

Physicochemical characteristics and sensory acceptance of mortadella with jaboticaba (*Myrciaria cauliflora*) extract natural pigment

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Abstract – The aim of this research was to evaluate physicochemical characteristics and sensory acceptance of mortadella sausages made with the replacement of cochineal carmine pigment with jaboticaba (*Myrciaria cauliflora*) extract. Three mortadella formulations were prepared as follows: Control) without pigment addition; Carmine) with the addition of cochineal carmine pigment; Jaboticaba) with the addition of jaboticaba extract pigment. Physicochemical analyses (objective color – L*, a* and b* parameters, pH value, hardness and emulsion stability) and sensory acceptance using a 9-point hedonic scale with 60 consumers of this kind of meat product were carried out. Regarding physicochemical parameters, there were no differences ($p>0.05$) among all treatments in almost all evaluated parameters. However, the product with cochineal carmine pigment addition showed higher ($p<0.05$) values of a* than the mortadella with jaboticaba extract, i.e., showed a more desirable reddish color. Likewise, lower ($p<0.05$) sensory acceptance of color attribute was observed for mortadella with jaboticaba extract when compared with the other two treatments. On the other hand, Jaboticaba treatment showed better ($p<0.05$) texture acceptance and no differences were found for all other attributes (aroma, flavor and overall quality). One can conclude that jaboticaba extract may represent a good alternative to cochineal carmine as mortadella pigment.

Key Words – meat product, color, texture, cochineal carmine.

I. INTRODUCTION

Currently, consumers demand increasingly natural and healthy foods, including meat products. Due to this, the use of chemical additives has been also questioned, which also applies to the pigments

used in foods. Consumers associate the use of natural dyes to a best quality and healthier product. However, the variety and availability of natural pigments that can effectively be used by food producers is still small (1, 2).

The color decisively influence the consumer preference when purchasing a food and its visual impact usually overlaps the impact caused by other attributes. Usually, there is a need for the use of pigments in meat products, which lose color due to their processing (3, 4). Besides traditional pigments, as cochineal carmine, nowadays it has been highlighted the use of natural dyes, not only for the purpose of food coloring, but also regarding their antioxidant and antimicrobial characteristics.

In this context, the jaboticaba fruit (*Myrciaria cauliflora*) could represent a viable alternative for the supply of red pigment to meat products. Jaboticaba is a fruit native from Brazil and its composition is rich in anthocyanins, niacin and iron (5). Anthocyanins are plant pigments responsible for the majority of the blue, purple and red colors and are present in greater quantity in the fruit peel (6, 7, 8). These pigments are considered as potential substitutes for the synthetic dyes in foods, due to its attractive colors and water solubility (9) and also because of their antioxidant and antimicrobial potential.

The aim of this study was to evaluate physicochemical parameters and sensory acceptance of mortadella sausages added with the pigment obtained from the residue (peels and seeds) of jaboticaba fruit (*Myrciaria cauliflora*) processing, replacing the cochineal carmine pigment usually used in this kind of meat product.

II. MATERIALS AND METHODS

A. Preparation of jabuticaba (*Myrciaria cauliflora*) extracts

To obtain the extract of the residue of jabuticaba fruit, its pulping was conducted and the peels and seeds were used for the pigment extraction, which was performed with adding water at a ratio of 1:3 (residue:water), in the absence of light, under mechanical stirring (Agitator Marconi) for 6 hours. The fluid obtained was filtered and the crude extract was concentrated to 1/3 of its original volume using a rotary evaporator (Tecnal, TE-211) at 60°C coupled to a vacuum pump (Tecnal, TE-058). After concentration, the extract was dried in a spray dryer using maltodextrin as a carrier agent. After these procedures, the dry jabuticaba extract was applied to mortadella sausage.

B. Preparation of mortadella sausages

Three different treatments were prepared (Table 1): Control) Mortadella without pigment addition; Carmine) Mortadella added with traditional pigment cochineal carmine and Jabuticaba) Mortadella added with dried jabuticaba extract. All the experiments were repeated three times. The mortadella sausages were processed according to Normative Instruction n°. 4/2000 (10), packaged in plastic casings and stored at 4±1°C until evaluation.

C. Physicochemical parameters

The emulsion stability was determined according to Parks & Carpenter (11). Hardness (compression strength: maximum force required to compress the samples) was determined with a TA – TX 2i texture analyzer. Ten samples were analyzed for each treatment. The samples were cut into 20 mm high and 13 mm diameter cylinders, compressed on their round surfaces up to 50%. For measurements of pH values a pH meter (Model HI 99163, HANNA Brand) with combined electrode was applied for reading in triplicate and color analysis was carried out using a portable colorimeter (mod. MiniScan XE HunterLab mark) through the scale L *, a *, b *, CIE Lab system.

Table 1. Composition of different treatments of mortadella sausages.

Ingredients	Quantities (%)		
	Control	Carmine	Jabuticaba
Beef	25	25	25
CMS	60	60	60
Water	7.5	7.5	5.5
Cassava starch	5	5	5
Jabuticaba extract	0	0	2
Cochineal carmine	0	0.05	0
Sodium nitrite	0.25	0.25	0.25
Sodium chloride	1	1	1
Condiment	1	1	1
Phosphate	0.25	0.25	0.25

D. Sensory evaluation

Sixty consumers were recruited among the university's students, staff and faculty; enjoying mortadella sausage was the only selection criterion. The recruited consumers were given a free and informed consent form to be read and signed prior to performing samples evaluation. An acceptance test using a 9-point hedonic scale was conducted in individual booths. Two slices of 2mm of each treatment were given to each consumer. A randomized complete block design was used, and the samples were served to the participants individually in disposable plastic plates that were coded by three-digit numbers. The panelists assessed color, aroma, texture, flavor and overall quality attributes.

E. Statistical Analysis

All results were analyzed using analysis of variance (ANOVA) with SAS (Statistical Analysis Software) version 9.1.3. The means were compared using Tukey's test at 5% significance level. The acceptance responses of the evaluated attributes were also analyzed by ANOVA,

considering the effect of consumers in the statistical model.

III. RESULTS AND DISCUSSION

The results obtained in the physicochemical analyses of mortadella sausages are described in Table 2. Regarding a^* parameter (red color), there was no difference ($p < 0.05$) when comparing the control treatment (without dye) with the other two ones. However, mortadella added with cochineal carmine pigment showed the highest a^* value ($p < 0.05$), which means that it became more reddish than the product with jaboticaba extract. For the parameter b^* and L^* , no significant differences were observed ($p > 0.05$) in the products prepared with different pigments, but there was a tendency of reduction of these parameters in the mortadella added with jaboticaba extract (Table 2). In practice, these results reflected in a pinker mortadella when cochineal carmine was added, while the jaboticaba extract generated a darker product, tending to a violet color.

Table 2. Results of physicochemical analyses of mortadella sausages.

		Control	Carmine	Jaboticaba
L^*	M	55.63 ^a	53.84 ^a	51.12 ^a
	SE	1.24	2.12	1.72
a^*	M	16.24 ^{ab}	18.36 ^a	14.65 ^b
	SE	0.59	0.85	0.81
b^*	M	14.47 ^a	13.71 ^{ab}	11.70 ^b
	SE	0.53	0.65	0.48
Hardness (g)	M	3868 ^a	3263 ^a	3164 ^a
	SE	94	257	267
pH	M	6.25 ^a	6.24 ^a	6.07 ^a
	SE	0.04	0.08	0.10
Emulsion stabil. (%)	M	95.8 ^a	94.83 ^a	92.24 ^a
	SE	0.36	1.65	1.19

^{a-b} Treatments with different superscripts are significantly different ($P < 0.05$).

M = mean; SE = standard error

For the results of emulsion stability, hardness and pH value, no differences were verified ($p > 0.05$) among all treatments, indicating that the replacement of commercial dye with the one obtained from jaboticaba peels did not influence negatively in these evaluated parameters. These results are in agreement with the results found by

Doménech-Asensi et al. (2), which replaced the cochineal carmine dye with tomato paste, in concentrations of 2, 6 and 10%, in mortadella sausages and also did not find significant differences in texture parameters.

Results of sensory acceptance of mortadella sausages are showed in Table 3. The sensory acceptance of color attribute of mortadella sausage with jaboticaba extract was lower ($p < 0.05$) when compared to the other two treatments, indicating that the darker color conferred by jaboticaba extract reduced the acceptance of this product. But it is worth mentioning that the mean score given by consumers (5.58) was still in the range of acceptance (around liked slightly). On the other hand, texture attribute showed the opposite effect, being that the treatment containing jaboticaba extract presented higher ($p < 0.05$) sensory acceptance of this attribute than the mortadella with cochineal carmine dye. Regarding the attributes aroma, flavor and overall quality, no differences ($p > 0.05$) were verified among all treatments, indicating that the replacement of the cochineal dye with jaboticaba extract did not affect the acceptance of mortadella sausages by consumers in a global way. Similarly, the results found by Doménech-Asensi et al. (2) on sensory evaluation of mortadella added with tomato paste showed higher scores on the intensity of the color, but no differences were found for taste and texture attributes.

Table 3. Sensory acceptance of mortadella sausages.

		Control	Carmine	Jaboticaba
Color	M	7.09 ^a	7.52 ^a	5.58 ^b
	SE	0.17	0.13	0.25
Aroma	M	7.00 ^a	7.01 ^a	6.58 ^a
	SE	0.16	0.19	0.23
Texture	M	6.38 ^{ba}	6.11 ^b	6.90 ^a
	SE	0.20	0.24	0.20
Flavor	M	6.88 ^a	6.66 ^a	6.88 ^a
	SE	0.17	0.21	0.21
Overall quality	M	7.0 ^a	6.76 ^a	6.68 ^a
	SE	0.13	0.18	0.22

^{a-b} Treatments with different superscripts are significantly different ($P < 0.05$).

9 = like very much, 5 = neither like/nor dislike, 1 = dislike very much

M = mean; SE = standard error

IV. CONCLUSION

In the tested conditions, the replacement of cochineal carmine pigment with the extract obtained from the residues of jaboticaba fruit (*Myrciaria cauliflora*) processing did not negatively affect most of the physicochemical parameters evaluated and also did not affect the sensory acceptance of the overall quality of mortadella sausages. Therefore, one can recommend the use of jaboticaba extract as mortadella sausage pigment, aiming its appeal as a most natural ingredient and a better use of fruit processing waste. Other studies are being carried out to evaluate the antioxidant and antimicrobial effects of this natural pigment in meat products.

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