SENSORY ACCEPTANCE AND PHYSICOCHEMICAL PARAMETERS OF CHOPPED HAM WITH PEA FIBER ADDITION

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Abstract – The objective of this work was to evaluate sensory and physicochemical parameters of chopped ham made with addition of pea fiber partially replacing pork meat. Two treatments were processed: Control (C) - similar to commercial and Fiber Less Meat (FLM) - reduction of 5% of meat and addition of 1% pea fiber. The products were characterized regarding the objective color, proximal composition and sensory evaluation. The parameters L*increased ($p<0.05$) and a* and b* decreased in the samples FLM. Consumers scores for the attributes aroma, appearance, texture and flavor did not differ ($p>0.05$) between samples. It is possible to use pea fiber in chopped ham as a partial substitute for meat having a final product with high sensory acceptability.

Key Words – cost reduction, meat products and food fibers.

I. INTRODUCTION

Pork is the most produced meat in the world with a production of approximately 110.7 million tons a year [1]. Industrialization becomes an alternative flow for the use of this raw material, besides providing an increase in the useful life of products such as processed meat products.

The addition of diet fibers in meat products is excellent to partially substitute the meat content of these products due to its functional and nutritional inherent effects keeping the sensory quality and reducing the cost of production of these products [2, 3, and 4]. Besides the beneficial effects to health, including diet fibers in meat products increases the volume, reduces loss after cooking and cause none or only small alterations in the parameters texture because it improves the ability to retain water, bringing advantages for both consumers and producers [5].

The main fibers used in meat products are obtained from orange, beetroot, wheat, oat, and pea [6]. Pea fiber can be defined as a mixture extracted from the pea composed essentially by food fibers, starch and proteins (ROQUETTE FRERES, FRANCE). The use of this fiber in meat products has been studied due to the characteristics and properties that it presents (ease dispersion in water and oil, ability to absorb liquids, ease link of fiber to seasoning and essences, neutral flavor, and odor free). In face of the exposed data, the objective of this study was to evaluate the sensory and physicochemical parameters of chopped ham elaborated with pea fiber addition as a partial substitute of pork.

II. MATERIALS AND METHODS

A. Experimental design

Two different formulations were elaborated (Table 1): 1) Control (C): no pea fiber, similar to a commercial formulation and 2) Fiber Less Meat (FLM): reduction of 5% of meat, addition of 1% of pea fiber and 4% of water. The experiment was repeated twice.

B. Materials and preparation of chopped ham

The raw material was separately weighted, as all the other ingredients, and the water. The mixture for chopped ham (Doremax) contained all the seasoning and additives (salt, condiment, curing salt, antioxidant, and emulsifier). The pork meat was ground in an electric grinder, with a 16 mm plate. After that, the meat and the other ingredients were mixed for 10 minutes until got to a homogeneous mass. A pneumatic stuffer (V25, Sirman) was used to stuff the resulting mass in polyamide casings , which was placed in a metal press molds. After that, the chopped ham were immersed in water boiled at 70ºC for one hour and after at 80ºC until the product reached an internal temperature of 72ºC. Products were then cooled by water immersion until they reached an internal temperature of 45ºC. Next, the pieces were refrigerated for 24 horas before being removed from the press mold. Hams were stored at 4ºC until the analysis being carried out.

Table 1: Formulations used in the production of chopped ham.

	C[1]	FLM[2]
Ingredients	%	%
Pork Shoulder	80	75
Pea Fiber	0	1
Water	16	20
Chopped Ham Mix	4	4

[1]Control; [2]Fibre less meat

C. Physicochemical parameters

Proximate Composition: AOAC Official Methods of Analysis [7] were used to determine moisture content (950.46), fixed mineral residue or ash content (920.153), and protein content (928.08). The lipid content was determined by the Bligh & dyer method [8]

pH Values: The determination of pH was performed through a portable pH meter (Model HI 99163, Brand HANNA) with perforation electrode. This determination was run in triplicate.

Instrumental Color Analysis: Samples were submitted to objective color analysis using a portable colorimeter (Model MiniScan XE, Brand HunterLab) applying an e L*, a* and b* scales from the evaluation system CIELab - "Commission Internationale de L'éclairage" with the illuminant D65, observation angle 10º and 30 mm cell opening. The analysis was performed in triplicate, in which three measures were taken from each sample.

D. Sensory Evaluation

An affective acceptance test was performed with 60 consumers using a 9-point hedonic scale varying from “I like extremely” (9) to “I dislike extremely” (1). The analyzed attributes were: aroma, appearance, texture, flavor and general acceptance. The samples were sectioned in slices of approximately 2mm and served at a temperature of approximately 10ºC (frequent consumption temperature).

E. Statistical Analysis

The results were subjected to analysis of variance (ANOVA) and Tukey’s test for means comparisons. SAS (Statistic Analysis System) software was used, considering 5% of significance level.

III. RESULTS AND DISCUSSION

The results of proximate composition are expressed in Table 2. The sample FLM presented higher ($p<0.05$) moisture and ashes levels. The moisture increase in the FLM treatment was proportional to the quantity of water added to this treatment (4%). It was found higher ($P<0.05$) levels of proteins and lipids in the formulation C due to the reduction of 5% of meat content (main source of intramuscular protein/fat) in the formulation FLM.

Table 2: Proximate composition (mean ± standard error) of chopped ham formulations.

	C[1]	FLM[2]
Moisture (%)	74.81 ± 0.03^{b}	77.15 ± 0.005^{a}
Ashes (%)	3.61 ± 0.01^{b}	3.91 ± 0.005^{a}
Lipids (%)	2.75 ± 0.03^{a}	2.10 ± 0.005^{b}
Proteins (%)	19.78 ± 0.08^{a}	17.32 ± 0.005^{b}

[1]Control: formulation similar to the commercial; [2]Fibre/Less Meat: reduction of 5% of meat, addition of 1% of pea fiber and 4% of water. Different low-case letters in the same row indicate significant differences ($p<0.05$) among the treatments.

Pea fiber addition (1%) and meat reduction (5%) did not affect the pH value ($p>0.05$) of the product (Table 3). The pH value results observed were similar to the ones found by Pedroso et al. [10] by analyzing cassava starch addition (0 to 2%) and carrageenan (0 to 1%) in cooked turkey ham and did not find differences according to these rates.

Table 3: Physicochemical characteristics (mean ± standard error) of chopped ham elaborated with or without pea fiber.

Characteristics	C[1]	FLM[2]
pH	5.86 ± 0.01[a]	5.88 ± 0.01[a]
L*	55.64 ± 0.16[b]	57.06 ± 0.01[a]
a*	5.41 ± 0.11[a]	4.45 ± 0.03[b]
b*	5.28 ± 0.05[a]	4.98 ± 0.04[b]

[1]Control: formulation similar to the commercial one;[2]Fiber/Less Meat: reduction of 5% of meat, addition of 1% of pea fiber and 4% of water. Different low-case letters in the same row indicate significant differences ($p<0.05$) among the treatments.

Regarding the variables of color, the formulation FLM presented higher ($p<0.05$) L* and lower ($p<0,05$) a*and b* values than the formulation C (table 3). According to LINDAHL et al. [11], the values for red (a*) present high correlations with the content of pigment and by the forms of myoglobin almost at the same extension. In other words, the reduction of a* values in FLM formulations is possibly related to the reduction of the relative level of myoglobin caused by the low quantity of meat content used in this formulation. Teixeira et al. [12] by carrying out the study with chopped ham with partial substitution of meat content for yacon flour (0 to 5%), reported that the formulations with yacon flour presented a darker shade and a great part of a yellow shade.

The results of sensory evaluation are shown in table 4. It is observed that the attributes aroma, appearance, texture and flavor did not present differences between the formulations ($p>0.05$), and regarding general acceptance the formulation FLM presented higher average score ($p<0.05$). Although the attributes aroma, appearance, texture and flavor did not show differences ($p>0.05$) between the formulations, the highest scores were attributed for the treatment with pea fiber, reaching the rate “Liked Moderately” (rate 7 of the scale used). Thus, the reduction of the meat content and the application of pea fibre in the formulation of chopped ham did not cause any negative effects in the consumers’ acceptance.

Sordi et al. [13] analysed the rates for acceptance of the ham with 1.5% addition of wheat soluble fibre and commercial ham through the hedonic scale in which the judges answered if they liked or disliked the products and they did not find any significant differences between the samples. Pedroso et al. [10] analysed the acceptance of ham with cassava starch addition (0 to 2%) and carrageenan (0 to 1%) and reported that the turkey ham samples did not show any significant differences regarding its acceptance.

Table 4: Sensory acceptance (average ± bit error rate) of chopped ham formulated with or without pea fibre.

Attributes	C[1]	FLM[2]
Aroma	6.85 ± 0.20[a]	7.15 ± 0.18[a]
Appearance	6.86 ± 0.19[a]	7.06 ± 0.17[a]
Texture	7.15 ± 0.17[a]	7.23 ± 0.18[a]
Flavor	7.15 ± 0.19[a]	7.41 ± 0.17[a]
General Acceptance	7.05 ± 0.16[b]	7.48 ± 0.15[a]

[1]Control: formulation similar to the commercial; [2]Fibre/Less Meat: reduction of 5% of meat, addition of 1% of pea fiber and 4% of water. Different low-case letters in the same row indicate significant differences ($p<0.05$) among the treatments.

IV. CONCLUSION

It was concluded through this present study that it is possible to use pea fiber in chopped ham as a partial substitute for meat with cost reduction and increase of general acceptance. This kind of fibre is efficient in the balance of the formulation and did not affect negatively most of physicochemical characteristics of the product.

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