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RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Beef Science Cluster



Extending the shelf life of marinated steaks

Project Title:

Effect of high pressure processing on quality, sensory attributes and microbial stability of marinated beef steak during refrigerated storage

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Researchers:

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Background

High Pressure Processing (HPP) can extend the shelf life of food by killing microorganisms that can cause spoilage. HPP has been approved for use in the US, but Canada's Food and Drug regulations classify HPP-treated products as novel foods.

Objectives

The objective of this activity is to investigate the effects of HPP on the quality, nutrition and shelf life of a marinated beef steak product stored under refrigeration.

What they did

Semitendinosus (eye of round) muscles were cut into eight steaks. One steak was used fresh; the other seven steaks were marinated. The eight steaks were exposed to no pressure (both the fresh steak and one marinated steak), or pressures ranging from 300 to 350, 400, 450, 500 and 600 MPa (43,500 to 87,000 psi) for three minutes at 8°C. The steaks were then subjected to a series of measurements, including Warner-Bratzler shear force (a mechanical measure of how difficult meat is to bite through), bacterial counts to assess shelf life at 7, 15, 28, 42, 57 and 85 days of refrigeration, a consumer panel assessment and an evaluation of nutrient levels.

What they learned

HPP treatment of marinated eye of round steaks at 350 to 450 MPa (50,000 to 65,000 psi) gave the best results. Beef became paler and tougher when pressures above 450 MPa were used. The Warner Bratzler shear force measurements indicated that steaks treated with HPP at 450 MPa were no tougher than the marinated steaks that were not treated with HPP. Steaks treated at 500 or 600 MPa were tougher than the rest. The steaks treated with higher pressures had longer shelf lives; bacterial counts indicated that steaks treated with 350, 400 and 450 MPa were acceptable for 15, 42 and 85 days, respectively.

The sensory evaluation involved 85 people who assessed the appearance, flavour, tenderness, juiciness and overall acceptability of five different types of eye of round steaks cooked medium-well (fresh steaks, marinated with no HPP, marinated plus HPP at 400 MPa and refrigerated for 31 days, and marinated plus HPP at 450 MPa and refrigerated for 31 or 61 days). Regardless of the sensory indicator, steaks cooked fresh were rated best, the steaks that were marinated but not HPP-treated were rated lowest, and the three marinated HPP treatments were intermediate and no different from each other.

The levels of 30 different nutrients were compared between three sets of steaks treated with no HPP, 450 MPa for three minutes, or 450 MPa for three minutes, repeated three times. No differences were seen for any of the nutrients measured, including protein, fat, saturated fat, omega-3 and omega-6 fatty acids, cholesterol, iron or potassium.

What it means

HPP treatment at 450 MPa for three minutes can significantly extend shelf life without negatively affecting the meat quality, sensory attributes or nutritional values of marinated beef steaks.

The data collected in this study were also instrumental in gaining regulatory approval for high pressure processing. Data were submitted to Health Canada for approval on June 3, 2015. A letter of "non-novelty" for these HPP-treated foods was issued by Health Canada on April 8, 2016. Industry clients can now start producing and selling HPP marinated raw meats in the marketplace immediately.

As with all new technologies, whether the process will be adopted will largely depend on the capital and operating costs of the HPP equipment relative to the benefits in terms of reduced product storage costs and extended shelf life.

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