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PHYSICAL, PHYSICOCHEMICAL, AND BIOACTIVE CHARACTERIZATION OF COQUINHO-AZEDO FRUITS (*Butia capitata*)

CARACTERIZAÇÃO FÍSICA, FÍSICO-QUÍMICA E BIOATIVA DE FRUTOS DE COQUINHO-AZEDO (*Butia capitata*)

CARACTERIZACIÓN FÍSICA, FÍSICO-QUÍMICA Y BIOACTIVA DE FRUTOS DE COQUINHO-AZEDO (*Butia capitata*)

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REMUNOM
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Abstract

Butia capitata is a native species of the Brazilian Cerrado with economic and functional potential; however, it remains poorly studied outside its natural distribution area. In this context, the objective of this study was to characterize the physical, physicochemical, and antioxidant attributes of fruits produced in southern Minas Gerais, Brazil. Biometric characteristics, fruit composition, color parameters (CIELAB), physicochemical quality of the pulp, and bioactive compounds were evaluated. The fruits showed dimensions consistent with the species, with an average mass of 9.92 g and high pulp yield (57.87%). Color analysis indicated a predominance of yellow tones, more intense in the pulp. Soluble solids (14.67 °Brix), titratable acidity (0.97%), and ratio (15.12) indicated a balanced sugar–acid profile. High levels of total phenolic compounds (135.32 mg GAE 100 g^{-1}) and strong antioxidant activity (90.01%) were observed. Overall, the fruits exhibited suitable characteristics for consumption and processing, with attributes consistent with those reported in the literature for the species. These results indicate potential for agroindustrial applications; however, the species' performance under different environmental conditions should be confirmed by comparative, multi-environment, and multi-season studies.

Palavras-chave: Native fruits; postharvest quality; phenolic compounds; antioxidant activity; agroindustrial potential

Resumo

O *Butia capitata* é uma espécie nativa do Cerrado com potencial econômico e funcional, porém ainda pouco estudada fora de sua área de ocorrência natural. Nesse contexto, o objetivo deste trabalho foi caracterizar os atributos físicos, físico-químicos e a atividade antioxidante de frutos produzidos no sul de Minas Gerais. Foram avaliadas características biométricas, composição do fruto, parâmetros de cor (CIELAB), qualidade físico-química da polpa e compostos bioativos. Os frutos apresentaram dimensões compatíveis com a espécie, com massa média de 9,92 g e elevado rendimento de polpa (57,87%). A coloração indicou predominância de tons amarelos, mais intensos na polpa. Os sólidos solúveis (14,67 °Brix), a acidez titulável (0,97%) e o ratio (15,12) evidenciaram equilíbrio entre açúcares e acidez. Foram observados elevados teores de compostos fenólicos totais (135,32 mg EAG 100 g^{-1}) e alta atividade antioxidante (90,01%). De modo geral, os frutos avaliados apresentaram características adequadas para consumo e processamento, com atributos compatíveis aos relatados na literatura para a espécie. Esses resultados indicam potencial de aplicação agroindustrial, devendo sua adaptação a diferentes condições de cultivo ser confirmada em estudos comparativos.

Palavras-chave: Frutos nativos; qualidade pós-colheita; compostos fenólicos; atividade antioxidante.

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Resumen

Butia capitata es una especie nativa del Cerrado con potencial económico y funcional; sin embargo, aún está poco estudiada fuera de su área de distribución natural. En este contexto, el objetivo de este trabajo fue caracterizar los atributos físicos, fisicoquímicos y la actividad antioxidante de frutos producidos en el sur de Minas Gerais. Se evaluaron características biométricas, composición del fruto, parámetros de color (CIELAB), calidad fisicoquímica de la pulpa y compuestos bioactivos. Los frutos presentaron dimensiones compatibles con la especie, con una masa media de 9,92 g y alto rendimiento de pulpa (57,87%). La coloración indicó predominio de tonos amarillos, más intensos en la pulpa. Los sólidos solubles (14,67 °Brix), la acidez titulable (0,97%) y el ratio (15,12) evidenciaron un equilibrio entre azúcares y acidez. Se observaron altos contenidos de compuestos fenólicos totales (135,32 mg EAG 100 g^{-1}) y elevada actividad antioxidante (90,01%). En general, los frutos evaluados presentaron características adecuadas para el consumo y el procesamiento, con atributos compatibles con los reportados en la literatura para la especie. Estos resultados indican potencial de aplicación agroindustrial; sin embargo, su adaptación a diferentes condiciones de cultivo debe ser confirmada en estudios comparativos.

Palabras clave: Frutos nativos; calidad poscosecha; compuestos fenólicos; actividad antioxidante.

1. Introduction

Butia capitata, popularly known as coquinho-azedo or *butiá*, is a palm species native to Brazil, with predominant occurrence in Cerrado areas, especially in the states of Minas Gerais, Bahia, and Goiás (Cidón *et al*., 2023). In Minas Gerais, it stands out mainly in the northern region of the state, where it has socioeconomic importance for extractive communities, being used for both consumption and income generation (Nascimento *et al*., 2020).

The fruits of this species have distinctive sensory characteristics, such as a sweet–acid flavor, and are widely used in the production of pulp, juices, jams, and other processed products (Da Fonseca *et al*., 2024). In addition, they present relevant nutritional and functional value due to the presence of bioactive compounds, such as phenolics, which are associated with antioxidant activity (Pereira *et al*., 2023).

Fruit quality is influenced by genetic and environmental factors, with edaphoclimatic conditions playing a determining role in fruit development, composition, and physical and chemical attributes (Singh *et al*., 2026). In this

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Pages: 1-17

context, the occurrence of the species in regions outside its natural distribution area may result in significant variations in fruit quality, especially in locations with different climatic conditions (Sá *et al*., 2020).

Although *Butia capitata* is more frequently found in Cerrado regions, there are records of its occurrence and production in other areas of Minas Gerais, such as the southern region, including the municipality of Lavras, which presents distinct climatic conditions characterized as Cwa, with dry winters and milder temperatures (Carvalho *et al*., 2024). These environmental differences may directly influence fruit development and their physicochemical and functional characteristics (Dias *et al*., 2022).

Despite the importance of the species, there is still limited information in the literature regarding the characterization of fruits produced outside their typical occurrence region, especially with respect to the description of their quality attributes under different cultivation conditions.

In this context, the present study is distinguished by evaluating fruits produced under edaphoclimatic conditions different from those considered ideal for the species, contributing to a preliminary understanding of its behavior under distinct environmental conditions.

The hypothesis is that fruits of *Butia capitata* produced outside their natural occurrence area present variations in their physical, physicochemical, and bioactive attributes, while maintaining characteristics of interest for consumption and processing.

Therefore, the objective of this study was to characterize the physical, physicochemical, and antioxidant attributes of *Butia capitata* fruits produced in southern Minas Gerais.

2. Material and methods

The experiment was conducted at the Fruit Growing Sector of the Department of Agriculture of the Federal University of Lavras (UFLA), in the municipality of Lavras, Minas Gerais, Brazil (21°14′ S, 44°59′ W, altitude of 919 m).

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Pages: 1-17

The regional climate is classified as Cwa (humid subtropical with dry winter), according to the Köppen classification (Dantas *et al*., 2007).

Fruits of *Butia capitata* (Mart.) Becc. were collected from four mother plants, approximately 10 years old, belonging to the Native and Exotic Fruit Plant Collection of UFLA, with approximately 75 fruits per plant. The sampling units were structured to represent sample variability; however, they do not correspond to independent experimental units in an inferential sense. Fruit collection was carried out in December 2025, at the yellow–orange maturity stage, visually characterized by the predominance of yellow coloration with orange tones on the peel, as described by Rodrigues *et al*. (2023).

After harvest, fruits were visually selected, and those presenting injuries or apparent damage were discarded. A total of 180 fruits were used. Subsequently, the fruits were disinfected in a sodium hypochlorite solution (100 ppm) for 15 minutes and dried at room temperature.

Physical parameters

Fruit length, diameter, and fresh mass were evaluated, as well as peel, pulp, and seed fresh mass. Length and diameter measurements were performed using a digital caliper, with results expressed in millimeters (mm), while masses were determined using an analytical balance and expressed in grams (g). Pulp yield was calculated and expressed as a percentage (%).

Fruit firmness was determined using a digital fruit penetrometer (FR-5120 Lutron), with a 2 mm tip, and results were expressed in Newtons (N).

Color analysis

Peel and pulp color were determined using a portable colorimeter (Konica Minolta, model CR-400), in the CIELab system, obtaining the parameters L* (lightness), a* (green to red variation), and b* (blue to yellow variation). Four readings per fruit were performed.

Physicochemical analyses

Fruits were manually pulped using stainless steel knives, and the pulp was homogenized. Physicochemical analyses were carried out according to AOAC (2005).

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Pages: 1-17

pH was determined by direct reading using a digital pH meter (Hanna Instruments, model pH 21), previously calibrated with buffer solutions at pH 4.0 and 7.0.

Soluble solids (SS) were determined using a portable digital refractometer, and results were expressed in °Brix.

Titratable acidity (TA) was determined by titration with sodium hydroxide solution, with results expressed as percentage (%).

The ratio was calculated as the relationship between soluble solids and titratable acidity (SS/TA).

Bioactive compounds

Extract preparation

Extracts were obtained according to Rufino et al. (2010), with adaptations. A total of 2.5 g of sample was weighed, and 20 mL of 50% methanol was added, remaining under agitation for 30 minutes protected from light. After filtration, the residue was subjected to a second extraction with 20 mL of 70% acetone in an ultrasonic bath for 30 minutes. The extracts were combined, and the volume was adjusted to 50 mL with distilled water, then stored in amber flasks under refrigeration until analysis.

Total phenolic compounds

Total phenolic content was determined using the Folin-Ciocalteu method (Paradiso *et al.*, 2018). In 96-well microplates, 30 µL of extract, 150 µL of Folin–Ciocalteu reagent (10%), and after 4 minutes, 120 µL of sodium carbonate (4%) were added. Absorbance was measured at 720 nm after 2 hours of incubation protected from light. Results were expressed as mg of gallic acid equivalents (GAE) per 100 g of sample.

Antioxidant activity (DPPH)

Antioxidant activity was determined using the DPPH method (Brand-Williams et al., 1995), with adaptations. The reaction mixture consisted of 0.1 mL of extract and 3.9 mL of ethanolic DPPH solution (6×10^{-2} mM). After 30 minutes of incubation in the dark, absorbance was measured at 515 nm.

The inhibition percentage was calculated according to the equation:

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Pages: 1-17

$$\% \text{ inhibition} = [(A_{control} - A_{sample}) / A_{control}] \times 100$$

Where:

$A_{control}$ = Absorbance of the initial DPPH solution.

A_{sample} = Absorbance of the reaction mixture after 30 minutes.

Moisture

Moisture content was determined according to AOAC (2005).

Statistical analysis

A total of 180 fruits were evaluated, organized into three sets of 60 fruits. Considering the descriptive nature of the study, the analyses were not intended for statistical inference, and the data were presented using descriptive statistics.

Since the study consisted of the characterization of a single sample group, without the application of treatments or experimental factors, no inferential statistical analyses or normality tests were performed.

Thus, the data were analyzed using descriptive statistics, including mean, standard deviation, minimum and maximum values, and coefficient of variation (CV%). Analyses were performed using Microsoft Excel® software, version 2025.

3. Results and discussion

Regarding the physical characteristics of the fruits (Table 1), *Butia capitata* showed an average length of 30.13 mm and a diameter of 23.62 mm. The range between minimum and maximum values was relatively low, indicating good uniformity among the evaluated fruits.

The fresh mass (Table 1) was 9.92 g, indicating adequate fruit development under the conditions in which they were produced. Regarding fruit composition, the pulp represented the main fraction, with an average mass of 5.74 g, while the seed and peel showed mean values of 1.97 g and 1.06 g, respectively. This distribution pattern is relevant, as it indicates a higher proportion of edible portion in relation to the other fruit structures (Machado *et al*., 2025).

A pulp yield of 57.87% was observed, which is a significant value considering the industrial potential of the species. This result suggests suitability for processing,

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Pages: 1-17

since higher yields are directly associated with greater efficiency in the production of derivatives such as pulp, juices, and other products. In this context, the evaluated fruits present favorable characteristics for both fresh consumption and agroindustrial use.

Table 1. Physical characteristics of coquinho-azedo fruits.

Variable (unit)	Mean	Standard deviation	Minimum	Maximum	Cv (%)
Fruit lenght (mm)	30.13	1.91	24.48	36.06	6.35
Fruit diameter (mm)	23.62	1.09	20.99	26.17	4.63
Fruit fresh mass (g)	9.92	0.23	9.69	10.14	2.30
Peel fresh mass (g)	1.06	0.06	1.02	1.11	5.64
Pulp fresh mass (g)	5.74	0.86	5.13	6.35	15.04
Seed fresh mass (g)	1.97	0.08	1.91	2.03	4.01
Pulp yield (%)	57.87	2.15	59.35	56.58	3.80

In a study evaluating the digital phenotyping of *B. capitata* fruits for genetic improvement (Souza *et al*., 2025), results similar to those found in the present study were observed regarding the physical characteristics of the fruits.

Based on the literature, it is observed that the fruits of *Butia capitata* showed dimensions and mass consistent with the standard described for the species (Souza *et al*., 2025), indicating that the cultivation conditions in southern Minas Gerais were suitable for fruit development. The observed uniformity suggests low variability among the evaluated individuals, which may be associated with both genetic factors and the relative stability of environmental conditions during fruit development (Sá *et al*., 2020). The greater predominance of pulp in relation to the other fruit fractions is a relevant aspect, as it is directly related to utilization potential (Sant'ana *et al*., 2026). Fruits with a higher proportion of pulp tend to present better industrial yield, which is particularly important for the production of derivatives (Hamda *et al*., 2024). In this sense, the observed pulp yield indicates that, even outside its typical occurrence area, the species maintains desirable characteristics for economic exploitation.

In addition, the distribution among pulp, peel, and seed can be explained by the physiological pattern of the species and may be influenced by factors such as

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Pages: 1-17

water availability, temperature, and radiation (Bacelar *et al*., 2024). In regions with climatic conditions different from those of the Cerrado, such as Lavras, these variables may affect growth and reserve accumulation in the fruits; however, in the present study, no significant limitations in this process were observed.

There are differences in color between peel and pulp (Table 2). In the peel, the values of L* (56.39), a* (20.79), and b* (70.45) indicate a light coloration, with predominance of yellow–orange tones. The values of c* (77.97) and h* (74.46) demonstrate the intensity and predominance of these hues.

In the pulp (Table 2), higher values of L* (59.34) and b* (96.01) were observed, indicating a lighter and more intensely yellow coloration compared to the peel, while a* (17.93) was lower, suggesting a reduced contribution of reddish tones. The higher values of c* (97.70) and h* (78.66) confirm the predominance of a more intense yellow coloration in the pulp.

Overall, the fruits show a well-defined chromatic pattern, with pulp that is lighter and more intensely yellow than the peel, a characteristic desirable for both consumption and processing (Martineli *et al*., 2022; Souza *et al*., 2025).

Table 2. Color of peel and pulp of coquinho-azedo fruits.

Color parameters of fruit peel					
Variable (unit)	**Mean**	**Standard deviation**	**Minimum**	**Maximum**	**Cv (%)**
L*	56.39	2.53	51.89	61.15	4.49
a*	20.79	3.15	11.69	24.85	15.14
b*	70.45	17.37	51.89	92.25	24.66
c*	77.97	11.83	21.43	94.94	15.17
h*	74.46	3.36	64.40	78.89	4.51
Color parameters of fruit pulp					
Variable (unit)	**Mean**	**Standard deviation**	**Minimum**	**Maximum**	**Cv (%)**
L*	59.34	0.68	58.11	60.03	1.14
a*	17.93	1.42	16.48	19.74	7.93
b*	96.01	7.09	81.63	99.87	7.39
c*	97.70	3.69	83.99	101.23	3.78
h*	78.66	2.13	75.76	80.61	2.71

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Pages: 1-17

In a study conducted by Wagner *et al*. (2020) with *Butia odorata* fruits, the authors observed results similar to those found in the present study, a pattern also reported by Andrade et al. (2019), with similar colorimetric values for peel and pulp (Martinelli *et al*., 2022).

The observed coloration, with predominance of yellow tones in both peel and pulp, is associated with the accumulation of pigments such as carotenoids, compounds widely reported in fruits of the genus *Butia* (Da Fonseca Antunes *et al*., 2024). The greater color intensity in the pulp compared to the peel suggests a higher concentration of these pigments in internal tissues, which is common in fruits at advanced stages of maturation (Ventura *et al*., 2022).

The difference in coloration between peel and pulp also reflects physiological processes related to chlorophyll degradation and pigment synthesis during ripening (Martineli *et al*., 2022). This process directly influences fruit appearance and is one of the main criteria used by consumers to assess quality.

In addition, color intensity may be related to environmental conditions during fruit development. Factors such as light and temperature influence pigment synthesis and may result in variations in final coloration (Bacelar *et al*., 2024). In this context, the observed values indicate that the cultivation environment favored the expression of desirable visual characteristics.

Based on Table 3, the fruits presented an average soluble solids content of 14.67 °Brix, indicating good sugar accumulation. Titratable acidity was 0.97%, with a mean pH of 3.35, reflecting the typical acidic nature of the species.

The ratio (15.12) reflects a balance between sugars and acidity, suggesting a favorable sensory profile (Table 3). Fruit firmness was 18.99 N, indicating a consistency compatible with fruits suitable for handling and processing.

Table 3. Physicochemical quality of coquinho-azedo fruits.

Variable (unit)	Mean	Standard deviation	Minimum	Maximum	Cv (%)
Soluble solids (SS)	14.67	1.53	13.00	16.00	10.41
Titratable acidity (TA)	0.97	0.05	0.92	0.99	5.15

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Pages: 1-17

pH	3.35	0.09	3.32	3.40	2.69
SS/TA ratio	15.12	0.03	15.00	15.19	0.20
Fruit firmness (N)	18.99	4.34	12.28	27.65	22.84

The soluble solids content (14.67 °Brix) was higher than that reported by Souza *et al*. (2018), who obtained values of 12.3 °Brix, and similar to that described by De Oliveira *et al*. (2026), with values close to 15 °Brix. This variation may be associated with climatic conditions during fruit filling, especially temperature and water availability.

The physicochemical parameters observed indicate that the fruits exhibit a balance between sugars and acidity, a characteristic essential for sensory quality (De Oliveira *et al*., 2026).

The high soluble solids content combined with moderate acidity suggests potential for processing into pulp and beverages, reducing the need for sugar correction. On the other hand, the high moisture content favors industrial yield, although it implies greater perishability, requiring careful postharvest handling.

The acidic pH observed is typical of the species and contributes both to flavor and fruit preservation, since more acidic environments tend to inhibit microbial growth, making this aspect particularly important for postharvest management and industrial processing (De Lima *et al*., 2025).

The fruits showed an average total phenolic content of 135.32 mg GAE 100 g^{-1} (Table 4), indicating a significant presence of metabolites associated with antioxidant activity. This result is supported by the high antioxidant activity observed (90.01% DPPH inhibition) (Table 4).

Pulp moisture content was 90.06%, a characteristic value of fleshy fruits, which contributes to their perishability but also favors processing into pulp and derived products.

Table 4. Bioactive compounds, antioxidant activity, and moisture content of coquinho-azedo fruits.

Variable (unit)	Mean	Standard deviation	Minimum	Maximum	Cv (%)

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DOI: 10.66104/1xzpsr70
Pages: 1-17

Total phenolic compounds (Folin–Ciocalteu) (mg GAE 100 g⁻¹)	135.32	5.69	130.22	139.98	4.20
Antioxidant activity (DPPH) (%)	90.01	2.98	89.78	91.36	3.31
Pulp moisture (%)	90.06	1.5	85.9	92.06	1.67

In the study conducted by Souza *et al*. (2018), regarding total phenolic compounds, the authors obtained values of 63.2 mg GAE 100 g⁻¹, while Lahlou *et al*. (2022) reported 142.3 mg GAE 100 g⁻¹ and Nascimento *et al*. (2021) reported 173.49 mg GAE 100 g⁻¹.

The total phenolic content (135.32 mg GAE 100 g⁻¹) was approximately 2.1 times higher than that reported by Souza *et al*. (2018) (63.2 mg GAE 100 g⁻¹) and lower than that observed by Nascimento *et al*. (2021) (173.49 mg GAE 100 g⁻¹). These differences may be related to both genetic variability and environmental growing conditions.

The total phenolic content and the high antioxidant activity observed reinforce the functional potential of *Butia capitata* fruits, as these compounds are directly associated with the ability to neutralize free radicals, being important from both nutritional and health perspectives (Da Fonseca *et al*., 2024).

Although phenolic compounds significantly contribute to antioxidant activity, other compounds present in the matrix may also be involved in this effect (Pereira *et al*., 2023). This aspect broadens the interest in the species not only for consumption but also for application in the functional food industry.

The high pulp moisture content is characteristic of fleshy fruits and is associated with greater perishability; however, this condition also favors processing, especially in the production of pulp and derived products, facilitating extraction and utilization (Da Fonseca *et al*., 2024).

A relevant aspect of this study is the evaluation of fruits produced outside the typical occurrence area of the species. The results indicate that, even under distinct climatic conditions, such as those observed in the municipality of Lavras, the fruits maintained adequate physical, physicochemical, and functional characteristics.

The observed results are consistent with the maintenance of quality

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Pages: 1-17

attributes under the evaluated conditions; however, this interpretation should be made with caution due to the absence of direct comparison with other regions where the species naturally occurs (Dias *et al*., 2022).

This study presents limitations inherent to its design, as it was conducted in a single location and a single season, without a simultaneous comparative group from the species' natural occurrence area. Furthermore, although fruits were collected from different mother plants, it was not possible to isolate the effect of each plant on the analyzed variables. Therefore, the results should be interpreted as a descriptive characterization of the evaluated sample set, not allowing causal inferences regarding the effect of edaphoclimatic conditions.

4. Conclusion

Fruits of *Butia capitata* produced in southern Minas Gerais showed physical, physicochemical, and bioactive characteristics consistent with those described in the literature for the species. Notable attributes include high pulp yield, a balanced relationship between soluble solids and acidity, and suitable coloration for consumption and processing.

In addition, the fruits exhibited significant levels of phenolic compounds and high antioxidant activity, indicating potential for functional and agroindustrial applications.

Overall, the results indicate that, under the evaluated conditions, the fruits present relevant quality attributes. However, confirmation of the species' performance under different edaphoclimatic conditions requires comparative studies conducted across multiple environments and seasons.

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Reference

ANDRADE, R.Q; PEREIRA, G. S. L.; SILVA, M. A. R.; SANTOS, T. C.; JESUS, C. A.; LIMA, J. P. Qualidade Pós-Colheita De Frutos Oriundos Do Cerrado Norte-Mineiro**. Inovação e Tecnologia na Gastronomia**, p. 328-329, 2019.

ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS. **Official methods of analysis of AOAC international**. 18 th. ed. Maryland, 2005. V.2.

BACELAR, E. *et al*. Impacts of climate change and mitigation strategies for some abiotic and biotic constraints influencing fruit growth and quality. **Plants**, v. 13, n. 14, p. 1942, 2024. DOI: https://doi.org/10.3390/plants13141942

BRAND-WILLIAMS W, CUVELIER ME, BERSET C (1995) Use of a free radical method to evaluate antioxidant activity. LWT - Food Sci Technol 28:25–30. DOI: https://doi.org/10.1016/S0023-6438(95)80008-5

CARVALHO, L. F. L. *et al*. Splitting Butia archeri (*Arecaceae*) of Brazilian central highlands: new taxonomical and conservation insights for Butia. **Plant Systematics and Evolution**, v. 310, n. 4, p. 24, 2024. DOI: https://doi.org/10.1007/s00606-024-01908-z

CIDÓN, C. F. *et al*. Phenotypic and molecular basis for genetic variation in jelly palms (Butia sp.): where are we now and where are we headed to?. **Genetics and Molecular Biology**, v. 46, p. e20230145, 2023. DOI: https://doi.org/10.1590/1678-4685-GMB-2023-0145

DA FONSECA ANTUNES, B. *et al.* Chemical composition, bioactive compounds, biological activity, and applications of Butia spp.: a review. **Trends in Food Science & Technology**, v. 148, p. 104510, 2024. DOI: https://doi.org/10.1016/j.tifs.2024.104510

DANTAS, A. A. A.; CARVALHO, L. G.; FERREIRA, E. Climatic classification and tendencies in Lavras region, MG. **Ciência e Agrotecnologia**, v. 31, p. 1862-1866, 2007. DOI: https://doi.org/10.1590/S1413-70542007000600039

REMUNOM
ISSN 2178-6925

Received: 13/01/2026 - **Accepted:** 24/04/2026
Vol: 13.07
DOI: 10.66104/1xzpsr70
Pages: 1-17

DE LIMA, C. F. M. *et al*. Sweet, nutritious, and diverse fruits: the genetic heritage of Butia odorata palm groves in southern Brazil. **Food Science and Technology**, v. 45, 2025. DOI: https://doi.org/10.5327/fst.514

DE OLIVEIRA, J. F. P. *et al*. New insights into the Butia capitata accessions from Cerrado: Physicochemical characterization, antioxidant activity, and phenolic acids profile. **Food Science and Technology**, v. 46, 2026. DOI: https://doi.org/10.5327/fst.597

DIAS, W. P. A *et al*. Reproductive biology of Butia capitata (Arecaceae) under cultivation-indicators for the domestication of a threatened fruit tree. **Scientia Horticulturae**, v. 304, p. 111297, 2022. DOI: https://doi.org/10.1016/j.scienta.2022.111297

HAMDA, A. S. *et al*. Valorization of fruit processing industry waste into value-added chemicals. In: **Value added products from food waste**. Cham: Springer Nature Switzerland, 2024. p. 107-126.

LAHLOU, A.; CHILEH-CHELH, T.; LYASHENKO, S.; RINCÓN-CERVERA, M. A.; RODRÍGUEZ-GARCÍA, I.; LÓPEZ-RUIZ, R.; URRESTARAZU, M.; GUIL-GUERRERO, J. L. Arecaceae fruits: Fatty acids, phenolic compounds and in vitro antitumor activity. **Food Bioscience**, v. 50, 102181, 2022.

MACHADO, C. A. A. *et al.* Elaboração, caracterização e aplicação da farinha do coproduto da agroindústria de coquinho-azedo (Butia capitata) em produtos de panificação. **Semina: Ciências Agrárias**, v. 46, n. 1, p. 109-130, 2025. DOI: https://doi.org/10.5433/1679-0359.2025v46n1p109

MARTINELI, M. *et al*. Quality of Butia capitata fruits harvested at different maturity stages. **Agronomía Colombiana**, v. 40, n. 1, p. 69-76, 2022. DOI: https://doi.org/10.15446/agron.colomb.v40n1.99651

NASCIMENTO, A. L. A. A. *et al*. Chemical characterization and antioxidant potential of native fruits of the Cerrado of northern Minas Gerais. **Brazilian Journal of Food Technology**, v. 23, p. e2019296, 2020. DOI:

REMUNOM
ISSN 2178-6925

Received: 13/01/2026 - **Accepted:** 24/04/2026
Vol: 13.07
DOI: 10.66104/1xzpsr70
Pages: 1-17

https://doi.org/10.1590/1981-6723.29619

PARADISO, V. M. *et al*. Nutritional characterization and shelf-life of packaged microgreens. **Food & function**, v. 9, n. 11, p. 5629-5640, 2018. DOI: https://doi.org/10.1039/c8fo01182f4

PEREIRA, G. S. L. *et al*. Extraction of bioactive compounds from Butia capitata fruits using supercritical carbon dioxide and pressurized fluids. **The Journal of Supercritical Fluids**, v. 199, p. 105959, 2023. DOI: https://doi.org/10.1016/j.supflu.2023.105959

RODRIGUES, M. L. M.; AGUIAR, F. S.; PINHEIRO, J. M. S.; MIZOBUTSI, G. P.; BRITO, F. S.; HENRIQUES, D. C.; PEREIRA, A, C. B.; LAGE, G. G. A. Caracterização física e química de coquinho azedo colhidos em diferentes estádios de maturação. **Contribuciones a las ciencias sociales**, v. 16, n. 12, p. 30940-30951, 2023. DOI: https://doi.org/10.55905/revconv.16n.12-113

RUFINO, M.; DO S.M.; ALVES, R.E.; DE BRITO, E.S.; PÉREZ-JIMÉNEZ, J.; SAURA-CALIXTO, F.; MANCINI-FILHO, J. Bioactive compounds and antioxidante capacities of 18 no-traditional tropical fruits from Brazil. Food Chemistry. v. 121, n. 4, p. 996-1002, 2010. DOI: https://doi.org/10.1016/j.foodchem.2010.01.037

SÁ, D.; SCARIOT, A.; FERREIRA, J. B. Effects of ecological and anthropogenic factors on population demography of the harvested *Butia capitata* palm in the Brazilian Cerrado. **Biodiversity and Conservation**, v. 29, n. 5, p. 1571-1588, 2020. DOI: https://doi.org/10.1007/s10531-018-1669-9.

SANT'ANA, Rodrigo Ribeiro Arnt *et al. Butia catarinensis* as a Sustainable Ingredient in Brazilian Mead: Chemical Properties, Volatile Composition, Sensory Profile and Consumer Acceptance. **Journal of Food Science**, v. 91, n. 4, p. e71007, 2026. DOI: https://doi.org/10.1111/1750-3841.71007

SINGH, L. *et al*. Pre-harvest factors influencing the production and quality attributes in fruit crops. In: **Temperate nut crops**. Apple Academic Press, 2026. p. 377-406.

REMUNOM
ISSN 2178-6925

Received: 13/01/2026 - **Accepted:** 24/04/2026
Vol: 13.07
DOI: 10.66104/1xzpsr70
Pages: 1-17

SOUZA, A. G.; FASSINA, A. C.; SARAIVA, F. R. S.; SOUZA, L. Caracterização Físico-Química De Frutos Nativos Da Região Sul Do Brasil. **Evidência,** Joaçaba, v. 18, n. 1, p. 81-94, jun. 2018.

SOUZA, P. N. S. *et al*. Digital phenotyping of Butia capitata fruits for genetic improvement: a case study. **Bragantia**, v. 84, p. e20240241, 2025. DOI: https://doi.org/10.1590/1678-4499.20240241

Stroheker, R., Henning, H.M., 1967. Analisis de vitaminas: métodos comprovados. Madrid: Paz Montalvo, 428.

VENTURA, L. J. M. *et al*. Cytological aspects of Butia capitata (Arecaceae) fruit maturation and senescence. **Scientia Horticulturae**, v. 297, p. 110938, 2022. DOI: https://doi.org/10.1016/j.scienta.2022.110938