Evaluation of the consumer profile of baru almonds at the IF Goiano - Campus Ceres

Avaliação do perfil do consumidor de amêndoas de baru no IF Goiano - Campus Ceres

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ABSTRACT
In recent years, there has been a significant increase in interest in healthy and targeted foods, boosting the consumption of cerrado fruits, such as baru almonds, which have gained prominence due to their high nutritional value and the benefits they offer for health. Although baru almonds are a promising product, there is still little information about their consumer profile. The aim of this study was to know the profile of baru almond consumers. Samples of roasted baru almonds, of two different brands, were obtained in markets and supermarkets in the municipalities of Ceres, Rialma and Goiânia, located in the state of Goiás. The consumer profile, product acceptance tests, purchase intention and acceptability index were evaluated. Regarding acceptance tests by attribute and purchase intention, the results were submitted to analysis of variance and differences in means compared by Tukey's test at a 5% significance level. The results of the consumer profile and acceptability index were evaluated in percentage. A completely randomized experimental design was used, in three lots. Regarding the almond consumption habit, the majority (54%) reported not having it, however 78% consumes almonds once a month. Most consumers know (74%) and consume (62%) Brazil nuts. Regarding the baru almond, 14% know about it and reported not consuming it. It was found that most participants (62%) buy almonds because it is a delicious product. Half of the assessed public (50%) is not in the habit of reading the label on the almond packages they consume, but 26% sometimes do this.
It was verified that 48% of the participants observe the price on the almond packaging labels and 28% look at the expiry date. This data is relevant to understand the factors that influence the purchase decision of consumers of these products. Of the survey participants, 54% of consumers know baru almond, 34% of consumers consume it, and subsequently 42% of consumers would buy this almond. Regardless of the evaluated sensory attribute, there was no significant difference between the samples, both were equally accepted by the research participants. The results showed that both samples had an acceptability index above 70% for the four sensory attributes evaluated. Regarding the purchase intention of baru almonds by the research participants, there was no significant difference between the samples. The presented results (3.64 and 3.94) are close to 4 and show that the research participants would probably buy the almonds. Most consumers know and consume more Brazil nuts than baru almonds. Participants decides to buy more based on price. There is a potential market for baru almond, with a good possibility of acceptance and growth.

**Keywords:** *Dipteryx alata* vog, nutrition, roasting, sensory.

**RESUMO**
Nos últimos anos, tem havido um aumento significativo no interesse por alimentos saudáveis e direcionados, impulsionando o consumo de frutos do cerrado, como as amêndoas de baru, que ganharam destaque devido ao seu alto valor nutricional e os benefícios que oferecem para a saúde. Embora as amêndoas de baru sejam um produto promissor, ainda são poucas as informações sobre o seu perfil consumidor. Objetivou-se com o presente estudo conhecer o perfil do consumidor de amêndoas de baru. Foram obtidas amostras de amêndoas de baru torradas, de duas diferentes marcas, em mercados e supermercados dos municípios de Ceres, Rialma e Goiânia, localizados no estado de Goiás. Foi avaliado o perfil dos consumidores, testes de aceitação dos produtos, a intenção de compra e o índice de aceitabilidade. Em relação aos testes de aceitação por atributo e intenção de compra os resultados foram submetidos à análise de variância e as diferenças das médias comparadas por teste de Tukey ao nível de 5% de significância. Os resultados do perfil de consumidores e índice de aceitabilidade foram avaliados em porcentagem. Foi utilizado o delineamento experimental inteiramente casualizado, em três lotes. Em relação ao hábito de consumo de amêndoa a maioria (54%) informou não ter, entretanto 78% consomem amêndoas uma vez por mês. A maioria dos consumidores conhece (74%) e consome (62%) castanha do Pará. Referente à amêndoa de baru 14% conhece e informaram não consumir a mesma. Constatou-se que a maioria dos participantes (62%) compram amêndoas de baru devido a ser um produto gostoso. Metade do público avaliado (50%) não possui o hábito de ler o rótulo das embalagens de amêndoas que consomem, porém 26% às vezes fazem essa leitura. Verificou-se que 48% dos participantes observam mais o preço nos rótulos das embalagens de amêndoas e 28% olham o prazo de validade. Esse dado é relevante para entender os fatores que influenciam na decisão de compra dos consumidores desses produtos. Dos participantes da pesquisa 54% dos consumidores conhecem amêndoa de baru, 34% dos consumidores consomem, e na sequência 42% dos consumidores comprariam essa amêndoa. Independente do atributo sensorial avaliado não houve diferença significativa entre as amostras, ambas foram igualmente aceitas pelos participantes da pesquisa. Os resultados mostraram que ambas as amostras apresentaram índice de aceitabilidade acima de 70%, para os quatro atributos sensoriais avaliados. Sobre a intenção de compra de amêndoas de baru pelos participantes da pesquisa, não houve diferença significativa entre as amostras. Os resultados apresentados (3.64 e 3.94) estão próximos de 4 e mostram que os participantes da pesquisa provavelmente comprariam as
amêndoas. A maioria dos consumidores conhece e consome mais a castanha do Pará, em relação à amêndoa de baru. Os participantes decidem a compra mais em função do preço. Há um mercado potencial para amêndoa de baru, com boa possibilidade de aceitação e crescimento.

Palavras-chave: *Dipteryx alata* vog, nutrição, sensorial, torrefação.

1 INTRODUCTION

In recent years, there has been a significant increase in interest for healthy foods, boosting the consumption of fruits of the cerrado (savanna), such as baru almonds (*Dipteryx alata* Vog.), which have gained prominence due to their high nutritional value and the benefits they offer for health, such as, helping to lower cholesterol and combat cardiovascular diseases, studies show that baru also helps to decrease the risks of Alzheimer's, diabetes, obesity and cancer. The Cerrado is a biome rich in biodiversity, which has been affected by intense human activity, including deforestation to give way to pastures and monocultures. This has left only fragments of remaining vegetation, making the preservation and sustainable use of natural resources even more important (PEREIRA et al., 2021; ARAKAKI et al., 2009).

The baruzeiro (*Dipteryx alata* Vog.), is an important native tree of the Brazilian Cerrado that produces edible fruit in the form of pulp and almonds, belonging to the Leguminosae family. In Brazil, baru almonds have several popular names, such as barujó, baruzeiro, baruí, coco-beans, cumbaru, cumaru and pau-cumaru. These trees bloom and fruit at the start of the rainy season, and the fruits ripen during the dry season (VERA; SOUZA, 2009).

Baru almonds have a low level of humidity, high nutritional value, high levels of proteins and lipids, and pleasant palatability. These characteristics make this food an important source of food, with great productive potential in the Cerrado, with an expressive market in the state of Goiás. Therefore, the use of baru pulp and almonds in industrialized products can add nutritional value and help in the preservation of the native species, as well as contribute to regional sustainable development (LIMA et al., 2010).

Therefore, the conservation of natural resources associated with the use of products or by-products coming from the Cerrado has aroused the interest of consumers, researchers and companies. In this sense, the information on the chemical and nutritional characteristics of the fruit of the Cerrado are crucial for the evaluation of the consumption and formulation of new products. However, in spite of their importance, few studies are available in the specialized...
literature, mainly regarding the chemical composition of these fruits and their technological application (SILVA et al., 2008).

Even though baru almonds are a valuable natural resource, coming from a Brazilian savannah plant, they are not yet cultivated in orchards or industrialized, which highlights the importance of scientific research to assess their potential in the formulation of products and in the generation of alternative income for family farmers, with the trade and extraction of baru fruits (BRAGA FILHO et al., 2009; ROCHA; SANTIAGO, 2009).

Although baru almonds are a promising product, there is still little information about their consumer profile. Researchers from the Nutrition School of the Federal University of Goiás (UFG) have dedicated themselves to investigating the benefits of consuming this almond to prevent chronic diseases, such as Alzheimer's, Parkinson's, cirrhosis, diabetes, cancer and heart diseases, and the other benefits for human health. In addition, another study conducted at the same institution sought to understand the effects of consuming baru almonds in overweight individuals. Both studies configure baru almonds as an important component in the process of prevention or treatment of these diseases, with great benefits (BENTO, 2014; SOUZA, 2014).

Thus, the consumer profile of baru almonds is a little explored subject, however studies indicate that the consumer audience can be quite diverse and some surveys indicate that the interested public is composed of people concerned with health and who seek functional and nutritious food, while others suggest that consumers are people who value regional and satisfactory products (OLIVEIRA et al., 2019).

Therefore, the increase in the consumption of almonds is increasing and may be related to the nutritional benefits of this food, which is rich in healthy proteins, fibers and vitamins, besides containing vitamins and minerals important for health. Thus, it is important to investigate consumer behavior and their motivations for buying this product, because the search for healthy food and better quality of life are more and more discussed and encouraged (COIMBRA et al., 2018; SOUZA, 2014).

Knowledge of the consumer profile can be used to improve the production of baru almonds, as well as the development of new products with this ingredient. Thus, it is of paramount importance to seek to know both the profile and the purchase intent of consumers, which is essential for the emergence of new entrants in the market (GOMES, 2019).
In this context, the objective of the present study was to know the consumer profile of baru almonds.

2 MATERIAL AND METHODS

For the purchase of samples of baru almonds, a survey was carried out and verified in which supermarkets and markets had samples for sale and their variation in prices. Afterwards, samples of roasted baru almonds were obtained in three different manufacturing batches of two different brands found in markets and supermarkets of the municipalities of Ceres, Rialma and Goiânia, located in the state of Goiás, being them, Belvedere manufactured in Goiânia and Bem Natus manufactured in Nerópolis.

The participants were approached in the corridors of IF Goiano - Campus Ceres, in the block of Agrarian Sciences, in the morning and evening shift, informed of the test and later invited to participate in the research. After acceptance, they signed the Term of Free and Informed Consent (TCLE) in two ways, leaving one way with the researcher in charge and the other with the participant.

The sensory tests were conducted with the participation of 50 untrained participants, among students and adult servers of the Federal Institute of Goiano Campus Ceres: independent of class and social group. The research counted on the participation of students serving at the institution (full-time and outsourced), of different sexes (male and female), color/race (white, black, mixed race), age group (from 18 years of age) and level of schooling (primary to postgraduate).

The consumer profile was evaluated to obtain demographic data and consumption of almonds and baru derivatives, applying a questionnaire with closed questions.

The acceptance tests (blind test), of the samples of roasted baru almonds, were carried out evaluating the attributes of overall impression, texture, taste and appearance. The judges evaluated the samples, using a structured hedonic scale of nine points, ranging from 1 (very disliked) to 9 (very much liked), according to MINIM (2010). Acceptance of samples was assessed monadistically in individual cabins with white light. About 15 g of each sample was served in disposable, three-digit coded dishes (blind test).
The intention to purchase the different formulations was evaluated by means of a structured five-point scale (1 = would certainly not buy; 2 = would probably not buy, 3 = would perhaps buy, 4 = would probably buy and 5 = would certainly buy).

To evaluate the Acceptability Index (AI), we adopted the formula of Teixeira et al. (1987), in which the MI with a value equal to or greater than 70% represents good acceptability of the product, and the IA (%) = A x 100 /B, where, A= average score obtained for the product and B= maximum score of the scale.

In relation to the acceptance tests by attribute and intention of purchase, the results were submitted to the analysis of variance and the differences of the averages compared by Tukey test at the level of 5% significance, using the software SISVAR (SISVAR, 2011). The results of the consumer profile and acceptability index were evaluated in percentage. The experimental design was entirely casualized, in three batches.

The project was forwarded and approved for execution by the Ethics Committee in Research of the Federal Institute of Goiano, through the Opinion of 2.312.028.

3 RESULTS AND DISCUSSION

The majority of consumers (Figure 1) were male (68%), aged between 18 and 40 years (96%), with incomplete higher education degree (88%).
Figure 1 - Information on the profile of the consumer of baru almonds by sex, age group, education grade and occupation.

As for the occupation, 94% reported being undergraduate students (Figure 1). However, it is important to point out that these results do not represent the entire consumer market for baru almonds, since other research may present different results. In addition, other information such as consumption habits, influences and purchasing motivations can complement the analysis of consumer profiles.

Regarding the habit of consuming almonds, the majority of the interviewees (54%) reported no, however, 78% consume almonds once a month (Figure 2). The majority of consumers know (74%) and consume (62%) Brazil nuts. Regarding baru almond 14% know and reported not to consume it.
The results presented are in line with the studies carried out by Oliveira et al. (2019) on the consumption profile of chestnuts and almonds in the city of São Paulo, in which 37.4% of the participants of the research consumed almonds and 62.2% consumed Brazil nuts, due to the fact that it is a more popular chestnut.

A study conducted by Miranda et al. (2019) on the consumption of oilseeds in a city in the interior of São Paulo, highlighted that 44.9% of consumers consumed almonds and 79.2% of these consumed Brazil nuts. The data from these studies corroborate the results found in the present study, demonstrating that Brazil Nut is consumed more than almonds in general. The preference for chestnuts is highlighted, which can be attributed to the fact that these foods are better known and available on the market.
The majority of respondents (84%) do not use almonds in snacks (Figure 2). These results corroborate the research conducted by Araújo et al. (2018), in which most consumers of almonds reported not consuming them as a snack between main meals.

It was found that the majority of participants (62%) buy almonds (Figure 3) because it is a tasty product, and 26% for its healthy food.

Studies by Cardoso et al. (2017) point out that taste is a determining factor for the choice of these products, taste is very important in the decision to buy healthy foods.

Half of the evaluated audience (50%) do not have the habit of reading the label of the almond packaging they consume, but 26% sometimes do this reading (Figure 3).

It is also important to note that, although many consumers do not read the labels on the packaging, a significant proportion of them do so even occasionally, which indicates that there is a concern to better understand the composition of the food they consume.

It was found that 48% of the participants observed more the price on the labels of the almond packaging and 28% looked at the expiry date (Figure 4). This data is relevant for understanding the factors that influence the consumer's decision to purchase these products.
The price was a determining factor for almost half of consumers when choosing chestnuts or almonds, indicating a greater concern for the economy than for the quality or nutritional benefits of the products. This result is in line with another study conducted by Pereira et al. (2021), which identified that price is also an influencing factor in the choice of healthy foods by Brazilian consumers.

Of the participants in the survey, 54% of consumers know of baru almonds, 34% of consumers consume baru almonds, and 42% of consumers would buy baru almonds (Figure 4). The study indicated that more than half of the consumers know about baru almonds and a good part already consume this kind of food, indicating a potential acceptance of the product on the market. This information is corroborated by a study by Almeida et al. (2019), which also identified a growing demand for natural and healthy foods, such as baru almonds, in the Brazilian market.

However, the majority (66%) reported that they do not consume and would not buy (58%) this type of almond (Figure 4), showing the importance of attracting this share of consumers.
On reading the labels of industrialized products that consume 40% of consumers sometimes read (Figure 4). It is also important to note that, although a significant portion of consumers sometimes read the labels on the packaging, the number of consumers who do not do so is still high, indicating a possible lack of information on the ingredients and nutrients of the products. This result reinforces the importance of educational campaigns and awareness about the importance of reading labels and about the nutritional benefits of almonds and chestnuts for health.

Regardless of the sensory attribute evaluated, there was no significant difference between the samples (Table 1), both were equally accepted by the participants of the survey.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Global Printing</th>
<th>Texture</th>
<th>Taste</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullet 1</td>
<td>7.4a±0.16</td>
<td>7.4a±0.19</td>
<td>7.3a±0.20</td>
<td>7.2a±0.20</td>
</tr>
<tr>
<td>Tag 2</td>
<td>7.5a±0.16</td>
<td>7.5a±0.19</td>
<td>7.7a±0.20</td>
<td>7.6a±0.20</td>
</tr>
</tbody>
</table>

Coefficient of Variation

15.65  18.49  18.88  19.23

Legend: Mark 1 (from Goiânia), Mark 2 (from Nerópolis).

Averages in the same column and with equal letters do not differ significantly from each other by Tukey’s test (p<0.05).

The values correspond to the mean of three repetitions with estimated standard deviation.

Source: The Authors

A similar study conducted by Machado et al. (2019) that evaluated the acceptance of different almond marks by means of a sensory test with hedonic scale, found that there was no significant difference in the reception of the different marks evaluated, as well as in the present study. This shows that the quality of the different almond brands can be similar, allowing the consumer to choose the brand based on other factors such as price and provenance.

The results showed (Table 2) that both samples showed acceptability index above 70%, for the four sensory attributes evaluated, indicating that they were accepted and can be marketed.
Table 2 - Acceptability index (%) per attribute of the samples of roasted baru almonds.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Attributes</th>
<th>Global Printing</th>
<th>Texture</th>
<th>Taste</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullet 1</td>
<td></td>
<td>82</td>
<td>82</td>
<td>81</td>
<td>80</td>
</tr>
<tr>
<td>Tag 2</td>
<td></td>
<td>83</td>
<td>83</td>
<td>86</td>
<td>84</td>
</tr>
</tbody>
</table>

Legend: Mark 1 (from Goiânia ), Mark 2 (from Nerópolis).
Source: The Authors

According to Dutcosky (2007), in order for the product to be accepted, in terms of its sensory properties, it is necessary for it to obtain an Acceptability Index (AI) equal to or greater than 70%.

In numerical terms, brand 2 achieved a higher acceptability index for the four attributes compared to brand 1, with a higher prominence for the flavor attribute.

In studies by Teles et al. (2019), the acceptability of similar foods, such as cashew nuts and Pará, was evaluated and similar results were observed, with controlled acceptability indices for several sensory attributes.

Therefore, the results presented in Table 2 indicate that samples of baru almonds are accepted by consumers in relation to their sensory attributes, which can contribute to the increase of this food and consequently to the promotion of health and prevention of diseases.

Regarding the intention of buying baru almonds by the research participants, there was no significant difference between the samples (Table 3).

Table 3 - Mean values of the intention and purchase of the samples of roasted baru almonds.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Purchase Intention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullet 1</td>
<td>3.64a</td>
</tr>
<tr>
<td>Tag 2</td>
<td>3.94a</td>
</tr>
</tbody>
</table>

Coefficient of Variation 27.74

Legend: Mark 1 (from Goiânia ), Mark 2 (from Nerópolis).
Averages in the same column and with equal letters do not differ significantly from each other by Tukey's test (p<0.05).
The values correspond to the mean of three repetitions with estimated standard deviation.
Source: The Authors

The results presented (3.64 and 3.94) are close to 4 and show that the participants in the research would probably buy the almonds. Thus, it is possible to observe that the purchase intent values for the two baru almond brands are relatively close. This result is similar to that found in a study by Rodriguez-Torres et al. (2020), which evaluated the intention to purchase almonds of
different brands. The study showed that the brand was not a determining factor in consumers' purchase intention, but rather the quality and price of the product.

The coefficient of variation is a measure of dispersion indicating relative variability with respect to the mean. In this case, a coefficient of variation of 27.74% indicates that the dispersion of the data is relatively high relative to the average and suggests a great variability in consumer preferences. This may be related to factors such as brand, product quality and price, as well as other factors such as availability and convenience of purchase. These results are in line with a study by Bimbo et al. (2019), which evaluated the purchase intent of food products and found a great variability in consumer preferences.

4 CONCLUSIONS

In this study, it was observed that the majority of consumers know and consume more Brazil nuts, in relation to baru almonds.

Participants decide to purchase more in line with the price.

There is a potential market for baru almonds, with good possibility of acceptance and growth.
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