

Brine injection of beef

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Full Title of the project

The effect of moisture enhancement by brine injection on the chemical, microbial and sensory quality of beef

Aims of the project

- To determine the effect of injection of non-nitrite moisture enhancing injection brines on the nutritional value of beef.
- To determine the effect of injection of non-nitrite moisture enhancing injection brines on the chemical and microbial stability of beef under refrigerated and frozen storage.
- To determine the effect of injection of non-nitrite moisture enhancing injection brines on the textural and sensory properties of beef.

Executive summary

The effect of different injection levels of non-nitrite brines on meat quality characteristics of unaged and aged beef loins was investigated. Beef loin cuts aged for 3 or 10 days were injected with 5, 10, 15 or 20 % brine (weight basis) and compared with non-injected loins with regards to nutritional value, sensory and textural quality, water holding properties, and colour, chemical and microbial stability.

The results illustrated that brine injected in beef loin are retained between 50 to 70 % of injection levels. This resulted in a clear nutrient dilution, best illustrated by the decrease in protein content from 21.1 % in the Control loins to 18.5 % in the loins injected to a target yield of 20 %. The dilution of protein became evident only at an injection level of 10 % and higher but did not increase further with higher levels of injection. Brine injection also increased the levels of phosphate (35 %) and salt (50 %) and the effect was consistent across all injection levels. This is very important since salt and sodium content of especially meat products are currently under the spotlight with new legislation on sodium levels of meat products being implemented on 30 June 2016.

The chemical stability of beef loin as measured by TBARS (measurement of rancidity) was not affected by brine injection. Neither fresh samples, displayed for 6 days, or frozen samples, stored for 180 days, were affected, despite the fact that salt is a pro-oxidant and chemical deterioration was expected with brine injection.

Colour and colour stability were affected by brine injection. Initial colour (just after treatment) measured as chroma (typical colour of fresh meat) was negatively affected only at injection levels above 10%. However, as days on display continued (up to 6 days), all injected samples showed poorer colour stability (lower chroma values) than Control samples. Likewise, injected samples were duller (lower values for lightness, L*).

Brine injected samples tended to show higher initial (day of injection) total aerobic micro-organism counts (0.5 – 0.7 of a log) likely due to the recirculation of the brine during application. However, microbial growth was later (day 6 on the shelf) inhibited, probably by the potassium lactate in the brine mix, eventually leading to the brine injected samples having lower total aerobic bacteria loads (between 0.5 and 0.8 of a log) than Control samples. Also because of recirculation of brine, yeasts and molds were higher in injected samples (0.8 to 1.0 log) after injection, but differences between Controls and injected samples became insignificant after 6 days on the shelf.

Both Warner Bratzler shear force and sensory tenderness showed beneficial effects due to brine injection even at levels as low as 5 %. A slight linear increase (lower shear force and higher tenderness score) was observed with increasing level of injection although the effect was not statistically significant above 10 % injection level. The taste panel also scored injected samples higher for juiciness and although these scores increased slightly with level of injection, no significant effect was observed above 10% levels. As expected, the taste panel also scored injected samples higher for saltiness, but no off-flavours were identified.

Another advantage of brine injection was a reduction in thawing and total cooking losses. The maximum effect was observed at 5 % injection level and cooking loss slightly increased as injection level increased.

In conclusion, it seems that the advantages and disadvantages of brine injection is correctly balanced by the 10% brine injection limit enforced by the Agricultural Product Standards Act, 1990 (ACT No. 119 of 1990; 30 January 2015) for beef. Brine injection levels above 10% showed no additional effect on eating quality. Likewise, the negative effect on colour of freshly displayed meat deteriorated at levels above 10%, while the protein dilution effect also became evident at 10% level. Higher salt irrespective of injection level may be a health concern.