

Effect of Salt Changes on the Sensory Characteristics of Pork Sausages in Two Ripening Times

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Abstract: The objective of this work was to evaluate the sensory characteristics of meat sausages with 4 different salt formulations (Form1: 2% NaCl, Form3: 1.5% NaCl + 0.5% KCl, Form4: 1.5% + 0.5% NaCl, Form 5: 0.5% Sub 4 salt + 1.5% NaCl) and 2 ripening times (7 and 14 days). Attributes of appearance, odor, texture and flavor were evaluated by a qualified taste panel. The data were submitted to Generalized Procrustes Analysis (GPA) and Product Characterization (PC). The GPA results highlight some characteristics in the different formulations of meat sausages. However, only the firmness felt by the thumbs presented a discriminatory power between sausages with less time of maturation. On the other hand, the external color was the only attribute with significant discriminatory capacity in the sausages with longer maturation time. The results indicate that panelists do not detect very significant differences in sensory characteristics when changing salt levels in meat sausage formulations which may be important in the production of healthier products.

Key words: sausages, pork, salts substitution, sensory characteristics

1. Introduction

Sausages are processed products of high importance and tradition in Portugal, especially in the Transmontana region. Besides being a mark of national culture and ethnography, are a significant socioeconomic heritage for the sustainability of the countryside and the local economy, generating economic independence, employment and autonomous livelihoods. The manufacture and trade of traditional sausages are among the most perennial manifestations of popular culture in Portugal.

There is great concern about the link between salt intake and high blood pressure leading to cardiovascular disease [1]. Thus, reformulations of processed food products have been made to decrease NaCl content and thus reduce sodium consumption [2].

However, this reduction may be accompanied by changes in the sensory characteristics of foods, thereby altering their quality [3-5]. The quality of food, in general, and meat, in particular, is directly associated with their sensory characteristics, such as appearance, odor, texture, and taste. Thus, the objective of this work was the sausages, in which the addition of salt was altered, in two different ripening times, sensory characterization by a taste panel.

2. Materials and Methods

Data were obtained from meat sausages produced at the Carcass and Meat Technology and Quality Laboratory with Bísaro pork supplied by Bísaro Salsicharia Lda. In all formulations, 92.6% of meat, 2% water and 3.4% condiments were used. In Form1 2% NaCl, in Form3 1.5% NaCl and 0.5% KCl, in Form4 1.5% KCl and 0.5% Sub4Salt, and in Form5 1.5% NaCl and 0.5% Sub4Salt were added. The produced sausages were subjected to a 7 and 14 days curing

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process and then evaluated by a 10-elements qualified in meat products taste panel, following Portuguese standards, particularly NP-ISO-8586-1 [6] and using a 7-point scale, where 1 represents the minimum or absence of sensation and 7 the maximum or excessive value. The evaluated attributes were appearance (exterior and interior color), odor (intensity before and after cutting), taste (salty, bitter and metallic), texture (firmness perceived by the thumb and hardness, juiciness and chewability in the mouth), and the flavor (overall sensation, intensity and persistence). Five samples of each formulation were evaluated considering salt formulations in two sessions for a shorter maturation time. The same number of samples were evaluated for a longer maturation time.

The 7 days of cure sausage samples were submitted to a thermal processing in electric grill, with heat above and below, until reaching 80°C in its thermal center. The 14-day cured sausages did not undergo any heat treatment. Both were evaluated while raw externally and internally after cutting in slices of about 5 mm. Those with shorter curing time were cut after heat treatment. All samples were coded adequately with random 3-digit numbers and served to the tasters monadically.

Statistical analysis of the data was performed using the XLStat program, a Microsoft Office Excel add-in. The procedures used were the Product Characterization, using as factors the products, the tasters and their interaction, and the Generalized Procrustean Analysis (APG) that minimizes the differences between tasters.

3. Results and Discussion

Table 1 shows the discriminatory power (test values and p-values) of the various sensory attributes produced by the Product Characterization procedure. Only 1 of the 14 attributes used to evaluate the sausages showed significant discriminatory power ($p < 0.01$) between different salt formulations in the sausages with 7 days of cure. The firmness felt by the thumbs was higher in Form5 (average 2.8 in 7) and lower in Form3 (average 2.3 in 7), although the mean values are close to 2.4 and 2.5 in Form 1 and Form4, respectively. In chorizo sausages with 14 days of cure were 2 in 14 attributes in which there was a significant discriminatory power ($p < 0.05$). The exterior color of Form 1 (average 5.3 in 7) was darker, and Form 5 (average 4.9 in 7) the lightest, although close to the other formulations averaging 5 in 7.

Table 1 Discriminatory power of sensory attributes for sausages under study.

Sausages with 7 days of ripening			Sausages with 14 days of ripening		
Descriptors	Test-values	p-values	Descriptors	Test-values	p-values
Firmness	2.580	0.005	Exterior color	2.171	0.015
Interior odor	1.550	0.061	Hardness	1.754	0.040
Bitter taste	1.246	0.106	Exterior odor	0.676	0.250
Color	1.013	0.156	Salty taste	0.487	0.313
Chewiness	0.620	0.268	Metallic taste	0.235	0.407
Flavor (intensity)	0.583	0.280	Firmness	0.175	0.431
Juiciness	0.264	0.396	Flavor (intensity)	0.117	0.453
Interior color	0.241	0.405	Juiciness	-0.153	0.561
Hardness	0.118	0.453	Chewiness	-0.234	0.592
Salty taste	-0.083	0.533	Interior odor	-1.317	0.906
Exterior odor	-0.526	0.701	Interior color	-1.416	0.922
Metallic taste	-0.549	0.709	Flavor (persistency)	-1.623	0.948
Flavor (persistency)	-2.309	0.990	Bitter taste	-3.102	0.999

Figs. 1 and 2 show the biplot of the consensus configuration where the correlations between sensory attributes and APG factors F1 and F2 and the coordinates of the different sausages with 7 and 14 days of cure, respectively, are observed. Three factors explained all data variability, F1 and F2 together explained 78% and 76% of the total variability in sausages with 7 and 14 days of cure, respectively. Given the position of the meat types and the direction (correlation) of the sensory attributes concerning the main factors, it can be said that Form1 sausages had a higher interior odor intensity and flavor persistence. Form 3 sausages had darker interior color (darker red), higher odor intensity, hardness and bitter taste. Form4 was where basic taste values were most noticeable, though not very high, and Form5 had the highest texture, external color and flavor intensity.

In sausages with longer curing time, APG indicated Form1 with the highest hardness, chewability, exterior color, internal odor, bitter taste and persistence of flavor. Form3 was considered the juiciest and salty, Form4 was the one that had the highest firmness, and

Form5 had the highest intensity of interior color and metallic taste.

Our results are different from those found by Vilar et al. [7] which concluded that the inclusion of seaweed and reduction of salt and fat impacted on the sensory properties of frankfurters. Making further modifications than the ones made in the present work, they found significant differences in color, liking of appearance, aroma, flavor and texture attributes between samples, also overall acceptability of reformulated frankfurters containing seaweed was greatly influenced by the type of added seaweed.

In cooked hams Tamm et al. [8] found that salt reduction by a combined approach of high-pressure treatment and the salt replacer KCl could potentially reduce product acceptability, since a lower salty taste was detectable in sensory evaluations. They suggest “additional investigations must focus on providing technical alternatives that enhance the saltiness perception and initiatives to educate and modulate consumer preference for low-salt products”.

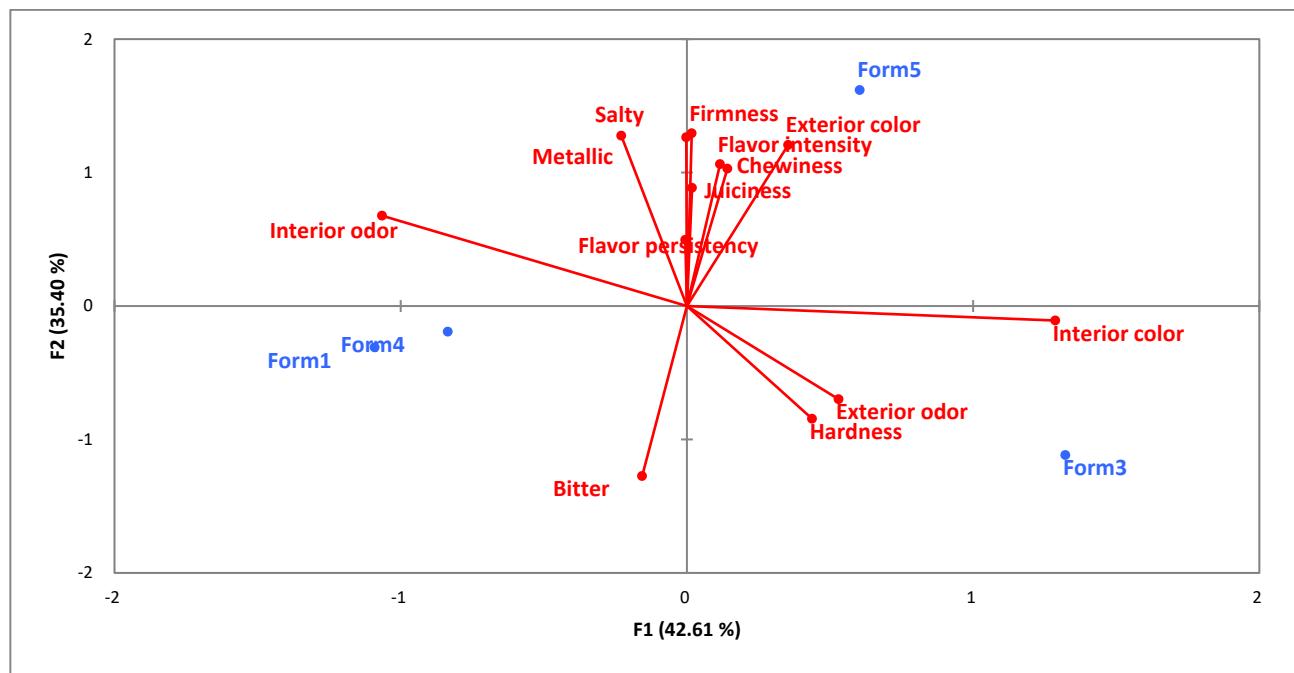


Fig. 1 Consensus configuration: joint representation of the correlation between sensory attributes and F1 and F2; and coordinates of the sausages with 7 days of curing under analysis.

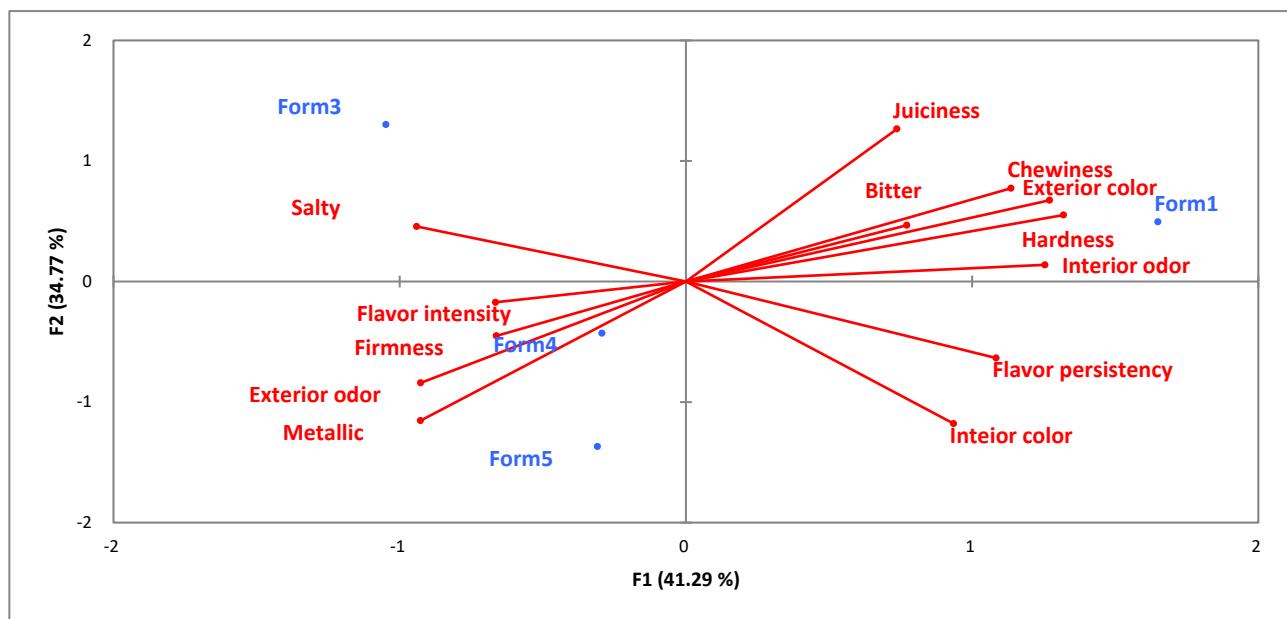


Fig. 2 Consensus configuration: joint representation of the correlation between sensory attributes and F1 and F2; and coordinates of the sausages with 14 days of curing under analysis.

5. Conclusions

Although tasters can distinguish chorizo sausages with different formulations, the results obtained indicate that tasters do not detect very significant differences in sensory characteristics when changing salt levels in sausage formulations which may be important in the production of healthier products.

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