



Brine injection of beef

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

Industry Sector: Cattle And Small Stock

Research Focus Area: Animal Products, Quality And Value-Adding

Research Institute: Agriculture Research Institute – Animal Production Institute

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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.

Year Of Completion : 2017

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.

Popular Article

THE EFFECTS OF BRINE INJECTION LEVEL AND POST MORTEM AGING ON SENSORY AND PHYSICAL CHARACTERISTICS OF BEEF LOIN

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Abstract – The enhancement of beef, pork and chicken with brine solutions has become common practice in many countries.

The combined effects of aging and brine injection level on beef quality is unknown. Our study investigated the effects of five

brine injection level (0, 5, 10, 15, 20%) combined with post mortem aging period (3 and 10 days) on sensory characteristics of broiled beef loin. Injected samples were scored higher for saltiness but aging reduced the effect. Brine injection had no effect on flavour but tenderness was improved up to 15% injection level. Apart from 0 and 5 % injection levels, aging had no effect on tenderness score. Juiciness was improved up to 10% injection level after 10 days aging and up to 5 % injection level for 3-day aged cuts. The results suggest that a maximum of 15% brine injection will give the best sensory results and save on post mortem aging time.

Key Words – tenderness, juiciness, saltiness.

I. INTRODUCTION

Brine injections have been used in the poultry industry since the 1950's [1]. Red meat processors saw this technology

as an opportunity to improve beef and pork palatability that deteriorated as a result of the production of increasingly

leaner animals that contain less fat [2,3,4], although atypical flavours may also develop [2, 3]. Hamling et al. [5] found

that post mortem aging could be substituted by brine injection. High levels of injection may not necessarily improve

eating quality while other negative effects such as purge may also occur [6]. The abuse of brine injection of poultry meat

in the South Africa resulted in legislation stipulating a maximum of 10% to 15% brine for whole carcasses and portions,

respectively after extensive research. However, brine injection of beef in South Africa was limited to 10% without any

scientific verification [7]. Our study investigated the effects of post mortem aging and brine injection levels on sensory

quality of loin cuts of young grain-fed beef.

I. MATERIALS AND METHODS

Sixty beef loin primal cuts were subjected to five brine treatments: a non-injected control and four groups respectively injected to 5, 10, 15, and 20% level with a salt, sodium tripolyphosphate (STPP), potassium lactate containing brine; and two aging periods: 3 and 10 days post mortem. Loin steaks were oven-broiled and evaluated by a ten-member trained sensory panel on an 8-point hedonic scale for aroma,

juiciness, tenderness/texture, beef flavour intensity, metallic/tin-like/bloody, chemical (salty), and sour off-flavours. Data were subjected to analysis of variance for a splitplot design with injection level as whole plots and days post mortem as sub-plots.

II. RESULTS AND DISCUSSION

Despite adding salt to the control samples, injected steaks scored higher values for saltiness, although level of injection did not have an effect (Table 1). The effect of injection was less for cuts aged 10 days than for those aged 3 days. Knock et al. [4] reported higher scores for typical beef flavours, when beef loins were enhanced with KCl brine to 8.5% level, especially after 9 days aging. Although the different brine levels in our study had similar levels of salt, Knock et al. [4] showed higher scores for saltiness and rancidity when salt levels were increased. In contrast to our study, Grobbel et al [3] reported off-flavours, such as salty, metallic or chemical descriptors for brine injected beef loin. Injected steaks scored higher for tenderness in our study irrespective of aging period. Higher injection levels generally gave better results, although the effect plateaued at 15% injection level for 3 day aged steaks and at 10% injection level for steaks aged for 10 days. Injected steaks also scored higher for juiciness. The effect of injection level on juiciness plateaued at 10% for steaks aged for 3 and at 5% for steaks aged for 10 days. Knock et al. [4] found no effect of brine injection will follow later (8.5%) on beef loin tenderness or juiciness, while Hoffman et al. [2] reported similar results as our study for four unaged muscle types injected to a 15% level. Hamling et al. [5] reported higher scores for tenderness, flavor and juiciness at 20% injection levels and this was unaffected by aging to 14 days. In our study, added effects of aging on tenderness and flavour were found at 5 % injection level. Aging had no effect on juiciness perception, but 10 day aged samples injected to 10 and 15% levels scored lower than 3 day aged samples. Likewise, all 10 day aged injected samples, except 20%, scored lower for saltiness than 3 day aged samples.

I. CONCLUSION

Ten percent seems to be the optimum injection level for improved juiciness and tenderness of loin primals, while flavour is not affected by brine injection. Perception of saltiness due to brine injection is reduced when samples are aged. In general, brine injection can save on post mortem aging time with regards to improvement of tenderness.

ACKNOWLEDGEMENTS

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Please contact the Primary Researcher if you need a copy of the comprehensive report of this project – Dr Philip Strydom on pstrydom@arc.agric.za

■ Animal Products, Cattle and Small Stock, Quality and Value-adding

◆ 2017, ARC, ARC-API, Paper, Strydom

< Heterosis effects on beef sensory and leather quality traits

> The food composition of raw and cooked beef offal

DEADLINES for RESEARCHERS 2021

Proposals for 2021: TBC

Progress reports: 28 Jan 21

Final reports: 29 Jan 21 Final includes comprehensive report and popular article

COMMITTEE MEETINGS for 2021

RMRDSA CSS Planning - TBC

Project Committee - TBC

Pork Planning - TBC



Calendar

< > Apr 2021						
Sun	Mon	Tue	Wed	Tur	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

PORK Priority Areas

Cattle & Small Stock Programmes

1 Sustainable natural resource utilisation

2 Improvement of Livestock production and forage

3 Management of agricultural risk to create a resilient Red Meat sector

4 Sustainable health and welfare for the Red Meat sector

5 Enhancement of production and processing of Animal Products

6 Consumer and market development of the Red Meat sector

7 Commercialisation of the emerging sector

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