EFFECT OF SODIUM CHLORIDE SUBSTITUTION ON SENSORY CHARACTERISTICS IN DRY CURED MEAT PRODUCTS

GOU P., GUERRERO L., CASADEMONT G. and ARNAU J.

IRTA. Centre de Tecnologia de la Carn.,Granja Camps i Armet s/n, Monells, SPAIN.

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SUMMARY

Raw cured ham is a meat product containing a high level of sodium which could have an adverse effect on those consumers with problems related to hypertension. The aim of this study was to determine the effect caused by substituting NaCl with KCl (0% - 60%), potassium lactate (0% - 100%) and glycine (0% - 100%) on the sensory and mechanical characteristics of raw cured ham models. The ham models used consist of pieces of the *Longissimus dorsi* muscle.

Introduction

There is a relationship between high sodium intake and the incidence of hypertension (Kolari, 1980). Dry cured ham has a high sodium content, over 2000 mg in 100 g of product. Efforts have been made to reduce the Na content in different meat products, using several substitutes. NaCl and LiCl have been used as NaCl substitutes with country-style hams (Hand et al., 1982; Keeton, 1984). LiCl is not recognized as safe, and KCl substitution at 33,3% level presented a slight bitter taste, being unacceptable at a 50% level and over.

The preservative action of lactate ion (Annemiche et al, 1990) indicate that potassium lactate (K-lactate) could be regarded as a possible substitute of NaCl, but the off-flavour associated with K (Terrell and Olson, 1981; Pasin et al., 1989) may limitate its use. Askar et al (1994), in other meat products, concluded that the substitution of 40% NaCl by K-lactate is possible without affecting sensory characteristics and microbiological stability. Glycine, which reduces the a_w (Chen and Karmas, 1980), may improve the microbiological stability and could be used as a NaCl substitute, though it is necessary to determine its effect on the flavour of dry cured products.

The aim of this study was to evaluate the effect of NaCl substitution with KCl, K-lactate and glycine on the sensory characteristics of a dry cured ham model.

Material and methods

The treatments for each substitute corresponded to molar substitutions of NaCl progressively 10 by 10%, from 0 up to 60% for KCl and from 0 up to 100% for K-lactate or glycine. 15 loins from gilt carcasses with a pH at 45 minutes post-mortem above 6 were frozen at - 20°C for two days and thawed at 4°C. Three loins were cut into 7 pieces each, which were then put aside for the 6 substitutions with KCl and a control. For the treatments with K-lactate and glycine 6 loins were divided into 6 pieces each, which were then put aside for a control and 5 substitutions (from 10 to 50% or from 60 to 100%). The 3 pieces with the same substitution were sampled from different zones of the loin: the head, centre and back. Salting was carried out using a surface massage. 35 g/kg of NaCl and 0.5 g/kg of KNO_3 were added to the control. At 8 days the loins were stuffed and were kept for 5 days in a chamber at a temperature of 2-3°C. They were then stored for 2 days in a drier at 9-11°C and relative humidity of 80-90%, and then for 21 days at 11-13°C and relative humidity of 70-80%.

A Texture Analyser (model TA.XT2 of Stable Micro Systems Ltd.) was used to determine the texture profile, TPA (Bourne, 1978), for 3 samples of each piece. The samples (1x1x1 cm^3) were compressed to 60%. Crosshead speed was 5 mm/seg. The following parameters were calculated: springiness (%), cohesiveness (%) and chewiness (kg).

Five selected and trained judges (ISO 8586-1, 1993) undertook the sensory analysis. Three pieces, each with different substitution level, were evaluated in each session, using an incomplete block design. Saltiness and off-flavour were evaluated on a non-structured 10-point scoring scale (Amerine et al., 1965).

The data was analyzed for each substitute by variance analysis, using the GLM procedure of SAS (SAS, 1985). The model for instrumental texture parameters included the substitution level and the loin as fixed effects. The model for sensory characteristics included the substitution level, the loin and the combination assessor by session as fixed effects and the piece as a random effect. The substitution level effect was tested using the piece effect as the error term.

Results and discussion

The substitution with KCl did not affect the texture, except for a slight reduction in springiness in substitutions of 50% and above (Table 1). However, the bitter taste detected in substitutions of 50 and 60% means that the use of this substitute above 40% would not appear to be feasible.

The TPA showed a reduction in springiness and cohesiveness, using substitutions with K-lactate at levels of more than 20% (Table 2). A slight decrease in saltiness was also noted at this level. With a 50% substitution an unacceptable lactate taste was detected as well as an important decrease in saltiness and springiness. These results indicate that substitution with K-lactate is acceptable up to 40%, despite the slight effect on texture above 20%.

Substitutions with glycine below 40% only reduce saltiness slightly (Table 3). However, at 40% a significant reduction in springiness and saltiness was noted, as well as the presence of a sweet taste unacceptable in this product. The other texture parameters were seen to be affected in greater substitutions: cohesiveness from levels of 50% and chewiness from 60%. These results indicate that substitutions with glycine above 30% present serious taste problems and changes in the springiness of the product.

Conclusion

The bitter taste was the only impediment in the substitution of NaCl for KCl in dry cured loins, which was unacceptable at levels of 40% and above. Substitution with K-lactate at levels of 20% or more changed certain texture characteristics, though flavour defects were not considered to be important up to 50%. Substitution with glycine at levels of 40% or more changes texture characteristics and brought about a significant reduction in saltiness and an unacceptable level of sweetness.

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