












Fatty acid profile and physicochemical characterization of buriti oil during storage

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ABSTRACT: The objective of this research was to evaluate the fatty acid profile and physicochemical properties of buriti oil under storage conditions. The oil was analyzed for 70 days by evaluating the physicochemical characteristics of acidity index, refractive index, bulk density, absolute viscosity, peroxide index, lipid oxidation by TBARS method, color parameters (L^* , a^* , b^* , C^* e h^*) and carotenoid profile (α -carotene and β -carotene) for every 10 days of storage, in addition to the β -carotene/linoleic acid system and fatty acid profile. Variables remained stable over the analysis periods and the total carotenoids ranged from 836.91 to 1036.96 $\mu\text{g/g}$. Oleic acid accounted for the highest content among fatty acids, with a value of 78.06 g/100 g of fatty acids and a $\omega 6/\omega 3$ ratio of 1.95. Buriti oil has a nutritional quality and a fatty acid profile that justifies recommendations for its consumption, suggesting the need for regulatory bodies to draw up a standardized protocol for extracting oil from the fruit pulp.

Key words: *Mauritia flexuosa* L., oxidative stability, total carotenoids, $\omega 6/\omega 3$.

Perfil de ácido graxo e qualidade físico-química do óleo de buriti sob armazenamento

RESUMO: Objetivou-se neste trabalho avaliar o perfil de ácido graxo e a qualidade físico-química do óleo de buriti em condições de armazenamento. O óleo foi analisado durante 70 dias avaliando as características físico-química índice de acidez, índice de refração, densidade aparente, viscosidade absoluta, índice de peróxidos, oxidação lipídica pelo método de TBARS, parâmetros de cor (L^* , a^* , b^* , C^* e h^*) e carotenoides (α -caroteno e β -caroteno) a cada 10 dias de armazenamento, além do sistema β -caroteno/ácido linoléico e perfil de ácidos graxos. As variáveis se mantiveram estáveis durante os períodos de análises e os carotenoides totais variaram entre 836,91 a 1036,96 $\mu\text{g/g}$. O ácido graxo com maior teor foi o ácido oleico com valor de 78,06 g/100 g de ácidos graxos e relação $\omega 6/\omega 3$ de 1,95. O óleo de buriti apresenta qualidade nutricional que justifica o estímulo ao consumo devido aos ácidos graxos que apresenta, necessitando dos órgãos reguladores a elaboração de um protocolo de extração do óleo da polpa do fruto.

Palavras-chave: *Mauritia flexuosa* L., estabilidade oxidativa, carotenoides totais, $\omega 6/\omega 3$.

INTRODUCTION

Oils from different plants contain diverse compounds with bioactive potential such as carotenoids, tocopherols, free fatty acids or those esterified with glycerol, and unsaturated fatty acids from the series $\omega 3$, $\omega 6$ and $\omega 9$ (PEREIRA et al., 2019). The proportion of $\omega 3$ and $\omega 6$ in plant oils has gained prominence for their potential health benefits; however, there is no consensus on the ideal

ratio of $\omega 6:\omega 3$ (SIMOPOULOS, 2002). Variations in the quantity and types of these triacylglycerols are responsible for the wide range of oils found in nature and their specific health-promoting effects (CERIANI et al., 2008).

Mauritia flexuosa, a species commonly known as buriti and found in the Amazon and Cerrado, is a palm tree with fruits of bright orange-yellow color. Several studies have indicated that these fruits contain β -carotene in the pulp and; are therefore, a

source of provitamin A; moreover, the oil can be used in different culinary preparations (FERREIRA, 2019; SILVA et al., 2009; BATAGLION et al., 2015; RIBEIRO et al., 2010). CANDIDO & SILVA (2017) observed variation in the content of the fruit oil across both the regions; however, a high proportion of oleic acid was detected regardless of the region from where the fruit was collected.

The properties of vegetable oils sourced from many unconventional species of palm fruits, and the inherent presence of tocopherols, carotenoids, mainly β -carotene and unsaturated fatty acids, and their potential health benefits have been highlighted. However, more scientific data is needed to validate the safety of buriti oil consumption and application before industries can start commercial production of this oil (RODRIGUES et al., 2010; SPERANZA et al., 2016; SERRA et al., 2019).

Among unsaturated fatty acids in buriti oil, oleic acid (C18: 1 ω 9C) is reported in large quantities (SILVA et al., 2009; COSTA et al., 2011; AQUINO et al., 2012; FREITAS et al., 2017). SILVA et al. (2009) found that triacylglycerols account for 91.9 % of constituents present in buriti oil, whereas free fatty acids constituted just 3.1 %.

Generally, the quality of oil is determined by the type of the unsaponifiable portion as well as the content of unsaturated fatty acids; however, other parameters such as acidity, density, and oxidation index should be highlighted since there is no standardized oil extraction process and the oil quality largely depends on the extraction process, which can be industrial or manual in nature (SILVA et al., 2009).

Water-containing vegetable oil matrices may release water during the oil extraction process and thus affect the oxidative stability of the product. Enzymatic action may also release fatty acids (FREGA et al., 1999) that may alter the acidity through hydrolysis of the triacylglycerol molecules, thereby affecting the oil quality during due to the release of off-flavors (PIERGIOVANNI & LIMBO, 2010).

Due to the lack of standardized protocol for extracting oil from the buriti fruit pulp, the quality of the oil obtained and stored in cooperative stores for consumer market supply may not be satisfactory enough either for consumption or to meet the market demand based on its bioactive potential. Thus, the purpose of the present study was to evaluate the fatty acid profile and the physicochemical quality of buriti oil under storage conditions.

MATERIALS AND METHODS

The buriti oil sample was acquired from a cooperative store located in Montes Claros - MG, in October 2018. It was packed in aluminum foil and stored in original packaging at -18 °C until further analysis.

Physicochemical analysis

The buriti oil and its physicochemical characteristics were analyzed in triplicate for 70 days at 10 days intervals, and analyzed samples were marked as follows: 1 (t_1), 10 (t_{10}), 20 (t_{20}), 30 (t_{30}), 40 (t_{40}), 50 (t_{50}), 60 (t_{60}), and 70 (t_{70}) days. The decay of the β -carotene/linoleic acid was checked by measuring absorbance every 30 days. The fatty acid profile was assessed at the time of the acquisition of the oil.

Index of acidity and refraction

The acidity index was determined according to method 325/IV of the Adolf Lutz Institute (IAL, 2008) and the refractive index (R) was determined according to method No. 921.08 of the AOAC (2012), by using a Biobrix® brand Abbé bench refractometer.

Apparent density and absolute viscosity

The density was determined according to the AOAC (2012) method No. 985.19 using a pycnometer and the absolute viscosity was determined using a Brookfield® brand viscometer (model LVT, MA, USA) following the manufacturer's recommendations by using a 19 mm outer diameter cylinder (reference *Spindle S-61*) and adjusting the torque-speed at 6 rpm after total immersion of the cylinder.

Peroxide index and lipid oxidation by the TBARS method

The peroxide index was determined according to AOAC (2012) method No. 965.33 and lipid oxidation was measured by thiobarbituric acid reactive substances (TBARS) following the methodology described by RAMANATHAN & DAS (1992) and TANG et al., (2002). The calibration curve was prepared using the tetra methoxy propane solution (TMP) and by calculating the recovery test (R) and conversion factor (K) as described by TARLADGIS et al. (1960) and QUEIROZ (2006). The results were expressed in mg of malondialdehyde (MDA)/kg of sample.

Color parameters

The color parameters (a^* , b^* , L^*) were determined using the Konica Minolta® colorimeter

(model CM-700d, Japan), calibrated with CM-A177 white standard (Illuminant D65, 10° standard observer). Results were expressed using the CIE Lab system on the scale (L^* , a^* , and b^*). The saturation index values (C^*) and the hue angle (h^*) were obtained as described by RAMOS & GOMIDE (2007). To express the hue, the results were converted to degrees $h^* = \arctan(b^*/a^*)$.

Carotenoids (α -carotene and β -carotene)

The content of carotenoids (α -carotene and β -carotene) was determined following the methodology described by SPERANZA et al. (2016), α -carotene and β -carotene contents were calculated as per their absorbance values at 444 nm and 453 nm, respectively. The total content was calculated using the molar absorptivity ($E_{1\text{cm}}^{1\%}$): 2800 for α -carotene and 2592 for β -carotene by following the method (355/IV) described in IAL (2008).

β -carotene/linoleic acid measurements

The determination of β -carotene/linoleic acid was performed following the methodology described by RUFINO et al. (2007). A Trolox solution with standard solution, and the spectrophotometer was calibrated with distilled water. Results were expressed as a decrease in the absorbance as a function of time.

Quantification of unsaponifiable and saponifiable fatty acids

To extract the fatty acids, the samples of buriti oil were subjected to the separation of the unsaponifiable and saponifiable fractions. Unsaponifiable fraction was obtained by using the method Ca 6b-53 (AOCS, 2003). After separation, the ethereal phase was obtained, dried, and the extracted content was weighed and results were expressed as % of unsaponifiable mass/oil mass.

The fatty acids from the saponifiable fraction were extracted following the methodology described by FOLCH et al. (1957), and esterified according to the method described by HARTMAN & LAGO (1973).

The obtained esters were subjected to gas chromatography according to the methodology described by MONTEIRO et al. (2017) and expressed as a percentage of total fatty acids (g/100 g of total fatty acid). Saturated fatty acids (SFA), total monounsaturated fatty acids (MUFA), and total polyunsaturated fatty acids (PUFA) were analyzed according to the methodology described by FARIA et al. (2015). The proportion of each group of fatty acids was determined according to their degree of

unsaturation and identification of the double bond position on the total fatty acids.

Fatty acid quality indices

The quality indices of fatty acids were evaluated by considering the Atherogenic Index (AI) and the Thrombogenic Index (IT) as described by ULBRICHT & SOUTHGATE (1991). The ratio of hypocholesterolemic to hypercholesterolemic (h/H) fatty acids was determined as described by SANTOS-SILVA et al. (2002). The indices were calculated as described by MELO et al. (2019).

Statistical analysis

The results were subjected to descriptive statistical analysis and expressed as mean values \pm standard deviation. For the β -carotene/linoleic acid system the results were expressed by the decrease in absorbance as a function of the time.

A correlation matrix between the physical and chemical variables was built to determine the correlation coefficient, considering $r > 0.70$ to construct a mathematical model of the linear regression of equation $y = \beta_1 x + \beta_0$; the coefficient of determination was considered to be $R^2 > 0.90$. The data was analyzed with the help of the statistical program R® version 3.6.1. (2019).

RESULTS AND DISCUSSION

The buriti oil samples were analyzed over a 70-day period, with 10 days intervals and samples were indicated as 1 (t_1), 10 (t_{10}), 20 (t_{20}), 30 (t_{30}), 40 (t_{40}), 50 (t_{50}), 60 (t_{60}), and 70 (t_{70}) days.

The refractive index ranged from 1.464 to 1.466, the density ranged from 0.905 to 0.910 g/cm³, and the viscosity ranged from 53.33 to 65.00 mPa.s (Table 1). These parameters indicated the stability and quality of oils as they are related to the presence of unsaturated fatty acids in the sample and represent the level of degraded compounds responsible for altering the physical and chemical characteristics of oils. Similar values for refractive index and density and viscosity of buriti oil were reported by SILVA et al. (2009) and CERIANI et al. (2008).

The total acidity index ranged between 12.27 and 13.77 mg KOH/g and the titratable acidity of oleic acid ranged between 6.24 and 6.92 g/100 g of sample (Table 1). The maximum acidity of cold-pressed and non-refined oils and fats should not exceed 4.0 mg KOH/g sample (BRAZIL, 2005); our results showed that the acidity of the buriti oil samples was beyond the approved limits. Since the acidity

Table 1 - Mean values \pm standard deviation of physicochemical parameters of buriti oil (*Mauritia flexuosa* L.) during storage.

Storage time (days)	ATT (mgKOH/g)*	AT(g/100g)**	Index of refraction	Density (g/cm ³)	Viscosity (mPa.s)
t ₁	12.44 \pm 0.26	6.25 \pm 0.13	1.465 \pm 0.00	0.910 \pm 0.008	58.33 \pm 2.89
t ₁₀	12.27 \pm 0.18	6.24 \pm 0.09	1.465 \pm 0.00	0.907 \pm 0.005	65.00 \pm 0.00
t ₂₀	13.58 \pm 0.50	6.82 \pm 0.25	1.464 \pm 0.00	0.905 \pm 0.004	58.33 \pm 2.88
t ₃₀	12.73 \pm 0.27	6.40 \pm 0.13	1.465 \pm 0.00	0.908 \pm 0.005	56.66 \pm 2.88
t ₄₀	13.44 \pm 0.78	6.75 \pm 0.39	1.464 \pm 0.00	0.907 \pm 0.004	53.33 \pm 2.88
t ₅₀	12.68 \pm 0.33	6.37 \pm 0.16	1.464 \pm 0.00	0.905 \pm 0.000	55.00 \pm 0.00
t ₆₀	12.98 \pm 0.17	6.52 \pm 0.08	1.466 \pm 0.00	0.905 \pm 0.000	55.00 \pm 0.00
t ₇₀	13.77 \pm 0.48	6.92 \pm 0.24	1.464 \pm 0.00	0.906 \pm 0.000	58.33 \pm 2.88

*ATT: Total titratable acidity; **AT: Titratable acidity of oleic acid.

index evaluates the content of free fatty acids in a sample and the release of these acids is subjected to the hydrolysis of the oils and fats (FREGA et al., 1999; PIERGIOVANNI & LIMBO, 2010), the quality of the buriti oil (AGUIAR & SOUZA, 2017) is likely to depend on the mode of extraction and/or storage of the oil and extent of hydrolysis. AGUIAR & SOUZA (2017) observed a variation in the pH and acidity values of the buriti pulp due to storage and demonstrated hydrolysis of fatty acids over time. However, the presence of carotenoids in the oil prevented lipid peroxidation as observed in other studies on the buriti pulp (AGUIAR & SOUZA, 2017).

According to RADUNZ et al. (2018), the high oleic acid concentration indicates an advanced level of triacylglycerol deterioration through hydrolysis of the ester bonds and release of free fatty acids. Thus, the storage conditions of fruits such as storage duration and temperature, and the type of oil extraction process would determine the quality of the oils (MELO, 2010). This highlighted the need to standardize the process related to the handling of the fruits before oil extraction, during oil extraction, and processing by the extraction cooperatives and companies, and also to standardize the storage temperature of this oil. AQUINO et al. (2012) and FREITAS et al. (2017) observed variations in the acidity of the buriti oil and ARAÚJO (2008) and SILVA et al. (2009) observed various concentrations of free oleic acid in crude buriti oil samples, which reinforces the need to develop a standardized protocol for extraction and storage of the fruit oil.

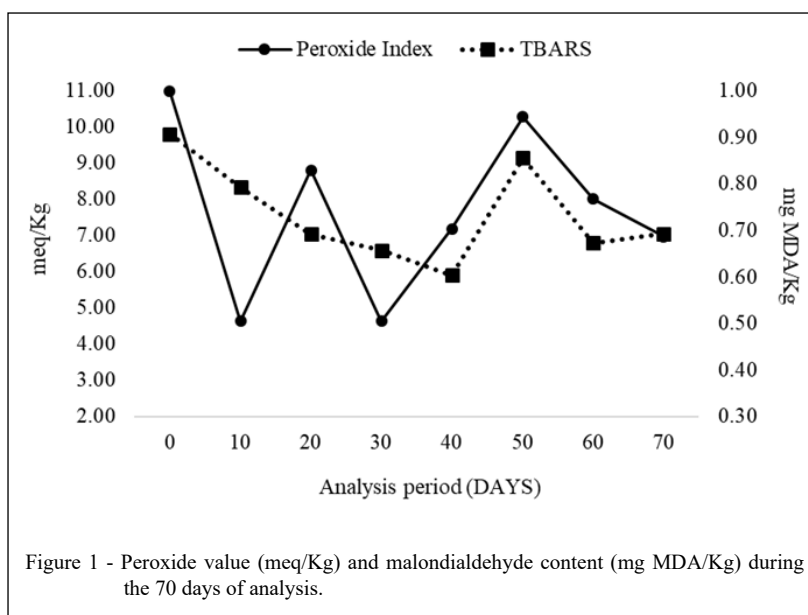
The peroxide index varied from 4.63 to 10.98 meq/Kg while the malondialdehyde content varied from 0.60 to 0.90 mg of MDA/Kg of buriti oil (Figure 1). Peroxides represent the primary compounds

of fatty acid degradation through oxidation and are represent free radicals. The peroxide index of cold-pressed and unrefined oils should not exceed 15 meq/Kg of a sample (BRAZIL, 2005).

The attenuation of malondialdehyde content between Days 10 and 40 may be formation of complexes among the compounds present, generation of substances not detected in this study, or due to the antioxidative effects of the carotenoids. Carotenoids, such as β -carotene, prevent the oils from oxidative damage (SPERANZA et al., 2016). Phospholipids and malondialdehyde may interact with each other (AHAMED et al., 2007). The sudden increase in malondialdehyde content on Day 50 may be an indication of the high amount of free fatty acids in the oil sample, their continued degradation through peroxidation (which was confirmed by the presence of peroxides during analysis), and the formation of secondary compounds.

The color parameters (L^* , C^* and h^*) remained constant throughout the study period (Table 2). The corresponding hue angle (h^*) in degrees, calculated according to RAMOS & GOMIDE (2007) were presented in the first quadrant (red, orange, and yellow) and varied from 41.31 to 47.83, with the predominance of orange. Carotenoids, mainly β -carotenes, impart the characteristic orange or red-orange color to the buriti oil (ALBUQUERQUE et al., 2005; SERRA et al., 2019). The red index (a^*) ranged from 23.99 to 25.97 and the yellow index (b^*) from 21.11 to 27.55 (Figure 2), with the hue leaning towards red and yellow.

In the correlation matrix based on the 70 days analysis, the most significant coefficient was observed between the saturation index (C^*) and the yellow index (b^*), where $r = 0.9695$ ($P < 0.001$). This relation was directly proportional;



as the values of b^* increased, the response in C^* increased proportionally. Thus, a linear model was constructed and $C^* = 0.88977 \times (b^*) + 13.30500$ with $R^2 = 0.9426$ and p-value of 3.85×10^{-15} was obtained (Figure 3). This model can explain the variation in the saturation index as a function of the yellow index in 94.26 % of the cases.

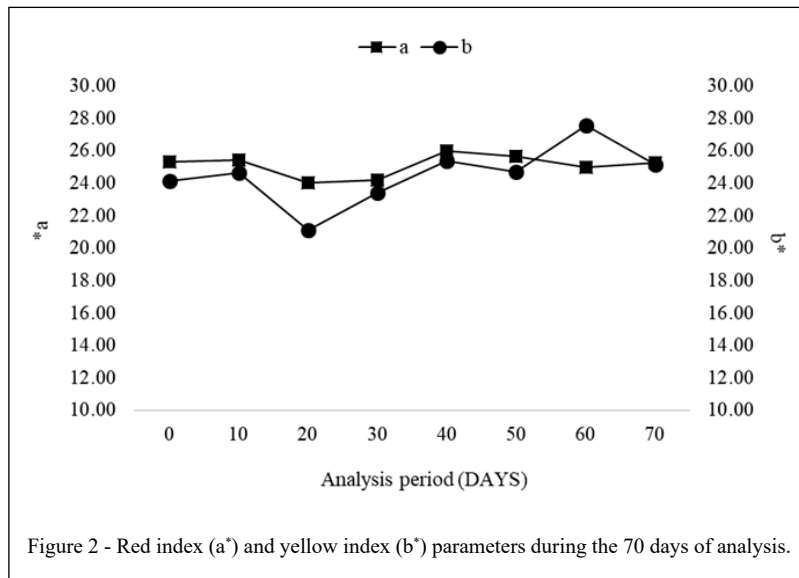
The total carotenoids were between 836.91 and 1036.96 $\mu\text{g/g}$ in the buriti oil. Considering the decrease in the carotenoids during the analysis period, the formation of secondary compounds such as epoxy-carotenes and apocarotenes was considered; their antioxidant activity sequestered the free radicals and resulted in quantitative decrease in the

carotenoids. Compounds like these are observed at the beginning of the oxidation as intermediates, and hence, are not present in large quantities (RODRIGUEZ-AMAYA, 2004). Several studies reported varied carotenoid contents for buriti oil and buriti pulp (ALBUQUERQUE et al., 2005; SILVA et al., 2009; AGUIAR & SOUZA, 2017; FREITAS et al., 2017; SERRA et al., 2019).

According to AMORIM-CARRILHO et al. (2014) carotenoids are subject to oxidation and isomerization reactions due to exposure to light, temperature, and presence of acids and oxygen, among others, which leads to the formation of epoxides and apocarotenoids, and degradation into low molecular-

Table 2 - Mean values \pm standard deviation of the brightness and color parameters (L^*), saturation index (C^*), and tonality angle (h^*) of buriti oil (*Mauritia flexuosa* L.) during storage.

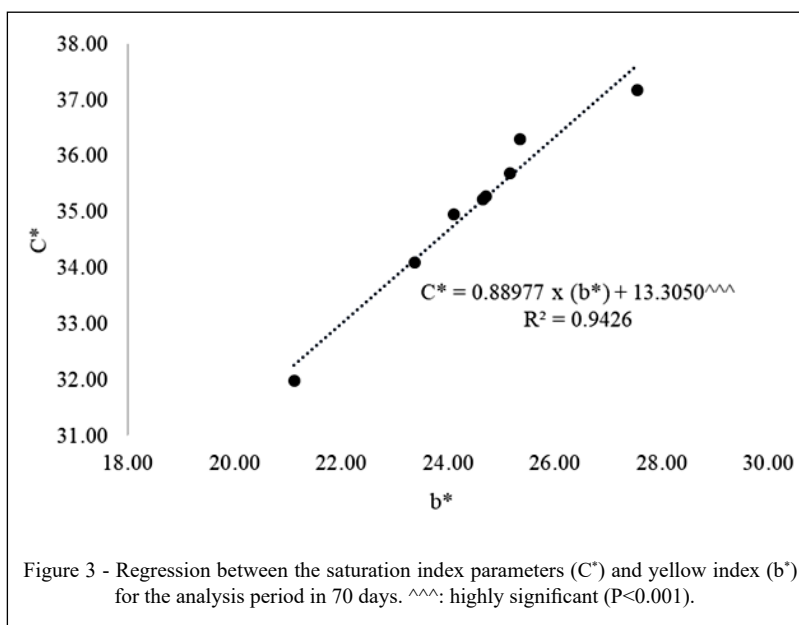
Storage time (days)	L^*	C^*	h^*
t_1	23.14 \pm 1.42	34.96 \pm 1.71	43.56 \pm 0.013
t_{10}	23.79 \pm 1.46	35.40 \pm 1.09	44.09 \pm 0.021
t_{20}	24.84 \pm 2.08	31.96 \pm 1.57	41.31 \pm 0.021
t_{30}	25.06 \pm 1.68	33.65 \pm 2.64	43.90 \pm 0.041
t_{40}	23.47 \pm 1.46	36.29 \pm 1.24	44.28 \pm 0.015
t_{50}	24.04 \pm 1.67	35.61 \pm 0.39	43.92 \pm 0.026
t_{60}	23.41 \pm 0.37	37.17 \pm 0.65	47.83 \pm 0.027
t_{70}	24.03 \pm 1.07	35.64 \pm 1.99	44.86 \pm 0.026



weight molecules that result in loss of biological activity and change in color (RODRIGUEZ-AMAYA, 2001). Carotenoids impart health benefits and are not influenced by activity of provitamin A. The antioxidant property of carotenoids is affected by singlet oxygen and free radical sequestration (RODRIGUEZ-AMAYA, 2004). Carotenoids helps to stabilize compounds that may trigger degradation reactions through peroxidation. The total content of

carotenoids in the buriti oil may vary according to the degree of ripeness of the fruit, soil, extraction procedure (SANTOS et al., 2015), regions and cultivars (AGÓCS & DELI, 2011), and climate or geographical location (RODRIGUEZ-AMAYA, 2004).

In the β -carotene/linoleic acid system, the decrease in the absorbance was observed for the extract with buriti oil and the synthetic antioxidant (Trolox) when measured for 120 minutes (Figure 4)



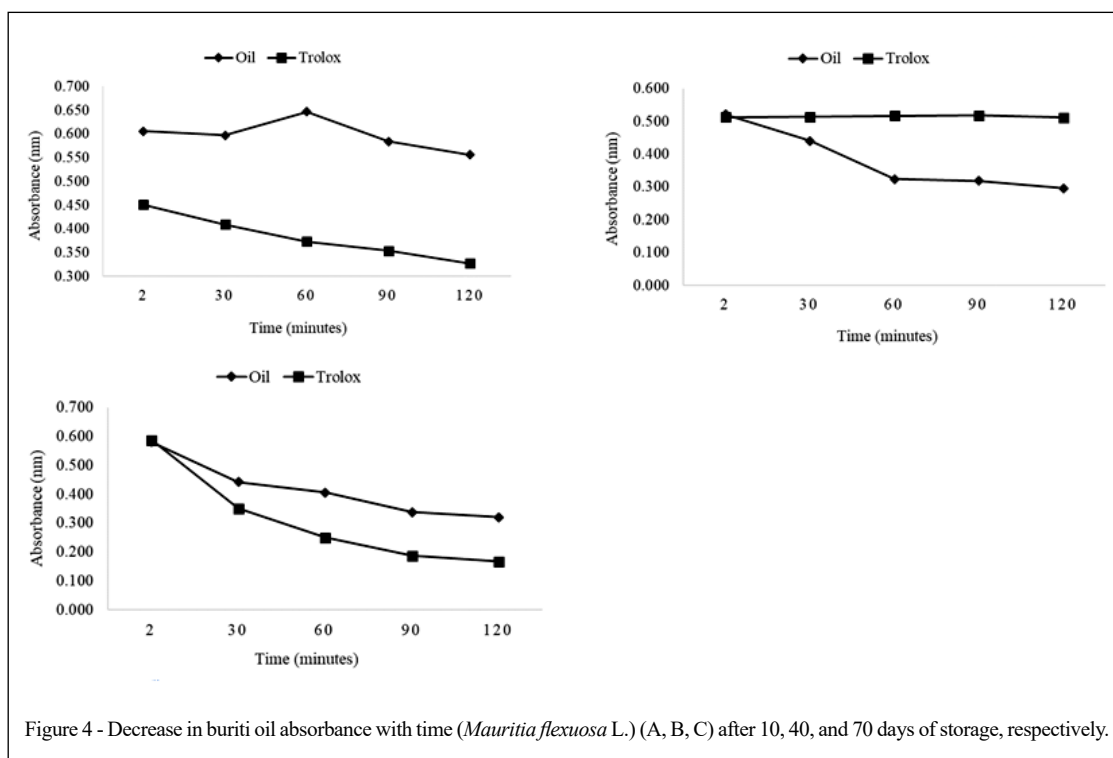


Figure 4 - Decrease in buriti oil absorbance with time (*Mauritia flexuosa* L.) (A, B, C) after 10, 40, and 70 days of storage, respectively.

at 10 days (A), 40 days (B), and 70 days (C) (Figure 4); the oil extract showed less variation compared to Trolox. The synthetic antioxidant remained constant during the storage and the extract indicated decay in the first 60 minutes after which it remained almost stable. As the storage period increased, the decrease in absorbance was steeper, as observed after 70 days (C), which can be attributed to the amount of antioxidants present in the buriti oil, and as can be observed in table 3, there was a decrease in β -carotene during the same period. The decrease in absorbance was evaluated through the spectrophotometer, and the difference

in absorbance from the beginning of the experiment to the end can be noticed by the discoloration of the solutions; greater the discoloration during the measurement time indicated enhanced oxidation of β -carotene present in the test system. β -carotene reacts with peroxy radicals, hydroxyl, and singlet oxygen (RODRIGUEZ-AMAYA, 2004), leading to characteristic discoloration (ARAÚJO, 2015).

The oil had $3.57 \pm 0.69\%$ (g/ 100 g of oil) of unsaponifiable content. The predominant fatty acid was oleic acid (C18: 1 ω 9c), which accounted for 78.06% (Table 4) as previously reported in literature

Table 3 - Mean values \pm standard deviation of carotenoid content in $\mu\text{g/g}$ of buriti oil (*Mauritia flexuosa* L.) during storage duration.

Storage time (days)	α -carotene ($\mu\text{g/g}$)	β -carotene ($\mu\text{g/g}$)	Total carotenoids ($\mu\text{g/g}$)
t_1	471.10 \pm 11.36	565.86 \pm 30.08	1036.96
t_{10}	465.42 \pm 12.83	562.59 \pm 48.68	1028.02
t_{20}	474.82 \pm 16.29	548.24 \pm 31.77	1023.06
t_{30}	446.67 \pm 17.24	499.44 \pm 26.26	946.11
t_{40}	399.07 \pm 17.08	437.85 \pm 22.88	836.91
t_{50}	465.11 \pm 7.56	439.63 \pm 9.30	904.74
t_{60}	418.29 \pm 13.27	441.19 \pm 17.23	859.49

Table 4 - Fatty acid profile of Buriti oil (*Mauritia flexuosa* L.). Values expressed in g per 100g of identified fatty acid.

Fatty acids	Mean±Std Deviation (%)
C6:0	0.29±0.41
C14:0	0.02±0.03
C15:0	0.02±0.03
C16:0	16.40±0.14
C16:1	0.18±0.02
C17:0	0.07±0.01
C17:1	0.03±0.03
C18:0	1.89±0.01
C18: 1ω9c	78.06±0.02
C18: 2ω6c	1.69±0.11
C18: 3ω3	0.88±0.09
C20:0	0.11±0.05
C20:1	0.26±0.03
C20: 4ω6	0.06±0.03
C20: 5ω3	0.02±0.03
C22:0	0.02±0.00
Σ Saturated	18.83±0.25
Σ Unsaturated	81.17±0.01
Σ MUFA	78.53±0.01
Σ PUFA	2.65±0.26
Σ ω3	0.90±0.12
Σ ω6	1.75±0.14

MUFA= Monounsaturated fatty acids; PUFA= Polyunsaturated fatty acids.

(SILVA et al., 2009; COSTA et al., 2011; AQUINO et al., 2012; FREITAS et al., 2017). TERÉS et al. (2008) reported the blood pressure reducing-effects of oleic acid present in high proportions in olive oil, which would support the health benefits of buriti oil as well since the latter too has high content of oleic acid. Moreover, the proportion of oleic acid is high in buriti oil, independent of the

region of cultivation, and harvest and the time of the extraction process.

The buriti oil had a low ratio of ω3/ω6 (0.51) and a ratio of ω6/ω3 higher than 1 (Table 5). The ideal value for the unsaturated fatty acid ratio of the ω3 and ω6 series is controversial and depends on diets and lifestyles. However, the PUFA/SFA ratio below 1.0 meets current recommendations

Table 5 - Nutritional quality of Buriti oil (*Mauritia flexuosa* L.). Values expressed in g per 100 g of identified fatty acid.

Quality parameter	Mean±Standard Deviation
ω3/ω6	0.51±0.03
ω6/ω3	1.95±0.11
PUFA/SFA	0.14±0.02
IA (%)	0.20±0.00
IT (%)	0.42±0.00
h/H	4.91±0.04

Σω3/ω6= Σω3/Σω6; ω6/ω3= Σω6/Σω3; PUFA/SFA= Polyunsaturated/saturated fatty acids; IA= Atherogenic index; IT= Thrombogenic index; h/H= Σhypocholesterolemic/Σhypercholesterolemic.

for the consumption of polyunsaturated fatty acids (SIMOPOULOS, 2002).

The fatty acids of the series $\omega 6$ and $\omega 3$ should be part of the diet since humans cannot convert the fatty acids of the series $\omega 6$ to $\omega 3$, which makes the ingestion of this type of compound important for health, especially for the cardiovascular system since both series perform an antagonistic metallic activity (SIMOPOULOS, 2002).

CONCLUSION

Buriti oil has high nutritional value due to favorable fatty acid profile that justifies recommendations for its consumption; however, the lack of standardization in the fruit harvesting and oil extraction methods can cause changes in physicochemical properties such as acidity index, thereby contributing to nutritional loss and the formation of off-flavors. Therefore, there is a need for the regulatory agencies to create a standardized protocol for the extraction of oil from the Buriti fruit pulp.

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DECLARATION OF CONFLICT OF INTERESTS

The authors declare no conflict of interest. The funding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

AUTHORS' CONTRIBUTIONS

The authors contributed equally to the manuscript.

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