EFFECT OF PHOSPHATE, CASEINATE AND SOY PROTEIN CONCENTRATE ON WATER AND FAT BINDING OF LOW-SALT COOKED SAUSAGE

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Background

Sodium intake exceeds the nutritional recommendations in many industrialized countries. A reduction of sodium intake in diets is highly recommended in order to lower blood pressure of sodium sensitive individuals (Law *et al.* 1991). The main source of sodium in meat products is common salt, NaCl. Thus, reduction of sodium chloride in meat products is an important way to decrease dietary sodium. Salt solubilizes meat proteins, which contribute to meat binding, moisture and fat retention, and the formation of desired gel texture upon cooking (Hamm 1972). Salt reduction in most meat products will thus have an adverse effect on water and fat binding. Phosphates enhance the effect of salt. The combined effects of salt and phosphates on improving the water retention properties in processed meats are well known (Hamm 1972, Matlock *et al.* 1984). Proteins have been used in sausages to improve the textural properties in low-salt products.

Objectives

The purpose of this study was to investigate the effect of sodium phosphate mixture (NAP), sodium caseinate (CAS) and soy protein concetrate (SPC) for improving water and fat binding of low-salt cooked sausage using the response surface methodology. The study is a part of a project aiming at a reduction of the sodium content in meat products.

Methods

The response surface models have been computed from the database of the main study consisting of 152 sausage recipes using general linear modelling. Three levels of salt (1, 1.3 and 1.6%), sodium phosphate mixture (0.15, 0.22 and 0.30% determined as P_2O_5), sodium caseinate (0, 0.85 and 1.7%) and soy protein concetrate (0, 1.075 and 2.15%) were analysed in different combinations. 28 sausage recipes were included when the effect of phosphate was analysed (Fig. 1a), and all other sausage recipes containing phosphate were included, when the effect of soy protein concentrate and sodium caseinate was analysed (Figures 1b-c). All the computational work, including the graphical presentations of the response surface models, has been performed using a Statistica for Windows software package (version 5.5, edition 99, Statsoft, Inc., Tulsa, OK, USA).

Basic formulation in 'Bologna type sausage' contained 36% lean pork (fat content 12%), 18% pork back fat (fat content 89%), 5% pork skin, 0.012% $NaNO_2$, 0.06% ascorbic acid, 0.45% spices and 40.5% added water.

Basic formulation in 'Finnish ring sausage' contained 15% lean pork (fat content 12%), 12% pork back fat (fat content 89%), 18% beef (fat content 22%), 7% pork skin, 8% potato flour, 0.012% $NaNO_2$, 0.06% ascorbic acid, 0.45% spices and 39.3% added water.

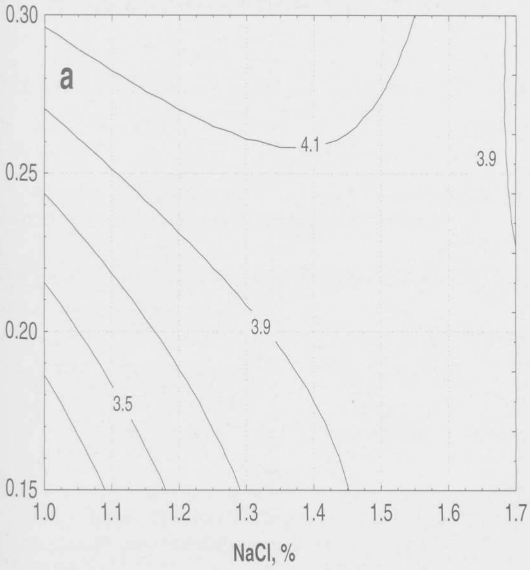
Sensory analysis

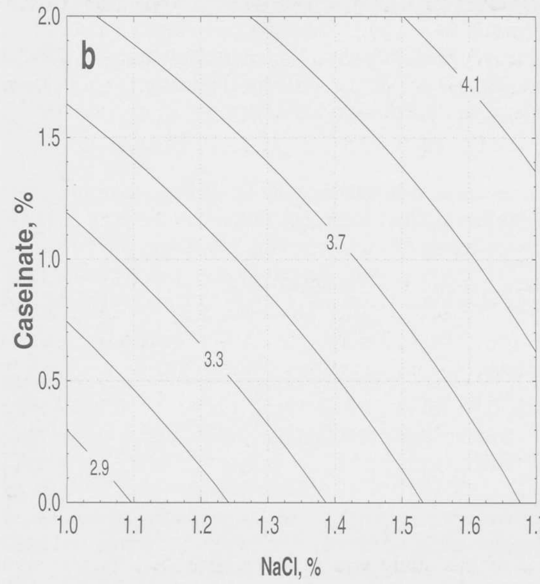
A five-member panel evaluated visually water and fat binding on the cut surface of cold frankfurters using five- point scale: 5=very strong water and fat binding, 4= strong water and fat binding, 3=slightly weakened water and fat binding, a little dull, 2= weakened water and fat binding, dull, 1=weak water and fat binding, broken structure.

Results and discussion

Water and fat binding was evaluated visually. Phosphate improved water and fat binding especially at salt contents less than 1.5% (Figure 1a) (R^2 = 0.768). Above this salt content, neither salt nor phosphate does affect. At higher salt contents the effect of phosphate even decreased. SPC and CAS improved water and fat binding similarly on all salt levels studied (Figures 1b-c) (R^2=0.681) but the effect was much weaker than that of NAP at the content studied.

NAP was most effective in increasing binding at low-salt contents, but it also increased the sodium content most. Sodium phosphate mixture used in this study contained 30% sodium. When 0.5 % sodium phosphate mixture (0.3% determined as P_2O_5) is added into the formulation, the sodium content increases by 0.15 g Na/100g. This amount of sodium equals to the amount of sodium in 0.38% NaCl. SPC contains only 1.1% and CAS 1% sodium.





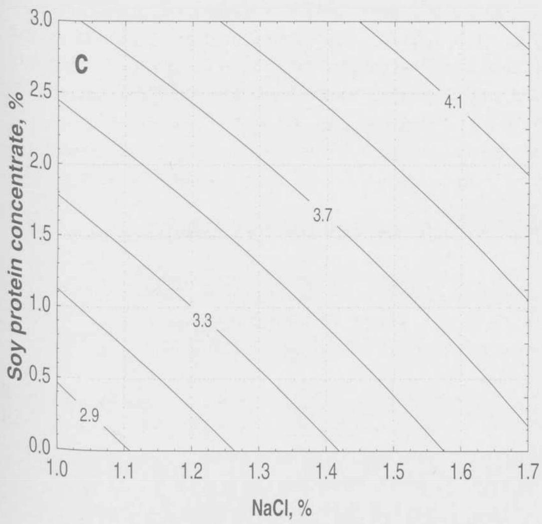


Figure 1. Water and fat binding of cooked sausage evaluated visually. a) by NaCl and P_2O_5 content b) by NaCl and caseinate content, and c) by NaCl and soy protein concentrate content. If the variable is not on the coordinate axis, it is constant as follows: P_2O_5 content = 0.15%, caseinate content = 1 %, soy protein concentrate content = 1.5 %.

Although, water and fat binding were visually evaluated in this study, the results are in agreement with the previous results of Puolanne *et al.* (2001) when the water-holding in cooked sausage was determined by a laboratory sausage method.

It can be concluded that in manufacturing low-salt cooked sausages, the combined usage of phosphate and other extenders can be recommended.

Literature

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Acknowledgements

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