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ANÁLISE SENSORIAL DE MANDIOCA DE MESA NA SERRA DA IBIAPABA-CE

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RESUMO: O objetivo deste trabalho foi avaliar a qualidade, sabor e aceitabilidade de 4 variedades de mandioca de mesa (Bom na Mesa, Crivela, Água Morna Branca e Água Morna Amarela), cultivadas no campo experimental do IFCE, campus Tianguá- CE. Para tal avaliação foi usado o tempo de cocção das variedades e uma análise sensorial por meio da escala hedônica que vai de 1 (desgostei muitíssimo) a 9 (gostei muitíssimo) com 30 provadores não treinados, para os seguintes critérios: aparência, sabor, textura e impressão global. Para o tempo de cocção, o tempo médio variou de 15 minutos (Bom na Mesa) a 46 minutos (Água Morna Branca). Para os atributos sensoriais analisados, todos tiveram a média entre 6(gostei ligeiramente) a 8(gostei muito). Para as variedades testadas, houve uma maior aceitação para variedade Bom na Mesa em três atributos (sabor, textura e impressão global). Para o atributo aparência, a variedade Água Morna Amarela apresentou a melhor nota (8,50). A variedade Água Morna Branca apresentou as piores notas nos quatros atributos analisados (aparência, sabor, textura e impressão global).

Palavras-chave: *Manihot esculenta* Crantz, escala hedônica, qualidade de mandioca.

SENSORY ANALYSIS OF TABLE CASSAVA IN THE SERRA DA IBIAPABA- CE

ABSTRACT: The objective of this study was to evaluate the quality, flavor and acceptability of 4 varieties of table cassava (Bom na Mesa, Crivela, Água Morna Branca and Água Morna Amarela) cultivated in the experimental field of the IFCE, Tianguá-CE campus. For this evaluation, the cooking time of the varieties and a sensory analysis using a hedonic scale ranging from 1 (I truly disliked it) to 9 (I truly I liked it) with 30 untrained tasters for the following criteria: appearance, flavor, texture and overall impression. The average cooking time varied from 15 minutes (Bom na Mesa) to 46 minutes (Água Morna Branca). For the sensory attributes analyzed, all had an average of 6 (liked slightly) at 8 (I truly (liked)). For the varieties tested, the three attributes (flavor, texture and global impression) of the Bom na Mesa variety were most highly accepted. For the appearance attribute, the Água Morna Amarela variety presented the best score (8.50). The Água Morna Branca variety presented the worst scores for the four attributes analyzed (appearance, flavor, texture and global impression).

Keywords: *Manihot esculenta* Crantz, hedonic scale, quality of cassava

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1 INTRODUCTION

Cassava (*Manihot) sculpting Crantz* is a perennial shrub belonging to the Euphorbiaceae family. Its cultivation originated in Latin America, in Brazil, initially by indigenous people, and was later widely spread to other continents. According to Souza (2017), its origin was probably in Brazil, with the product being disseminated to other continents by the Portuguese and Spanish during the colonial period.

For Farias, Seixas According to Filho and Miranda (2019), cassava has undeniable historical and cultural value in Brazil, where a range of derived products of inestimable social and economic value are produced. From the colonial period, when it began to gain status in records through Portuguese letters, to the present day, cassava contributes as a staple food for the development and construction of Brazil.

According to the FAO (2021), the world's largest cassava producers are Nigeria, with 20% production, followed by the Democratic Republic of Congo (14.5%), Thailand (9.6%), Ghana (7.2%), and Brazil, with the 5th position in global production, with a 5.7% share. Currently, Brazilian cassava production reaches almost 19 million tons of roots (IBGE, 2023a), with the North region, with the state of Pará being the largest producer, producing 3.77 million tons, with the municipality of Acará having the highest production, followed by the state of Paraná, with a production of 3.38 million tons and São Paulo with 1.66 million tons (IBGE, 2023b**).** The state of Ceará is in the 7th position, with a root production of 728,000 tons, with the municipality of Salitre being the largest cassava producer in the state (IBGE, 2023c**).**

According to Feltran *et al.* (2023), cassava cultivation requires few inputs for its production, which makes it sustainable even under conditions of low-fertility soils and lower-technology cultivation. This allows its adaptation to low-impact production systems or even organic farming. For this reason, it is present in many marginal environments, in rural backyards, and in urban and peri-urban agriculture. Cassava plants exhibit high adaptability to stressful environments and can be cultivated where other crops cannot produce adequately. This occurs through physiological adjustments in the plant's water use system and through associations with microorganisms—vesicular–arbuscular mycorrhizae and diazotrophic bacteria—that ensure the absorption of phosphorus (P) and nitrogen (N), respectively.

It is also a source of carbohydrates, second only to rice and corn. In addition to being consumed *raw* (cooked or fried), it generates byproducts such as flour, beiju (a type of flatbread), tapioca, starch, and tacacá (a traditional Amazonian dish), among others. Therefore, cassava is considered a multipurpose crop, serving as food for families, animal feed, and raw material for a variety of products, generating more added value, including its significant participation in high-tech products such as fine cosmetics, unrefined flour, and even high-tech starch gel. FAO (2013).

For human consumption, it is necessary to pay attention to the levels of cyanogenic compounds (linamarase and lotaustralin enzymes) present in the root, as these compounds release hydrocyanic acid, which is considered toxic. According to Zago *et al.* (2016), sweet cassava, also known as table cassava, manioc, or macaxeira, has a hydrocyanic acid (HCN) content < 100 mg of HCN per kg of fresh root. Moreover, bitter cassava, also called poisonous cassava, has an HCN content > 100 mg per kg of fresh root and is therefore used in byproducts such as flours and starch.

To reduce cyanogenic levels, processing the roots—cooking and high temperatures—is recommended. However, cooking is less efficient at eliminating cyanogenic compounds, which is why cassava for table consumption needs to have lower HCN levels.

The Serra da Ibiapaba region stands out for its significant cassava production, mainly for family farming. However, many questions remain regarding the organoleptic differences and potential of each variety. Therefore, this research aimed to demonstrate the differences in appearance/color, flavor, and texture through

a presentation and tasting of the four varieties studied. Specifically, this work aimed to evaluate the cooking time and sensory analysis of four varieties of table cassava (Bom na Mesa, Crivela, Água Morna Branca, and Água Morna Amarela) cultivated in Serra da Ibiapaba, Ceará, Brazil.

2 MATERIALS AND METHODS

The work was developed at the Plant Production Technology Laboratory (TPOV), and the cassava varieties were cultivated in the Vegetable Crops sector of IFCE Campus Tianguá-CE, located in the Ibiapaba Microregion, Northwest Mesoregion of Ceará. The region's climate is of type Aw, meaning tropical with a dry winter season and summer rains, with an average temperature of the coldest month greater than or equal to 18°C and rainfall of the driest month less than 30 mm. The municipality's geographical location is defined by the coordinates 03° 43' 93" south latitude and 41° 00' 74" west longitude, with an altitude of 778 m. The soil in the experimental area has a sandy loam texture, and before the experiment was set up, simple soil samples from the 0–20 cm layer were collected and transformed into a composite sample for fertility assessment (Table 1).

Table 1. Chemical characteristics and texture of the soil in the experimental area.

Chemical characteristics [1]												
Prof[1].	pH	P	K	Ca	Mg	Na	Al	H+Al	SB	CTC	V	M.O
cm	H_2O	mg dm^{-3}	----------	$cmol_c\ dm^{-3}$	----------						%	g kg^{-1}
0 - 20	5.8	0.01	12	1.05	0.44	0.0	0.09	2.66	1.52	4.18	36.36	7.5

Physical characteristics				
Prof.	Sand	Silt	Clay	Textural classification
cm		%		
0 - 20	87.0	2.6	10.4	Sand

[1.] Depth; P and K extractor, Mehlich $^{-1}$; Cation exchange capacity (CEC); Base saturation percentage (V); Organic matter (OM)

Five plants of each cassava variety (Bom na Mesa, Crivela, Água Morna Branca, and Água Morna Amarela) were randomly collected on January 27, 2025, and processed on the same day, 12 months after planting. in the experimental area of the IFCE campus, Tianguá-CE. Immediately afterwards, the material was removed, peeled, and 2 kg was subjected to cooking of the raw pulp in 2.5 L of boiling water in a Tramontina brand pan, with 25 g (1%) of salt, carried out in the TPOV Laboratory, following all the standards of the Good Practices for Food Services Handbook (ANVISA, 2004)**.** This procedure was performed on the four varieties of cassava.

The cooking time was considered the moment the processed roots were placed in boiling water. The ideal cooking point was determined empirically through visual analysis of color, appearance, and texture, using a fork to determine the ideal cooking point, characterized by the moment when the raw material offered no resistance to being pierced by the fork.

For quality and acceptability assessment, 10 kg of cassava of each variety was cooked separately and subjected to sensory evaluation. Thirty untrained tasters were randomly selected from the mixed common area for students, teachers, and staff of the Federal Institute of Ceará, Tianguá campus. The analysis was conducted with the tasters having contact with one variety at a time and assigning a score to the analyzed variables using a 9-point hedonic scale, with evaluation scores: 1 = disliked very much; 2 = disliked a lot; 3 = disliked moderately; 4 = disliked slightly; 5 = indifferent; 6 = liked slightly; 7 = liked moderately; 8 = liked a lot; and 9 = liked very much.

Each cassava sample was identified and analyzed on the basis of the following attributes: appearance, flavor, texture, and overall impression. Samples were provided to

each taster on glass plates with stainless steel forks, along with evaluation forms.

For comparisons between means, ANOVA was used, with Tukey's test at a 5% probability level, and with the aid of the SISVAR statistical analysis program. (Ferreira, 2011).

3 RESULTS AND DISCUSSION

Table 2 shows the cooking time data for each variety of cassava for table consumption and the characteristics of the pulp color after cooking for each variety. The average cooking time of the roots refers to plants harvested 12 months after planting. Among the average cooking times for the four varieties studied, the Água Branca Morna variety exceeded 30 minutes, which is considered unsatisfactory for cassava cultivars intended for table consumption. Cooking times ranged from 15 minutes (Bom na Mesa) to 46 minutes (Água Morna Branca). The cooking data for the four varieties revealed that the two varieties were below the overall average cooking time, which was 29 minutes (Bom na Mesa and Crivela).

Table 2. Characteristics of the roots of four varieties of table cassava at different cooking times 12 months after planting.

Varieties	Cooking time (min)	Color of the pulp (after cooking)
Good at the Table	15'	Cream
Crivella	25'	Yellow
Warm White Water	46'	White
Warm Yellow Water	30'	Yellow

When the quality of cassava for consumption is considered, the first attributes that are relevant for the acceptance of the roots are cooking time and texture. The most recommended cooking time is less than 30 minutes (15 to 20 minutes is best). The most acceptable texture is that of a crumbly texture, which is considered brittle and easily mashed with a fork after cooking.

Using the hedonic scale (Table 3), we can observe that for the appearance attribute, the Água Morna Branca variety (6.93) differed statistically from the Bom na Mesa (8.07), Crivela (8.30), and Água Morna Amarela (8.50) varieties. The variety that presented the best score according to the hedonic scale was Água Morna Amarela, and the worst score was for Água Morna Branca.

Table 3. Results of the sensory analysis, using the hedonic scale for table cassava, with four attributes evaluated: appearance, flavor, texture, and overall impression.

Variety	Appearance**	Flavor**	Texture**	Global Impression**
Good at the Table	8.07a	8.13a	8.23a	8.20b
Crivella	8.30a	7.30ab	7.47ab	7.63b
Warm White Water	6.93b	6.57b	6.83b	6.67a
Warm Yellow Water	8.50a	7.67a	7.40ab	7.63b

Means followed by the same lowercase letter in the column do not differ from each other at a 5% probability level according to Tukey's test. ** significant at 1%, * significant at 5%, and ns: not significant according to Tukey's test.

With respect to the attribute of flavor, the varieties Bom na Mesa (8.13), Água Morna Amarela (7.67), and Crivela (7.30) did not differ statistically from each other, nor did the varieties Crivela (7.30) and Água Morna Branca (6.57). The best score was given to Bom na Mesa, and the variety with the worst score was Água Morna Branca. For the attribute of Texture, the varieties Bom na Mesa (8.23), Crivela (7.47), and Água Morna Amarela (7.40) did not differ statistically from each other, nor did the varieties Crivela (7.47), Água Morna

Branca (6.83), and Água Morna Amarela (7.40). The variety with the best score was Bom na Mesa, and the variety with the worst score was Água Morna Branca.

For the last attribute analyzed, which is Overall Impression, the Água Morna Branca variety (6.67) differs statistically from the other varieties. The Bom na Mesa (8.20), Crivela (7.63), and Água Morna Amarela (7.63) varieties do not differ from each other. The variety with the highest score was Bom na Mesa, and the variety with the lowest score was Água Morna Branca.

With respect to the averages for the attributes used on the hedonic scale (Table 3), we can observe that the Bom na Mesa variety presented the best scores for three attributes: flavor (8.13), texture (8.23), and overall impression (8.20). For the appearance attribute, the Água Morna Amarela variety presented the best score (8.50). The Água Morna Branca variety presented the worst scores for the four attributes analyzed: Appearance (6.93), Flavor (6.57), Texture (6.83), and Overall Impression (6.67).

The varieties of cassava used for table consumption are usually named after popular sayings; therefore, no studies were found for the cultivars studied in this work. Compared with those in other studies on varieties of cassava for table consumption, the cooking times analyzed in this work were longer than the maximum obtained by Reis *et al*. (2022). 41.6 minutes; lower than the minimum observed by Rodrigues *et al.* (2018), 17 minutes, and with a time equal to the minimum value and higher than the maximum value observed by Pedri *et al. (*2018), 15 minutes and 35 minutes, respectively. The overall average cooking time for the four varieties analyzed was 29 minutes, which is considered acceptable for a table variety (30 minutes).

The hedonic scale measures the level of liking and the degree of acceptability of a product, with 9 to 6 being considered acceptable and 1 to 4 indicating rejection. It is the most widely used method because of its ease of understanding. According to Stone and Sidel (1993), the hedonic scale is a tool used to measure the liking or disliking of a particular product and is among the most widely used tools in sensory testing.

With respect to the acceptability of cassava for table consumption using the hedonic scale, the varieties were well received, as the overall impression attribute ranged from 'I liked it slightly' to 'I liked it very much'.

4 CONCLUSIONS

For the cooking time evaluation, the average time ranged from 15 minutes (Bom na Mesa) to 46 minutes (Água Morna Branca), considering the optimal cooking time for the Bom na Mesa (17 minutes), Crivela (25 minutes), and Água Morna Amarela (30 minutes) varieties. The Água Morna Branca variety had an unsatisfactory cooking time of 46 minutes.

The cooking time was satisfactory for the Bom na Mesa (15 minutes), Crivela (25 minutes), and Água Morna Amarela (30 minutes) varieties. The Água Morna Branca variety had an unsatisfactory cooking time of 46 minutes.

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