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SENSORY EVALUATION OF A FERMENTED SAUSAGE EXTENDED WITH A CARBOHYDRATE-RICH MATERIAL

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INTRODUCTION

Extension of products such as cooked ham and sausages has been extensively studied regarding the improvement in consumer's acceptance and cost reduction by using hydrocolloids, such as starch, carrageenan and CMC. However, there is little information regarding the effect of the addition of starch in meat products which are subsequently subjected to microbial action. The objective of promoting lactic fermentation in meat products is to increase its shelf-life by reducing spoilage flora and pathogens, by the production of some bacteriostatic compounds (Ahn and Stiles, 1990), as well as by reducing its water activity during the drying period and production of flavour and aroma compounds. An advantage in producing fermented sausages in semi-tropical areas is their long shelf-life. These products fall in the category of intermediate meat products and they can be used in areas with ambient temperatures ca. 30C without undergoing spoilage. At the same time, intermediate moisture meat products keep their succulence (Ledward, 1986). However due to the raw materials used (meat in a high percentage), as well as their inventory costs, this results in a very expensive product for the consumer.

In a previous study, the physicochemical and microbial changes caused by the extension of a fermented sausage with a carbohydrate-rich material were reported (Kuri *et al.*, 1992). The objective of this study was to analyze possible sensory differences between a fermented product, extended with starch and a non-extended one.

MATERIAL AND METHODS

Sausages fabrication

Sausages were prepared imitating a traditional fermented product. The meat (85:15 pork) was taken from carcasses where breed, sex, age or nutrition were not recorded. It was mixed with lard (30%) 4.0 salt, 5.0 sucrose, 0.4 pepper, (expressed as percentage of the meat) and 160ppm of sodium nitrate in the final product.

Sausages in one batch ("modified") were substituted in 24% of the meat block with a gel made of MaicenaTM (Productos de Maïz, Mexico City) a fecula starch, which forms a very stable gel with a fast increase in viscosity during heating between 70 and 85°C. The amount of starch in the sausage was constant for all samples (4% starch/sausage). The gelling temperature for the starch used was higher than used in normal processing, making it was necessary to form the gel before adding it to the product, by heating at 80°C for 10 minutes. In the `control' batch of sausages starch was not added. The formulations of both batches were adjusted so as to have the same proportions for each ingredient.

All sausages were then inoculated with a commercial starter (LM-3, Vigusa, Mexico City) consisting of a mixture of *lactobacillus plantarum* and *micrococcus kristinae-varians*. The inoculum was prepared by growing the starter in a modified YLA medium, described by Sánchez-Banuelos *et al.* (1992) and incubated at 37°C with continuous agitation

for 24 hours until O.D.=1 in the cell suspension, measured at 590nm. The meat block was then inoculated with 3% (v/w) of the undiluted medium, stuffed into ViskaseTM casings, in 250g portions and incubated for 24 hours at 35°C and 85% RH, until pH5.0. The sausages were ripen at 15°C and 85% RH for up to 30 days. During the ripening time, pH and microbial populations, indicating the presence of pathogens were analyzed. All samples were pathogen free.

Sensory analysis

A four-member trained panel evaluated both treatments, by the differentiation index procedure (R-index), in order to define the probability of discriminating between two stimuli (Brown, 1974; O'Mahony 1979; 1983; 1991). R-index is a probability of distinguishing correctly between two objects (treatments, products, etc). The experiments were evaluated in triplicates; each replicate consisted in 10 coded samples (five samples taken from the control and five from the "modified" sausage). The samples were presented to the panellists in a random order. The panellists were asked to described the samples as: "control with no doubts", "doubted control", "modified with no doubts", and "doubted modified", after tasting the control and the modified salami.

The panel then carried out a Quantitative Descriptive Analysis for both treatments. In this analysis 18 attributes were evaluated in four replicates, following the methodology described by Sidel and Stone (1985). The evaluated attributes were (counter clockwise in Figure 1):

Odour: 1. fat, 2. fresh meat, 3. fermented, 4. spicy, 5. sour;
Flavour: 1. pork, 2. sour, 3. salty, 4. spicy, 5. starchy;
Texture: 1. dry with no fat, 2. minced meat, 3. thready, 4. cohesive;
After taste: 1. salty, 2. sour, 3. seasoned, 4. dry.

The data were analyzed by analysis of variance using SENPAK statistical package (RSSL, England) and a SAS package (SAS Institute, 1986) for R-index.

RESULTS AND DISCUSSION

The results indicated no significant differences with respect to odour and flavour between the two batches; whereas texture showed a significant difference. The R-index was: 52%, 61% and 75.5% for odour, flavour and texture, respectively. These values were subjected to a t-student test. The first two indexes (52 and 61%) were not significantly different from 50%, whereas the last one (75%) was significantly different from 50% ($P<0.01$).

The analysis of variance showed no significant difference among replicates for the three attributes. There was no significant differences among panellists for odour and flavour, but texture showed a significant difference among panellists. Based on a Duncan multiple range test one panellist had considerably lower averages than the other three.

CONCLUSIONS

From the sensory evaluation, it can be concluded that the addition of starch at the levels used in this experiment did not alter flavour and odour of the product. However, there was a change in texture. According to the descriptive analysis (Figure 1) significant deviations were observed in the modified product in relation to a "starchy" flavour, and a "thready" and "dry" texture.

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Table 1. Differentiation index (R index).

Sensory attribute	R index	t-student	d.f.	t0.05	t0.01
Odour	61.0%	2.033	10	1.812	2.764
Flavour	52.0%	0.319	10	1.812	2.764
Texture	75.5%	4.146	10	1.812	2.764

H_0: x=0.5
H_1: x>0.5

Table 2. Analysis of variance for replicates.

Sensory attribute	F	Level of significance
Odour	3.04	0.137
Flavour	3.71	0.103
Texture	1.10	0.403

Table 3. Analysis of variance among panellists.

Sensory attribute	F	Level of significance
Odour	3.20	0.120
Flavour	2.96	0.137
Texture	4.80	0.063*

* Duncan multiple range was applied at this level of significance.