

SENSORY QUALITY OF SALT REDUCED CORNED BEEFS FORMULATED WITH SALT REPLACERS

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Abstract – The aim of this study was to investigate the impact of varying sodium levels (0.2% - 1.0%) and salt replacers in corned beef on sensory properties. Samples formulated with CaCl₂, MgCl₂ and KCl scored higher ($P < 0.01$) in saltiness perceptions, but correlated negatively ($P > 0.05$) to liking of flavour and overall acceptability. However, a sodium reduction of 60% in corned beef was determined to be achievable as assessors liked ($P < 0.05$) the flavour of the sodium reduced corned beef containing 0.4% sodium and formulated with potassium lactate and glycine (KLG), even with the noticeable lower salty taste.

Key Words – Corned beef, Salt reduction, Salt replacer, Sensory analysis

I. INTRODUCTION

Corned beef is a traditional cured meat product from Western Europe and America which is popular in Ireland and the United Kingdom. The meat processing industry is trying to develop low-salt meat products to address consumer concerns and adhere to health recommendations as excessive sodium intake is linked with mortality and the risk of developing coronary heart diseases [1,2,3,4]. Sodium chloride is the main additive used in manufacturing processed meat as it contributes to developing the texture and flavour, and furthermore extension of shelf-life [5]. Due to their high contribution of the daily salt intake in the Irish population the salt level of cured meat products, such as corned beef, has to be reduced [6]. No research has been carried out to date on salt reduction in corned beef. Therefore, the objective of this study was to investigate the impacts of varying sodium levels (0.2% - 1.0%) and salt replacers in corned beef on physicochemical (colour, hardness, cooking loss) and sensory (Affective and Descriptive) properties in order that a healthier and more consumer acceptable product might be produced.

II. MATERIALS AND METHODS

Semitendinosus muscles within the pH range from 5.5 ± 0.1 were taken for production. Salt replacer combinations (Table 1) were added to the brine solution to achieve acceptable low salt (0.4% sodium) corned beef samples with a residual potassium nitrite level of 0.0185%. Sensory acceptance testing was conducted using untrained assessors ($n = 25$) in the age from 19 – 56 [7] who consumed corned beef regularly. The experiment was conducted in panel booths, which conformed to International Standards (ISO, 1988). Samples were served cold as 3 mm thick slices, coded in randomised order and presented in duplicate to assessors. The assessors were asked to assess samples using the sensory acceptance test, on a continuous line scale from 1 to 10 cm in relation to the following attributes: liking of appearance, liking of flavour, liking of texture, liking of colour and overall acceptability (hedonic). The assessors then participated in ranking descriptive analysis (RDA) [8] using the consensus list of sensory descriptors, including; grain quantity, fatness, spiciness, saltiness, juiciness, toughness and off-flavour (intensity), which was also measured on a 10 cm line scale. All samples were again presented in duplicate [7].

III. RESULTS AND DISCUSSION

Seven different salt replacer combinations were added to corned beef samples containing 0.4% sodium with the target of improving the flavour profile and producing significant consumer-acceptable end product. The sensory evaluation of these sodium-reduced corned beef samples are shown in an APLSR plot (Figure 2) in conjunction with the ANOVA values for hedonic and descriptive sensory assessments (Table 1). Sodium-reduced corned beef samples formulated with KLG achieved positive ($P < 0.05$) correlations to liking of flavour and additionally displayed a positive directional correlation to overall acceptability. This sample was scored very low ($P < 0.001$) in saltiness perception and no off-flavours were detected ($P < 0.05$). Previously, significantly lower scores for saltiness were also reached for

fermented sausages formulated with a mixture of sodium chloride, potassium lactate and glycine (60/20/20%) [9]. Nevertheless, in the present study, assessors preferred corned beef samples with the lowest salty taste.

Table 1

P-values of regression coefficients from ANOVA-Partial Least Squares regression (APLSR) for hedonic and intensity sensory terms of corned beef samples with different sodium contents with and without using salt replacers.

Sample	Hedonic term					Intensity term					
	Appearance	Colour	Flavour	Texture	Acceptability	Saltiness	Juiciness	Toughness	CB flavour	Cured flavour	Off-flavour
CB_Control 50.4	0.6468 ^{ns}	0.8080 ^{ns}	0.7584 ^{ns}	0.5782 ^{ns}	0.6930 ^{ns}	-0.9137 ^{ns}	-0.5498 ^{ns}	0.9427 ^{ns}	0.9587 ^{ns}	-0.8608 ^{ns}	-0.7586 ^{ns}
CB_KCl	-0.7696 ^{ns}	-0.8632 ^{ns}	-0.2471 ^{ns}	0.6709 ^{ns}	-0.3889 ^{ns}	0.2839 ^{ns}	0.1494 ^{ns}	-0.6876 ^{ns}	-0.9712 ^{ns}	0.5906 ^{ns}	0.3352 ^{ns}
CB_KLCl	-0.9862 ^{ns}	-0.8894 ^{ns}	-0.7386 ^{ns}	-0.8497 ^{ns}	-0.7771 ^{ns}	0.8884 ^{ns}	0.8586 ^{ns}	-0.8705 ^{ns}	-0.9596 ^{ns}	0.9883 ^{ns}	0.8005 ^{ns}
CB_KCPCl	-0.1512 ^{ns}	-0.5546 ^{ns}	-0.2325 ^{ns}	-0.2107 ^{ns}	-0.0854 ^{ns}	0.6127 ^{ns}	0.2242 ^{ns}	-0.3482 ^{ns}	-0.4131 ^{ns}	0.3520 ^{ns}	0.3925 ^{ns}
CB_KLG	0.4990 ^{ns}	0.7805 ^{ns}	0.0198 [*]	0.4033 ^{ns}	0.0714 ^{ns}	-0.0001 ^{***}	-0.7983 ^{ns}	0.5719 ^{ns}	0.9771 ^{ns}	-0.2589 ^{ns}	-0.0123 [*]
CB_CaMgKCl 1	-0.9599 ^{ns}	-0.9480 ^{ns}	-0.3911 ^{ns}	-0.9754 ^{ns}	-0.6161 ^{ns}	0.0018 ^{**}	0.5168 ^{ns}	-0.9175 ^{ns}	-0.9433 ^{ns}	0.2033 ^{ns}	0.3330 ^{ns}
CB_CaMgKCl 2	-0.8159 ^{ns}	-0.7783 ^{ns}	-0.9220 ^{ns}	-0.7406 ^{ns}	-0.8592 ^{ns}	0.0033 ^{**}	0.7714 ^{ns}	-0.4834 ^{ns}	-0.5773 ^{ns}	0.1156 ^{ns}	0.6585 ^{ns}
CB_KClG	0.8082 ^{ns}	0.9233 ^{ns}	0.1322 ^{ns}	0.8314 ^{ns}	0.3510 ^{ns}	-0.0116 [*]	-0.0791 ^{ns}	0.9770 ^{ns}	0.7495 ^{ns}	-0.3537 ^{ns}	-0.2120 ^{ns}

Sample code: CB = corned beef, S = sodium. KCl = potassium chloride, KLCl = mixture of potassium lactate and potassium chloride, KCPCl = potassium citrate, potassium phosphate, potassium chloride, KLG = mixture of potassium lactate and glycine, CaMgKCl 1 = mixture of calcium chloride, magnesium chloride, potassium chloride (15/5/45), CaMgKCl 2 = mixture of calcium chloride, magnesium chloride, potassium chloride (15/5/25), KClG = mixture of potassium chloride and glycine.

Significance of regression coefficients: ns = not significant, * = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$.

IV. CONCLUSION

A sodium reduction of 60% in corned beef is achievable based on assessors' feedback. Assessors liked ($P < 0.05$) the flavour of sodium-reduced corned beef containing only 0.4% sodium and formulated with potassium lactate and glycine (CB_KLG), even with the noticeable lower salty taste.

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