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USE OF AMARANTH FLOUR FOR THE DEVELOPMENT OF SALT CRACKERS

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Abstract: Non-Conventional Food Plants (PANC) have edible parts and express nutritional indices equal to or greater than commonly used vegetables, roots and fruits. Among the several known species, the caruru (*Amaranthus sp.*) stands out, common in vegetable gardens and gardens. Thus, the objective of this research was to use amaranth (*Amaranthus sp.*), in the form of flour, for the preparation of salt cracker. For this, two crackers recipes were elaborated, one standard, with wheat flour, and the other with the total replacement of wheat flour by amaranth flour. The results of the centesimal analysis showed differences between the standard cracker and the cracker with amaranth flour only in terms of moisture content, of 1.94% (± 0.18) and 8.80% (± 0.07), respectively. The other determinations of carbohydrates, proteins, lipids, ashes and fibers were approximate between the samples. From this, the nutritional information of the two crackers was prepared, in which the standard crackers and the one with amaranth flour presented in the portion, respectively, 124 kcal and 114 kcal of energy value, 23g and 20g of carbohydrates, 3.2g and 2.9g of protein, 2.1g and 2.5g of total fat, 0.9g and 0.9g of saturated fat, 0.8g and 0.9g of dietary fiber, and 172mg and 175mg of sodium. These results showed that the two crackers presented approximate values in their nutritional composition. In a complementary way, the results of the sensorial analysis reinforced the approval of both crackers, by the acceptance index. However, the standard cracker showed greater acceptance and purchase intention compared to the cracker with amaranth flour. Thus, the use of PANC amaranth (*Amaranthus* sp.), becomes an alternative for consumption and expansion of its culinary use, and can be easily incorporated into conventional preparations, contributing to the development of new food products, stimulating greater food variety.

Keywords: PANC. Amaranth. Cracker.

INTRODUCTION

In Brazil there are at least three thousand species of known food plants and it is estimated that in our country 10% of the native flora is food. Plants can be born alone, native or spontaneous, and are present in flowerbeds, gardens or vegetable gardens, in the countryside or in the city, bringing the richness of spaces. Some are classified as "weeds" or "weeds", as they often appear in places where they were not cultivated. However, many are edible and express nutritional indices equal to or higher than vegetables, roots and fruits that are part of the population's eating habits (KELEN et al., 2015).

The Ministry of Agriculture, Livestock and Food Supply (MAPA) classifies non-conventional food plants (PANC) as those that do not receive deserved attention by society, which results in consumption installed in specific regions of cultivation, making it difficult to be inserted in other regions. Moreover, as it does not have a production chain, it does not strengthen the interest of seed, fertilizer or agrochemical companies (BRASIL, 2010a).

The nutritional value of PANC, depending on the species, is related to the considerable levels of mineral salts, vitamins, fibers, carbohydrates and proteins, in addition to the recognized functional effect, which includes foods that can bring health benefits and also nourish the body with the substances contained in it (BRASIL, 2010b; DIAS, 2018).

The vast majority of existing PANC do not have an established production chain, they are sub-spontaneous plants that grow in any area and can be extracted for consumption. In addition, they can also be cultivated, but they are generally more rustic and less demanding of agronomic care and do not arouse economic interest. Therefore, compared to

conventional plants, PANC are less dependent on man to stay alive, becoming little known and widespread (KINUPP; LORENZI, 2021). This way, we sought to highlight in this study Caruru (*Amaranthus sp.*) as it is considered very common in gardens and gardens, fast growing and rich in some micronutrients (INSTITUTO KAIRÓS, 2017).

Little known and widespread in Brazil, amaranth is characterized as a pseudocereal that, from a botanical point of view, are attributed to the dicotyledonous group (as opposed to cereals, which belong to the monocotyledonous group), but all are capable of producing seeds. rich in starch, which makes it possible to substitute cereals (AMAYA-FARFAN; MARCÍLIO; SPEHAR, 2005; FERREIRA; MATIAS; ARÊAS, 2007).

Popularly known as caruru, it is also known as bredo in Bahia, used in local cuisine (BRASIL, 2010b). belonging to the family *Amaranthaceae* and the subfamily *Amaranthoideae*, the *Amaranthus sp*., is a plant native to South or Central America (KELEN et al., 2015; PINTO; VELÁSQUEZ, 2010).

The attraction of this PANC is that it can practically be used completely. Just like, its leaves can be used as vegetables, its stems in animal feed, the inflorescence as natural dyes and through its seeds flours are manufactured (JUAN et al., 2007).

It is a source of betacarotene, vitamin C, magnesium, iron and potassium. Because some species possibly have toxic substances when raw, they must be used preferably submitted to cooking. Its seeds, on the other hand, have a high content of essential amino acids and can be toasted and used as a food supplement in various culinary preparations or even in the form of flour, being added or replaced in recipes such as cakes, breads and even in options that are easy to prepare and enjoy, such as cracker (KELEN et al., 2015).

The present study aimed to use amaranth (*Amaranthus* sp.), in the form of flour, in the preparation of salt cracker.

MATERIALS AND METHODS

Two crackers recipes were elaborated, one with a standard cracker and the other with the substitution of wheat flour for amaranth flour. From the standardization of the recipes, the proximate analysis of the two crackers samples was carried out through the determination of moisture by the method of drying in the oven at 105ºC, total ash by burning in a muffle furnace at 550ºC, crude fiber by the Weende method, total proteins by the micro Kjeldahl method, lipids by the Soxhlet method and determination of carbohydrates by difference (IAL, 2008; GALVANI; GAERTNER, 2006).

From the analyses, the nutritional information of the two crackers was elaborated, based on the data obtained by the determination of humidity, ashes, fibers, proteins and lipids, through the centesimal analysis.

Subsequently, a sensory analysis was carried out, evaluating the acceptance and purchase intention of the products with a pre-screening test questionnaire. For the evaluation, the test method of hedonic and intention scales was used.

For the product to be considered approved by the participants, the acceptability index must be at least 70% (TEIXEIRA, 2009).

This work was carried out at the Laboratory of Food Analysis and Technology of the Nutrition Course, at "Universidade de Ribeirão Preto", with the approval of the Research Ethics Committee of the UNAERP (CAAE 57938622.4.0000.5498) and the agreement and signature of the Term of Free Consent and Clarified, by the participants, at the time of carrying out the sensory analysis. This document aimed to inform participants about the research (title, objective,

methodology, possible harm to participants, benefits and data for contacting researchers and the UNAERP CEP) and allowing them to choose whether or not to participate.

In order to carry out the sensory analysis, individuals, male and female, aged between 18 and 60 years were included, and as an exclusion criterion, individuals with respiratory problems, smokers, and those who manifested allergy and/or intolerance to wheat were excluded.

RESULTS AND DISCUSSION

After standardizing the recipes, it was found that the centesimal composition of the standard cracker had 1.94g (± 0.18) of moisture; 2.35g (± 0.03) ash; 10.61g (± 0.36) of protein; 7.14g (± 0.13) of lipids; 2.58g (± 0.10) of fiber and 75.54g (± 0.02) of carbohydrates. The centesimal composition of the cracker with amaranth flour showed 8.80g (± 0.07) of moisture; 2.90g (± 0.03) of ash; 9.63g (± 0.51) of protein; 8.37g (± 0.52) of lipids; 2.89g (± 0.34) of fiber and 67.40g (± 0.32) of carbohydrates. The results obtained from the crackers are described in Table 1.

Determinations (%)	Standard cracker	Cracker with amaranth flour
Moisture	1.94 (± 0.18)	8.80 (± 0.07)
Ashes	2.35 (± 0.03)	2.90 (± 0.03)
Proteins	10.61 (± 0.36)	9.63 (± 0.51)
lipids	7.14 (± 0.13)	8.37 (± 0.52)
Fibers	2.58 (± 0.10)	2.89 (± 0.34)
Carbohydrates	75.54 (± 0.02)	67.40 (± 0.32)

Average (± DP).

Table 1 – Centesimal analysis of the standard cracker (100g), cracker with amaranth flour (100g), carried out at the Food Analysis and Technology Laboratory, Ribeirão Preto, 2022.

According to the results obtained, it is possible to observe that there was a difference between the standard cracker and the cracker with amaranth flour only in the moisture content, of 1.94% (± 0.18) and 8.80% (± 0.07), respectively, showing that amaranth flour provides more moisture to the cracker recipe. The other determinations of carbohydrates, proteins, lipids, ash and fiber were similar between the samples.

To prepare the nutritional information for the standard cracker and cracker with amaranth flour (Tables 1 and 2), the results obtained by the proximate analysis, the current legislation RDC nº 429/2020 and IN nº 75/2020 and the Food Composition Table were used (ANVISA, 2020a, 2020b; PHILIPPI, 2021). The portion established for the nutritional information was 30g, according to IN nº 75/2020, which refers to the category of bakery products, cereals, legumes, roots, tubers and their derivatives. Thus, the home measure was calculated from the weight of 10 units (30g), the portion being equivalent to 10 units of cracker (ANVISA, 2020b).

From the association of these data, it was possible to elaborate the nutritional information of the standard cracker (Table 1), which presented in the portion of 30g (10 units) the values of 124 kcal (6% DV) of energy value, 23g of carbohydrates (8% DV), 0g total sugar, 0g added sugar (0% DV), 3.2g protein (6% DV), 2.1g total fat (3% DV), 0.9g saturated fat (5% DV), 0g trans fat (0% DV), 0.8g dietary fiber (3% DV) and 172mg (9% DV) sodium.

NUTRITIONAL INFORMATION			
Servings Per Pack: About 7 Portion: 30g (10 units)			
	100 g	**30 g**	**%VD***
Energy value (kcal)	412	124	6
Carbohydrates (g)	76	23	8
Total sugars (g)	0	0	
Added Sugars(g)	0	0	0
Proteins(g)	11	3.2	6
Total fats (g)	7.1	2.1	3
Saturated fats (g)	2.8	0.9	5
Trans fats (g)	0	0	0
Dietary fiber (g)	2.6	0.8	3
Sodium (mg)	558	172	9
*Percent Daily Values provided per serving.			

Table 1- Nutritional information of the standard cracker, prepared from the centesimal analysis and food composition table, Ribeirão Preto, 2022.

Source: The own author .

NUTRITIONAL INFORMATION			
Servings Per Pack: About 7 Portion: 30g (10 units)			
	100 g	**30 g**	**%VD***
Energy value (kcal)	382	114	6
Carbohydrates (g)	67	20	7
Total sugars (g)	0	0	
Added Sugars(g)	0	0	0
Proteins(g)	9.6	2.9	6
Total fats (g)	8.4	2.5	4
Saturated fats (g)	3.5	0.9	5
Trans fats (g)	0	0	0
Dietary fiber (g)	2.9	0.9	4
Sodium (mg)	566	175	9
*Percent Daily Values provided per serving.			

Table 2- Nutritional information for cracker with amaranth flour, based on centesimal analysis and food composition table, Ribeirão Preto, 2022.

Source:The own autor.

Table 2 describes the nutritional information of the cracker with amaranth flour, in which in its 30g portion (10 units) it presents the values of 114 kcal (6% DV) of energy value, 20g of carbohydrates (7% DV), 0g total sugar, 0g added sugar (0% DV), 2.9g protein (6% DV), 2.5g total fat (4% DV), 0.9g saturated fat (5% DV), 0g of trans fats (0% DV), 0.9g of dietary fiber (4% DV) and 175mg (9% DV) of sodium.

Based on the results obtained from the nutritional information of the two crackers, it is possible to observe that, in relation to the amounts of nutrients in the portion, the one with amaranth flour showed similar values to the standard cracker in terms of energy value, carbohydrates, proteins, total fat, saturated fats, trans fats, dietary fiber and sodium.

The results obtained in the sensorial analysis showed that the cracker with amaranth flour presented acceptance of 69% of flavor, 70% of odor, 75% of texture, 74% of appearance and 72% of overall impression, while the standard cracker had an acceptance rate of 74% for taste, 75% for odor, 75% for texture, 76% for appearance and 76% for overall impression, as shown in Figure 1.

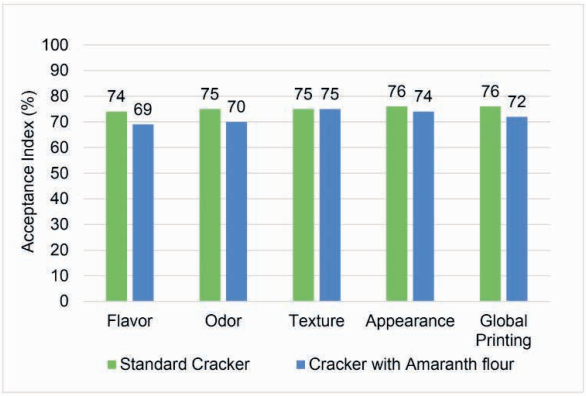

Figure 1 – Acceptance index (%) of the standard cracker and the cracker with amaranth flour by the participants (n=69) obtained through Sensory Analysis, carried out at the Laboratory of Analysis and Food Technology, Ribeirão Preto, 2022.

Source:The own autor.

Based on the results of the sensory analysis, it can be seen that the two crackers developed showed little variation in terms of the evaluated acceptance criteria. It is possible to observe that in the "flavor" criterion, the cracker with amaranth flour was very close with 69% approval, but did not reach the 70% recommended for approval. Regarding the other evaluated criteria, the two samples had an acceptance rate above 70%, with the two crackers developed being considered approved by the participants (TEIXEIRA, 2009).

In the comments on the evaluation form, some tasters reported that the crackers with amaranth flour was softer, tastier and crunchier, but others reported that it had a looser consistency, generated crumbs and this would be a nuisance factor, as observed in the study by Bianchini et al. (2020) in which some tasters reported liking the bran and others having the feeling of "sand in the mouth" and in the research by Marcílio et al. (2005) who, when evaluating the acceptance of amaranth flour in the preparation of a gluten-free cracker, some tasters classified the cracker as "crumbly".

Regarding the data obtained by the study by Bianchini et al. (2020), who prepared five chocolate biscuits, one standard biscuit (BP) with rice flour and the others with the addition of 25% (B25), 50% (B50), 75% (B75) and 100% (B100) of amaranth flour, the BP, B25 and B50 biscuits stood out for manifesting an acceptance greater than 90%, for all attributes, but the B75 and B100 biscuits had less acceptance, with emphasis on the flavor and texture attributes that were lower than 80% for both. As in the present study, the B100 biscuits, with 100% replacement, also had a lower acceptance compared to the standard biscuit, with emphasis on the flavor attribute, which also had a lower percentage.

In another study, Vieira et al. (2015) prepared crackers in proportions of 100% with wheat flour (F1) to compare with the others, in which F2 consisted of the proportion of 30 g/100g amaranth, 10 g/100g quinoa, 40 g/100g soy, 20 g /100g cassava starch and F3 consisted of the proportion of 35 g/100g amaranth, 10 g/100g quinoa, 30 g/100g soybean, 25 g/100g cassava starch. As a result of the sensory analysis, it was found that the control sample (F1) had a better global evaluation, but the formulations containing mixed flours had acceptability rates greater than 70%, except for the flavor attribute for the F2 sample (VIEIRA et al., 2015). As in the present study, the standard cracker sample presented equal or superior evaluation in relation to the evaluated attributes. However, as the acceptability rates were greater than 70%, they are considered approved and may be commercially promising.

Thus, it was observed that the levels of acceptance may be associated with eating habits, that is, due to the fact that people have little habit of consuming products with the absence of the gluten "web" or else that are not commonly used. This can influence the

evaluation of the crackers, by the participants, in terms of taste, odor, texture, appearance and overall impression.

In the sensory analysis form, the participants also evaluated the intention to purchase the standard cracker and the cracker with amaranth flour. Figure 2 shows the result of the purchase intention of the two products. It is noted that the standard cracker had a higher percentage of purchase intention with 60% compared to 52% for the cracker with amaranth flour, with a difference of 8% between the acceptance of the developed products, which can be explained by the fact of people having a certain resistance to the purchase and consumption of products without gluten and different from their usual consumption.

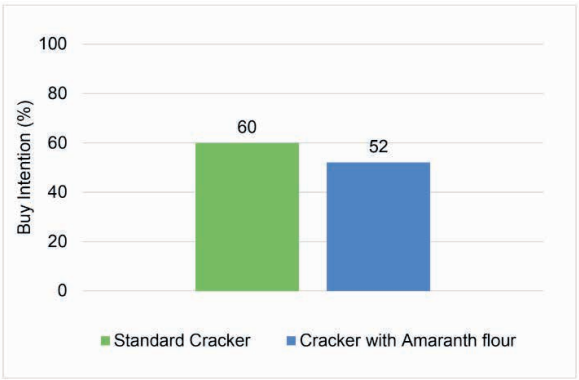

Figure 2 – Intention to purchase standard cracker and cracker with amaranth flour by the participants (n=69), obtained through Sensory Analysis, carried out at the Laboratory of Food Analysis and Technology, Ribeirão Preto, 2022.

Source:The own autor.

According to the study by Bianchini et al. (2020), the standard biscuit (BP) was the formulation that presented the highest scores and highest percentages for the purchase intention criterion and for samples B25 and B50 they had 44% and 36% respectively on the purchase intention. In relation to the B100 biscuit, the judges showed greater doubt about the purchase intention and corroborated for higher percentages in the negative criteria, that is, that they probably or certainly would not buy the biscuits when compared to the other formulations (BIANCHINI et al., 2020). This fact also occurred in the present study when compared to the modified cracker with the standard cracker.

It is worth considering that these types of products meet the demand of consumers who are willing to invest in innovative foods that may have a higher nutritional content. However, the choice of ingredients directly influences the acceptance of the evaluators, so it is necessary to modify and use different combinations so that these different characteristics have the least possible influence on the acceptance of the product.

CONCLUSION

The elaboration and standardization of cracker recipes proved that the use of non-conventional food plants in recipes is satisfactory because they are easy to use in preparations and because they provide the consumption of healthier foods.

The centesimal analyzes showed difference only in the moisture content between the two samples, while the other determinations were similar. This situation was replicated in the prepared nutritional information, with little variation between the two cracker samples.

With regard to the acceptance of cracker recipes, with the exception of the flavor attribute of the cracker with amaranth flour, both were approved. However, the standard cracker had greater acceptance and purchase intention compared to the cracker with amaranth flour.

This way, the use of PANC caruru (*Amaranthus sp.*), in the form of amaranth flour for the preparation of salt cracker, is an alternative for consumption and expansion of the culinary use of this plant, which can be easily

incorporated into conventional preparations, replacing total or added to recipes, which can contribute to the development of new food products, encouraging greater food variety for the composition of healthy eating habits.

APOIO FINANCEIRO

UNAERP.

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