



RESEARCH ARTICLE

PHYSICO-CHEMICAL PARAMETERS OF NATIVE FRUITS OF AMAZON, MARANHÃO, BRAZIL

¹Djanira Rubim dos SANTOS, ²Georgiana Eurides deCarvalho MARQUES, ²Clenilma Marques BRANDÃO, ³Adriano Souza FONSECA and ³Marciel Justino NASCIMENTO

Degree in Chemistry, Federal Institute of Education, Science and Technology of Maranhão, Av. Getúlio Vargas, district Monte Castelo, São Luís

Department of Chemistry, Federal Institute of Education, Science and Technology of Maranhão, End. Av. Getúlio Vargas, district Monte Castelo, São Luís

Graduating in Chemistry, Federal Institute of Education, Science and Technology of Maranhão, Av. Getúlio Vargas, district Monte Castelo, São Luís

ARTICLE INFO

Article History:

Received 11th August, 2017
Received in revised form
27th September, 2017
Accepted 10th October, 2017
Published online 30th November, 2017

Key words:

Native fruits, Biodiversity, Parameters.

ABSTRACT

Native fruits are important foods for the traditional communities of the state of Maranhão. Thus, the objective of this work was to analyze the physical-chemical characteristics of some native fruits found in the transition forest biome of the Amazon. Fruit pulps of the species Açaí (*Euterpe oleracea* Mart), buriti (*Mauritia flexuosa* L), bacuri (*Platonia insignis* Mart.) and murici (*Byrsonima crassifolia* L. (Kunth)) were analyzed. The analyzed parameters were the physical and chemical, such as the composition centesimal, vitamin C, pH, ATT and STT according to the methods described by the AOAC. The results showed the nutritional richness of these native fruits, with important values for dietary fiber and differentiated minerals for each fruit analyzed. Therefore, these fruits are important for the food diets of the populations involved and for the food industry.

Copyright©2017, Djanira Rubim dos SANTOS et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Djanira Rubim dos SANTOS, Georgiana Eurides deCarvalho MARQUES, Clenilma Marques BRANDÃO, Adriano Souza FONSECA and Marciel Justino NASCIMENTO. 2017. "Physico-chemical parameters of native fruits of amazon, maranhão, Brazil", *International Journal of Current Research*, 9, (11), 60342-60345.

INTRODUCTION

The state of Maranhão is privileged to have a part covered by the Amazon forest, about 34%, but it is the fourth state of the Legal Amazon that most deforests the forest (LEMONS, SILVA, 2011). The presence of this biome favors the planting of its fruit species, such as the açaí (*Euterpe oleracea* Mart), the buriti (*Mauritia flexuosa* L), the bacuri (*Platonia insignis* Mart.) and the murici (*Byrsonima crassifolia* L. (Kunth)), as can be seen on the territory Baixo Munim / MA. *Euterpe oleracea* Mart. is found in flood plains and igapós and grows abundantly in the Amazon River estuary on flood plains (SHAUSS, 2006). The pulping of the açaí is still done in a handmade way where the açaí fruits are placed in warm water to facilitate the removal of the pulp, later to be crushed and filtered in sieves. *Mauritia flexuosa* L. is typical of humid areas and its fruits have pale brown scales when young and when ripe reddish brown. To take off the buriti it is necessary the leave soak it in the ponds or in containers to soften the pulp

*Corresponding author: Djanira Rubim dos SANTOS,
Degree in Chemistry, Federal Institute of Education, Science and Technology of Maranhão, Av. Getúlio Vargas, district Monte Castelo, São Luís

and facilitate the removal of the same. The in natura pulp of buriti has a high nutritional value, being considered a functional food (MANHÃES, 2007). And the oil extracted from buriti can also be used for biodiesel synthesis (ALQUINO, 2011). *Platonia insignis* Mart. is a tree species that occurs in the terra firme forests, being native to the Amazon region, also found in the State of Maranhão. It has a berry almost circular and of yellow color, containing four seeds covered by a soft and edible white pulp (SOUZA et al., 1996). The pulp of bacuri slowly are included in the national gastronomy because it has a peculiar scent and flavor, but it needs technical improvement as to the processing to be accepted in the international market. *Byrsonima verbascifolia* L. (Kunth) found in the Amazon savannas, cerrado, fields and coastal forests, are found from December to March (GUIMARÃES and SILVA, 2008). The murici is a fruit of yellow color, fleshy and macenta, among its characteristics are the scent and the flavor. The fruits of native cerrado species are gradually gaining a biotechnological potential (SILVA, 2011). And this is very important because these fruits offer a great nutritional value that can be added to the diets of human's diets and in animal feeds.

In the state of Maranhão these fruits serve as a source of food and income for traditional communities. The Açaí and buriti are often served as main dishes in meals accompanied by flour and fish, the buriti is also much consumed in the form of sweet. These habits and customs are highly valued by these traditional communities. The fruits mentioned in this study can be consumed as juice, ice cream, creams, jams, jellies and liqueurs and are gradually incorporated into the diet. Some are very rich in fiber and these are of great importance for the diet of the human being, since their ingestion is being studied in the last years in the area of nutrition and health. It is perceived that there is a great concern with a healthy diet seeking to balance with fibers present in the fruits, vegetables and cereals, along with healthy lifestyle promoting wellness. Therefore, this work aimed to characterize physically the pulps of açaí, bacuri, buriti and murici.

MATERIAL AND METHODS

Preparation of the samples

The experimental stage was conducted at the Food Laboratory of the Academic Department of Chemistry of the Federal Institute of Maranhão - IFMA - Campus São Luís - Monte Castelo. The fruits of açaí (*Euterpe oleracea*), buriti (*Mauritia flexuosa*), bacuri (*Platonia insignis*) and murici (*Byrsonima verbascifolia*) came from the territory of Baixo Munim in the municipality of Morros in the State of Maranhão, being transported to São Luís for the fruits be pulped, frozen and lyophilized for data collection. The collected material is duly registered in Table 1. Initially the pulps were frozen (-20°C), after lyophilization process for a better stabilization, preserving the analyzed samples and their nutritional values.

Table 1. Quantities of plants and native fruits collected, Morros, MA-Brazil

Specifications	Number of plants/ fruits	Fruits number
<i>Euterpe oleracea</i> Mart	5	1 bunch
<i>Platonia insignis</i> Mart	5	20 units
<i>Mauritia flexuosa</i> L.	5	20 units
<i>Byrsonima verbascifolia</i> L. (Kunth)	3	1Kg

Determination of the centesimal composition the native fruits

The analyzes of proteins, lipids and mineral residues were performed in triplicate, according to the methodologies described by AOAC (2009). The crude fiber content was determined by a gravimetric method in which the samples were submitted to acid hydrolysis according to the methodology of Adolfo Lutz (2008). The carbohydrate content was calculated using the average obtained for the other nutrients. Starch was determined by the Lane-Eynon method. The vitamin C determination of the samples was determined by the Balentine method. Total soluble solids (° Brix) were determined using a bench refractometer at 20 ° C. The pH was determined by a titrated digital pH meter (MS TECNOPON Instrumentation) calibrated with buffer solutions of pH 4.0 and pH 7.0. The Total Acidity (ATT) was determined in triplicate by titration with NaOH 0.1 mol/ L.

RESULTS AND DISCUSSION

For analysis of the fruit content of açaí, buriti, bacuri and murici the following results were obtained arranged in Table 2. The results were compared with data of the literature.

Table 2. Physical, chemical and physico-chemical characteristics of fruits the açaí (*Euterpe oleracea* Mart), buriti (*Mauritia flexuosa* L), bacuri (*Platonia insignis* Mart) and murici (*Byrsonima verbascifolia*L. (Kunth)) in the Maranhão, Brazil

Characteristics	<i>Euterpe oleracea</i> Mart	<i>Mauritia flexuosa</i> L	<i>Platonia insignis</i> Mart	<i>Byrsonimaver bascifolia</i> L. (Kunth)
Length	4.33±0.32	43.65±4.98	82±0.31	8.2±0.3
Diameter	2.7±1.59	49±7.21	6.42±0.35	37.7±9.25
pH	5.1±0.26	3.45±0.09	3.5±0.25	3.52±0.01
SST	2.5±0.09	3.87±2.32	2.93±0.8	2.33±0.58
ATT	1.3±0.14	4.5±0.17	1.45±2.63	5.66±0.15
Vitamin C	18.31±12.7	21.47±8.8	24.58±5.45	22.68±7.8

The açaí fruit had a satisfactory pH (5.1), while buriti, bacuri and murici showed more acidic pH values of 3.45, 3.5 and 3.52, respectively. The total acidity was lower in the buriti fruit when compared to the fruits of açaí, bacuri and murici. It is known that both acidity and pH are important factors for food preservation, leaving them more stable regarding deterioration (LUTZ, 2008). Regarding the vitamin C content, bacuri presented high values in relation to other fruits. Vitamin C is of great importance for the formation of connective tissue and the hydroxylation of collagen fibers (AZULAY *et al.*, 2003). Regarding the protein values of the fruits, the murici presented lower values (1.7%) to the other fruits. But, a quantity of carbohydrates, 69.38%, very high. Being the highest values of proteins found for bacuri and açaí, respectively. Proteins are of great importance to our body and muscle formation (Table 3). The açaí and buriti presented significant values of lipids and fibers, accompanying the results of another article that determined the physical chemical composition of the açaí from the city of Tomé Açu - PA (ALEXANDRE *et al.*, 2004). The murici presented the lowest value for lipid and fiber contents. When determining dietary fiber it is possible to determine soluble and insoluble portions of the fibers (MONTEIRO *et al.*, 2015) one-third soluble and two-third insoluble (WONG, 2007). The high fiber content found in the fruits analyzed is very important as it helps prevent heart disease, cancer, cholesterol and overweight. In addition, the fibers play a very important role for proper bowel functioning. Lipids are sources and suppliers of energy for cells and fatty acids, an important substance in our body when consumed without exaggeration, acting as carriers of fat-soluble vitamins (A, D, E and K).

Lipids are of great importance to the food industry because they greatly influence taste and texture and serve as facilitators in certain chemical reactions such as hydrogenation and interesterification. Hydrogenation serves to preserve liquid oil in plastic greases and interesterification, and fractionation offers a great alternative to the trans fats problems generated by partial hydrogenation (FIB, 2016). The mineral residues present presented high values for buriti, about 6.42% of the centesimal composition of the fruit (table 2). However, the value found was very high when compared to values of 0.94% and 1.04%, respectively (MANHÃES, 2007; SANDRI, 2016). The murici presented the lowest value of mineral residue among the fruits analyzed. Differences in results may also be related to genetic factors. The results of the ash content analyzes can be observed in Table 3. Potassium, sodium and manganese were the minerals found in greater abundance in the freeze-dried pulp of buriti, respectively. For the lyophilized açaí pulp, the most important minerals found were potassium (1,58 ± 0,48) and calcium (1,34 ± 0,1).

Table 3. Centesimal composition of fruits the açai (*Euterpe oleracea* Mart), buriti (*Mauritia flexuosa* L), bacuri (*Platonia insignis* Mart) and murici (*Byrsonima verbascifolia*) in the Maranhão, Brazil

Plants	Protein (%)	Lipids (%)	Fibers (%)	Ash content (%)	Carbohydrates (%)	Starch content (%)
<i>Euterpe oleracea</i> Mart	6.28±1.63	51.22±17.05	31.78±2.48	3.97±1.56	28.52±17.88	38.8±8.3
<i>Mauritia flexuosa</i> L	2.7±1.59	49±7.21	26.5±2.93	6.42±0.35	31.88±7.29	37.7±9.25
<i>Platonia insignis</i> Mart	6.7±1.9	23.71±6.8	9.30±2.58	3.04±1.2	54.09±3.1	33.4±0.95
<i>Byrsonima verbascifolia</i> L. (Kunth).	1.7±0.3	23.62±8.4	2.26±0.87	3.04±1.2	69.38±4.2	57.52±64

Table 4. Minerals in lyophilized in natura pulps of regional fruits of Maranhão, Brazil

Minerals	<i>Mauritia flexuosa</i> L	<i>Euterpe oleracea</i> Mart	<i>Byrsonima verbascifolia</i>	<i>Platonia insignis</i> Mart
Na	3,34±1,23	0,89±0,28	0,64±0,13	0,58±0,04
Ca	1,76±0,5	1,34±0,1	0,35±0,49	2,9±0,1
P	0,38±0,1	0,49±0,1	1,19±0,36	2,33±1,25
Fe	0,01±0,008	0,015±0,004	0,0003±0,006	0,03±1,11
K	4,25±0,51	1,58±0,48	3,27±0,86	2,23±0,09
Mg	0,86±0,16	0,35±0,079	0,35±0,009	0,1±0,075
Mo	0,001±0,006	0,006±0,003	0,003±0,002	--
Mn	3,17±2,39	0,012±0,003	0,0013±0,002	0,04±0,001
Ni	0,005±0,003	0,002±0,004	0,004±0,003	--
Zn	0,014±0,009	0,003±0,0041	0,02±0,04	0,003±0,0004

The minerals with the highest highlights for the fruit pulp of the murici were potassium (3.27 ± 0.86) and phosphorus (1.19 ± 0.36). Potassium is essential for salt balance in human tissues (15). The bacuri presented satisfactory amounts of minerals in relation to calcium (2.9 ± 0.1), phosphorus (2.33 ± 1.25) and potassium (2.23 ± 0.09). Micronutrients such as manganese have a beneficial role of great importance for human health (RDA, 2004). The Manganese can act as an enzymatic activator and is also associated with a number of metalloenzymes, which is involved with the formation of the bone organic matrix, the also as a peroxide dismutase, an enzyme with antioxidant function (ZHU *et al.*, 2015). The Macronutrients such as calcium are of great importance because it acts on the activation of adenosine triphosphatase, acting on the release of a phosphate group of the ADP molecule. Calcium also participates in blood clotting and hormone control. Like calcium, phosphorus is heavily influenced by vitamin D and parathyroid hormone, it also plays a key role for the cell in the form of ATP. Potassium is very important for the human body as it facilitates muscle contraction by helping to regulate the level of acidity in the blood and also helps to decrease the effects of sodium in the body while maintaining normal blood pressure (FAO, 2001).

Conclusion

The fruit pulps native to the transition forest biome of the Amazon located in the territory of Baixo Munim, Morros (Maranhão) presented essential characteristics for human nutrition as a source of energy, food fiber, as açai (31.78 ± 2.48), minerals, potassium, and vitamin C, in particular bacuri (24.58 ± 5.45). The fruits are of great value for the diets of traditional communities in the state of Maranhão and for the food industries.

Acknowledgment

To the Federal Institute of Education, Science and Technology of Maranhão (IFMA). To the Nucleus of Studies in Agroecology (NEA). To the National Research Council (CNPq). The Foundation for Support of Research in Maranhão (FAPEMA)

REFERENCES

- Alexandre, D.; Cunha, R. L.; Hubinger, M. D. Conservação do açai pela tecnologia de obstáculos. Ciências Tecnologia Alimentos, Campinas, v. 24, n. 1, 2004.
- AOAC. Crude Fiber Analysis in Feeds by Filter Bag TechniqueBa 6^a-05. 2009
- Alquino, J. S. Avaliação físico-química e experimental do óleo de buriti (*Mauritia flexuosa* L.) em ratos e da sua utilização em formulação de biscoitos. Pernambuco, 2011, 193 p. Tese (Doutorado). Universidade Federal de Pernambuco (UFPE). CCS. Nutrição.
- Azulay, M. M.; Lacerda, C. A. M.; Perez, M. A.; Filgueira, A. L.; Cuzzi, T. 2003. Vitamin C/Vitamina C. Na bras Dermatol, Rio de Janeiro, 78 (38): 265 - 274, maio/jun
- FIB. Food Ingredients Brasil. Nº 37, 2016: 55 – 61. Disponível em: <<http://revista-fi.com.br/artigos/artigos-editoriais/os-lipidios-e-suas-principais-funcoes>>. Acesso: 21 agos. 2017.
- Guimarães, M. M.; Silva, M. S. Valor nutricional e características da polpa do murici (*Byrsonimaverbacifolia*). Cienc. E Tecnol. Aliment., Campinas, 28(4): 817-821, out-dez. 2008.
- Manhães, L. R. T. Caracterização da polpa do buriti (*Mauritia flexuosa*, M.): um potente alimento funcional. Rio de Janeiro, 2007, 78 p. Dissertação (Mestrado em Ciências e Tecnologia de Alimentos). Faculdade de Engenharia de Alimentos. Universidade Federal Rural do Rio de Janeiro (UFRRJ).
- Monteiro, D. C. B.; Sousa, W. C.; Pires, C. R. F.; Azevedo, L. A.; Borges, J. S. Caracterização do fruto da geleia de murici (*Byrsonima crassifolia*). Enciclopédia Biosfera, Centro Científico Conhecer – Goiânia, v.11 n.21; p. 3364, 2015.
- RDA. Recommended Dietary Allowances, 2001. In: Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington, D.C.: National Academic of Sciences.
- Sandri, D. O. Elaboração, centesimal composição, qualidade microbiológica e estabilidade ao armazenamento de barra de cereal com sabor de buriti (*Mauritia flexuosa* L. F.). Cuiabá, 2016. 111 p. Dissertação (Mestre em Ciência e

- tecnologia de Alimentos). Instituto Federal de educação, Ciência e Tecnologia do Mato Grosso (IFMG).
- Silva, S. J. Avaliação do potencial biotecnológico de plantas do cerrado *Bysonomia verbacifolia*. Anápolis, 2011, 25 p. Dissertação. Universidade Estadual de Goiás (UEG).
- Schauss, A. G.; WU, X.; Prior, R. L.; OU, B.; PATEL, D.; Huang, D.; Kababick, J. P. Phytochemical and nutrient composition of freeze-dried Amazonian palm berry, *Euterpe oleracea* Mart. (Acai). J. Agric. Food Chem. 2006, 54, 8598-8603.
- Wong JM, Jenkins DJ. 2007. Carbohydrate digestibility and metabolic effects. J Nutr.; 137(Suppl 11):2539S-46S.
- Zhu, Y.-W., L. Lu, W.-X. Li, L.-Y. Zhang, C. Ji, X. Lin, H.-C. Liu, J. Odle, and X.-G. Luo. Effect of dietary manganese on antioxidant status and expression levels of heat-shock proteins and factors in tissues of laying broiler breeders under normal and high environmental temperatures. Br. J. Nutr. 2015, 114:1965–1974.
- Lemos, A.L., Silva, J. de A. Desmatamento na Amazônia legal: Evolução, causas, monitoramento e possibilidades de mitigação através do fundo amazônico. Floresta e Ambiente, 2011, 18:98-108.
- Food and agriculture organization of the United Nations (FAO). FAO/WHO expert consultation on human vitamins and mineral requirements. 2001. 303p.
