INFLUENCE OF LOW FAT CONTENT ON TEXTURE OF COOKED SAUSAGES

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INTRODUCTION

Previous studies have showed the high functionality of soya protein (Matulis *et al.*, 1995), potato starch (Berry and Wergin, 1993) and carragenans (Foegending and Ramsey, 1986) in contrast to other substances, to achieve a low-fat frankfurter with similar characteristics of texture the convencional product has. On the other side, both apple pectin and carboxilmetilcellulose (CMC) are two hydrocoloids that offer wide possibilities at the time to reduce the fat content of food (Pszczola, 1991; Mittal and Barbut, 1992). However, it seems to be that the mere addition of a single type of substance is not enoguh for this purpose and it is necessary an adequate combination of them (Glicksman, 1991).

The aim of this study is to value the suitability of different functional mixtures, based on the combination of the previously mentioned substances, in order to develop a certain type of low-fat frankfurters provided the reduction or substitution of fat does not affect the sensory quality of the product with regard to its texture.

MATERIALS AND METHODS

Samples: The analysed products were two lots of 21 commercial frankfurters and 4 experimental frankfurters. Experimental frankfurters included a traditional formulation and three low-fat frankfurters, based on combining soya protein, potato starch and carragenan, with apple pectin or CMC (table 1). The process was as follows: ingredients were minced, mixed and emulsion was stuffed into cellulose casings. Sausages were dried at 55°C for 15 min, smoked at 60°C for 15 min, cooked at 75°C until an internal temperature of 72°C was reached, cooled and after removing casings, vacuum packed, pasteurized at 75°C for 45 min and held under refrigeration at 4-5°C.

Sensory analysis of texture: The chosen method for the sensory evaluation was a quantitative descriptive test known as Sensory Texture Profile Analysis (Szczesniak, 1963; Brennan, 1980). It was designed a test based on texture profile proposed by Civille and Liska (1975), that include thirteen attributes of texture: elasticity, hardness, cohesiveness, chewiness, gumminess, adhesiveness, particles perception, skin perception, moisture, oiliness, easy of swallow, juiciness and final residue. The selection and training of panel, constituted by ten members, was done according to Civille and Szczesniak (1973). Besides, acceptability was tested by consumers. Samples were introduced into water at 75 °C for 15 min, were cut into homogeneous pieces of 1cm thick and immediatelly 3 hot pieces of each sample were served for texture evaluation.

Instrumental evaluation of texture: Instrumental Texture Profile Analysis (TPA) was used to evaluate the instrumental texture (Breene, 1975). The texturometer Texture Analyzer Stable Micro Systems XT.RA Dimension, with a cylindrical probe of 1 cm diameter was used. Cross-head speed during the test was 1 mm/min and the level of compression was 70% of the thickness of the sample (1 cm). In each case, consecutive measurements were carried out on ten portions of the same sample, obtaining the average curve. Samples were prepared identically than for the sensory analysis.

RESULTS AND DISCUSSION

A study of principal components was performed to define the characteristic profile and to classify commercial frankfurters that were studied (Piggott and Sharman, 1986).

Table 1. Formulation of experimental sausages.

Formulation	20% fat	15% fat	10% fat	10% fat
PORK LEAN MEAT	35	40	40	40
PORK JOWLS	20	10	10	10
BACK FAT	5	2.5	-	-
ICE	30	37.8	28.5	38
POLYPHOSPHATE	0.25	0.25	0.25	0.25
SALT	1.6	1.6	1.6	1.6
SEASONING	0.7	0.7	0.7	0.7
Na ASCORBATE	0.05	0.05	0.05	0.05
DEXTROSE	0.25	0.25	0.25	0.25
Na LACTATE	1	1	1	1
SKIMMED MILK	1	1	1	1
SOY PROTEIN	2.5	2.5	2.5	2.5
POTATO STARCH	2.5	2.5	2.5	2.5
CARRAGENAN	-	0.5	0.5	0.5
PECTIN GEL *	-	-	10	-
CMC	-	-	-	0.1

* 94.42% water, 0.58% Ca citrate and 4% pectin.

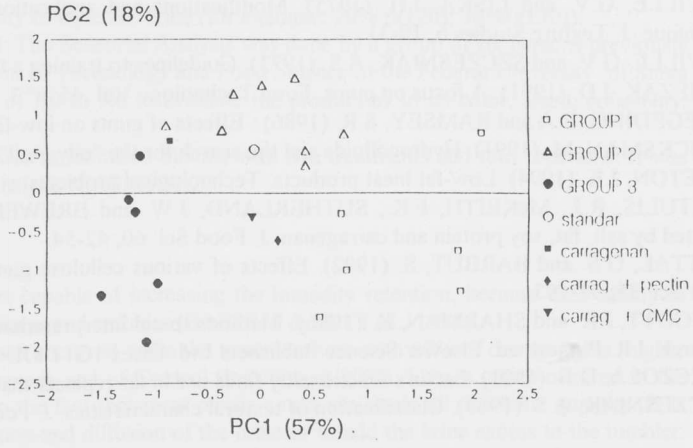

Figure 1. Plot of the first two principal components score vectors. Location of samples in the plane.

Acording to results, hardness, gumminess, chewiness, skin perception and adhesiveness, which are correlated between themselves (r>0,800), are the most relevant to offer information about frankfurters texture, as they are the significant parameters of the first principal component (PC1). This explains a 57% of the total variance. To obtain a more complete information about the texture of the product it is necessary a second principal component (CP2, representing a 18% of the variance), that explains the behaviour of the frankfurters concerning the perception of moisture, fat and juiciness, which are correlated between themselves (r>0,800).

The coordinates of the different frankfurters in relation to the new principal component are shown in figure 1. This permitted of a classification of the commercial sausages in three different groups with differentiated texture properties. With regard to the level of acceptability of the texture, the preferred sausages were those includes in group 2, while the sausages in group 3 were defined as the worst from the sensory point of view. Texture of the four types of sausages produced in pilot plant are included among the texture profiles found in commercial sausages. In addition, the low-fat frankfurters (10%) made with pectin and CMC, as well as the standard sausage (20% fat), belong to group 2, which had the highest degree of acceptance by the panelists. Morover, the texture profile of the standard frankfurter with 20% of fat content and the texture profile corresponding to sausages with 10% of fat are very similar, there not being significant differences after an analysis of variance or ANOVA (α=0,05). All these results indicates that low-fat frankfurters with the same or similar sensory characteristics of texture than conventional sausages could be elaborated. This is possible if an adecuated combination of proteins, starch and gums are used (Dziezak, 1991; Keeton, 1993).

On the other hand, the frankfurter made only with carragenan, of a 15% of fat, appears classified between groups 2 and 3, what indicates that, in general, it would be considered as a worse sensory quality sausage though not worse than other commercial sausages. Foegeding and Ramsey (1986) studied the use of different types of gums to produced low-fat frankfurters (11-12% fat) and concluded carragenan (addition of 1%) is the more adecuated gum to keep the levels of moisture and to increase the hardness in this products. Concerning the behaviour of this kind of frankfurters, results show clear differences with respect to the rest of the samples elaborated in pilot plant (ANOVA, α=0,05). While the carragenan with pectine or CMC frankfurters are of a similar, or even higher, hardness than the standard sample, the sausage made only with carragenan turned out to be softer than the latter. It presented a lower cohesiviness, chewiness, gumminess and hardness, in spite of its higher fat levels, though juiciness was a bit higher.

With respect to low-fat frankfurters (10%), the texture profiles are very similar. Results showed that the sausages elaborated with pectin are significant harder and of a higher degree of chewiness than those with CMC. Regarding juiciness, moisture and oilness significant differences between them were not noticed. Referring the rest of parameters of texture there are not significative differences between the two samples, except for the skin perception. The addition of CMC promotes a higher degree of hardness on the surface of the product what makes the skin feeling to increase, that agrees with Mittal and Barbut (1992).

CONCLUSIONS

Low-fat frankfurters with texture characteristics similar to those of the conventinal frankfurters could be obtained, through the addition of functional mixtures of proteins and hydrocoloids. So, the combination of soya protein, potato starch and carragenan with CMC or apple pectin, in right levels, turn out to be two of the possible options to elaborate low-fat frankfurters (10% fat) with a suitable texture. On the other hand, the combination of carragenan with CMC or apple pectine is more efficient than the use of carragenan alone, as both combinations allow a higher reduction of fat in the product, achieving also a more suitable final texture.

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