# Lipid nutritional quality of the pulp and kernel of bocaiuva (*Acrocomia aculeata* (Jacq.) Lodd).

## Qualidade lipídica da polpa e da castanha de bocaiuva (*Acrocomia aculeata* (Jacq.) Lodd)

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## Abstract

Bocaiuva (*Acrocomia aculeata* (Jacq.) Lodd.) is a fruit of the Brazilian cerrado, whose flour is handcrafted, representing a typical regional product. Mature bocaiuva fruits from the State of Mato Grosso do Sul were processed to produce flour. The fatty acid profile of the flour obtained from pulp and kernel of bocaiuva was determined to evaluate possible changes in the composition due to processing. The main fatty acids found in pulp were monounsaturated fatty acids, especially oleic acid; saturated fatty acids predominated in the kernel, with a higher percentage of lauric acid. The nutritional quality of the lipid fraction of the bocaiuva indicates that the oil can be used as food, as well as the kernel oil, although the atherogenicity index (AI) was higher than recommended.

**Key-words**: Atherogenicity index, carotenoids, fatty acid, linoleic acid, oleic acid.

## Resumo

Bocaiuva (*Acrocomia aculeata* (Jacq.) Lodd.) é um fruto do Cerrado brasileiro, cuja farinha representa um produto típico da região. Frutos maduros de bocaiuva do Estado de Mato Grosso do Sul foram processados para obter farinha. O perfil de ácidos graxos da polpa e das castanhas de bocaiuva foram avaliadas afim de verificar as possíveis alterações em sua composição devido o processamento. Os principais ácidos graxos

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encontrados na polpa foram os ácidos graxos monoinsaturados, especialmente o ácido oleico; ácidos graxos saturados predominaram nas castanhas, com um teor mais elevado para ácido láurico. A qualidade nutricional da fração lipídica da bocaiuva indicou que o óleo pode ser utilizado como alimento, bem como o óleo das castanhas, embora o índice de aterogenicidade (IA) tenha sido maior do que o recomendado.

**Palavras-chave**: Índice aterogenicidade, carotenoides, ácidos graxos, ácido linoleico, ácido oleico.

## INTRODUCTION

The Brazilian Cerrado is a world biodiversity hotspot of native or adapted fruit trees with promising potential for agro-industrial use. Fruits of native species of the Cerrado are considered exotic and have sensory interesting attributes such as peculiar color, flavor and aroma, still little commercially exploited (SILVA et al., 2008, p. 549) and representing relatively little significance to science. The technological use of native fruit species can be an alternative source of food for the country (RAMOS et al., 2008, p. 90).

Bocaiuva (*Acrocomia aculeata* (Jacq.) Lodd) is a fruit with potential for technological dietary and oleaginous use. It is marketed mainly in nature in local markets. The fruit, also known as macaúba, belongs to the family Arecaceae and is found in throughout Brazil, and in the Mato Grosso do Sul State, it predominates in open fields (AQUINO et al., 2008, p. 95; MUNHOZ et al., 2014, p. 165; SANJINEZ-ARGANDOÑA and CHUBA, 2011, p. 1023).

The fruit pulp of color ranging from light yellow to dark orange, is commonly consumed fresh and in the form of products like ice cream, bulk candy, flour and liquor. Carotenoids present in bocaiuva pulp are responsible for the yellow color of this fruit. Regarding nutrition, its importance is due to antioxidant activity and provitamin A activity, whose intake are related to the prevention of cardiovascular diseases, cancers and other degenerative diseases (RAMOS et al., 2007, p. 3186).

The proximate composition of the pulp indicates a significant amount of calcium, lipids, dietary fiber and carotenoids. In the kernel, the content of protein, lipid, fiber and minerals are the constituents with the greatest relevance (SILVA et al., 2008, p. 549; RAMOS et al., 2007, p. 3186; HIANE et al., 2006, p. 683). The knowledge of the fatty acid profile is important in order to evaluate the nutritional quality of its lipid fraction. Linoleic acid (C18:2 $\omega$-6) prevalent in corn, sunflower and soybean oil, and alpha-linolenic acid (C18:3 $\omega$-3) predominating in linseed, canola, rapeseed and fish oil are essential fatty acids, belonging to $\omega$-6 and $\omega$-3 series, respectively, and are known to promote reduction in blood triglyceride and cholesterol levels, thus reducing the risk of cardiovascular diseases (FREITAS and NAVES, 2010, p. 269).

Dietary factors related to the incidence of chronic diseases, including cardiovascular diseases, include those related to the composition of dietary fat that can promote and/or protect against these diseases. The nutritional assessment of this fat has been performed, based on the fatty acid composition, by determining indices that relate the content of saturated, monounsaturated and $\omega$-6 and $\omega$-3 polyunsaturated fatty acids (ULBRICHT and SOUTHGATE, 1991, p. 985). Speciation of nutrients in pulp and kernel of native fruit, such as fatty acids, and studies of their effects on human nutrition and health are of great importance for the use of these fruits in the food industry. The goal of this study was to characterize the lipid quality of the pulp and kernel flours of bocaiuva, determining the indices of quality of their fatty acids.

## MATERIAL AND METHODS

### Fruit samples

Fruits of bocaiuva (*Acrocomia aculeata* (Jacq.) Lodd.) were collected in the municipality of Vicentina, Mato Grosso do Sul State, Brazil (22° 27' 32,69" S latitude and 54° 25' 42,24" W longitude) between October and December, 2015. Fruits were washed, sanitized by immersion in a solution of sodium dichloro-S-triazinetrione dihydrate (Sumaveg) at 0.66% for 10 min. Then, fruits were peeled and pulped manually. The coats were broken with a vise and kernels were removed manually. The pulp was dried in a tray dryer with forced air circulation at 45°C, constant air velocity of 0.5 $m.s^{-1}$ for about 8 h. The kernel and the dehydrated pulp were ground and sieved to 60 mesh.

### Determination of carotenoids

The determination of carotenoids in the fresh and dried (flour) pulp of bocaiuva was performed according to Rodriguez-Amaya (1999). Carotenoids were extracted with acetone from the pulp of the fruit and flour, followed by petroleum ether partition. The ether extract was concentrated in a rotary evaporator (T≤ 35°C) and dried with nitrogen. Immediately prior to injection into the chromatograph, the dry extract was redissolved in chromatographic grade acetone and filtered through 0.22μm PTFE filter. Quantitation was performed by reading the absorbance in a spectrophotometer (Agilent 8453) at 450 nm using the absorption coefficient of β-carotene (2592 in petroleum ether) for being the major carotenoid in the sample. The chromatographic analysis was performed on high performance liquid chromatograph (Shimadzu LC-20AT) with diode array (DAD) and $C_{18}$ monomeric column (Spheriosorb ODS1, 30mm, 4.6 x 150mm). The mobile-phase consisted of acetonitrile: methanol: ethyl acetate, from 95: 5: 0 to 60:20:20 for 20 minutes, keeping this rate until the end of the run, flow of 0.5 mL/min and re-equilibration time of 15 minutes.

### Extraction of oil

Oils of the kernel and dehydrated pulp were cold extracted according to Bligh and Dyer (1959), in which the oil is extracted using a mixture of three solvents (chloroform-ethanol-water).

### Physical and chemical characteristics of the oils

The total lipid content of the pulp and kernel of bocaiuva was determined by Soxhlet extraction with ethyl ether. The iodine content was determined by the Wijs method, using the Wijs solution and 0.1 $mol.L^{-1}$ sodium thiosulfate. The refractive index was obtained by direct reading in Abbé refractometer. The saponification number was determined by saponification with 4% potassium hydroxide solution and titration with 0.5 N hydrochloric acid (BRASIL, 2005).

## Composition of fatty acids

For analysis of fatty acid composition, the total lipid fraction was subjected to saponification with 0.5N KOH in anhydrous methanol, followed by esterification with a mixture of $H_2SO_4$ and $NH_4Cl$ in methanol and transferred to hexane, according to the method proposed by Hartman and Lago (1973) and modified by Maia and Rodriguez-Amaya (1993). The analysis of methyl esters of fatty acids was performed in chromatograph Shimadzu GC-2010 with autosampler AOC-5000 and flame ionization detector (DIC). The column used was a Restek Stabilwax fused silica, stationary phase, polyethylene glycol with 30 m long, 0.25 mm internal diameter and 0.25 μm of film. The injector and detector temperatures were maintained at 250°C. The initial temperature of the oven was 80°C for 3 min and then increased to 140°C at a rate of 10°C. min-1, then to 240°C at a rate of 5°C.min$^{-1}$, the final temperature was maintained for 11 min. The injected volume was 1.0 μL in Split at a ratio of 1:50. Helium was the carrier gas at a linear velocity of 30.0 cm.s$^{-1}$. Identification of peaks was made based on retention time and comparison with standards of methyl esters of fatty acids, the quantification used the area correction factors according to the standard Ce 1e-91 of AOCS.

## Nutritional quality indices

The nutritional quality of the lipid fraction was evaluated by three indices from the fatty acid composition data, by calculating the Atherogenicity Index (AI) (Eq 1), Thrombogenicity Index (TI) (Eq 2) according to Ulbricth and Southgate (1991); and ratio between hypocholesterolemic and hypercholesterolemic fatty acids (HH) (Eq 3) according to Santos-Silva et al. (2002), where AGMI are all the monounsaturated acids.

$$AI = \frac{C_{12:0} + 4 \times C_{14:0} + C_{16:0}}{\Sigma AGMI + \Sigma\omega6 + \Sigma\omega3} \quad (1)$$

$$TI = \frac{C_{14:0} + C_{16:0} + C_{18:0}}{0.5 \times \Sigma AGMI + 0.5 \times \Sigma\omega6 + 3 \times \Sigma\omega3} \quad (2)$$

$$HH = \frac{C_{18:1CIS9} + C_{18:2\omega6} + C_{20:4\omega6} + C_{18:3\omega3} + C_{20:5\omega3} + C_{22:5\omega3} + C_{22:6\omega3}}{C_{14:0} + C_{16:0}} \quad (3)$$

## Statistical analysis

Analyses were performed in triplicate. Data were subjected to analysis of variance and means were compared by Tukey test at 5% probability.

# RESULTS AND DISCUSSION

## Physical and chemical characteristics of the oils and composition of fatty acids

The physical and chemical composition of oil of the pulp and kernel of bocaiuva is listed in Table 1.

**Table 1. Values of the lipid content, refractive index, iodine value and saponification number of oils of flour and kernel of bocaiuva[1].**

| Characteristics | Pulp flour | Kernel |
|---|---|---|
| Lipid content ($g.100g^{-1}$) | 29.02 ± 0.38 [a] | 48.83 ± 0.66 [b] |
| Refractive index at 40 °C | 1.468 ± 0.03[a] | 1.457 ± 0.02[b] |
| Iodine value (g $I_2$.100 g oil $^{-1}$) | 49.61 ± 0.14 [a] | 23.77 ± 0.26 [b] |
| Saponification number (mg KOH.g $oil^{-1}$) | 467.72 ± 0.24 [a] | 533.06 ± 0.40 [b] |

*[1] Data presented as mean ± standard deviation. Different letters in the same row indicate significant differences ($p<0.05$).*

The bocaiuva fruit (pulp and kernel) presented high lipid content. Ramos et al. (2008) reported lower lipid values for pulp and Hiane et al. (2006) found similar values for the kernel.

The oil refractive index was 1.468 for the pulp and 1.457 for the kernel, values similar to those obtained by Hiane et al. (2005) for the pulp oil (1.4609) and the kernel oil (1.4539). The pulp oil has a higher amount of fatty acids with longer carbon chain (more than 16 carbons) and also a greater number of unsaturations than the kernel oil, which caused a higher refractive index than that of the kernel.

Iodine values were higher in the pulp oil, due to the higher number of unsaturated fatty acids (Table 2), as the iodine value is a measure of the degree of unsaturation of fatty acids present in the oil. Hiane et al. (2005) obtained 75.43 g $I_2$.100 g $oil^{-1}$ and 54.05 g I2.100 g $oil^{-1}$ to for oil of the pulp and kernel of bocaiuva, respectively, originating in Campo Grande-MS. Belén-Camacho et al. (2005) found a lower value (29.87 g $I_2$.100 g $oil^{-1}$) for the kernel of bocaiuva originating from Venezuela.

In relation to the saponification number, it is influenced by the chain length of the fatty acid: the lower the molecular weight of the fatty acid, the higher the saponification number. In this work, the kernel oil presented saponification number greater than that of the pulp oil (Table 1), however, the values of these indices were higher than those cited by Hiane et al. (2005) of 210.5 mg KOH.g $oil^{-1}$ and 258.0 mg KOH.g $oil^{-1}$ for pulp and kernel, respectively. Belén-Camacho et al. (2005) reported a lower value for bocaiuva kernel (205 mg KOH.g $oil^{-1}$). The differences in iodine and saponification indices may be related to variations in the amounts of saturated and unsaturated fatty acids of this work with the literature. Herein, saturated fatty acids were present with values above 60% in bocaiuva kernel and unsaturated fatty acids were majority (76.50%) in the pulp (Table 2). These variations within the same species are related to soil and climatic conditions and genetic variability, since bocaiuva is a native fruit, not yet domesticated, and shows variations among fruit of the same species as in other native fruits, such as pequi and baru (VERA et al., 2009, p. 112).

The fatty acid profile of the pulp and kernel of bocaiuva is showed in Table 2.

**Table 2. Fatty acid composition of the pulp and kernel oil of bocaiuva in relative percentage to the total fatty acids.**

| Fatty acids | Percentage of total fatty acids | |
|---|---|---|
| | Pulp flour oil (%) | Kernel oil (%) |
| Saturated | 22.46 | 62.84 |
| Caproic (C6:0) | 0.42 ± 0.09 [a] | 0.35 ± 0.02 [b] |
| Caprylic (C8:0) | 0.18 ± 0.02 [a] | 3.23 ± 0.07 [b] |
| Capric (C10:0) | 0.13 ± 0.01 [a] | 3.27 ± 0.05 [b] |
| Lauric (C12:0) | 0.74 ± 0.05 [a] | 39.02 ± 0.23 [b] |
| Myristic (C14:0) | 0.41 ± 0.02 [a] | 7.47 ± 0.02 [b] |
| Pentadecanoic (C15:0) | 0.03 ± 0.01 | nd |
| Palmitic (C16:0) | 18.92 ± 0.06 [a] | 6.30 ± 0.02 [b] |
| Margaric (C17:0) | 0.04 ± 0.01 | Nd |
| Stearic (C18:0) | 1.42 ± 0.01 [a] | 2.93 ± 0.02 [b] |
| Arachidonic (C20:0) | 0.11 ± 0.01 [a] | 0.19 ± 0.01 [b] |
| Behenic (C22:0) | 0.03 ± 0.01 [a] | 0.04 ± 0.01 [b] |
| Lignoceric (C24:0) | 0.03 ± 0.01 [a] | 0.04 ± 0.01 [b] |
| Monounsaturated | 70.01 | 33.06 |
| Palmitoleic (C16:1ω-7) | 3.75 ± 0.06 | nd |
| Oleic (C18:1ω-9) | 62.64 ± 0.29 [a] | 32.70 ± 0.28 [b] |
| Vaccenic (C18:1ω-7) | 3.51 ± 0.04 [a] | 0.21 ± 0.01 [b] |
| Gadoleic (C20:1 ω-9) | 0.11 ± 0.01 [a] | 0.15 ± 0.01 [b] |
| Polyunsaturated | 6.49 | 3.08 |
| Linoleic (C18:2 ω-6) | 5.54 ± 0.02 [a] | 3.08 ± 0.02 [b] |
| Linolenic (C18:3 ω-3) | 0.95 ± 0.01 | Nd |
| Unidentified | 1.04 | 1.02 |

*[1] Data presented as mean ± standard deviation. Different letters in the same row indicate significant differences (p<0.05). Nd: non-detected.*

The composition of the fatty acids profiles of the pulp and kernel oil differed statistically from each other (p> 0.05). For the pulp, oleic and palmitic were the predominant fatty acids. In the kernel, prevailed lauric and oleic acids.

The unsaturated acids found in bocaiuva fruit have beneficial health effects. Monounsaturated fatty acids are as effective as polyunsaturated in reducing the level of HDL cholesterol in humans (BORA and ROCHA, 2004, p. 158). Bocaiuva showed significant levels of oleic acid in the pulp (62.64%) and kernel (32.70%).

Additionally, Hiane et al. (2005) reported values for the oleic acid in the pulp similar to this study (62.16%) and higher in the kernel (40.17%). Bora and Rocha (2004) found for macaíba (*Acrocomia intumescens*) oleic acid values for the pulp of 63.24% and for the kernel of 19.67%. Belén-Camacho et al. (2005) and Hernadez et al. (2007) registered lower levels of oleic acid for bocaiuva kernel, 18.67% and 17.9%, respectively.

Besides, the vaccenic acid, found in the pulp and in smaller quantities in the kernel, is an isomer of oleic acid with difference in the double bond position and presents a higher melting point (39.5°C) than the oleic acid (16.3°C). This acid is synthesized from the palmitic acid via palmitoleic acid production by delta-9 desaturase enzyme and elongated by an elongase. The vaccenic acid has been found in many oilseeds used for biodiesel production (BARTHET, 2007, p. 411; ORDOÑEZ-PEREDA, 2005, p. 33). Lima et al. (2007) reported the presence of vaccenic acid in the pulp and kernel of pequi (1.9% and 1.38%, respectively). Andreu et al. (2009) recorded 1.3% of vaccenic acid in jatropha seeds. Barthet (2007) reported 0.4-3.3% in seeds of *Brassica* species.

As for linoleic acid, the pulp showed 5.54% and the kernel, 3.08%. This fatty acid represents the ω-6 family and is essential in the diet, its lack in the body results in adverse clinical symptoms, such as scaly rash and reduced growth. Considering this same acid, Hiane et al. (2005) found similar values for the pulp (5.10%) and higher for the kernel (5.91%). In macaiba (*Acrocomia intumescens*), Bora and Rocha (2004) reported higher values for the pulp (8.75%) and detected no linoleic acid for the kernel. Belén-Camacho et al. (2005) observed 2.5% of linoleic acid for the bocaiuva kernel. Hernadez et al. (2007) registered similar values for the bocaiuva kernel (3.14%).

In turn, linolenic acid was found in small amounts (0.95%) only in the pulp. This acid represents the ω-3 family, is a precursor of eicosapentaenoic acid and docosahexaenoic acid. It is essential for the diet and its lack can result in neurological abnormalities and impaired growth. The linoleic and linolenic acids, among other functions, are important in the formation of prostaglandins, thromboxanes, prostacyclins and leukotrienes, which play an important role in mediating allergic and inflammatory immune responses (BORA and MOREIRA, 2003, p. 2003).

Hiane et al. (2005) verified higher values for the pulp (2.52%) and 1.92% for the bocaiuva kernel. Bora and Rocha (2004) reported for macaíba (*Acrocomia intumescens*), higher values for the pulp (6.81%) and no linolenic acid for the kernel. Belén-Camacho et al. (2005) and Hernadez et al. (2007) also did not detect linolenic for the bocaiuva kernel.

Palmitic acid represented 18.92% of the pulp oil and 6.30% of the kernel oil. This fatty acid is particularly useful for improving the textural properties of foods such as cookies, ice cream, soft candies, among others. Regarding the palmitic acid in the oil pulp, Bora and Rocha (2004) reported, for macaíba (*Acrocomia intumescens*), values slightly lower (13.26%) than those found in this study and for the kernel, values were slightly higher (7.97%). Hiane et al. (2005) found close values for the pulp (18.53%) and higher for the kernel (12.62%). Lauric acid has important properties for application in food products, since it has low molecular weight. The kernel oil has almost 40% lauric acid. Carr and Hogg (2005) analyzed the prospects for use by manufacturers of palm oil and palm kernel based products, the latter rich in lauric acid. There is a wide variety of uses in bakery products, in the development and imitation of plant creams, in emulsions in foods, among others, so it is possible to recommend bocaiuva kernel oil as a substitute or complement of palm kernel oil for the aforementioned products.

For lauric acid of the bocaiuva kernel, Hiane et al. (2005) reported lower values (12.95%). Belén-Camacho et al. (2005) observed 50.9% lauric acid for bocaiuva kernel originating from Venezuela. Hernández et al. (2007) mentioned 45% lauric acid for the kernel of *Acrocomia aculeata* also from Venezuela. Bora and Rocha (2004) found, for macaíba (*Acrocomia intumescens*), higher values (45.53%) of lauric acid. Faria et al. (2008) obtained 42.1% lauric acid for pindo palm.

Regarding nutritional potential of oils with high content of lauric acid, such as bocaiuva kernel oil, De Roos et al. (2001) compared the effects of solid fats having a high content of lauric acid and solid fats having a high level of trans fatty acids in human serum lipoproteins and their effect on cholesterol. The study showed that consumption of fats with a high content of lauric acid is more favorable for the total cholesterol than the consumption of hydrogenated fats rich in trans fatty acids, obtained from soybean oil. Trans fats besides increasing serum LDL cholesterol concentrations, such as saturated fats, also reduce the levels of the HDL fraction, thus significantly altering the LDL/HDL ratio compared to the diet with lauric acid. Saturated fatty acids improve texture, palatability and consistency of foodstuffs used in the diet, and may replace hydrogenated vegetable fat by palmitic and/or lauric acid (FARIA et al., 2008, p. 549).

Fatty acids with odd carbon number, such as pentadecanoic and margaric acids found herein in the bocaiuva pulp, appear in small amounts in foods due to their synthesis from two units acetyl with two carbon atoms (SENA JÚNIOR et al., 2010, p. 191).

## Nutritional quality indices

The nutritional quality of the lipid profile evaluated by different indices is described in Table 3.

**Table 3. Nutritional quality indices of the lipid fraction of oils of the pulp flour and kernel of bocaiuva.**

| Indices | Pulp flour oil | Kernel oil |
|---|---|---|
| P/S | 0.29 | 0.05 |
| ω6/ω3 | 5.83 | - |
| AI | 0.28 | 2.08 |
| TI | 0.45 | 0.92 |
| HH | 3.58 | 2.60 |

*P/S: ratio between polyunsaturated and saturated fatty acids. ω6/ω3: ratio between ω6 and ω3 fatty acids. AI: atherogenicity index. TI: thrombogenicity index. HH: ratio between hypocholesterolemic and hypercholesterolemic fatty acids.*

Foods with a ratio between polyunsaturated and saturated fatty acids (P/S) below 0.45 have been considered as undesirable to the diet (Department of Health and Social Security, 1984), as they influence the increase of blood cholesterol. In this study, this ratio was 0.29 for the pulp flour oil and 0.05 for the kernel, however, the P/S evaluated separately is limited, because it generalizes all fatty acids as inducers of increased blood cholesterol and does not consider the metabolic effects of monounsaturated fatty acids. Moreover, it should be noted that the fresh and dried pulp have a high carotenoid content, especially β-carotene, which are associated with the prevention of oxidative processes (Table 4), beyond the presence of phenolic compounds and dietary fiber. Despite the loss of total carotenoids, after processing for the production of flour (64%), more studies are needed to analyze the interaction of other nutritional factors with the of P/S value. Hiane and Penteado (1989) also observed that processing bocaiuva pulp to obtain the flour led to a significant decrease in the vitamin A value of the processed sample, with an average loss of 63.1% (AU).

**Table 4. Carotenoids content in the fresh and dried (flour) pulp and in the kernel of bocaiuva, expressed in µg/g of dry sample.**

| | Pulp | Flour | Kernel |
|---|---|---|---|
| Total carotenoids (µg/g dry basis) | 140.88 | 91.01 | 1.25 |

The ratio between polyunsaturated and saturated fatty acids (P/S) registered in this study was similar to that found by Hiane et al. (2005) for pulp (0.25), however for the kernel, the authors found a higher ratio (0.15). The knowledge of the relationship between ω6 and ω3 fatty acids (ω6: ω3) is another important factor in human health, because excessive consumption of ω6 fatty acid, associated with reduced intake of ω3 fatty acid, is a risk factor for cardiovascular disease. These fatty acids compete for the enzymes involved in the chain desaturation and elongation reactions, although these enzymes have greater affinity for the ω3 fatty acids family, the conversion of linolenic acid into long chain polyunsaturated fatty acid is strongly influenced by linoleic acid levels in the diet. In this regard, the bocaiuva pulp showed a ω6: ω3 ratio consistent with that recommended, from 5: 1 to 10: 1. The bocaiuva kernel showed no ω6: ω3 ratio, because we detected no ω3 fatty acids.

Indices based on the functional effects of different fatty acids allow a better assessment of the nutritional quality of lipids in food. The main hypercholesterolemic fatty acids are myristic and palmitic acids. The ratio between hypocholesterolemic and hypercholesterolemic fatty acids (HH) considers the specific effects of fatty acids on cholesterol metabolism, higher values of this ratio are desirable since they indicate that the amount of hypercholesterolemic fatty acids is lower than that of hypocholesterolemic fatty acids. In the present study, we verified HH values for the pulp and kernel close to those registered by Guimarães et al. (2013) in sesame oil, whose index was 4.82.

Indices of atherogenicity (IA) and thrombogenicity (IT), relating pro- and anti-atherogenic fatty acids and pro- and anti-thrombogenic fatty acids, respectively, and considered better nutritional quality of the diet as a reduction factor of incidence risk of cardiovascular disease when present lower values (SENSO et al., 2007, p. 298). The values of AI and TI (Table 3) for the pulp flour and kernel of bocaiuva were lower than 1.0, with the exception of the AI for the kernel oil, this is due to the presence of more than 60% of saturated fatty acids in the kernel. Guimarães et al. (2013) observed AI and TI values lower than 1.0 for linseed and sesame oils. Nozaki et al. (2012) registered for oil of the pulp and kernel of guarirova (*Syagrus oleracea*), respectively, AI of 0.69 and 11.53, TI of 1.32 and 4.82 and HH of 1.39 and 0.49.

## CONCLUSIONS

The flours of the pulp and kernel of bocaiuva presented high content of lipids. In the dehydrated pulp of bocaiuva, monounsaturated fatty acids predominated, especially oleic acid. In the kernel, saturated fatty acids predominated, with a higher percentage of lauric acid. The nutritional quality of the lipid profile of the oil from the dried bocaiuva pulp, assessed by ω6: ω3, AI, TI and HH indices, indicates that the oil can be used as food. The HH and TI indices were favorable to the use of bocaiuva kernel oil in the diet, although the atherogenicity index (AI) was higher than recommended.

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