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Effect of Chickpea Flour Addition (Cicer Arietinum L.) in Cooking Losses During Blanching of Chorizos

Lesly L. Torres[1], Piedad M. Montero[2] and Raúl J. Martelo[3]

[1] Faculty of Engineering, Research Group Modeling and Application of Advanced Oxidation Processes, University of Cartagena Av. El Consulado, St. 30 No. 48-152, Colombia

[2] Faculty of Engineering, Research Group Innovation, Agricultural and Agro-industrial Development University of Cartagena Av. El Consulado, St. 30 No. 48-152, Colombia

[3] Faculty of Engineering, Research Group in Communications and Informatics Technologies GIMATICA. University of Cartagena, Colombia

Abstract

The purpose of this study was to analyze the effect of the addition of chickpea flour (*Cicer arietinum* L.) in cooking losses and sensory properties of chorizos. Four treatments were evaluated for this experiment: T1, T2, T3 and T4 with incorporation of chickpea flour at 0%, 3%, 6%, and 9%, respectively. The sensory evaluation was carried out with 30 untrained panelists; it was reported that the best degree of acceptance of color, odor, crunchiness, and fattyness was for T4 (9%), and for the flavor it was T1. All treatments had statistically significant differences in cooking losses; a lower percentage was found for T3 (1.57%) with 6% chickpea flour. All the samples with chickpea flour incorporation showed lower losses with respect to the control treatment.

Keywords: *Cicer arietinum* L., cooking losses, sensory evaluation

1. Introduction

According to data from DANE, in Latin America, Colombia is the third country with world production of beef. Within the diet of a large part of the population in the world, meat is considered as the main source of protein [1]. The consumption of this one, is absolutely fundamental in the nutrition since it is part of all the tissues of the organism, they are in charge of elementary and important activities for the development [2], however, in Colombia the deficient of protein intake reaches 36%, which means that the recommended daily intake (0.91 g / kg of weight) is not satisfied in a large sector of population [3]; this deficiency has a greater impact on children, because their protein and energy needs per kilogram of body weight are higher and their vulnerability to infection is higher, which increases protein and energy requirements especially [4].The high cost of protein-rich foods mainly affects the stratum population 0 and 1, so many researchers have reported the importance of using non-meat ingredients such as cereals, legumes, and fruits (rich in protein and carbohydrates) to improve this problematic. In order to reduce production costs, some substances have been used in the formulation of meat products (as additives or substitute), called "extenders". The purpose of replacing part of the animal protein with vegetable protein is to increase the utilities and offer a product with proteins of high biological value and adequate functionality [5]; it should be noted that the incorporation of meat extenders is not always to replace part of the animal protein, but also to replace much of the fat contained in the product.

The flours, concentrates and isolates of cereals and legumes are examples of meat extenders most used in the food industry; they have functional properties such as water retention, emulsification of fats, absorption of lipids and gelation [6]. Among them is the chickpea (*Cicer arietinum* L.), a plant of the legume family, whose seeds are used both in human food and farm animals. There are two types of chickpeas: Kabuli and Desi, morphologically they are different; Kabuli forms long pods, corrugated seeds, and they are usually honey-colored, and the Desi variety is brown, and their seeds smaller [7]. It is a legume rich in proteins (23-24%) and starch (36-41%), with readily available energy [8]. The functional properties of chickpea flour include its water retention capacity, emulsifying capacity, ability to form gels, and ability to form foam [7]. Therefore, the aim of this study was to analyze the effect of the addition of chickpea flour (*Cicer arietinum* L.) in cooking losses and sensory properties of chorizos.

2. Methodology

Chickpea grains, meat and non-meat ingredients were obtained from a super market in the city of Cartagena de Indias, Colombia, and were transferred to the Food Engineering pilot plants of the University of Cartagena.

2.1 Flour preparation

To obtain the flour, the grains (dried) were selected taking into account that they were healthy (whole and without weevil bites). Then they were milled in a traditional mill, posing as a No. 40 mesh sieves until obtaining fine flour [9].

2.2 Chorizos preparation

Table 1 details the four emulsion formulations, varying the chickpea flour content from 0% to 9%; to make the products, the meat was first cut, then ground in a CRT stainless steel mill, then the meat and non-meat ingredients were mixed in a bowl cutter to obtain a fine paste with a good emulsion, then stuffed, and scalded to an internal temperature of 75°C, a thermal shock was performed and stored in zip lock bags to prevent moisture loss. Finally, the emulsions were kept refrigerated for 18 hours for sensory analysis.

Table 1. Chorizos formulations

Raw Material	Control T1 (%)	T2 (%)	T3 (%)	T4 (%)
Beef	85	85	85	85
Pork Bacon	15	12	9	6
C. arietinum Flour	0	3,0	6,0	9,0
Ice	10	10	10	10
Sodium chloride	1.6	1.6	1.6	1.6
Chorizo Seasoning	1	1	1	1
Pepper	0,50	0,50	0,50	0,50
Liquid Smoke	0.15	0.15	0.15	0.15
Scallion	5	5	5	5
Garlic	1.5	1.5	1.5	1.5
Nitrite	1.5	1.5	1.5	1.5
Polyphosphate	0.4	0.4	0.4	0.4
Ascorbic Acid	0.045	0.045	0.045	0.045

2.3 Sensory evaluation

The analysis was carried out with 30 untrained panelists from the University of Cartagena. The 5-point hedonic scale test was applied (I dislike it a lot, I dislike it, I do not like it or dislike it, I like it, and I like it a lot) to evaluate sensory characteristics such as color, odor, flavor, crunchiness, and fattyness; similar to what has been done by Torres et al., [6].The test was conducted in an area with good lighting and pleasant temperature, factors that did not affect the perceptions of the sensory characteristics of chorizos. Disposable plates marked with the different samples, containers with water, toothpicks and napkins were used; the samples delivered were fried superficially. Prior to the tasting, the panelists were told what the test was about and how they should use the delivered format.

2.4 Cooking Losses

After cooking (blanching) and heat shock the chorizos were allowed to stand. Cooking losses were calculated as the percentage difference in weight between samples of chorizos before blanching (fresh) and cooked in relation to the weight of fresh samples. It was calculated with equation 1 [10]. This analysis was performed for each treatment.

$$PPC = \frac{weight\ of\ raw\ chorizo - weight\ of\ cooked\ chorizo}{weight\ of\ raw\ chorizo} \times 100 \quad (1)$$

2.5 Analysis of data

To analyze the results of the different formulations, the analysis of variance (ANOVA) was applied to establish if there were significant differences between the variables, though the Tukey HSD multiple comparisons test with 5% error margin. All data were expressed as the average with its standard deviation, performing each treatment in triplicate. The statistical analysis was carried out with the Statgraphics Centurion program (version 16.2.04, StatPoint Technologies Inc., USA).

3. Results

3.1 Sensory evaluation

In Table 2, the average results of the sensory evaluation of the treatments with incorporation of chickpea flour and the control sample are reflected, observing that T1 (control sample) and T4 (9%) presented the highest acceptance values for the color, indicating that the addition of chickpea flour was accepted, because it did not modify the color characteristic of chorizos [11].

Tabla 2. Evaluation of Sensory Characteristics

Treatment	Color	Odor	Flavor	Crunchiness	Fattyness
T1	3.80 ± 0.71	3.70 ± 0.65	3.93 ± 0.78	3.20 ± 0.96	3.23 ± 1.07
T2	3.63 ± 0.76	3.63 ± 0.80	3.73 ± 1.04	3.26 ± 0.86	3.10 ± 1.06
T3	3.70 ± 1.08	3.33 ± 1.02	3.73 ± 1.05	3.43 ± 0.97	3.10 ± 1.21
T4	3.83 ± 0.87	3.80 ± 0.84	3.66 ± 1.12	3.20 ± 1.12	3.76 ± 0.97

The perception of flavor decreased as the chickpea flour content increased, in contrast to Torres et al., [6] and Hernández and Güemes [12], who reported that the flavor values increased when the flour content of Lens culinaris verdina variety and orange peel meal in sausages increased, respectively. In the present study, it was observed that the effect of chickpea flour incorporation prevailed in

the possible acceptance of chorizo, since the different percentages used (3%, 6% and 9%) affected one of the most important criteria for endorse a new product with sensory quality. Regarding the crunchiness, it was observed that the values were similar, with a higher acceptance of the T3 treatment, possibly due to the intermediate content of chickpea flour. On the other hand, the effect of the incorporation of 9% chickpea flour (T4) on the degree of acceptance was effective for color, odor, and fattyness; however, it presented the lowest values in comparison with the other treatments in terms of flavor and crunchiness.

3.2 Cooking Losses

In Table 3, it is evidenced that the addition of chickpea flour influenced the cooking losses of the emulsions; all treatments had lower losses with respect to the control. The sample with the lowest weight loss was T3 (1.57%), i.e. a proportion of 6% chickpea flour is useful in retaining moisture in the product. The higher percentage of flour addition increased the losses for cooking in T4 (5.26%), results that coincide with those reported by Hleap-Zapata et al., [13], who found greater moisture losses from cooking as they increased the quinoa flour content in sausages. The low cooking loss is possibly due to the water retention capacity (WHC) of the myofibrillar protein in meat, the protein content and presence of hydrophilic compounds in chickpea flour. Other authors indicate that a high incorporation of white malanga starch does not necessarily imply a reduction in losses; given the ease of leaching the high amylose content present in this tuber [14].

Tabl3 3. *Cooking Losses*

Treatments	**T1 (%)**	**T2 (%)**	**T3 (%)**	**T4 (%)**
Cooking Losses	5.37 ± 0.26^{d}	4.23 ± 2.3^{b}	1.57 ± 0.8^{a}	5.26 ± 0.9^{c}

4. Conclusion

The addition of chickpea flour in chorizo can have beneficial effects on the degree of acceptance by consumers. The best results in aspects such as color, odor, and fattyness were T4 (9% chickpea flour); and T3 in terms of flavor (6% chickpea flour), presenting greater acceptance. All treatments had significant statistically differences for cooking losses; that is, chickpea flour influenced this characteristic, obtaining better results T3 treatment. The use of chickpea flour in meat emulsions can be beneficial for both the consumer and the food industry, obtaining proteins of high biological value and affordable costs.

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