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ACCEPTABILITY OF A GLUTEN-FREE CHICKEN CROQUETTE MADE WITH PEACH PALM (*BACTRIS GASIPAES* H.B.K.) COCONUT

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ABSTRACT

Celiac disease is a condition in which genetically predisposed people have an autoimmune reaction to gluten proteins found mainly in wheat. Celiac disease patients have few and expensive options of gluten-free food products. The aim of this study was to create a gluten-free alternative to the wheat chicken croquette, a food largely consumed in Brazil. The main raw material used for the elaboration of gluten-free croquette was peach palm coconut, a cheap and quite available raw material, which has farinaceous texture, formation of alloy in the process of manipulation and when cooked results in a soft mass easy to model. This product was compared to the wheat traditional version by means of a sensory analysis, considering general aspect, consistency, flavor and aroma. General aspect and aroma did not differ significantly between the two products. The consistency of the traditional product had a higher rate than that of the gluten-free one. However, flavor was more favorable to the gluten-free coconut croquette. These results validate the gluten-free product regarding its sensory acceptability. This product can be an attractive alternative to celiac disease patients.

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INTRODUCTION

Adverse reactions to foods can be broadly divided into those with an immune basis – food allergies and celiac disease, or those without an immune basis – termed food intolerances (TURNBULL *et al.*, 2014). The diseases may impose the adoption of differentiated eating habits by the bearers of these genetic predispositions. These habits generally include food restrictions that are difficult to adopt due to the scarcity of food products that are restrictive of one or more components and at the same time attractive to consumption. Celiac disease is a condition in which genetically predisposed people have an autoimmune reaction to gluten proteins found in all wheat types and closely related cereals such as barley and rye. This reaction causes the formation of autoantibodies and the destruction of the villi in the small intestine, which results in malabsorption of nutrients and other gluten-induced autoimmune diseases (CIACCI *et al.*, 2007).

Although considerable scientific progress has been made in understanding celiac disease and in preventing or curing its manifestations, a strict gluten-free diet is the only treatment for celiac disease to date (NEWINSKI, 2008). However, a lot of other vegetable and animal foods such as fish, poultry and meats, as well as fruits and vegetables, are permitted in their natural state and rice, corn and potatoes have been widely used as substitute of gluten-containing grains (SATURNI; BACCETTI, 2010). The objective of this study was to create a new gluten-free product, chicken croquette, using coconut of peach palm (*Bactris gasipaes* H.B.K.) in its composition alternatively to wheat flour, and to compare its sensory acceptability with that of the traditional product. According to food historians, chicken croquette was developed during the industrialization of Sao Paulo to be marketed as a cheaper and more durable substitute for traditional chicken thighs that were sold on factory doors. From Sao Paulo, the recipe quickly spread to the rest of the state and then to Brazil (CASCUDO, 1983). Peach palm is a tropical palm tree native to South and

Central America. It was domesticated by pre-Colombian people, in the region which is nowadays comprised between Bolivia and Honduras (MIURA, 1993; CARVALHO; ISHIDA, 2002). Peach palm has two important products – fruits and hearts of palm. The fruits have enhanced nutritional value especially due to the abundance of carotenes in the pulp and are widely used in the Amazonian cuisine, with great potential to reach other markets (BOVI, 2000; FERREIRA, 2005).

MATERIAL AND METHODS

The main raw material used for the elaboration of gluten-free croquette was the fruit (with peel, without seeds) of peach palm, which has farinaceous texture, formation of alloy in the process of manipulation and when cooked results in a soft mass easy to model. The coconuts were purchased at the Porto Velho weekly fair at room temperature. The other ingredients were purchased at random in the local market of Porto Velho. The products were taken to the Laboratory of Dietary Practices of the University Center São Lucas - UniSL, where the croquettes were produced. For the production of the doughs and filling, the dry ingredients were weighed on a scale (Tomate® SF400) with graduation 0.1 g and the liquid ingredients were measured in graduated beakers. The filling used in the two kinds of croquettes was the same (Table 1). To make the filling, chicken breast was cooked with garlic, salt, colorific (Kitano® - cornmeal, seeds of *Bixaorellana* and salt), soybean oil and water in a pressure cooker for 30 minutes under pressure. After the pressure cooker cooled completely, it was opened and the chicken breast was shredded. The broth was reserved. The shredded chicken was placed in a pan along with the broth and onions, cut into small cubes of approximately 1 cm³. This sauce was cooked for 20 minutes. The sauce was cooked for more five minutes, until no more apparent liquid was available. The sauce was put in a plastic container that was placed to cool in a domestic refrigerator at 12°C for two hours.

Table 1. Ingredients of the filling of both croquettes with and without gluten, for the preparation of 1,000 grams of chicken croquette

Ingredient	Weight (g)	Ingredient	Weight (g)
Chicken breast	337.50	Chives	6.93
Onion	30.91	Salt	4.97
Water	23.78	Oil	4.60
Garlic	7.43	Colorific	0.59

To prepare the peach palm dough (Table 2), the fruits were washed and cooked in a pressure cooker for 50 minutes. After cooking, the fruits were cut in half, peeled and have seeds removed. After this procedure, the fruits were ground in a blender. The finished dough was wrapped in plastic film and kept in a refrigerator at 12°C for 2 hours. The flour for breading was obtained according to the procedure described, but the fruits were not peeled and the cooking time was 15 minutes. After this procedure, the fruits were shredded in a blender and dehydrated in a combined electric oven (dry heat) at 120°C for 30 minutes. Then they were ground again and sieved. For the preparation of the traditional dough (Table 2), in a pan, flour was mixed with water, margarine, salt and colorific. The dough was cooked until it loosened from the pan. Then the dough was wrapped in plastic wrap and kept in a refrigerator at 12°C for 2 hours. Subsequently, 15 g balls (of

traditional and peach palm dough) were manually opened and filled with 10 g filling, and then closed by joining the edges. The peach palm croquettes were breaded with peach palm flour and the traditional croquettes were breaded with breadcrumb. All the croquettes were then taken to the freezer and frozen at -18°C for five days. For sensory analysis, the croquettes were reconstituted in the combined electric oven using moist heat (steam) at 90°C for 30 minutes.

Table 2. Ingredients of the dough of croquettes with and without gluten, for the preparation of 1,000 grams of chicken croquette

Ingredient	Traditional croquette (g)	Gluten-free croquette (g)
Peach palm coconut	-	743.38
Peach palm flour	-	50.25
Wheat flour	350.00	-
Water	350.00	-
Margarine	60.00	-
Breadcrumb	50.00	-
Salt	12.00	-
Colorific	2.25	-

After reconstitution the traditional croquettes were immersed in hot oil at 230°C until golden brown. The peach palm croquettes were taken to the combined electric oven using dry heat (convection) at 160°C for 15 minutes and then immersed in hot oil at 230°C for 1 minute. The gluten-free and traditional chicken croquettes were submitted to sensory evaluation in the Laboratory of Sensory Analysis of the Centro Universitário São Lucas (UniSL) in individual cabins at 25°C. The test was carried out with the participation of 91 evaluators, among students, teachers and employees of the institution itself, of both genders, from 18 to 60 years, non-trained, non-celiac disease patients, chicken croquette consumers, which had motivation to voluntarily participate in the test. The test was applied in the afternoon, usual time of consumption of this product. Prior to the test, the evaluators were given instructions about the general procedures. Two samples weighing approximately 15 g were presented to each evaluator in disposable dishes identified with random numerals using the methodology described by Dutcosky(2013) and served at 47°C±1°C (2008). Mineral water was offered for cleaning the taste buds. The evaluators gave rates according to a hedonic scale of seven points, ranging from 1 - extremely disliked to 7 - extremely liked, regarding the attributes: global aspect, aroma, consistency and flavor (MINIM, 2006). The results obtained in the sensory evaluation were submitted to analysis of variance and the averages compared by Tukey test (5%), by using the Assisat 7.5 statistical program. This research was approved by the Permanent Research Ethics Committee of the Centro Universitário São Lucas - UniSL (CAAE: 34041314.4.0000.0013). All participants in the study were informed about the procedures and voluntarily participated in the study, signing a Term of Free and Informed Consent.

RESULTS AND DISCUSSION

In Table 3 are presented the average rates obtained at the sensorial analysis of the traditional wheat croquette and the coconut gluten-free product. General aspect and aroma did not differ significantly between the two products. The consistency of the traditional product had a higher rate than that of the gluten-free one. However, flavor was more favorable to the gluten-free coconut croquette. These results validate the gluten-free product regarding its sensory acceptability and encourage more elaborations and tests in order to improve the

consistency of this product. Tracy (1987) determined that peach palm flour at 10% could serve as a substitute for wheat in bread baking, yielding dough of excellent baking quality. Peach palm fruits have also been studied for possible use in producing pasta from a mixture of 15% peach palm flour and 85% wheat. In cooking tests for spaghetti and twist noodles, adding peach palm flour to the pasta did not significantly alter its quality and texture (OLIVEIRA *et al.*, 2006).

Table 3. Sensory evaluation of traditional wheat croquette and gluten-free coconut croquette

Sensory characteristics	Traditional	Gluten-free
General aspect	5.63 a	5.46 a
Consistency	5.71 a	4.85 b
Flavor	4.04 b	5.61 a
Aroma	5.71 a	5.33 a

*Averages followed by the same letter in the rows do not differ significantly at 5% probability by Tukey's test.

The flavor of the coconut croquette was well evaluated, what is in agreement with the study of Ugalde and Pineda (2004), who evaluated the sensory characteristics of cakes elaborated with peach palm flour (10, 15, 20 and 25%) and wheat flour. These authors found higher levels of acceptability as the concentration of peach palm flour increased and mentioned that the substitution of wheat flour for peach palm flour is favored by the excellent nutritional properties of the last one. Azizi *et al.* (2012) also found positive effects with the incorporation of peach palm flour into breads. They compared the acceptability of breads with 5, 10, 15, 20 and 25% of peach palm flour to the traditional bread made with wheat flour, and observed higher rates for general aspect, consistency, flavor and aroma with the incorporation of 10 and 15% peach palm flour. Oliveira and Marinho (2010) evaluated the chemical composition and acceptability of a panettone made with peach palm flour (25%), and found high levels of protein, lipids and carotenoids and good acceptability – all consumers expressed positive intention of purchasing the product if it was launched. The authors point out that the incorporation of peach palm flour adds nutritional value to the traditional product, without signs of rejection by consumers. Peach palm processing offers a good option for making use of fruit types that consumers do not prefer for direct consumption and for thus alleviating problems of overproduction. However, processing of peach palm fruits has not yet spread widely, since diverse peach palm products have not been developed and promoted, and linkages between farmers and the food industry are virtually non-existent. Nonetheless, processed peach palm products are considered to hold considerable potential for national and international markets. To realize this potential the food industry needs to identify desirable traits for potential food products (GRAEFE *et al.*, 2013). Stevens (2008) made a comparison between costs of 56 gluten-free products and their reciprocal regular foods, and found that all the labelled gluten-free were significantly more expensive (on average 242%) than the regular ones. This may impact on compliance to a gluten-free diet, with potential nutritional and clinical consequences, together with an increased risk of complications (SINGH; WHELAN, 2011).

Other relevant aspect is the availability of raw material for gluten-free products. As mentioned by Alvarez-Jubete *et al.* (2010), several gluten-free sources exist, such as the pseudocereals amaranth, quinoa and buckwheat, but their commercialization is quite scarce, limiting the options for

celiac disease patients. On the contrary, the basis of the product elaborated in this study is peach palm coconut – a product widely used in the Amazonian cuisine. Besides, according to Rojas-Garbanzo *et al.* (2011), peach-palm fruit constitute a rich source of carotenoids in the diet of many communities and has been a major food staple of native populations since pre-Colombian times. Today, peach-palm fruit is considered as an important alternative food crop, mainly because of its nutritional value in terms of high levels of fiber, fat, carotene and eight essential amino acids, and low contents of sodium and sugar. Peach palm flour is a valuable alternative source of vitamin A, which is highly bioavailable in this product (YUYAMA *et al.*, 1991; YUYAMA; COZZOLINO, 1996). Besides, these fruits contribute importantly to food security and the cash income of farmers (GRAEFE *et al.*, 2013).

Conclusion

A new gluten-free food product was elaborated and validated regarding its sensory acceptability in comparison to its counterpart, a wheat chicken croquette, largely consumed in Brazil. The basis of this product is peach palm coconut, a quite available and nutritionally rich raw material. This product can be an attractive alternative to celiac disease patients.

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