



Purchase and consumption habits for quinoa and amaranth in Brazil

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Abstract

A large amount of information about consumer profile can be obtained when consumption habits are observed. Thus, the aim of this work was to identify the profile of consumers and their consumption habits in relation to quinoa and amaranth in Brazil. Data were collected through an online questionnaire survey method, covering aspects such as consumer profile, knowledge and consumption of quinoa and amaranth, diet diversification, and packaging preferences. Within two months, 520 responses were obtained. Around 90% of participants knew quinoa and 43% knew amaranth. High nutritional quality and diet diversification were the main motivations for the consumption of these pseudocereals, and the purchase of these products in grains and in bulk were the most common forms of commercialization among participants. Despite quinoa being more widely consumed, it was concluded that most participants were interested in including amaranth in their diets. A broader dissemination of these foods could contribute to their inclusion in the diet of an increasing number of people.

Keywords: amaranthus; *Chenopodium quinoa*; consumer profile; diet diversification; functional foods.

Practical Application: Quinoa and amaranth consumption in Brazil has expanded due to their high nutritional quality.

1 INTRODUCTION

A healthy diet must provide the body with essential nutrients in adequate amounts; therefore, diversifying food intake is crucial (Gomes & Teixeira, 2016). Nonetheless, modern lifestyle changes often lead to a decrease in dietary quality. On the other hand, in the XXI century, several factors have been contributing to an increase in food quality, since, every year, an increasing number of people are concerned with the health benefits associated with the food they consume (Petrescu et al., 2020).

Pseudocereals like quinoa and amaranth can be used to diversify diets as they have all features of a functional food (Balakrishnan & Schneider, 2022; Ishimoto & Monteiro, 2010). Their nutritional and functional qualities, including serum cholesterol reduction and the absence of gluten, are comparable (Almeida & Sá, 2009; Jan et al., 2023; Zevallos et al., 2015). Therefore, incorporating these grains into diets has the potential to enhance health, especially for individuals with celiac disease, who are intolerant to gluten intake (Almeida & Sá, 2009; Angeli et al., 2020; Ishimoto & Monteiro, 2010; Zevallos et al., 2015).

Quinoa (*Chenopodium quinoa* Willd) is an herbaceous species, native to the Andes Mountains, which presents a mean protein content of 14.1%, along with fibers, minerals, and vitamins (Spehar, 2006; USP, 2023; Valencia-Chamorro, 2003). The main species of amaranth (*Amaranthus* spp.) are native to

Central America and contain, in dry matter, a mean protein content of 13.6% (USP, 2023). It is rich in lysine, sulfur amino acids, fibers, vitamins (A and C), and minerals like calcium, iron, and sodium (Amaya-Farfan et al., 2005; Ascheri et al., 2004; Ferreira et al., 2007).

Despite their nutritional value, the consumption of amaranth in non-Andean countries is relatively lower than the consumption of quinoa, which is also considered limited. In Brazil, the dietary habits and traditional uses inherited from the European colonizers largely revolve around cereals, especially rice, wheat and maize (Borges et al., 2010). Diversifying the foods consumed allows for the ingestion of a broader spectrum of nutrients, contributing to a healthier diet (Gomes & Teixeira, 2016).

These pseudocereals are typically commercialized in three distinct forms, each catering to a specific market niche (Schmidt et al., 2023). Grains can be cooked and incorporated into other foods, such as salads and breakfast cereals; flours can completely or partially replace wheat flour in the dough of some recipes of biscuits, breads, cakes and pies; and flakes can be incorporated into fruit salads, pancakes and some beverages like milk, yogurts, and smoothies (Borges et al., 2010; Brito, 2016; Ferreira et al., 2007; Spehar, 2006; Teixeira et al., 2003).

The observation of the consumer habits of quinoa and amaranth can generate extensive information about the profile

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of their consumers, such as gender, age group and why they consume them. Surveys are recommended to obtain information on features, actions, or opinions of a certain population (Freitas et al., 2000).

In quantitative research, questionnaires are among the main instruments for data collection (Alyrio, 2009). They consist of a set of questions designed to gather data aligned with the objectives of the researchers (Parasuraman et al., 2006). Since researchers are typically not present when respondents fill out the questionnaires, they must be written in a simple and objective manner, in order to minimize comprehension difficulties and doubts (Alyrio, 2009).

Given the limited information and dissemination of knowledge regarding quinoa and amaranth among Brazilian consumers, the production and consumption of these pseudocereals in Brazil remain relatively low. Conducting research works on consumption habits and determining consumer profiles is essential to promote the consumption of healthy, functional foods and dietary diversification. The disclosure of the data obtained in these research works also contributes to increasing the visibility of these grains in the centers of commercialization.

The aim of this work was to identify the consumer profile and consumption patterns for quinoa and amaranth in Brazil.

2 MATERIAL AND METHODS

The research project was approved by the Ethics Committee (CAAE 20181019.0.0000.5504) on November 29th, 2019.

For data collection, the Survey method was used. Given the inability to quantify the population of the research, it was considered infinite, and a non-probabilistic convenience sampling was performed. Non-probabilistic samplings are characterized by the lack of knowledge of the probability that an element of the population belongs to the sample, in other words, the elements of the population inaccessible to the researcher cannot compose the sample (Tavares, 2011). Among the types of non-probabilistic samplings, convenience sampling is greatly used and participants are chosen based on their availability and willingness to collaborate with the research (Freitas et al., 2000).

Data collection was performed through an online questionnaire using Google Forms, a survey management application that automatically transmits survey results to a spreadsheet. The questionnaire was available during the months of August and September 2020 via a link that directed participants to the page of the form. This link was shared on major Brazilian electronic communication media, with the possibility of being shared for more users by the participants themselves.

The online questionnaire comprised twelve mandatory closed questions with predefined alternatives. Open-ended questions (without predefined alternatives and allowing free-form answers) were omitted, as they do not favor data standardization and levelling (Alyrio, 2009; Gerhardt & Silveira, 2009).

The questionnaire covered three aspects of the consumer profile (gender, age range, and gluten intolerance), seven about the knowledge and consumption of quinoa and amaranth, one

aspect about diet diversification, and one about regarding packaging preference in commercialization.

Initially, the information obtained after applying the questionnaire were individually analyzed, followed by cross-referencing using the Filter function of Microsoft Excel 2016. The crossing of information aimed to analyze the most important questions relevant to answer the research goals. In non-probabilistic sampling, it is not possible to calculate the margin of error resulting from the generalization of sample results for the entire population, since the probability of an element from the population being included in the sample is unknown (Tavares, 2011).

3 RESULTS AND DISCUSSION

During the period in which the questionnaire was available online, 520 responses were obtained. From this total, 70% of the participants belonged to the female gender and 30% to the male gender, and the prevailing age range in the sample was from 21 to 30 years old (Table 1). Only 2.5% of the participants reported having intolerance to gluten.

Regarding familiarity with quinoa and amaranth, 90.4% of the participants answered they knew quinoa, 43.0% knew amaranth, and 8.8% did not know either of these plants (Table 2). This lack of awareness about amaranth in relation to quinoa may contribute to its lower consumption (Aderibigde et al., 2022).

When this information was correlated with the age range of the participants, it was observed that the youngest participants, aged 20 years old or less, were the ones who knew the most

Table 1. Gender and age range of the participants of the research.

| Age range | Female | Male | Total | Female (%) | Male (%) | Total (%) |
|-----------|--------|------|-------|------------|----------|-----------|
| ≤ 20 | 21 | 25 | 46 | 4.0 | 4.8 | 8.8 |
| 21-30 | 94 | 63 | 157 | 18.1 | 12.1 | 30.2 |
| 31-40 | 48 | 25 | 73 | 9.2 | 4.8 | 14.0 |
| 41-50 | 43 | 15 | 58 | 8.3 | 2.9 | 11.2 |
| 51-60 | 80 | 17 | 97 | 15.4 | 3.3 | 18.7 |
| ≥ 61 | 78 | 11 | 89 | 15.0 | 2.1 | 17.1 |
| Total | 364 | 156 | 520 | 70 | 30 | 100 |

Table 2. Knowledge about quinoa and amaranth, in relation to age range and gender of the participants.

| Knowledge (%) | Quinoa | Amaranth | None | Total (%) |
|---------------|--------|----------|------|-----------|
| Age range | | | | |
| ≤ 20 | 95.6 | 32.6 | 4.4 | 100 |
| 21-30 | 89.2 | 40.8 | 10.8 | 100 |
| 31-40 | 89.1 | 50.7 | 8.2 | 100 |
| 41-50 | 86.2 | 43.1 | 12.1 | 100 |
| 51-60 | 92.8 | 47.4 | 7.2 | 100 |
| ≥ 61 | 91.0 | 41.5 | 7.9 | 100 |
| Gender | | | | |
| Female | 92.3 | 45.6 | 6.6 | 100 |
| Male | 85.9 | 37.2 | 14.1 | 100 |
| Total | 90.4 | 43.0 | 8.8 | 100 |

about quinoa, totalizing 95.6% of respondents. On the other hand, this same demographic presented the lowest awareness about amaranth (32.6%). Participants above 50 years old also presented values above the average for the knowledge on quinoa, while the greatest knowledge on amaranth was observed among those aged 31 to 40 years old.

Given the high nutritional and functional qualities of quinoa, this grain has gained widespread popularity among people striving for a healthy, balanced diet (Besantes-Morales et al., 2019; Ishimoto & Monteiro, 2010; Jan et al., 2023). Therefore, the dissemination and promotion of quinoa by digital influencers within this niche may explain why younger individuals have greater awareness of this product, since they have more exposure to social media and electronic devices in Brazil (We Are Social Inc., 2021).

Regarding gender, a higher percentage of male participants (14.1%) did not know any of these pseudocereals, compared to the female group (6.6%). All participants with intolerance to gluten intake knew quinoa; nevertheless, 30.8% of them were unfamiliar with amaranth, suggesting the consumption of the latter is less encouraged and widespread, even among people with celiac disease. In similar research, Tarouco et al. (2019) observed, after the application of a questionnaire to 113 clients of establishments in the food sector in São Miguel do Oeste, Santa Catarina (SC), that only 53.1% of participants knew quinoa. The discrepancy in the value for this question, in relation to the 90.4% found in this research, might be related to the scope of population sampling, since the application of the online questionnaire was not focused on a specific location.

Of the 474 participants who knew quinoa and/or amaranth, 312 (65.8%) reported having consumed one or both pseudocereals, with 65.2% having tried quinoa and 20.7% having tried amaranth. Azevedo et al. (2022) and Tarouco et al. (2019) obtained values of 72.4 and 46.05% for participants who knew quinoa and had already consumed it at least once, respectively.

The frequency of consumption followed the same pattern for both species, with the majority of participants consuming quinoa and/or amaranth less than once a month (Table 3). Azevedo et al. (2022) and Tarouco et al. (2019) also found that quinoa consumption was most observed once to twice a week or rarely.

In this study's sample, the most frequent consumer profile was of men and women aged 31 to 40 years old and 61 years old or older for quinoa, and of men and women aged 51 to 60 years old for amaranth. Consumption of these pseudocereals one or more times a week was considered frequent. Regarding participants

with celiac disease, 30.8% reported consuming quinoa one or more times a week, while 15.4% reported consuming amaranth at the same frequency.

The reasons why participants consumed quinoa and/or amaranth were classified into seven categories (Table 4):

- high nutritional quality;
- diet diversification;
- gluten-free;
- pleasant taste;
- indication by friends and/or family;
- substitution of ingredients in certain recipes;
- indication by nutritionists.

High nutritional quality and diet diversification were the main reasons for the consumption of these pseudocereals. For Tarouco et al. (2019), the high nutritional quality of quinoa was also the main reason for the consumption of this pseudocereal, followed by pleasant taste and recommendation from acquaintances.

When correlating the two main reasons for the consumption of these pseudocereals with participants' age range, it was observed that younger individuals tended to consume them for diet diversification, whereas older individuals consumed them due to their high nutritional quality. Considering the gender of participants, most women consumed quinoa and/or amaranth because of the high nutritional quality, while most men consumed them to diversify their diets (Table 4).

The fact that many of the participants have been consuming these pseudocereals to diversify their diets is notably positive, as

Table 3. Frequency of consumption of quinoa and amaranth.

| Frequency of consumption (%) | Quinoa | Amaranth |
|------------------------------|--------|----------|
| More than once a week | 7.2 | 2.1 |
| At least once a week | 8.2 | 2.5 |
| From once to twice a month | 15.2 | 3.6 |
| Less than once a month | 34.6 | 12.5 |
| Does not consume | 34.8 | 79.3 |
| Total (%) | 100 | 100 |

Table 4. Reasons for the consumption of quinoa and amaranth in general and in relation to age range and gender of the participants.

| Reasons (%) | Frequency | |
|--|--------------------------|----------------------|
| High nutritional quality | 58.9 | |
| Diet diversification | 58.5 | |
| Gluten-free | 6.3 | |
| Pleasant taste | 2.5 | |
| Indication by friends and/or family | 1.3 | |
| Substitution of ingredients in certain recipes | 1.0 | |
| Indication by nutritionists | 0.6 | |
| Reasons (%) | High nutritional quality | Diet diversification |
| Age group | | |
| ≤ 20 | 50.0 | 69.2 |
| 21-30 | 63.3 | 67.7 |
| 31-40 | 63.4 | 58.5 |
| 41-50 | 67.7 | 41.9 |
| 51-60 | 49.2 | 57.1 |
| ≥ 61 | 57.1 | 48.2 |
| Gender | | |
| Female | 61.0 | 57.0 |
| Male | 53.4 | 62.5 |

the intake of a diverse range of foods results in a greater variety of nutrients being delivered to the organism (Gomes & Teixeira, 2016; Lachat et al., 2017; Vispute et al., 2023).

Diets that are not diverse were considered poor and monotonous by many families of workers interviewed in the municipality of Paulínia, São Paulo (SP), suggesting the use of the same products in most meals can negatively impact people's sense of well-being (Canesqui, 2005). Therefore, the consumption of quinoa and amaranth may contribute to the diversification and enrichment of the diet of several families (Balakrishnan & Schneider, 2022).

In the City of Mexico, Rojas-Rivas et al. (2019) also verified, through a questionnaire administered to 610 consumers of amaranth, that older participants were more likely to correlate consumption with functional properties and health promotion compared to younger participants. Additionally, these authors observed a high prevalence of amaranth consumption due to family tradition, which can be justified by the center of origin of the species.

Participants who currently consume or have already consumed these pseudocereals indicated some difficulties encountered during purchase and/or consumption (Table 5). For both species, the high price of the product was the greatest barrier found, followed by the lack of knowledge regarding preparation methods and availability in the markets.

When comparing the two species, it was observed that the highest percentage of the participants correlated the high price to quinoa, whereas the lack of knowledge regarding preparation methods and availability in the market were more commonly associated with amaranth. For Azevedo et al. (2022) and Tarouco et al. (2019), the lack of knowledge on the benefits and the high price were the main obstacles to quinoa consumption.

In this research, around 38.2% of quinoa consumers and 26.8% of amaranth consumers did not face difficulties in obtaining these products. Nevertheless, it is evident that amaranth presented more obstacles than quinoa.

The identification of these prohibitive factors for consumption strongly justifies the need for new strategies to insert these pseudocereals into the national market. Increasing the availability of these products could also reduce their market prices, thus contributing with the solution to two of the difficulties indicated by the participants of this research.

Among participants who consumed these pseudocereals, quinoa and/or amaranth in grains was the most common form of consumption, totaling 53.2%. Flour and flakes totaled 20.2%, suggesting they are not the most popular forms of consumption

Table 5. Difficulties found for the consumption of quinoa and amaranth.

| Difficulties (%) | Quinoa | Amaranth |
|---|--------|----------|
| High price | 46.7 | 38.9 |
| Lack of knowledge on the mode of preparation of the product | 25.1 | 35.0 |
| Lack of the product in the market | 12.8 | 28.7 |
| No difficulties | 38.2 | 26.8 |

among the sample population. Another 26.6% answered they would choose the three forms of commercialization of these products, depending on the recipe they would prepare (Table 6).

Tarouco et al. (2019) also reported the same preference pattern for quinoa consumption among participants from São Miguel do Oeste, SC; the preference for grains, flakes and flour was of 69.8; 18.6 and 7.0% of the total of consumers of quinoa, respectively. This preference is largely based on product availability, as grains are the most common form of commercialization, which directly interferes in the moment of purchase.

In general, purchasing quinoa and/or amaranth in bulk was the most common form of consumption among participants (Table 6). Among the other forms of commercialization, the cardboard packaging was more accepted than plastic ones, especially those with a transparent portion.

Nonetheless, observing the preferred form of consumption of these pseudocereals by the participants, it was noticed that bulk purchase was the highest only for grains. For flakes, participants preferred cardboard packaging with a transparent part and, for flour, the preference was for fully closed cardboard boxes. Thus, product visibility emerges as a crucial factor at the moment of purchase, especially for grains and flakes.

Inquiring about amaranth packaging in the City of Mexico, Rojas-Rivas et al. (2019) verified that almost all survey participants, regardless of gender or age range, preferred bulk consumption over labeled packaging. This behavior, once more, underscores how deeply food traditions can influence modern population preferences.

In Brazil, the consumption of quinoa and amaranth in bulk is not related to food tradition, as the dietary habits of Brazilians are primarily inherited from the European settlers, relying on cereals like rice and wheat (Borges et al., 2010). The trend to consume products in bulk may be related to another factor, such as the change in the behavior of the consumers in the past years (Patreau et al., 2023). Some studies indicate that many consumers have been changing their consumption habits, opting

Table 6. Forms of consumption and preference for the type of packaging used to commercialize quinoa and amaranth.

| Forms of consumption | Frequency (%) | | | |
|---|---------------|--------|--------|-------|
| Grains | 53.2 | | | |
| Flakes | 11.2 | | | |
| Flour | 9.0 | | | |
| The three forms, depending on the recipe to be prepared | 26.6 | | | |
| Total (%) | 100 | | | |
| Types of packaging (%) | General | Grains | Flakes | Flour |
| Fully closed plastic packaging | 5.5 | 4.9 | 14.3 | 3.5 |
| Fully closed cardboard box | 13.1 | 7.3 | 17.1 | 27.6 |
| Plastic packaging with a transparent part | 16.2 | 17.0 | 2.9 | 24.1 |
| Cardboard box with a transparent part | 29.0 | 26.1 | 42.9 | 20.7 |
| No packaging - in bulk | 36.3 | 44.9 | 22.9 | 24.1 |
| Total (%) | 100 | 100 | 100 | 100 |

for products with minimal environmental impact, instead of only satisfying their individual needs (Kheiry & Nakhaei, 2012; Ramalho, 2019).

The preference for non-plastic packaging suggests that this material is not very much accepted among the consumers of the pseudocereals studied in this research. Since these products are related to sustainability and a healthier life, it can be inferred that the profile of the consumer of these products reflects people who worry not only about their health, but also about the environment.

Around 57.4% of participants who consumed quinoa answered they would consume amaranth in the same way in their diets, and 16.4% would only do so in case quinoa were unavailable, suggesting a willingness among most participants to incorporate amaranth into their diets (Table 7). Conversely, 5.5% of participants stated they would not consume amaranth under all conditions proposed, and 37.1% of them were undecided.

Tarouco et al. (2019) observed that among participants who were unfamiliar with quinoa, 68.3% expressed interest to consume it after learning about its benefits and nutritional qualities. On the contrary, 31.7% of the participants that did not know quinoa were not interested in this food, even after being informed of its nutritional and functional properties.

From the answers obtained in the questionnaire, amaranth, despite being less known than quinoa, has the potential to be consumed more often among the participants of this research. Although many could not answer this question, it is observed that there is a willingness for the consumption of new products, since the percentage of participants who were not interested by this ingredient is very low.

It is also worth highlighting that some participants who until then did not know these products intend to try them and incorporate them into their diets, indicating research works of this nature may play a role in disseminating knowledge and providing information and clarifications to the population.

4 CONCLUSION

Regarding the consumer profile identified in the sample of this research, quinoa was most consumed by men and women aged 31 to 40 years old and 61 years old or older, and amaranth was most consumed by men and women aged 51 to 60 years old. Although the frequency of consumption among most of the participants was low, less than once a month, high nutritional quality and diet diversification were the main reasons for the consumption of these foods. Quinoa and amaranth in grains

or in bulk were the most common forms of consumption and commercialization among participants; nevertheless, cardboard boxes were also the preferred packaging among the consumers of flakes and flour. It was concluded that most of the participants were willing to include amaranth in their diets. It is emphasized that the disclosure of products such as quinoa and amaranth may contribute for these grains to be included in the diet of the Brazilian population, even if slowly and gradually.

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Table 7. Inclusion of amaranth in the diet of consumers of quinoa.

| Inclusion | Frequency (%) |
|--|---------------|
| Yes, even if there were both options available | 41.0 |
| Yes, only in case quinoa were unavailable | 16.4 |
| No, even if there were both options available | 3.8 |
| No, even if quinoa were unavailable | 1.7 |
| Could not answer | 37.1 |
| Total (%) | 100 |

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