

## **Comparative Analysis Of The Functional Properties Of Munguba (*Pachira Aquatica* Aubl.) And Their Possible Food Alternatives**

## **Análise Comparativa Das Propriedades Funcionais De Munguba (*Pachira Aquatica* Aubl.) E Seus Alternativos Alimentares Possíveis**

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## ABSTRACT

The *Pachira aquatica* Aubl. (Bombacaceae Family) is an Unconventional Food Plant (PANC), known as munguba. The work aimed to carry out a comparative analysis of the proximate composition of the munguba almonds (*P. aquatica*) and their possible dietary alternatives. The study began in November 2018 at the Municipal School Sister Edith Coelho Netto, in Campo Grande, MS. The research consisted of a qualitative and quantitative study with the following procedures: questionnaire, physicochemical analyzes of the munguba almonds, and the preparation of food recipes. It was observed that 53.73% answered that they had already seen the munguba and 46, 27% reported never having seen it. Of the components analyzed, there is a high content for lipids, with a value of 36.74% and with relevant amounts of carbohydrates (26.17%) and proteins (11.49%). Values for humidity were 3.25% and ashes 4.88%.it. The following recipes were tested: roasted chestnut, bonbon, and salted munguba cream. The volunteers who tried the recipes approved and reported that they should be passed on to the school community.

**Keywords:** wild cocoa, PANC, food.

## RESUMO

A *Pachira aquatica* Aubl. (Família Bombacaceae) é uma Planta Alimentar Não Convencional (PANC), conhecida como munguba. O trabalho visava realizar uma análise comparativa da composição próxima das amêndoas munguba (*P. aquatica*) e das suas possíveis alternativas alimentares. O estudo teve início em Novembro de 2018 na Escola Municipal Irmã Edith Coelho Netto, em Campo Grande, MS. A investigação consistiu num estudo qualitativo e quantitativo com os seguintes procedimentos: questionário, análises físico-químicas das amêndoas de munguba, e preparação de receitas alimentares. Observou-se que 53,73% responderam que já tinham visto a munguba e 46, 27% relataram nunca a terem visto. Dos componentes analisados, existe um elevado teor de lípidos, com um valor de 36,74% e com quantidades relevantes de hidratos de carbono (26,17%) e proteínas (11,49%). Os valores de humidade foram de 3,25% e de cinzas de 4,88%. Foram testadas as seguintes receitas: castanha assada, bombom, e creme de munguba salgado. Os voluntários que experimentaram as receitas aprovaram e informaram que as mesmas deveriam ser transmitidas à comunidade escolar.

**Palavras-chave:** cacau selvagem, PANC, comida.

## 1 INTRODUCTION

Unconventional Food Plants (PANC) is assigned the term “weed”, as it grows among cultivated plants (KINUPP; LORENZI, 2014). In Brazil, where we have several regions with nutritional deficiencies, the importance of spreading the knowledge of PANCs is extreme, due to its ecological, food, and easy access value. However, most of the time, such species are neglected and/or unknown by the population (KINUPP; LORENZI, 2014).

There are countless unknown PANC species, which is why the social relevance of the dissemination and the expansion of the knowledge of these plants. Besides, the

incentive to consume it is an alternative to local food, diverse and without pesticides, as well as a proposal to reduce spending and improve the quality of life of the population (LEAL, 2015). Thus, valuing the great nutritional potential of these plants is indispensable, since PANCs diversify the diet if consumed daily and promote an improvement in the health of the people who consume them.

The *Pachira aquatica* Aubl. (Bombacaceae Family) is an Unconventional Food Plant (PANC), known as munguba, monguba, chestnut, wild cocoa. Native from southern Mexico to northern South America, it is often found in wetlands and riparian forests (PEIXOTO, 2002). It is a species widely used in urban afforestation in many cities in Brazil (KINUPP; LORENZI, 2014).

Munguba fruits have a high concentration of oils and proteins and can be eaten raw, roasted, cooked, or roasted (JORGE; LUZIA, 2012). Flowers and leaves are used in food, and when ground or crushed the seeds become an excellent flour for various preparations (KINUPP; LORENZI, 2014).

According to Silva, Bora, and Azevedo (2010) vegetable protein is an alternative to animal protein due to its efficient substitution and a wide variety of sources such as legumes, cereals, and oilseeds. In this sense, the search for new protein alternatives has been carried out to improve the human diet and provide a better use of available resources.

Munguba is a plant with potential exploitation for human consumption and little known by the population. Thus, this work aimed to carry out a comparative analysis of the proximate composition of the munguba almonds (*P. aquatica*) and their possible dietary alternatives.

## 2 METHODOLOGY

The work started in November 2018 at the Municipal School Sister Edith Coelho Netto, in the neighborhood of Jardim Colúmbia in Campo Grande, MS (Latitude: -20.41688; Longitude: -54.62676). The Municipal School Sister Edith Coelho Netto, founded in February 1993, is a public elementary school, which takes care of early childhood education until the ninth grade of elementary school, in the morning and afternoon periods.

The work was carried out with students of the scientific initiation project of the school science laboratory, having as object of work the munguba, a plant from the region (Figure 1).

Figure 1. *P. aquatica* in Municipal School Sister Edith Coelho Netto.



Source: Authors, 2019.

The research consisted of a qualitative and quantitative study according to the work of Manzato & Santos (2012) with the following procedures: questionnaire carried out with the parents of the students, physical-chemical analyzes of the munguba almonds, and the preparation of food recipes for dissemination in the local community.

## 2.1 QUESTIONNAIRE:

The questionnaire was carried out with the parents of the students of the kindergarten and 1st year of elementary school classes. The questionnaire was also conducted with the external community: students of scientific initiation approached the residents of the Columbia Garden neighborhood and asked questions related to munguba.

When interviewing the participants (a total of 67 volunteers) the fruit of the munguba was taken so that they could visualize the object of the research (Figure 2).

The questions asked were:

- a) Have you seen this fruit? Yes or no;
- b) Have you ever eaten this fruit? Yes or no.

Figure 2. Fruits of *P. aquatica*.

Source: Authors, 2019.

## 2.2 SEED COLLECTION AND PHYSICAL CHEMICAL ANALYSIS:

The seeds were collected and peeled and then the almonds were taken to the domestic oven, at a temperature of 180°C for 30 min for drying.

For the study of physical and chemical analyzes, the centesimal composition was performed. The proximate composition indicates the percentage, by mass, of each element that constitutes a substance. In other words, it tells us the mass (in grams) of each element present in 100 grams of the substance.

The study of the proximate composition of almonds for moisture, ash, protein, and lipids used analytical techniques based on the methodology proposed by Jorge and Luzia (2012). Carbohydrates were determined by titration with Fehling's solution after hydrolysis with hydrochloric acid and the results are expressed as total carbohydrates in glucose. The samples were analyzed in the Physical Chemistry of Food laboratory at the Federal University of Mato Grosso do Sul, in Campo Grande - MS.

## 2.3 FOOD RECIPES:

Food recipes were made from the seeds and leaves of the munguba. The recipes were created and/or reproduced and tested in the laboratory and kitchen of Escola Irmã Edith Coelho Netto.

The following recipes were tried/tested: roasted munguba nuts, bonbons with munguba nuts, and salted munguba cream. A total of 17 teachers tasted the recipes. It is

worth noting that during the testing of the recipes, the participants said whether they approved or not and what kind of suggestions and/or criticisms they presented.

### 3 RESULTS AND DISSCUSSION

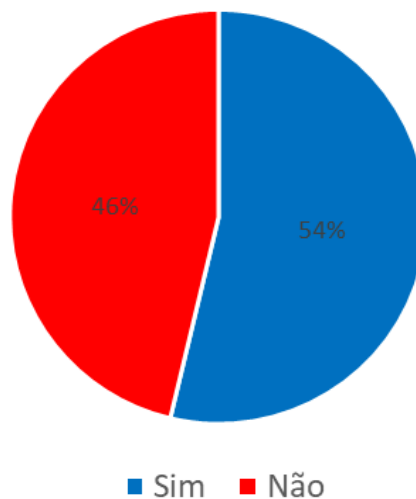
#### 3.1 QUESTIONNAIRE:

67 volunteers participated in the interview who answered the following questions. a) Have you seen this fruit, Munguba (*P. aquatica*)? Yes or no?

It was observed that 53.73% (36 people) answered that they had already seen the munguba and 46, 27% (31 people) reported never having seen it (Figure 3).

Figure 3. Questionnaire about the knowledge of munguba with volunteers.

Você já viu essa fruta?



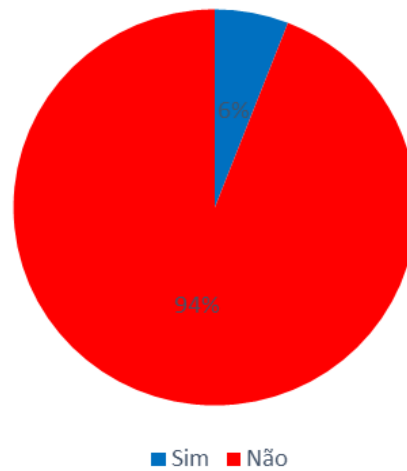
Source: Authors, 2019.

b) Have you ever eaten this fruit (*P. aquatica*)? Yes or no?

Of the respondents, 94.09% reported the fact that they had never eaten any recipe with the munguba and only 5.91% said they had already eaten (Figure 4).

Figure 4. Questionnaire on the knowledge of munguba carried out with volunteers.

### Você Já comeu essa fruta?



Source: Authors, 2019.

From the graphs above, it can be seen that people in the community have already seen the munguba in a certain location, however, they are unaware of its nutritional potential and its benefits. Magalhães et al. (2019) when working on analysis and acceptance of the use of the bread recipe with ora-pro-nobis (*Pereskia aculeata*), an unconventional food plant, as well as munguba, also showed that only 6% of interviews knew the plant and only 4% of the participants had already consumed it in some preparation.

Studies have indicated that munguba (*P. aquatica*) have high levels of lipids and proteins (POLIZELLI et al. 2008; OLIVEIRA et al. 2000). These indications reveal the importance of this plant within a food context.

Munguba is a species of cultivation that is very adaptable and produces edible fruits in large quantities. Such fruits are very appreciated by the Amazonian communities, and, unknown in other regions of Brazil. Due to their versatility, they can be consumed raw, roasted, boiled, or roasted (JORGE; LUZIA, 2012). The transformation of fruit into flour gives versatility to various recipes, such as bread and pancakes. Although little known by the local community, munguba can be a low-cost food alternative contributing to an affordable, healthy, and balanced diet.

### 3.2 CENTESIMAL COMPOSITION:

Chart 1 presents the results of the proximate composition of munguba almonds (experiment) and a comparative analysis with other works (LOPES et al. 2017; AZEVEDO, 2008; SILVA; BORA; AZEVEDO, 2010).

Chart 1. Proximate composition of almonds from *P. aquatica* (Experiment 1) and a comparative analysis with other works.

| <b>Análise</b> | <b>Experimento<sup>1</sup></b> | <b>Lopes et al.<sup>2</sup></b> | <b>Azevedo<sup>3</sup></b> | <b>Silva et al.<sup>4</sup></b> |
|----------------|--------------------------------|---------------------------------|----------------------------|---------------------------------|
| Umidade        | 3,25%                          | 3,47%                           | 5,52%                      | 5,53%                           |
| Cinzas         | 4,88%                          | 7,49%                           | 4,83%                      | 4,89%                           |
| Lipídeos       | 36,74%                         | 52,76%                          | 46,37%                     | 46,62%                          |
| Proteínas      | 11,49%                         | 11,74%                          | 14,43%                     | 13,75%                          |
| Carboidrato    | 26,17%                         | 27,99%                          | 28,85%                     | 29,20%                          |

Source: Authors (2019) <sup>1</sup>; Lopes et al. (2017) <sup>2</sup>; Azevedo (2008) <sup>3</sup>; Silva; Bora; Azevedo, 2010<sup>4</sup>.

Of the components analyzed, there is a high content for lipids, with a value of 36.74% and with relevant amounts of carbohydrates (26.17%) and proteins (11.49%). Values for humidity were 3.25% and ashes 4.88%.

Jorge e Luiza (2012) analisando as características químico nutricionais de espécies de sementes da munguba no interior de São Paulo alcançaram para a semente da *P. aquatica* um teor de lipídios (38,39%) e proteínas (11,86%), semelhantes aos índices encontrados neste estudo (lipídeos 36,74% e proteínas 11,49%).

The difference in values of the chemical composition of the munguba when compared to the other studies (Table 1), due to the procedures and drying time. Azevedo (2008) and Silva, Bora, and Azevedo (2010) used for circulating air oven drying for 48h and 24h, respectively. In relation to the work of Lopes et al. (2017), the domestic oven was used for drying for 60 minutes.

Silva, Azevedo, and Azevedo (2015) reported that these differences in relation to the centesimal composition are due to the climatic variations of each region, as well as the conditions of maturation of the species. Jorge and Luzia (2012) highlight that the way the plant was cultivated can determine the differences in the composition of the munguba seeds.

Oilseed plants are potentially used in food systems in manufactures or direct use for human and animal food (CAVALCANTI; BORA; CARVAJAL, 2009). *P. aquatica* seeds are promising in terms of their proximate composition, especially because they are

rich in proteins and lipids, thus being an interesting source for economic exploration (SILVA; AZEVEDO; AZEVEDO, 2015).

### 3.3 FOOD RECIPES:

The following recipes were tested:

- Roasted chestnuts: The munguba seeds were sliced and roasted in a conventional oven, stirring from time to time until they are crunchy;
- Candy: the seeds were peeled and taken to the domestic oven at 180 ° C for 30 min. Then, the seeds were crushed and placed in a container. Coconut oil and brown sugar were added to the seeds. The mixture was placed in silicone molds and taken to the freezer for 2 hours.
- Salty cream: Young munguba leaves were cleaned and then bleached. The bleaching consisted of, after washing the munguba leaves, adding them to a container with boiling water for one minute. Then, to stop the cooking process, the vegetable was placed in ice water. After bleaching, the leaves were finely chopped and sautéed with various spices (onion, garlic, green smell). The mixture was brought to the blender with sour cream, and then strained and served.

The seventeen (17) teachers who tried the recipes approved and reported that they should be passed on to the other members of the school. The recipes were tested to disseminate to the local community the nutritional benefits of munguba (a very common plant in the region where the school is located) through activities within the school space, such as mini-lectures and distribution of recipes.

## 4 CONCLUSION

Plants with great food potential must be related to what the local environment can provide. The interesting thing is not to import food, but to maximize what can be offered around a certain location, in an accessible way.

All regions of the country have great potential for exploring unconventional food plants (PANC) because there are many varieties of species. A diverse and varied diet brings all the nutrients that our organism needs and PANCs are a great way for an adequate, healthy, and responsible diet that our object of study proposes.

The munguba is a very common plant in the region, however not known by the community. It has an expressive nutritional potential, which can be used in different parts of the species such as flowers, leaves, and seeds. And so, complement and diversify food,

in a varied, accessible, economical, and healthy way. Thus, it is a food alternative for different tastes, tastes and can be used to increase menus in homes and commercial establishments.

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