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Caracterização física e biométrica da variedade de jabuticaba *'Pingo De Mel'* oriunda de cerrado goiano

Physical and biometric characterization of jabuticaba variety *'Pingo De Mel'* oriunda of cerrado goiano

Caracterización física y biométrica de la variedad de jabuticaba *'Pingo De Mel'* oriunda de cerrado goiano

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Resumo

A caracterização biométrica e física do fruto pode fornecer informações sobre formato, rendimento, concentração de sólidos solúveis. O objetivo foi caracterizar física e biometricamente a variedade de jabuticaba *'Pingo de mel'* do cerrado de Goiás. Foram utilizadas 200 jabuticabas. Foram determinados o teor de sólidos solúveis totais, os diâmetros longitudinal e transversal, a massa total, o volume, o índice de forma, a densidade, o

rendimento da polpa descascada e a espessura da polpa descascada. O teor de sólidos solúveis totais 15,16 ° Brix, sólidos solúveis é uma das ferramentas mais importantes para estimar a qualidade dos frutos. O diâmetro longitudinal e transversal foi 22,25 e 21,56 mm, respectivamente. A massa total teve uma variação média porque o coeficiente de variação estava acima de 20%. Variações podem ocorrer devido às técnicas de cultivo e o clima pode estar relacionado a isso também variações apresentadas para o volume desse fruto. Quanto ao índice de formato, o fruto foi classificado como redondo. A densidade era de 8,35 g mL^{-1}, o rendimento e a espessura da polpa já eram altos. Amostras de sólidos solúveis totais e produtividade são parâmetros utilizados como controle e seleção pela indústria de alimentos, ou seja, os frutos em avaliação apresentaram bom potencial de processamento industrial.

Palavras-chave: Biometria; Fruta tropical; Processamento industrial.

Abstract

The biometric and physical characterization can provide information on format, yield, concentration of soluble solids. The objective was to characterize physically and biometrically the jabuticaba variety 'Pingo de mel' from the cerrado of Goiás. 200 jaboticaba were used. The content of total soluble solids, longitudinal and transverse diameters, total mass, volume, shape index, density, yield of peeled pulp and the thickness of the peeled pulp were determined. The total soluble solids 15,16 ° Brix, soluble solids content is one of the most important tools to estimate fruit quality. The longitudinal and transverse diameter was 22.25 and 21.56 mm, respectively. The total mass had an average variation because the coefficient of variation was above 20%. Variations can occur due to cultivation techniques and climate can be related to this also variations presented for the volume of this fruit. As for the format index, the fruit was classified as round. The density was 8.35 g mL -1, yield and pulp thickness were already high. Samples of total soluble solids and yield are parameters used as control and selection by the food industry, it means that the fruits in evaluation presented good potential of industrial processing.

Keywords: Biometrics; Tropical fruit; Industrial processing.

Resumen

La caracterización biométrica y física puede proporcionar información sobre formato, rendimiento, concentración de sólidos solubles. El objetivo fue caracterizar física y biométricamente la variedad de jabuticaba 'Pingo de mel' del cerrado de Goiás. Se utilizaron

200 jaboticaba. Se determinó el contenido de sólidos solubles totales, diámetros longitudinales y transversales, masa total, volumen, índice de forma, densidad, rendimiento de pulpa pelada y el grosor de la pulpa pelada. El total de sólidos solubles 15,16 ° Brix, el contenido de sólidos solubles es una de las herramientas más importantes para estimar la calidad de la fruta. El diámetro longitudinal y transversal fue de 22.25 y 21.56 mm, respectivamente. La masa total tuvo una variación promedio porque el coeficiente de variación fue superior al 20%. Las variaciones pueden ocurrir debido a las técnicas de cultivo y el clima puede estar relacionado con esto, también las variaciones presentadas para el volumen de esta fruta. En cuanto al índice de formato, la fruta se clasificó como redonda. La densidad era de 8,35 g mL -1, el rendimiento y el grosor de la pulpa ya eran altos. Las muestras de sólidos solubles totales y rendimiento son parámetros utilizados como control y selección por la industria alimentaria, lo que significa que las frutas en evaluación presentaron un buen potencial de procesamiento industrial.

Palabras clave: biometría; Fruta tropical ; Procesamiento industrial.

1. Introduction

Among the native species of importance in Brazil, jabuticabeira (*Myrciaria sp*), belonging to the *Myrtaceae* family, stands out, whose fruits are highly perishable, presenting a short period of use due to its high content of water and sugars. After harvesting, the fruit has a shelf life of approximately three days, which impairs its commercialization (Ascheri et al., 2006; Sato & Cunha, 2009). It is a tropical fruit of great nutritional value, possessing high content of carbohydrates, fibers, vitamins, flavonoids and mineral salts like iron, calcium and phosphorus mainly, in its bark (Ascheri et al., 2006).

The species M. cauliflora is the most widespread in Brazil, being the main varieties: *M. cauliflora (DC) Berg (*jabuticaba paulista or jabuticaba ponhem or jabuticaba assu) and *M. cauliflora (Vell) Berg* (jabuticaba sabará) that produce fruits suitable for both industry and in natura consumption (Donadio, 2000, Mattos, 1983). The average size of the jabuticabeira was 8 m tall, with a smooth, reddish trunk with flowers emerging directly on small nodules on the trunk or on branches not very thin (Casagrande Junior et al., 2000).

The fruits are presented in the form of a globose berry, up to 3 cm in diameter, reddish bark, almost black, whitish, mucilaginous, sweet-sour, tasty, commonly with single seed, but

may present up to four (Lima et al., 2008). Among the forms of industrialization of jabuticaba is the production of frozen pulps, nectar, jelly, sweets in bulk, paste and syrup (Matta et al., 2005).

The biometric characteristics of the fruits generate important information, allowing the differentiation of species, through knowledge of weight, width, length, diameter, volume being an instrument to classify the fruits (Cruz et al., 2001). For Cardoso and Lomônaco (2003); Pinto et al., (2003) the biometry of fruits and seeds have importance for taxonomy, for the identification of varieties and to verify the occurrence of phenotypic variations. The objective of this research was to characterize physically and biometrically the jabuticaba variety 'Pingo de mel' from the cerrado of Goiás.

2. Methods

In the present study, the quantitative method was used to evaluate the data. This method generates sets or masses of data that can be analyzed using mathematical techniques such as percentages, statistics and probabilities, numerical methods, analytical methods and generation of equations and / or mathematical formulas applicable to any process. (Pereira et al., 2018).

The jabuticabas, from natural vegetation, located on the banks of BR 060, km 22 in Rio Verde - GO, were harvested manually in November 2017. After collection the fruits were packed in 30 x 40 polyethylene bags cm and placed in thermal boxes, transported to the Laboratory of Fruits and Vegetables of the IFGoiano - Campus Rio Verde - Goiás, where they were selected as to size, color and absence of mechanical injuries, and those that did not present any signs of fermentation, followed with a prewash and sanitization in chlorinated water at 150 ppm for 15 minutes and dried on paper towel. For the characterization of the morphological and physical analyzes, 200 jabuticaba were randomly selected.

The longitudinal and transverse diameters of the jabuticabas were measured using a digital-precision caliper ± 0.4mm (DIGIMESS-100.212, São Paulo-SP, Brazil), and denominated larger diameter (D1) and smaller diameter (D2). The fruit format index was calculated based on the methodology described by Brunini et al. (2004) (Equation 1).

$$\text{Format Index (mm)} = \frac{D1}{D2} \quad (1)$$

The fruit volume was obtained by means of a precision digital scale (0.1 mg) (CELTAC-Fa2104n, Tijucas do Sul-PR, Brazil). The fruit density was calculated (Equation 2).

$$\text{Density (g mL}^{-1}\text{)} = \frac{\text{fruit mass}}{\text{fruit volume}} \quad (2)$$

The fruit seed was removed by manual extraction (SOARES, 2015) and the seed mass obtained by weighing. The fruits were individually characterized for yield of pulp with film following methodology described by Melo et al. (2013). Equation 3 was used for the calculation.

$$\text{Yield of pulp with bark (\%)} = \left(\frac{\text{fruit mass-seed mass}}{\text{fruit mass}}\right) \times 100 \quad (3)$$

The length (h), the largest diameter (d1) and the smallest diameter (d2) of the seed were measured with a caliper (SOARES, 2015). For the calculation of the thickness of the pulp with bark (Equation 4) given by the larger diameter of the fruit o (D1) and larger diameter of the seed (d1).

$$\text{Thickness of the pulp with bark (mm)} = \left(\frac{D1\text{-}d1}{2}\right) \quad (4)$$

Total soluble solids (TSS) were determined using refractometer (KRUSS-DR 301-95, Hamburg, Germany) according to method nº 932.12 described by AOAC (2010) and expressed in ° Brix.

The data were analyzed by normality and descriptive statistics through the statistical program ASSISTAT version 7.7 beta, obtaining the maximum, average, minimum and standard deviation values.

3. Results and Discussion

The values found for the physical and biometric analyzes of the jabuticabas are expressed in Table 1, in which the values are arranged in mean, maximum, minimum and standard deviation.

Table 1 - Values of the physical and biometric characteristics of jabuticabas under study.

INDEXES	Medium	SD	Minimum	Maximum	CV (%)
Total soluble solids (° Brix)	15.16	1.95	10.70	19.70	12.88
Longitudinal diameter (mm)	22.25	1.16	19.87	25.51	5.21
Cross-sectional diameter (mm)	21.56	1.22	19.51	25.23	5.66
Total mass of jaboticaba (g)	4.74	1.06	2.94	7.91	22.28
Volume of jaboticaba (mL)	0.58	0.09	0.40	0.80	15.20
Index of format (mm)	1.03	0.03	0.93	1.11	3.07
Density of jaboticaba (g mL^{-1})	8.35	2.13	4.57	18.36	25.48
Yield of pulp in bark (%)	92.30	1.81	86.46	96.23	1.96
Thickness of the pulp with rind (mm)	17.68	0.98	15.69	20.17	5.53

SD - standard deviation, CV - coefficient of variation

The mean SST (Table 1) was 15.16 °Brix, Lima et al. (2008) reports that soluble solids content is one of the most important tools for estimating fruit quality because it represents the concentration of sugars, organic acids and other minor constituents. Lima (2009) obtained in his study with jabuticaba Paulista 14.90 and Sabará 14.13. In this study, the effect of sugarcane on the shelf-life of sugarcane was similar to that of sugarcane (Fig. 1). It can be observed that the values oscillated because the minimum value was close to 10 °Brix and the maximum value close to 20 °Brix, with a coefficient of variation above 10 %

representing little uniformity of the samples for this index.

As for the mean longitudinal diameter that was 22.25 mm and the mean transversal diameter (Table 1), which was 21.56 mm, it can be said that the fruits presented homogeneity among the samples, since the coefficients of variation of both were close of 5 %. Jesus (2004) in a study with four groups of jabuticabeira from São Paulo observed mean values varying from 13.3 to 17.8 for the transverse diameter and from 12.1 to 16.4 for the longitudinal diameter, both values lower than those found for the jabuticabas of Goiás used in the present study. However, they corroborate with Oliveira et al. (2003) that observed a variation of 17.3 to 24.5 mm for transverse diameter and 17.7 to 24.7 mm for longitudinal diameter and Botezelli et al. (2000) states that the differences observed may be due to climatic and edaphic influences, that is, the environment may favor the expression of a certain characteristic that would not manifest in a different locality.

For the average of the total mass of the jabuticaba (Table 1) it is observed a mean variation since the CV (%) presented above 20 %. Lima (2009) observed higher values for mean total mass of 9.16 g and 8.26 for the Paulista and Sabará varieties, respectively. The average weight of the fruits can be affected by several factors such as irrigation, fertilization, harvesting season, maturation stage, cultural treatments and climate (Moscow, 1956).

However, the volume of the medium jabuticaba (Table 1) was 0.58 mL, however, the fruits presented low homogeneity among the samples because they obtained CV (%) above 15 %. Castro et al (2011) in a study with jabuticaba of the variety Sabará observed a variation in volume of 3.05 to 5.05 mL higher than that found in the present study. Probably this difference is given by being a different variety and diverse cultivation conditions and climate as well.

As for the medium format index (Table 1), which was 1.03 mm, it is possible to consider a good index since it presented a low coefficient of variation, Oliveira et al. (2003) observed a variation from 0.96 to 0.99 for the variety You will know in this index, corroborating with the jabuticaba in study. According to Penha (2013), the relation DL/DT is related to the shape of the fruits, being the fruit considered round when with values for this index are close to 1 (one). The jabuticabas in analysis can then be classified in round shape.

The average density of jaboticaba (Table 1) was 8.35 g mL^{-1}, but this parameter had the highest coefficient of variation demonstrating high variation and presented values of

minimum and maximum of 4.57 and 18.36 g mL^{-1}, respectively. While, Luengo (2005) determined density for several fruits and vegetables, obtaining for grape and plum a value of 0.36 g/cm^3. This index is important for the sizing of industrial equipment.

The yield of medium-bark pulp (Table 1) was 92.30 %. Lima et al. (2002) reported that fruits with a pulp yield greater than 50 % presented adequate conditions to be commercialized, since according to Chitarra & Chitarra (2005) the concentrate, purees, nectars, etc. the pulp yield is an important quality parameter. Fruit yield is a very variable factor, since it depends on adequate cultivation and irrigation techniques, favorable climatic conditions and mineral nutrition (Silva et al., 2010). It is worth mentioning that this index presented the lowest variation with a coefficient of variation close to 2 %.

The average thickness of the pulp with peel (Table 1) was 17.68 mm. It showed homogeneity for this index because it obtained CV (%) close to 5 %. This high value contributed to the high pulp yield of these fruits. For Bruckner et al. (2002), fruit intended for industry should preferably have a thin bark and filled internal cavity, having a high yield of juice.

4. Final Considerations

Evaluating the physicochemical parameters of the fruit is essential for the application of new food products, as well as the results obtained, to evaluate the fruit's potential for application in various products.

In the evaluation of jabuticaba 'pingo de mel' it was noticed that the content of total soluble solids was high, but there are products such as wine, for example, that a high content of this index is required. Another interesting characteristic observed was the pulp yield of this fruit, which was above 92% being an important attribute of industrial interest. Samples of total soluble solids and yield are parameters used as quality control and selection of fruits by the food industry, it means that the evaluated fruits presented good potential of industrial processing.

Jabuticaba is a fruit with benefits for application in other foods, either to taste or to add nutritional valu

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