

# ADDITION OF CANOLA OIL AND INULIN AS A FAT SUBSTITUTES IN BRAZILIAN SALAMIS: EFFECTS ON SENSORY PROPERTIES

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**Abstract** – In this study, pork back fat commonly used in fermented dry sausages (Brazilian salamis) was partially replaced by canola oil and inulin in a pre emulsion form aiming to evaluate its effects on sensory properties (check all that apply questionnaire and overall acceptance). Four treatments were manufactured, FC-control, F1-reducing 50% of pork back fat + blend of canola oil; F2 – F1 + 2,5% inulin and F3 – F1 + 5,0% inulin. Results indicate that treatment containing only addition of canola oil (F1) had lower acceptance scores ( $P < 0,05$ ), compared to control treatment. Treatments containing 2,5% (F2) and 5% (F3) of inulin addition had the same acceptance scores of control, suggesting that the addition of fiber did not compromise consumer's acceptability. Regarding "check all that apply" questionnaire results, 3 groups were identified: control treatment, two treatments containing 2 levels of inulin (F2 and F3) and treatment which was added only canola oil (F1). We concluded that the addition of canola oil besides 5% inulin is a good alternative to reduce fat and simultaneously adding a functional benefit, since sensory properties in traditional Brazilian salamis had not changed significantly.

**Key Words** – salamis, check all that apply, inulin, canola oil

## I. INTRODUCTION

The growing concern about reducing fat ingestion in human diet has led to reformulation of traditional meat products necessity, such as in Brazilian salamis. This product contains up to 50% of fat as a result of drying [1], and the main source of fat used in salamis is pork back fat, rich in saturated fatty acids and cholesterol,

which in turn are correlated to higher incidence of chronic disorders, such as heart disease [2].

However, only reducing fat is not suitable, since this ingredient in meat products provides texture and flavor characteristics, and these sensory attributes should be kept to not lose consumer market and guarantee consumer's acceptability. Therefore, it is necessary to find an adequate fat replacer, which could add benefic ingredients, for example, vegetable oil or functional fiber [3]. A strategy to substitute animal fat in salamis could be replaced using a pre emulsion systems [4], resulted from an appropriated mix of vegetable oil, isolated soybean protein or other sources and water. However, to develop complex systems when pork back fat in pre emulsion is added, another stabilizer is need, such as carrageenan, which is a hydrocolloid and has gelation properties [5].

Canola oil is a good source of  $\alpha$ -linolenic acid, and has the lowest levels of saturated fatty acids when compared to other vegetable oils [6]. Inulin is a functional fiber that could be used as fat substitute improving characteristics of water holding capacity and gelation properties.

Sensory analysis is one of the most important procedures to evaluate if consumers approve or not a new product by overall acceptance. In addition to affective test, "check all that apply" questionnaire is a methodology that provides rapid response to classify samples according to features previously determined.

This study aimed evaluate the effects of pork back fat reduction and its substitution by canola

Table 1. Formulations and different treatments of reformulated Brazilian salamis added by canola oil and two levels of inulin

Raw Material (%)	Treatment			
	Control	F1	F2	F3
Pork beef	82	82	82	82
Pork back fat	18	5	5	5
Blend	0	13,00	15,50	18,00
Water		4,05	4,05	4,05
Isolated Soybean Protein - ISP		0,80	0,80	0,80
Canola Oil		4,05	4,05	4,05
Pork back fat		4,05	4,05	4,05
Carrageenan		0,02	0,02	0,02
Sodium tripolyphosphate		0,03	0,03	0,03
Inulin		0,00	2,50	5,00
Ingredients/Spices				
Glucose	0,5	0,5	0,5	0,5
Sucrose	0,5	0,5	0,5	0,5
White pepper	0,2	0,2	0,2	0,2
Garlic powder	0,3	0,3	0,3	0,3
Nutmeg	0,02	0,02	0,02	0,02
Sodium ascorbate	0,25	0,25	0,25	0,25
Sodium nitrate	0,015	0,015	0,015	0,015
Sodium nitrite	0,015	0,015	0,015	0,015
NaCl	2,5	2,5	2,5	2,5
Starter T-SPX	0,025	0,025	0,025	0,025

FC1- 100% pork back fat; F1- 50% pork back fat + blend containing canola oil; F2-50% pork back fat + blend containing canola oil and 2,5% inulin; F3- 50% pork back fat + blend containing canola oil and 5% inulin.

oil and inulin in pre emulsion form on sensory attributes of reformulated Brazilian salamis to provide healthier characteristics.

## II. MATERIALS AND METHODS

Reformulated Brazilian salamis were prepared following formulation as described in Table 1. The pork back fat content was reduced in 50% in reformulated Brazilian salamis, by adding canola oil (4%) and inulin (2,5% and 5%) in a pre emulsion form. Inulin was kindly donated by Clariant (Clariant S/A, São Paulo, Brazil) and canola oil (Cargill Foods, São Paulo, Brazil) was provided in local market. Regarding sensory analysis, one hundred and twenty consumers were

recruited to answer the affective test of acceptance and check all that apply (CATA) questionnaire.

Table 2. Degree of overall acceptance and standard deviation of reformulates Brazilian salamis with addition of canola oil and inulin

	Control	F1	F2	F3
Overall acceptance	7,13 <sup>a</sup>	6,52 <sup>b</sup>	6,69 <sup>ab</sup>	6,66 <sup>ab</sup>
Standard deviation	1,55	1,71	1,60	1,67

Averages with the same letter on the same row are not significantly different ( $P > 0.05$ ) by Tukey's test. FC1- 100% pork back fat; F1- 50% pork back fat + blend containing canola oil; F2-50% pork back fat + blend containing canola oil and 2,5% inulin; F3- 50% pork back fat + blend containing canola oil and 5% inulin.

According to Meilgaard *et al.* [7], in acceptance test each consumer evaluated samples using a structured 9-point hedonic scale ranging from “dislike extremely” to “like extremely”.

Consumers also answered a CATA questionnaire and a list of 27 words or phrases were presented and consumers were asked to mark how many were necessary to characterize each sample. This list of words was previously chosen by fifteen untrained consumers.

The data results were analyzed using the software XLSTAT 2015.5 (Addinsoft, Paris, France). One-way analysis of variance (ANOVA) and Tukey test, at 5% significance level was applied to acceptance test. Data from CATA were analyzed by Multiple Factor Analysis (MFA).

### III. RESULTS AND DISCUSSION

One of the most important parameters to guarantee the success of a specific meat product reformulation, such as fat reduction or changes in a fatty acid profile is consumer's sensory acceptability. Consumers study results of acceptance tests are showed in Table 2. Through 9-point hedonic scale the highest score was attributed to control treatment, being classified as “like moderately”. Compared to control, no statistical differences ( $P>0,05$ ) were observed in overall acceptance of the products where inulin was added (F2 and F3), so it can be concluded that different inulin levels applied did not compromise sensory acceptability. The lowest acceptance score was observed to F1 (treatment containing only canola oil), however was not significant different ( $P>0,05$ ) from treatments in which inulin was added. These results could indicate that even though there were great difference in reformulated products, such as reduced level of pork back fat and addition of canola oil and inulin, product was still acceptable to consumers.

CATA was applied using 27 sensory descriptors, 10 of which described appearance, 4 for aroma, 8 for flavor and 5 for texture. The CATA questionnaire results were evaluated by MFA, which explained 94,86% of the total variation of data in two dimensions. Therefore, treatments were divided in three groups according to the quadrants in which they belong, as shown in Figure 1. First group gathered treatments

containing inulin in two levels (F2 e F3), which were classified as sweet taste, without flavor, tender, crumbling texture and appearance, light color, uniform and pink, opaque and mild aroma.

It is important to observe that sweet taste of inulin was perceived by consumers, in a way that in MFA treatments were characterized as sweet and salty in opposite quadrants of sensory map.

The second group was characterized by treatment added only by blend containing canola oil (F1), which the attributes were: without salt, dry, acid aroma and taste and peppery. And the third group, which belongs control treatment was sensory characterized as spice flavor, strong aroma, too much fat and dark color.

### IV. CONCLUSION

The addition of canola oil and two levels of inulin (2,5 and 5%) in Brazilian salamis did not compromise consumer's acceptability. Also, the addition of inulin disguised the flaws promoted by fat reduction. Further studies are necessary to optimize canola oil and inulin levels, since consumers were capable of discriminate inulin presence.

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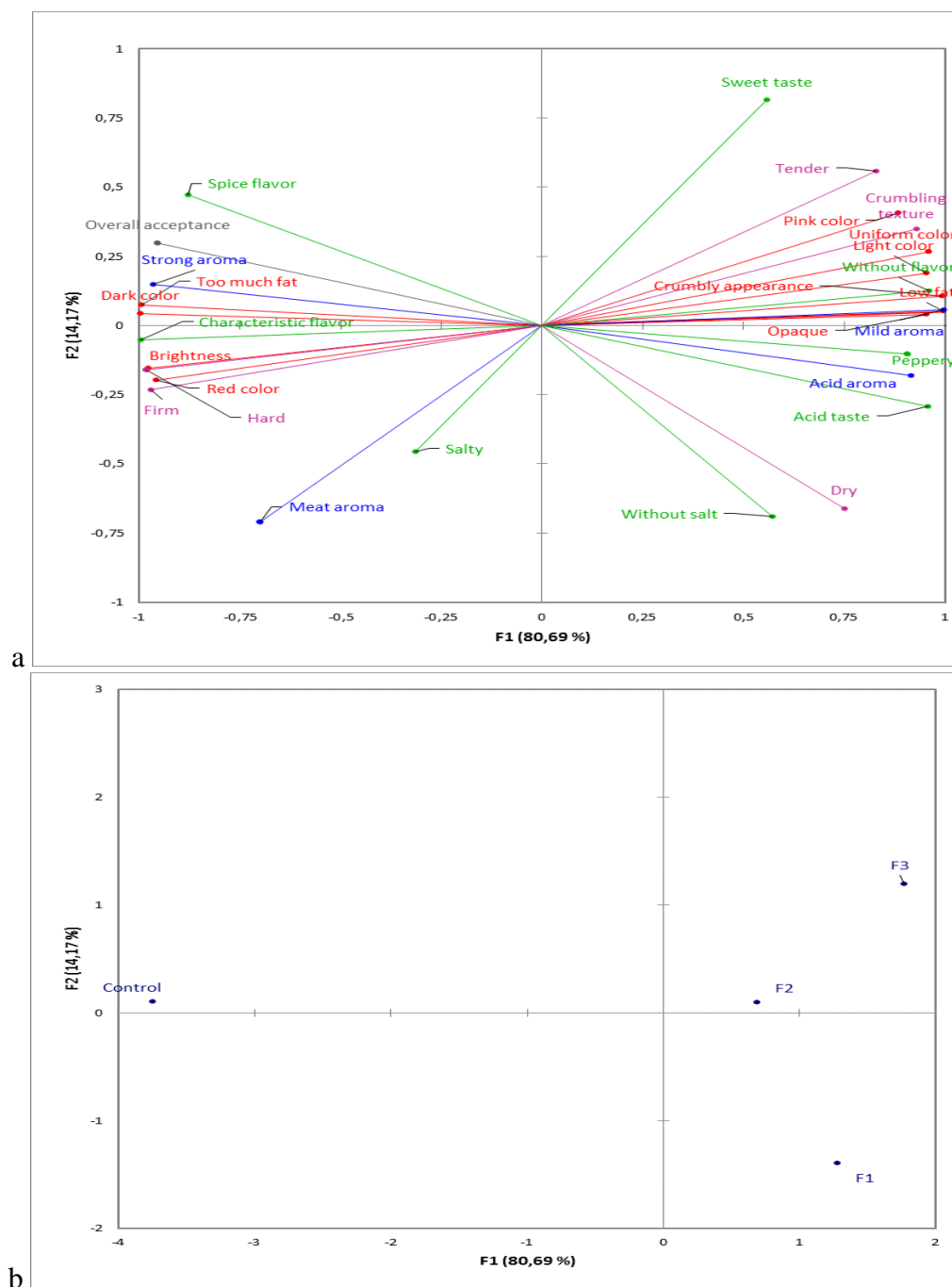


Figure 1. Representation of the terms (a) and samples (b) in the first and second dimensions of the multiple factorial analysis on check-all-that-apply (CATA) questionnaire data. FC1- 100% pork back fat; F1- 50% pork back fat + blend containing canola oil; F2-50% pork back fat + blend containing canola oil and 2,5% inulin; F3- 50% pork back fat + blend containing canola oil and 5% inulin.