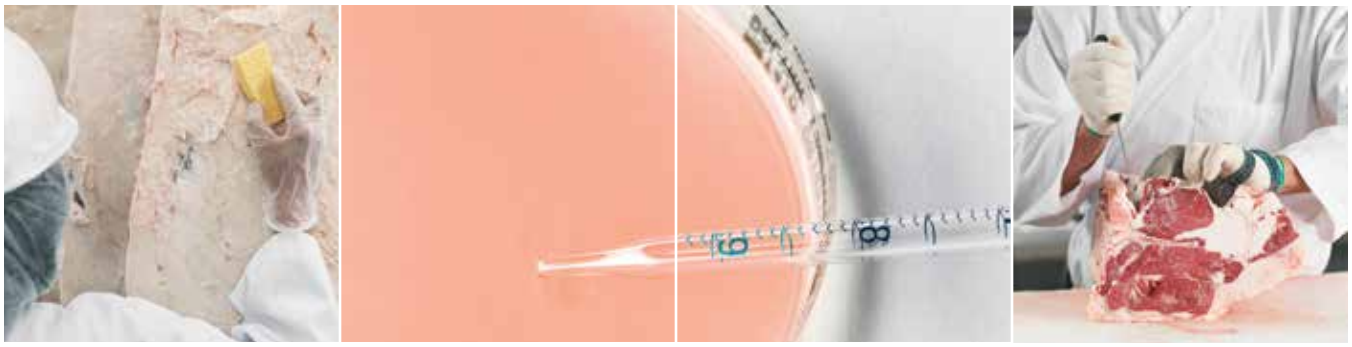
# *E. coli* O157
## Research and Education Strategy Fact Sheet



# *Cooking of Mechanically Tenderized Beef Roasts*

### Beef Quality and Mechanical Tenderization

Beef tenderness has been shown to be a major contributor to consumer satisfaction. Tenderness in beef is determined by the amount and type of connective tissue and muscle fibres. Tenderness can be improved by aging as well as by cooking methods, such as the use of moist heat over extended periods, which can soften connective tissue. The overall tenderness of meat can also be improved by cutting through muscle fibres and connective tissue using blades or needles. Mechanical tenderization can enhance eating quality, especially beef made from parts of the animal used in locomotion which are naturally tougher. Tenderness is enhanced without changes to the nutritional value of beef.

### Microbiology of Mechanical Tenderization of Meat

The action of mechanical tenderization can bring bacteria from the surfaces of meat and/or meat-contacting surfaces of the tenderizing equipment into the interior of meat products. These bacteria may potentially include pathogens such as Salmonella and verotoxigenic *E. coli*. Even so, mechanically tenderized beef is often not different in appearance from beef that is not tenderized. Due to the risks associated with consumption of undercooked mechanically tenderized meat, North American regulatory authorities now require mechanically tenderized meat be identified and labeled as such, and be cooked in a manner that would result in reductions in numbers of *E. coli* O157:H7 by ≥5 log CFU at any site throughout the meat.

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ALMA Alberta Livestock and Meat Agency Ltd.

CANADIAN BEEF CATTLE CHECK-OFF

BCRC BEEF CATTLE RESEARCH COUNCIL

CCA CANADIAN CATTLEMEN'S ASSOCIATION
National Voice Of Cattle Producers

## How Canadian Consumers Cook Beef Roasts

A survey of Canadian consumers commissioned by the Canadian Cattlemen's Association showed that the majority of Canadian consumers prefer to cook their roasts in ovens (77%) or slow cookers/crock pots (54%).[1] Roasts of small sizes (2 kg or less) are preferred by more than 80% of the respondents. Oven temperatures in the range of 160 to 180°C are used by about 50% of Canadian consumers. More than 90% of Canadian consumers cook their roasts to internal temperatures of 63°C or higher.

## Research on Mechanically Tenderized Roasts

Research was performed at the AAFC Lacombe Research and Development Centre to determine the minimum internal roast temperature at which a very high level of *E. coli* O157:H7 could be inactivated. *E. coli* O157:H7 bacteria were injected into the roasts at various points to simulate mechanical tenderization. Approximately 10 million *E. coli* O157:H7 bacteria were placed into eye of round roasts and prime rib roasts of 0.6 to 2.1 kg in weight. Such high levels of *E. coli* bacteria would not be found in reality, however they are utilized to test cooking methods of tenderized beef in the laboratory.

The roasts were cooked in conventional or convection toaster ovens operated at various temperatures. The slow cooker was tested at the high or low heat settings. The reduction in numbers of *E. coli* O157:H7 at each location in the meat as a result of cooking was determined.

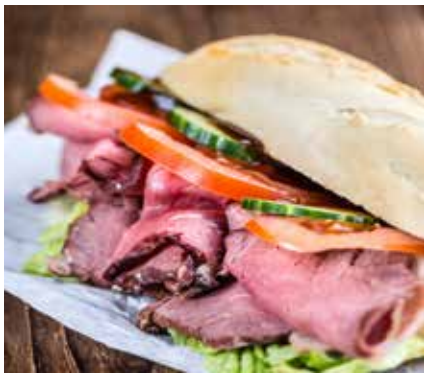
## Slow Cookers and Tenderized Roasts

After innoculation *E. coli* O157:H7, roasts were cooked to 60°C or 63°C (medium rare) internal temperature in the slow cooker at either low or high setting. No surviving *E. coli* O157 could be found when roasts were cooked to 63°C at either high or low settings although not all *E. coli* were destroyed at the 60°C internal roast temperature.

## Convection Ovens and Tenderized Roasts

Eye of round roasts were cooked to 65, 60, or 63°C at the centre of the roast in a convection oven operated at 120, 140, 180, and 200°C.

At the lowest oven temperature of 120°C it was necessary to cook roasts to 65°C at the centre to destroy the high level of *E. coli* used. While not all *E. coli* were killed at 63°C the reduction is likely sufficient to ensure product safety as very high levels of bacteria were used in the experiment.



When the oven was operated at 140 or 180°C all *E. coli* were killed even at 60°C internal roast temperature. At 200°C oven temperature all *E. coli* were killed at 63°C with some bacteria survival at 60°C.

*1. National survey of 1,000 Canadian consumers commissioned by the Canadian Cattlemen's Association and conducted by an independent market research firm.*

## Conventional Ovens and Tenderized Roasts

When conventional ovens were operated at 120°C all of the bacteria were killed at 63°C internal temperature. At 60°C there was limited surviving bacteria even with the very high numbers used in the laboratory experiment. However, when the oven was operated at 210°C it was necessary to cook the product to 71°C.

## Conclusions

Both the temperature at which the oven is operated and the internal temperature of the beef roast following cooking are important to food safety. It is recommended that mechanically tenderized roasts be cooked at 140 to 180°C oven temperature to a product temperature of 63°C. At oven temperatures higher than 180°C with small roasts it would be advisable to cook mechanically tenderized roasts to higher temperatures.