EFFECTS OF Na-LACTATE BY K-LACTATE REPLACEMENT ON ACCEPTANCE AND DESCRIPTIVE SENSORY PROFILE OF SAUSAGES WITH REDUCED SALT CONTENT

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The effects of Na-Lactate (NaL) substitution by K-lactate (KL) as well as NaCl replacement (50%) by KCl on acceptance and sensory characteristics of low cost emulsion type sausages (produced with high levels of mechanically deboned poultry meat) were investigated. Six formulations were evaluated by consumers using a 9 point hedonic scale for acidity, texture, aroma, taste, color, appearance and overall acceptability. The products were also evaluated by semi-trained assessors using a flash profile. The results showed that, despite slight variations, significant differences were not detected by the consumers among the formulations in acidity, texture, aroma, color and appearance. When using 2% NaCl, the addition of NaL or KL did not impact on taste or overall acceptability. However, in formulations containing 1% NaCl + 1% KCL the use of NaL resulted in significantly better products as measured by taste and overall acceptability. A preference map suggests that the consumers were able to distinguish the formulations and had a tendency to prefer products with 2% NaCl with or without NaL or Kl and 1% NaCl+1% KCl with NaL. The sensory descriptors that most differentiated the products were bitter and metallic.

Key Words – flash profile, mechanically deboned poultry meat, preference map

I. INTRODUCTION

Meat products have traditionally been described as villains in the diet because of their high salt (or sodium) content. Then, to create truly healthy meats, efforts should be directed towards the reduction of this component in the formulations that are less healthy, thereby improving the image of meat products for consumers. However, a simple reduction of NaCl content in sausages is unacceptable from a sensory and a technological point of view because this ingredient not only determines the characteristic salty taste of meat products but it contributes to microbiological safety [1]. The replacement of NaCl by other ingredients that perform similar technological functions while maintaining sensory characteristics is suggested as an alternative to make this meat product have a healthier appeal.

The use of sodium or potassium lactate with a corresponding reduction in NaCl tends to maintain certain saltiness while reducing the sodium content in products to some degree. Conjointly, it contributes to safety and quality of low-sodium meat products [2].

Conventional descriptive methodologies are very robust, and faster new methodologies using innovative statistical tools developed over the last years could potentially be used to profile products. Flash profile methodology is an original quick sensory profiling technique designed to meet industrial needs. It is a mixture of free-choice profiling terms selection in combination with a ranking method based on simultaneous presentation of the whole product set; it is attractive because it does not require a training stage and individual sessions are possible, reducing analysis time while obtaining good correlations [3].

In this context, the present study had as objectives to identify the impact of salt reduction on sensory characteristics and acceptance of emulsion type products containing high levels of mechanically deboned poultry meat using as a partial substitute KCl, combined with NaL or KL.

II. MATERIALS AND METHODS

The emulsion-type sausages were prepared following conventional processing and formulation as described in Table 1. The different evaluated treatments were formulated by varying the NaCl contents by KCl (Merse, Brazil) substitution (50%) and with the addition of Na-lactate and K-lactate at 30g/kg. The lactates were kindly provided by PURAC (commercially called NaL PurasalS® and KL (PurasalP®, Brazil). After processing, the meat emulsion was mechanically embedded (Mainca, model EC12, Spain) in permeable cellulose casings (VISKASE Brazil, 24 mm ø), cooked, cooled in a water/ice bath, manually peeled, vacuum packed and stored in a controlled cold chamber at 4-7°C for 2 weeks before the beginning of the analysis.

In the acceptance consumer testing one hundred emulsion-type sausages consumers were recruited at random, in Campinas city (São Paulo state, Brazil). The original research project was initially submitted and previous approved by the Ethics in Research Committee of the UNICAMP medicine institution. The consumers were instructed to evaluate the sausages samples with respect to their degree of liking for appearance, aroma, taste, texture, acidity, color and overall liking using a 9-point hybrid hedonic scale (1=disliked extremely; 5=Neither like nor dislike; 9=Like extremely).

The sensory profile was conducted using the methodology Flash profile as described by Dairou and Sieffermann [4] with 10 semi-trained assessors recruited based on their previous sensory descriptive experiences. Prior to the tests, the assessors were made aware of the research methodology procedures and instructed to generate their own attributes terms; after a succinct discussion, these terms set-list were improved, summarized and grouped. Subsequently, the six emulsion-type sausages samples coded with 3-digits numbers, were simultaneous presented to the assessors and they were requested to rank the samples, attribute by attribute [3].

The data from the acceptance tests were subjected to analysis of variance (ANOVA), and the comparison between means was determined by the Tukey-test at a 95% confidence level. Internal Preference Mapping was performed for the overall acceptability scores. Flash Profile data were typed in 10 matrix (one per assessor; samples in lines and attributes in columns) and analyzed by Generalized Procrustes Analysis – GPA; an appropriate statistic tool used for this methodology that reduces the scale usage effects, delivers a consensus configuration and also allows to compare the proximity between the terms that is used by different assessors to describe products [5]. These data analyses were performed using *X*LSTAT® add-in for Microsoft Excel® [6].

III. RESULTS AND DISCUSSION

The results from the acceptability tests are shown in Table 2. There were no statistical differences between the products for acidity, texture, aroma, color and appearance acceptability. In relation to taste and overall acceptability, some differences were found. Products containing 2% NaCl, alone or in conjunction with NaL or KL did not differ and the consumers slightly liked all the products. The products containing 1% NaCl + 1% KCl did not differ from the control (2% NaCl) or from the product containing 1% NaCl + 1% KCl + KL but were considered statistically less acceptable than the product containing 1% NaCl + 1% KCl + NaL.

Figure 1 shows the internal preference mapping derived from the data of overall acceptability. The consumers were able to distinguish the products and segregate them into three groups: one big group formed by F1 (CONT), F2(CNAL), F3(CKL) and F5 (FNAL), one formed by F6 (FKL) and the last group formed by F4 (NAKCL). This result showed that consumers better liked the big group and had a higher disliking for the formulations containing 1% NaCl + 1% KCl and 1% NaCl + 1% KCl + KL.

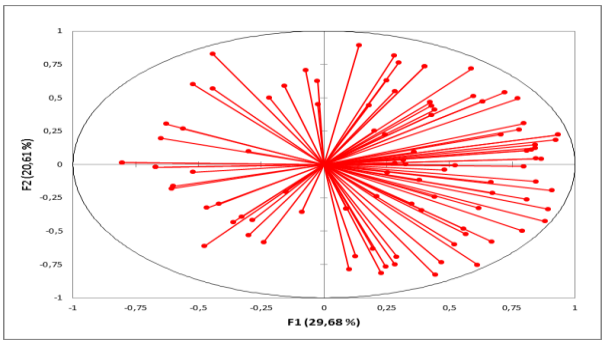
Table 1 Formulations of low-cost emulsion-type sausages containing different levels of NaCl, KCl, Na-lactate and K-lactate.

Raw Material / Ingredients (g/kg)	Treatments / Formulations					
	F1	F2	F3	F4	F5	F6
Bovine forequarter – fore shank	275.40	275.40	275.40	275.40	275.40	275.40
MDPM[a]	413.10	413.10	413.10	413.10	413.10	413.10
Pork backfat	100.00	100.00	100.00	100.00	100.00	100.00
Water/Ice	142.25	112.25	112.25	142.25	112.25	112.25
Salt (Sodium Chloride) - NaCl	20.00	20.00	20.00	10.00	10.00	10.00
Potassium Chloride - KCl[b]	-	-	-	10.00	10.00	10.00
Sodium Lactate - NaL	-	30.00	-	-	30.00	-
Potassium Lactate - KL	-	-	30.00	-	-	30.00
Sodium Nitrite - $NaNO_2$	0.15	0.15	0.15	0.15	0.15	0.15
Tripolyphosphates	2.50	2.50	2.50	2.50	2.50	2.50
Erythorbate	0.40	0.40	0.40	0.40	0.40	0.40
Cassava Starch	20.00	20.00	20.00	20.00	20.00	20.00
Isolated Soybean Protein - ISP	20.00	20.00	20.00	20.00	20.00	20.00
Spices / Seasonings						
White pepper	0.50	0.50	0.50	0.50	0.50	0.50
Garlic powder	2.20	2.20	2.20	2.20	2.20	2.20
Onion powder	2.20	2.20	2.20	2.20	2.20	2.20
Coriander	0.10	0.10	0.10	0.10	0.10	0.10
Cardamom	0.10	0.10	0.10	0.10	0.10	0.10
Marjoram	0.60	0.60	0.60	0.60	0.60	0.60
Jamaica pepper	0.50	0.50	0.50	0.50	0.50	0.50
Total	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00

F1 – Control formulation; F2 – Sodium lactate added; F3 – Potassium lactate added; F4 - NaCl + KCl (50% NaCl replacements); F5 - NaCl + KCl (50% NaCl replacements) added of Sodium Lactate; F6 - NaCl + KCl (50% NaCl replacements) added of Potassium lactate

[a] Mechanically Deboned Poultry Meat – MDPM – [b] Ionic Strength Correction – 38.26g KCl per batches of 3000g.

Figure 2 displays the biplot obtained by GPA (Generalized Procrustes Analysis) from the sausage evaluation´s flash profile data. The first two principal components accounted for the 63.85% of the total variability (Dimension 1 38.18% and Dimension 2 25.67%). The main descriptors that differentiated the products in relation to taste were metallic and bitter. Bitter was related to products containing 2% NaCl+ NaL or Kl. Metalic was related mainly to products containing KCl and K-lactate.



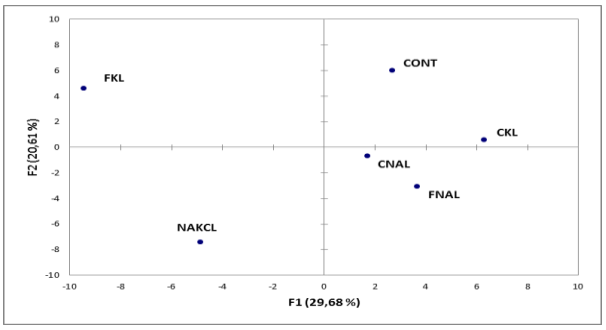


Figure 1. Internal preference mapping for mean scores of overall liking indicating consumers (n=100) (a) and samples positions (b).Dimension 1 29.68% and Dimension 2 20.61%, totaling = 50. 29%. CONT – F1 Control (20 g/kg NaCl); CNAL – F2 (20g/kg NaCl + 30g/kg Na-lactate); CKL – F3 (20g/kg NaCl + 30g/kg K-lactate); NAKCL – F4 (10g/kg NaCl + 10 g/kg KCl, 50% replacement); FNAL – F5 (10g/kg NaCl + 10 g/kg KCl + 30g/kg Na-lactate); FKL – F6 (10g/kg NaCl + 10 g/kg KCl + 30g/kg K-lactate).

Table 2 Means scores for sensory attributes of acidity, texture, aroma, taste, color, appearance and overall liking using 9-point hedonic scale*

Formulations	Sensory attributes / means values						
	Acidity	Texture	Aroma	Taste	Color	Appearance	Overall liking
F1	6,00 [a]	6,63 [a]	5,95 [a]	5,59[abc]	5,13 [a]	5,67[a]	5,77[abc]
F2	6,04 [a]	6,89 [a]	5,97 [a]	5,83[bc]	5,38 [a]	5,87 [a]	5,96[bc]
F3	6,33 [a]	6,76 [a]	5,93 [a]	6,02[c]	5,33 [a]	5,86 [a]	5,92[bc]
F4	5,97 [a]	6,63 [a]	5,73 [a]	5,20[ab]	5,04 [a]	5,67 [a]	5,39[ab]
F5	6,27 [a]	6,89 [a]	5,95 [a]	6,04[c]	5,23 [a]	5,57 [a]	6,03[c]
F6	5,81 [a]	6,80 [a]	5,72 [a]	5,10[a]	5,14 [a]	5,55 [a]	5,24[a]

F1 – Control formulation (20g/kg NaCl); F2 – 20g/kg NaCl + 30g/kg Na-lactate; F3 – 20g/kg NaCl + 30g/kg K-lactate; F4 – 10g/kg NaCl + 10 g/kg KCl (50% replacement); F5 – 10g/kg NaCl + 10 g/kg KCl + 30g/kg Na-lactate; F6 – 10g/kg NaCl + 10 g/kg KCl + 30g/kg K-lactate.

Mean values followed by the different small letter within the same column, are significantly different ($p \leq 0.05$) according to Tukey's test.

*9-Point hedonic scale = (9 - liked extremely; 8 - liked very much; 7 - liked moderately; 6-liked slightly; 5 - neither liked nor disliked; 4 -disliked slightly; 3 - disliked moderately; 2 - disliked very much; 1 - disliked extremely).

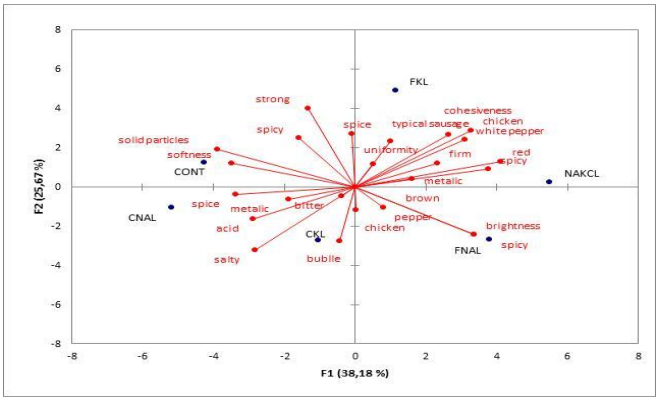


Figure 2. Principal component biplot of descriptive evaluation obtained by generalized procrustes analysis from flash profiling data.

IV. CONCLUSIONS

Reduction of salt content using KCl as a partial substitute (50%) did not reduce the overall acceptability scores although the consumers positioned the products in different quadrants in preference mapping. The use of NaL in conjunction with sodium reduction using KCl resulted in products with good acceptability, closer to products elaborated with 2% NaCl with or without NaL or KL.

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