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PHYSICOCHEMICALPROPERTIES OF GABIROBA (*Campomanesia lineatifolia*) AND MYRTLE (*Blepharocalyx salicifolius*) NATIVE TO THE MOUNTAINOUS REGION OF IBIAPABA–CE, BRAZIL[1]

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ABSTRACT - In Brazil, consumer preference of tropical native fruits has increased; however, many fruits are not commercially exploited, such as gabiroba (*Campomanesia lineatifolia*) and myrtle (*Blepharocalyx salicifolius*), from the Myrtaceae family. The present study aimed to evaluate the physical, physico-chemical, and functional characteristics of gabiroba and myrtle, harvested from native plants in the mountainous region of Ibiapaba–CE. The following characters were analyzed: pH, soluble solids, total acidity, total extractable polyphenols, ascorbic acid, and antioxidant activity by using the ABTS method. After pulping, the samples were divided into two groups. From the results, it was found that gabiroba had a low total acidity value (0.12 ± 0.01%) indicating a higher level of sweetness relative to myrtle. Myrtle presented values of longitudinal (0.94 cm) and transverse(1.35 cm) diameters, fresh weight (0.85g), pulp yield (68.0%), pH (4.5 ± 0.0), and total soluble solids (23.6 ± 1.7 °Bx) similar to those obtained in other studies. Bioactive compounds in gabiroba and myrtle included phenolics (GAE 229.37 ± 1.04and 511.65 ± 1.34mg/100g), ascorbic acid (74.44 ± 0.03 369.1 ± 0.28 mg/100g), and antioxidants (14.54 ± 1.0 and 16.05 ± 0.63 µ Mtrolox/g). Therefore, these fruits have the potential to be used as functional foods characterized by various health benefits.

Keywords: Bioactive compounds. Functional foods. Native fruit.

CARACTERIZAÇÃO FÍSICO-QUÍMICA DE GABIROBA (*Campomanesia lineatifolia*) E MURTA (*Blepharocalyx salicifolius*) NATIVAS DA REGIÃO SERRANA DE IBIAPABA-CE

RESUMO - No Brasil os frutos nativos tropicais vêm conquistando a preferência dos consumidores, entretanto, muitos deles não é aproveitada comercialmente, a exemplo da gabiroba (*Campomanesia lineatifolia)* e Murta (*Blepharocalyx salicifolius*), pertencentes á família das *Myrtaceae.* Este trabalhou teve como objetivo avaliar as características físicas, físico-químicas e funcionais da gabiroba e murta, colhidas de plantas nativas na região serrana da Ibiapaba – CE, por meio das seguintes análises: pH, sólidos solúveis,acidez total, polifenóis extraíveis totais, ácido ascórbico e atividade antioxidante pelo método ABTS. Depois de despolpadas as amostras foram divididas em dois lotes. A partir dos resultados, verificou-se que entre os frutos analisados destacou-se por apresentar menor valor de acidez titulável (0,12 ± 0,01%) indicando um maior teor de doçura com relação às outras espécies. A Murta apresentou valores de diâmetro longitudinal (0,94 cm) e transversal (1,35 cm), massa fresca (0,85g), rendimento de polpa (68,0%), pH (4,5 ± 0,0) e sólidos solúveis totais (23,6 ± 1,7°Brix), próximos aos valores obtidos por outros autores referente a mesma espécie. Para os compostos bioativos foram obtidos valores de compostos fenólicos (229,37 ± 1,04 mg GAE/100 g) ,(511,65 ± 1,34 mg GAE/100g), Ácido Ascórbico (74,44 ± 0,03 mg/100g) , (369,1 ± 0,28 mg/100g) e Capacidade Antioxidante (14,54 ± 1,0 µMol Trolox/g),(16,05±0,63 µMol Trolox/g), para gabiroba e murta , respectivamente, apresentando potencial para ser utilizado como alimento funcional caracterizando-se por oferecer vários benefícios à saúde.

Palavras-chaves: Compostos bioativos. Alimentos funcionais. Frutíferas nativas.

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INTRODUCTION

In Brazil, different native and exotic fruit varieties have been used by local people based on their considerable potential for development in the consumer market and commercialization. However, it is necessary to develop the culture and preservation of these species, and determine the potential of these fruits for their use in the functional food market. Currently, a greater demand for functional foods to complement diets and promote health benefits has been observed (NASCIMENTO et al, 2011; SOUSA et al, 2012).

Myrtaceae is one of the largest plant families in Brazil, with 23 genera and approximately 1,000 species (SOUZA; LORENZI, 2005), including *Blepharocalyx salicifolius* (myrtle). This arboreal species is found in many South America countries, such as Paraguay, Uruguay, Argentina, Bolivia, and Ecuador. In Brazil, it is distributed in the states of Bahia, Distrito Federal, Goiás, Minas Gerais, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul. It is found in deciduous and semi-deciduous forests, dense and mixed ombrophilous vegetation with a marine influence (restinga), and cerrado, steppes,and fields (DERNARDI; MARCHIORI, 2005; CARVALHO, 2006).

Another Myrtaceae species,*Campomanesia lineatifolia* (gabiroba), is popularly known in Brazil as guabirabeira, in Peru as palillo, and in Colombia as guayavo de Anselmo or guayava palo. This species is a fruit tree occurring in forests with elevations <2,000m above sea level. It is distributed in Colombia, Ecuador, Peru, and Brazil. It is seldom cultivated in home orchards. It isnative to the Amazon region in primary forests with solid ground. It flowers from September to November and the fruits ripen from February to April. The fruits contain juicy pulp with an acidic flavor and few seeds (ABE et al., 2014).

The study of native fruits such as myrtle and gabiroba, and the technological processes involved in food development are necessary for the evaluation and development of new products for the consumer market. We aimed to determine the physicochemical characteristics of the fruits from myrtle and gabiroba trees.

MATERIAL AND METHODS

Myrtleand gabiroba fruits were harvested in the early morning from native plants in the mountainous region of Ibiapaba-CE, Brazil. The fruits were selected manually based on their apparent maturity and coloration, which was reddish for myrtle and yellowish for gabiroba. Fruits with physical injuries and uneven coloring were discarded. After selection, the fruits were packed and transported in styro foam boxes to the Laboratory of Fruits and Vegetables of the Federal University of Ceará. In the laboratory, the fruits were washed and sanitized by immersion in a sodium hypochlorite solution (100 ppm) for 15 min, then washed in running water, drained, and pulped. Characterization analyses were performed 24 hafter fruit was harvested.

The samples were evaluated physically for the following parameters, including longitudinal and transvers diameters, fresh mass, and earnings. The physicochemical properties analyzed were pH (AOAC, 1995), total soluble solids (BRAZIL, 2005), and titratable acidity (BRAZIL, 2005), as well as ascorbic acid (ITAL, 1990), total extractable polyphenols (LARRAURI et al., 1997) and antioxidant capacity, based on the free radical capture ABTS method (RUFINO et al., 2007).

All analyses were performed in triplicate. The results were expressed as means with standard deviation shown between the samples. For physicochemical analyses, the arithmetic means were compared using an analysis of variance (ANOVA) and the Tukey test, using Assistat 7.6 beta software. The level of significance was considered at 5% probability ($p < 0.05$).

RESULTS AND DISCUSSION

The physical characteristics of gabiroba and myrtle fruit are shown in Table 1.

Table 1. Physical characteristics of gabiroba and myrtle fruit.

Physical characteristics	Gabiroba	Myrtle
Diameter I[1](cm)	4.2 ± 0.14	0.94 ± 0.01
Diameter II[2] (cm)	5.5 ± 0.01	1.35 ± 0.0
Fresh Mass (g)	33.3 ± 0.14	0.85 ± 0.07
Pulp yield (%)	13.5 ± 0.70	68.14 ± 0.47
Seed yield (%)	55.6 ± 0.07	32.75 ± 0.35

[1]Longitudinal;[2]Transverse.

Gabiroba fruit is round in shape, and its size varies depending on the cultivar. According to Table 1, the average value of the transverse diameter (5.5 cm) was 18% greater than the transverse diameter values found by Santos et al. (2009) for gabiroba. The mean values of fresh mass (33.3g) and seed yield (55.6%) were approximately 64 and 51.6%, respectively, which were higher than values found previously (SANTOS et al., 2009). However, Santos (2011) obtained an average pulp yield (60%) higher than that in the present study, but the seed yield (16%) was lower than that found in the present study. The discrepancies regarding the physical characteristics of these fruits can be attributed to variations in the soil type and climatic conditions of the growing region.

The longitudinal and transverse diameters and fresh mass of myrtle fruit were higher than those observed by Rego et al. (2010), who obtained longitudinal diameter values of 0.52 cm, transverse diameters of 0.55 cm, and the fresh mass of the fruits ranged between 0.21 and 1.01 g. The considerable variation in the fresh mass of fruit in the present and other studies is possibly because myrtle trees are undomesticated,witha wide variation in fruit size, even on the same tree.

The fruits of the myrtle tree showed suitable characteristics for commercialization, in form of frozen pulp, juices, jellies, nectars, and ice cream, resulting from the percentage of pulp yield in ripe fruit(68.47%) (Table 1).

From Table 2, gabiroba fruit had a pH value (3.47) lower than myrtle fruit (4.5), which is in agreement with the values obtained for the total titratable acidity.

Table 2. Physicochemical characteristics of gabiroba and myrtle fruits.

Physicochemical characteristics	Gabiroba	Myrtle
pH	$3.47^b \pm 0.01$	$4.5^a \pm 0.0$
Total soluble solids	$11.55^b \pm 0.07$	$23.6^a \pm 1.70$
Total titratable acidity (%)	$0.183^a \pm 0.0$	$0.12^b \pm 0.01$
Ascorbic acid (mg/100g)	$74.44^b \pm 0.28$	$370^a \pm 0.28$
Total polyphenol (mg GAE/100 g)	$229.37^b \pm 1.05$	$511.7^a \pm 1.35$
Antioxidant activity (µM Trolox/g)	$14.54^a \pm 1.0$	$16.05^a \pm 0.63$

*Means within rows with different superscripts letters differ significantly by Tukey test at 5% probability.

The titratable acidity of gabiroba was lower than that found by Freitas, Cândido, and Silva (2008), Santos et al. (2009), Santos (2011), and Pereira (2011), of 2.85, 0.48, 1.45, and 0.34 ± 0.02%, respectively. For myrtle, the results of titratable acidity were lower than those found by Rufino (2010) of 0.64% citric acid. Both fruits are in the acidic range of foods (pH ≤4.5), which affects commercialization, because as Silva et al. (2012) suggested high acidity is associated with a greater dilution of the product, which results in a considerable increment of the final yield at an industrial level. This aspect should be considered when determining the stability and safety of the product, as high acidity generally prevents microorganism growth.

The ascorbic acid content of myrtle (370 mg/100g) was higher than that in gabiroba (74.44 mg/100g). The concentration of ascorbic acid in gabiroba was lower than that cited by Santos et al. (2009) and Santos (2011), 233.56 ± 313.21 mg/100g, respectively. However, Pereira (2011) obtained lower values (±5.44 mg/100g) than thosein the present study. The total soluble solids and ascorbic acid for myrtle were lower than those obtained by Rufino (2010), who found results ranging from 15.22 to 19.4 °Bx and 181.1 ± 1 to65.38 mg/100g, respectively. The ascorbic acid content and soluble solids amounts vary widelyon the same tree, and in the type of fruit from different trees, and factors such as soil conditions, climate, photoperiod, rainfall patterns, and degree of ripeness influence their vitamin composition (SILVA, 2010).

The dietary reference intake (DRI) for vitamin C, according to Brazilian legislation, is 45mg (BRAZIL, 2005). Thus, 100g of gabiroba and myrtle pulp exceeds the required daily vitamin C content. Therefore these fruits are a great source of vitamin A, surpassing orange, pineapple, cashew, apples, and papaya (SILVA ; MEDEIROS, MILK, 2012).

Myrtle fruit presented, on average, twice the total polyphenols in relation to gabiroba fruit. Vasco (2008) suggested that the amount of total polyphenols varies greatly among species of fruits. He investigated the polyphenol content in fruits of Ecuador. Based on these studiesusing 163 samples of fresh matter, a polyphenol content rating was established: low (<100mg GAE/100g), medium (100 –500mg GAE/100g) and high (>500mg GAE/100g). Therefore, according to the proposed model, gabiroba and myrtle have medium and high polyphenol contents, respectively.

The polyphenol concentration obtained for gabiroba in the present study was similar to that observed by Santos (2011), with values of 131.90 ± mgGAE/100g., which were lower than those reported by Santos et al. (2009) (1,616 mg GAE/100g). The polyphenol contents in myrtle were similar to those observed by Hamm et al. (2009), with values of 427.11mgGAE/100g for red araçá fruit, which belongs to the same family. Significant differences were not detected (p> 0.05) for the antioxidant activity between gabiroba and myrtle. Therefore, the two species showed similar antioxidant activities, although there were significant differences between the polyphenol concentrations. According to Perumalla and Hettiarachchy (2011), the antioxidant activity of the polyphenols is mainly dueto its own reducing properties. The intensity of antioxidant activity exhibited by these phytochemicals is variable, and it depends on the types of polyphenols present in the material studied. Fruits, the main dietary sources of polyphenols, due to their intrinsic (cultivar, variety, maturity stage) and extrinsic (climatic conditions) factors, quantitatively and qualitatively present a wide variation of these compounds. However, the effectiveness of the antioxidant action depends on the chemical structure and concentration of these phytochemicals in food.

CONCLUSION

The results in the present study indicated that gabiroba and myrtle have considerable potential as an alternative source of vitamin C and phenolic compounds. Both fruits may be consumed as part of a healthy diet, since these compounds are associated with several benefits for human health.

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