INTRODUCTION & OBJECTIVES

It is well established that high pressure processing (HPP) can inactivate vegetative microbial cells without markedly altering the texture and flavour of ready to eat meat products. Hence it is commercially used in many parts of the world to extend shelf life. Results also show that fresh muscle foods are susceptible to pressure-induced colour change. Marinating is commonly used by the meat industry to enhance the moisture and improve the texture of processed products. Due to the colour from marinade, marinating may partially mask the discoloration from the HPP treatment. The objective of the study was to determine the effects of HPP treatments on quality and shelf life extension of marinated beef steaks.

MATERIALS & METHODS

Sample preparation
- Eight fresh post rigor semitendinosus (ST) muscles were used in each group
- Each ST was cut into eight steaks (2.54 cm thick)
- In order to minimize the intramuscular variability, location within the muscle was balanced to ensure that all treatments were assigned to all locations
- A group of steaks were used as fresh steak (no further treatment)
- The remaining seven steaks were tumbled with sweet teriyaki marinade (in-kind support by Griffith Laboratories Limited)
- Fresh and marinated steaks were individually vacuum packaged
- Marinated steaks were subjected to high pressure processing (HPP) at 300, 350, 400, 450, 500, or 600 MPa for 3 min at 8°C
- Marinated steaks without HPP processing were served as control

Physical and chemical analyses

The colour of steaks was digitally taken after HPP treatment. The colour (CIE L*a*b*), pH, water binding capacity (WBC), expressible moisture (EM), cook loss and Warner-Bratzler shear force (WBSF) were measured.

Microbiological analysis

Microbiological analyses (aerobic colony count, lactic acid bacteria, yeast, mold, coliforms, E. coli, Listeria monocytogenes, Salmonella spp.) were conducted after 7, 15, 28, 42, 57, 85 days of storage at 2°C.

Statistical analysis

Statistical analysis was performed using the General Linear Model procedure. The Tukey key test was used to compare the differences (p<0.05) between the treatments means.

RESULTS

Physical and instrumental results

- Statistically, marinated steaks with pressure of 350 MPa or less did not change the instrumental colour parameters (CIE L*a*b*)
- The pH of marinated steaks treated with 400, 450 and 600 MPa was significantly (p<0.05) higher than the control steaks
- Marinated steaks treated with 450 and 600 MPa had the highest WBC
- The fresh steaks had higher EM compared to all marinated steaks. Steaks treated with 300 and 350 MPa had the lowest EM
- The control steaks had a lower cook loss compared to steaks treated with 500 and 600 MPa, indicating that the cook loss increased with increasing pressure

- The WBSF value was lowest for control steaks and highest for steaks treated with 600 MPa. Marinated steaks treated with 500 MPa or less had a similar or lower WBSF value than fresh steaks

Microbiological results

- Microbiological data (limit of detection 1.7 log10 CFU/g) showed that HPP can significantly extend shelf life of marinated steaks; marinated steaks treated with 350 MPa were acceptable for up to 15 days; the samples treated with 400 MPa were acceptable for up to 42 days; while steaks treated with 450 MPa were acceptable for up to 85 days.

CONCLUSIONS

Treatment of marinated steaks with pressure ranging from 350 – 450 MPa significantly extends the shelf life without adverse effect on meat quality parameters measured in this study.