THE EFFECT OF BRINE INJECTION LEVEL ON THE PHYSICAL PROPERTIES AND SENSORY ACCEPTABILITY OF PORK LOINS

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Abstract – The injection of fresh meat with brines containing salt, phosphate, lactates and hydrocolloids has become common practice globally. The optimum brine injection level of fresh pork loins is not known. This study investigated the effect of five brine injection levels (0, 5, 10, 15, and 20 %) on the physical and sensory properties of pork loins. No significant differences in cooking loss and total moisture loss were observed while a significant increase in thawing loss was only observed at the 20 % injection level. Sensory ranking of brine injected treatments were significantly better than the uninjected controls. Results suggest that 10 % injection level is the optimum level for improvement of tenderness and sensory properties of fresh pork loins.

Key Words – moisture, tenderness, acceptability

I. INTRODUCTION

Injection of enhancement solutions in meat started in the 1950's in the poultry industry [1]. The practice of injecting chicken portions before freezing with amounts of brine, as high as 30 – 60%, was widely reported on in the South African media during 2011 and 2012 [2]. The pork industry see this injection technology as an opportunity to add value to fresh uncured pork. High injection levels may improve tenderness and succulence of meat, but may also result in nutrient dilution and increased thawing and cooking losses [3,4]. Recently published South African regulations limit the brine injection level of fresh pork to 10 % [5]. This limit was set without any scientific verification. The purpose of this study was to determine the effect of injection of non-nitrite moisture enhancing injection brines on the textural and sensory properties of pork, and to recommend an optimum injection level in terms of these quality parameters.

II. MATERIALS AND METHODS

Fifteen fresh bone-in pork loins were purchased from a local meat retailer. Loins were injected with brine (containing salt, sodium tripolyphosphate, potassium lactate, xanthan and carrageenan), equal to 5, 10, 15, and 20 % of the green weight. After 24 h equilibration, each loin was cut into 25 mm thick chops that were used for physical and sensory analysis. Physical analysis included thawing loss, cooking loss, total moisture loss and Warner-Bratzler shear (kg). A 75-member consumer panel was used for consumer preference ranking. Samples were oven baked at 260 °C to a core temperature of 75 – 77 °C. A nine-point hedonic scale ranging from 1, for dislike extremely, to 9, for like extremely, was used to rank the desirability of the samples in terms of taste, saltiness, texture, and overall acceptability. An analysis of variance procedure was used to determine the effect of brine injection level on the physical and sensory properties of brine injected loins. The Tukey-Kramer multiple comparison test ($\alpha = 0.05$) was carried out to identify significant differences between the treatment means [6].

III. RESULTS AND DISCUSSION

A significant increase in thawing loss of pork loin chops were only observed at the 20 % injection level (Table 1). No significant difference in cooking loss and total moisture loss were observed between pork loins chops, from any of the injection levels (Table 1). This may be attributed to the inclusion of salt, phosphate, lactate, carrageenan and xanthan in the brine, that are all expected to increase the water holding capacity of meat [7, 8]. Although no significant differences were observed in Warner-Bratzler shear of loin chops from different brine injection levels, all brine injection treatments demonstrated significantly lower Warner-Bratzler shear values compared to loin chops from the control treatment (Table 1). This results are in agreement with that of Hayes et al. [9]. All consumer sensory rankings fell in the range of "neither like nor dislike" to "like slightly", with the exception of the saltiness ranking for the control samples, which fell just under "neither like nor dislike" (Table 2). Consumers ranked brine injected samples

Table 1 Changes in thawing loss, cooking loss, total loss and Warner-Bratzler shear (kg) of loins at different injection levels.

Injection level	Control	5 %	10 %	15 %	20 %	Significance level
Thaw loss %	3.3[a]	2.4[a]	3.0[a]	3.4[a]	4.9[b]	$p < 0.001$
Cooking loss %	20.4	20.6	19.8	19.3	20.0	$p = 0.477$
Total moisture loss %	22.8	22.5	22.2	22.1	23.9	$p < 0.275$
Warner-Bratzler shear (kg)	2.2[b]	1.8[a]	1.7[a]	1.7[a]	1.8[a]	$p = 0.013$

Means with different superscripts in the same row differ significantly.

Table 2: The effect of the different injection levels on the sensory properties of pork loins.

Injection level	Control	5 %	10 %	15 %	20 %	Significance level
Taste	5.2[a]	6.6[b]	5.9[ab]	6.3[b]	6.2[b]	$p < 0.001$
Saltiness	5.0[a]	6.3[b]	5.4[ab]	6.105[b]	6.0[b]	$p < 0.001$
Texture	5.8[a]	6.8[b]	6.0[a]	6.5[ab]	6.4[ab]	$p = 0.004$
Overall acceptability	5.4[a]	6.8[c]	6.0[ab]	6.4[bc]	6.3[bc]	$p < 0.001$

Means with different superscripts in the same row differ significantly.

significantly more desirable in taste and saltiness, when compared to control samples, regardless of the level of injection. This is supported by the findings of Baublits et al. [10], who found pork loins injected with a salt and phosphate brine to have more desirable overall pork flavour, as well as an increased liking of the samples' saltiness, when compared to non-injected controls. Significant differences in desirability of texture could be observed between control samples and all injected samples, except the 10% injected samples. The texture of brine injected samples was generally more liked than that of the control samples. Consumers ranked overall acceptability significantly more desirable for brine injected samples than for the control, proving that the brine injected samples were preferred to the control samples. Similar results were obtained by Baublits et al. [10].

IV. CONCLUSION

Brine injection of fresh pork loins can be considered as a plausible way of increasing yield, tenderness and sensory characteristics, but only if producers are limited in the amounts of brine that may be injected. Injection levels above 10% showed no additional gain in value, compared to the lower injection levels. Ten percent gain on green weight seems to be the optimum level of injection of a phosphated brine, containing hydrocolloids, such as carrageenan and xanthan, with regard to improvement of tenderness and sensory properties.

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