

SENSORY ACCEPTANCE OF LOW-FAT BOLOGNA MORTADELLA SAUSAGES

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Abstract - The Brazilian population has a diet high in fat, even with recommendations to reduce consumption by the World Health Organization. Fat is an important ingredient in product structure as well as providing physiological and sensory characteristics for the consumer. In the Brazilian context, Bologna Mortadella sausage stands out as a popular emulsified meat product, widely consumed, low cost and with significant levels of fat. The Bologna Mortadella sausage has particular sensorial properties, very specific to the product, small changes can easily mischaracterize this product. Thus the objective of this study was to identify the sensory acceptance of Bologna mortadella sausage with 2/3 of the fat reduced. The sensory panel consisted of 101 members, they evaluated the appearance, texture, aroma, flavor and overall impression of two formulations T1 - containing 24% fat and T2 - with 8% fat. The results were analyzed by ANOVA and the data obtained for the attribute "overall impression" are represented by a preference mapping. The treatment with a reduced fat content was equal to or more acceptable than the T1. From the results it can be concluded that T2 is a viable market alternative recipe for the sausage.

Key Words – internal preference mapping, meat emulsion, sensory evaluation, reduction fat.

I. INTRODUCTION

The World Health Organization recommended a reduction in fat consumption from 15 to 30% of total daily calories consumed. Consumers are currently opting for foods with functional ingredients and/or levels of sodium, fats and sugars reduced [1] [2]. Meanwhile in Brazil the Household Budget Survey (POF 2008-2009) has shown that the Brazilian diet is high in fat, especially for the young [3]. Brazilian regulation identified as ANVISA [3] No. 27 of 1998 requires that products called "reduced products", must have fat content at least 25%

lower than the regular product. The Bologna Mortadella sausage stands out as a popular emulsified meat product, widely consumed in Brazil, with a low price and with significant levels of fat. Fat contributes to palatability and structural stability of emulsified products, due to the alloy rheological and structural properties. It is difficult to prepare emulsions with low fat [3]. Variations in fat content influence sensory properties by different mechanisms: changes in the water /fat ratio, the protein concentration changes in the emulsifiers and changes in lipophilic active compounds which act as precursors for odor development and stability and flavor [4]. Fat reduction can affect mouth, touch and smell perceptions, modifying the creaminess, appearance, flavor and texture of foods. The acceptance of food is essential in the process of substitution of ingredients to enhance health. The objective of this study was to identify the sensory acceptance of Bologna type sausage with reduced fat content.

II. MATERIALS AND METHODS

The Bologna Mortadella sausage was processed in the Meat Technology Center (CTC) of the Institute of Food Technology (ITAL), Campinas, SP, Brazil, according to the formulation of Table 1.

The frozen meat was subjected to the cutter, allowing the formation of the emulsion. The cutter process time is controlled by temperature, preventing the collapse of the meat emulsion. The non-meat ingredients were added slowly with ice, allowing the temperature to be maintained. The meat mixture was embedded into pieces of 500 grams of 10 cm diameter and 20 cm in length.

Table 1. Formulation of treatment Bologna Mortadella sausages.

Ingredients	Formulation (%)	
	T1	T2
Beef (Fourth Fontal Clean)	36	36
Pork Meat (brisket)	26	28
Pork Fat (80%)	12	4
Lard	12	4
Water (ice)	11.3	23.8
Milk soy	0	1.5
Condiments	0.8	0.8
Salt	1	1
Curing salt	0.3	0.3
Emulsifier (BKG - Adicon)	0.25	0.25
Curing accelerator	0.35	0.35

Afterwards the Bologna mortadella embedded went into the steam cooking chamber to obtain 72°C in the geometric point of mortadella, a process that took approximately four hours. After the Bologna Mortadella sausages were cooked they were subjected to a water bath at 25°C for 30 minutes, then the mortadella went into refrigeration at 4 ° C, to be kept there until the sensory test. This project was approved by the Ethics Committee of the Institution to carry out the sensory analyses using adults over 18 years and nonsmokers. The sensory panel was recruited on campus "Luiz de Queiroz" between students and staff. The Bologna Mortadella sausage passed the acceptance test one day after processing.

A total of 101 consumers in the university evaluated the Bologna Mortadella sausages and they were a representative sample. This sensorial analysis was in two sessions of test acceptance (48% women and 52% men – Age Mean 25 years; Age Median 22 years and standard 10 years). Half of tasters evaluated the samples of the first and the other the second processing. The treatments were evaluated using the nine-point hedonic scale (1 = disliked extremely and 9 = liked extremely) acceptance test for appearance, texture, aroma, flavor and overall liking.

The analysis results were submitted to an analysis of variance (ANOVA) at a significance level of 5% ($p \leq 0.05$). The results obtained from the overall impression of the

product were prepared as an internal preference map using the program XLSTAT.

III. RESULTS AND DISCUSSION

Fat reduction in T2 compared with T1 was 66%, results for acceptance testing (Table 2) made in T1 and T2, showed that with fat reduction there is a significant difference in appearance between T1 and T2, texture and overall acceptance of the Bologna mortadella sausage. For evaluated characteristics the mortadella with the reduced fat content was more acceptable.

Table 2. Results of acceptance evaluation.

	T1	T2
Appearance	6.2 ± 1.7 ^a	7.3 ± 1.5 ^b
Aroma	6.5 ± 1.5 ^a	6.5 ± 1.9 ^a
Texture	6.2 ± 1.7 ^a	6.8 ± 1.5 ^b
Flavor	6.5 ± 1.4 ^a	6.8 ± 1.6 ^a
Overall acceptance	6.4 ± 1.2 ^a	6.8 ± 1.4 ^b

N=101 consumers, means followed by same letters in the same column are not statistically different ($p \leq 0.05$). Bologna Mortadella T1 24% fat and T2 Bologna Mortadella 8% fat.

Table 2 also presents the results of aroma and flavor, and these do not differ ($p < 0.05$) between treatments. So the fat reduction didn't affect either attribute related to the palatability of the product. These results differed from those found by [5] who assessed a 50% reduction in fat for a fermented cooked meat product, in which the acceptance and sensory assessments weren't affected.

The results of the internal preference map are shown in Figure 1A and 1B.

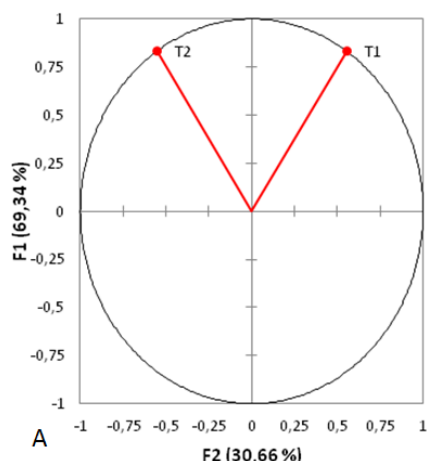


Figure 1A-Dispersion of samples Mortadella with respect to global acceptance.

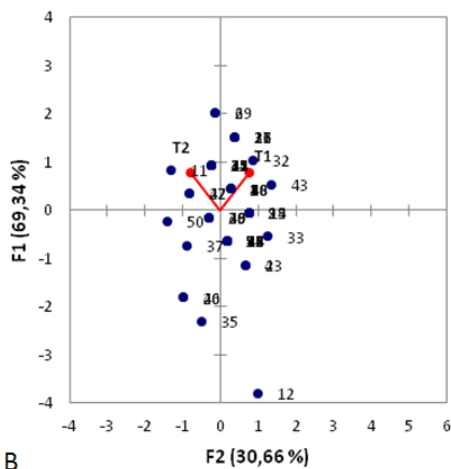


Figure 1B-Correlation between the data of each consumer acceptance first and the two principal components. F1-First principal component, F2-second principal component.

The first principal component (the main factors that influence consumer preference) explains 69.34% of the total variance and the second 30.66%. These components are sufficient to explain the samples scattering.

Samples of treatment T1 and treatment T2 in Figure 1A are located on the first (T1) and second quadrant (T2), this location shows that there are distinct difference between the Bologna mortadella sausages. However, the T1 obtained the highest acceptance, because the figure 1B shows a higher concentration of consumers around the midpoint between T1 and T2, however the consumers ratings are also very close to those for T2, indicating that the treatments, as perceived by consumers are very

similar. In this case the average of the ratings by consumers is not the best method of assessing results, it disregards the distribution of data, making it one-off measure. We can combine the results in Figure 1A with Figure 1B that shows higher concentrations of consumers between the first and second quadrant, the very region where the two treatments are located, so consumers have similar assessment for the two treatments.

In a paper by [7] greater or equal acceptance of treatments with lower fat were found (evaluated the acceptance of traditional mortadella with 10, 20 and 30% pork fat). The increase in fat concentration decreased sensory acceptability, because acceptance percentage was 64, 60 and 41% respectively for the formulation with 10, 20 and 30% pork fat.

In comparing the results obtained in this work and those from research [6] carried out by [8] developed Bologna mortadella with fiber replacing fat showed, a decrease in sensory acceptance (taste, texture and overall impression), when fiber quantity increased and the amount of fat was reduced.

IV. CONCLUSION

The Bologna mortadella with reduced fat had greater or similar consumer acceptability than the traditional mortadella. Thus, the 66% reduction in fat in Bologna mortadella is a realistic alternative in the market, because it did not affect consumer sensory characteristics.

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