Foods **2013**, *1*, 1-x manuscripts; doi:10.3390/foods10x000x

OPEN ACCESS

foods

ISSN 2304-8158

www.mdpi.com/journal/foods

Article

Bioactive compounds of asai palm fruit and their impact on health

Yuri M. Castillo [1,*], Mary Lares [2], Rafael H. Gutiérrez [3], María S. Hernández [4], J. Pablo Fernández-Trujillo [5]

[1] Institute of Food Science and Technology (ICTA), Master in Food Science and Technology, Faculty of Science, Universidad Nacional de Colombia, Carrera 45 No 26-85, Bogotá, Colombia.

[2] School of Nutrition and Dietetics, Central University of Venezuela, Dr. Carlos Arvelo Military Hospital, Av. José Ángel Lamas, San Martín, Caracas, Venezuela; E-Mail: marylares@hotmail.com

[3] Universidad Central de Venezuela, Escuela de Nutrición y Dietética,3er piso Residencias Femeninas, entrada plaza Venezuela, frente a las canchas de tenis, Ciudad Universitaria, Caracas, Venezuela; E-Mails: rafgutii@hotmail.com

[4] Instituto Amazónico de Investigaciones Científicas Sinchi, Avenida Vásquez Cobo entre 14 y 15 Leticia, Amazonas; E-Mails: shernandez@sinchi.org.co

[5] Universidad Politécnica de Cartagena (UPCT). Department of Agricultural and Food Engineering. Paseo Alfonso XIII, 48. ETSIA. E-30203 Cartagena (Murcia), Spain; E-Mails juanp.fdez@upct.es

***** Corresponding author. E-Mail: marylares@hotmail.com;
Tel.: +58-416-620-3588

Received: / Accepted: / Published:

Abstract: Quality of life depends on numerous factors; and diet and nutrition are cornerstones in the prevention and treatment of chronic diseases. An adequate intake of fruits and vegetables reduces the risk of these diseases, due to a high intake of biologically active substances (vitamins, minerals and antioxidants). The asai is an Amazonian palm tree with two species: *Euterpe oleracea* and *E. precatoria*, found on the banks of the rivers of the Amazon region. Due to its high content of anthocyanins, this fruit reduces the levels of free radicals and lipid peroxidation proinflammatory states. The objective of this study was to explore the therapeutic and phytochemical potential of asai. Regarding the profile of the fatty acids, palmitic stands out with between 23 -25.6% of the fat, the stearic acid content has a maximum of 1.84%, and oleic acid allows some researchers to compare the quality of the fat of asai with that of the avocado, olive oil and canola oil, since this fatty acid is more than 50% of the total fat of the fruit. Given this evidence regarding the composition of asai, one can see a possible cardioprotective and anticancer action that should be tested *in vivo* and *in vitro* models.

Keywords: asai; *Euterpe precatoria*; phytochemistry; antioxidants; biochemical markers; functional protection; amazonian fruits

1. Introduction

Today human health is being seriously threatened by a sedentary lifestyle, smoking, alcoholism and of course, bad cooking and eating habits such as excessive consumption of fast food, soda, candy, sweets and fried foods, along with a low intake of fruits and vegetables. This situation results in high morbidity and mortality rates associated with non-communicable diseases such as cancer, diabetes, respiratory diseases, atherosclerosis, heart failure, strokes and heart attacks [1]. In this context, considering also the negative characteristics and consequences of the "Western Diet", recent research shows the importance of consuming vegetables [2,3] and specifically foods rich in polyphenols [4,5] as one of the strategies for maintaining oxidative balance and health. Exotic fruits can contribute to this new diet [6] and within them those called "berries" can be a food source for a wide range of nutrients, secondary metabolites and antioxidants [7]. Among them, many healing properties are currently attributed to the polyphenols of asai fruit worldwide [8].

The asai is a plant belonging to the Arecaceae family, Palmae class, and *Euterpe* genus; widely distributed on the plains of the Amazon in countries such as Brazil, Peru, Bolivia, Ecuador, Venezuela and Colombia. Its berry fruits are round- oval in shape with diameters of up to 1.8 cm, forming green clusters when immature and dark purple ones with full maturation [9]. There are two species. One is well known and commercialized (*Euterpe oleracea*), that has been fully characterized and recognized for its potential as a functional food. In contrast, the second species, *Euterpe precatoria,* has recently attracted the attention of the scientific community and presents itself as a unique source of bioactive compounds that have been shown to have a positive impact on health [10,11].

A variety of bioactive phytochemicals with therapeutic potential are present in the asai fruit pulp [12,13]. Asai fruit has a noticeable content and diversity of anthocyanin type antioxidants [14-22], but also a fatty acid profile similar to that of olive oil and avocado [23] and a high antioxidant capacity. Encouraging results with asai fruit has been obtained for treatment and prevention of distinct pathological conditions related to proinflammatory states [10,15,20] and oxidative stress [24,25], cancer [26-30], cardiovascular diseases [31-33], respiratory emphysema [34] and even allergies [35].

The total polyphenols and antioxidant power of asai pulp is related to decrease oxidative stress and therefore the prevention of inflammatory processes and triggering de cardiovascular events. Different research shows scientific evidence that supports the benefits of asai with antioxidant, anti-inflammatory and cardioprotective activities, along with an antiproliferative effect. Particularly Schauss *et al.* 2006 [20] found that the asai polyphenols can join human neutrophils, inhibiting the formation of reactive oxygen species (ROS) and the enzymes cyclooxygenase 1 and 2 (COX-1 and

COX-2). Jensen *et al.* 2008 [24] examined the antioxidant activity of vegetable and fruit juice with asai being the main ingredient, noting that it increased the antioxidant capacity of the blood of the participants within 2 h post ingestion, resulting in decreased lipid peroxidation during the same time period in the majority of volunteers. Another study by Mertens-Talcott *et al.* 2008 [25] found that the increased plasma antioxidant capacity in each study subject was 3 and 2.3 times greater after consuming asai pulp and clarified juice of the fruit.

Kang *et al.* [10] in 2012 also evaluated the anti-inflammatory properties of asai species *precatoria* pulp as compared to those of the *oleracea* species, concluding that the ethyl acetic extract of the first inhibited the activation of the already mentioned nuclear factor by 23% as compared to other species that did not have a significant effect. Oliveira de Souza *et al* 2010 [31], not only showed the effect of antioxidants but also of hypocholesterolemics of the asai by supplying pulp to rats fed a standard diet or one high in cholesterol, concluding that the latter diet supplemented with the fruit saw a reduction in total cholesterol and low density lipoproteins.

Asai pulp induced a significant reduction in the activity of the Superoxide dismutase (SOD) only in rats with hypercolesterolemia. Udani *et al* in 2011[33] performed a study which evaluated the effect of asai pulp on some risk factors for Metabolic Syndrome through a pilot study with 10 overweight adults. After 30 days of asai consumption, researchers observed significant reductions in fasting glucose, insulin levels, total cholesterol, LDL cholesterol and the total cholesterol - HDL cholesterol ratio in the participants. Finally, Hogan *et al.* 2010 [27], Pacheco-Palencia *et al.* 2010 [28] and Stoner *et al.* 2011 [36] found an antiproliferative effect in asai preventing tumorigenesis. In summary, the pulp of this fruit could be considered a functional food because according to its composition it could induce a reduction of lipid peroxidation and production of proinflammatory cytokine which generates a cardioprotective and antiproliferative effect, imparting health benefits in the prevention of various pathologies.

The aim of this study was to carry out a bromatological and antioxidant characterization of asai pulp of the *precatoria* species, native to the Colombian Amazon.

2. Materials and Methods

2.1. Plant material

Asai pulp of the species *Euterpe precatoria* Mart. from the municipality of San José del Guaviare, Guaviare, Colombia, was processed in April 2012 according to the methodology of Peña *et al.* [37], transported to the laboratory in Bogotá, and stored at -20°C until analysis.

2.2. Sample preparation

For the bromatological and antioxidant characterization, lyophilized asai pulp was used. A Labconco ® lyophilizer was used at a condensation temperature of -80°C and 400 Pa vacuum pressure during the first part of the process, which yielded approximately lyophilized 60 g from 1.7 kg of pulp.

2.3. Bromatological analysis

For moisture, the analysis was performed according to AOAC 920.151. Ash were analyzed according to AOAC 940.26) ethereal extract by Soxhlet, protein by AOAC 920.152 and crude fiber by AOAC 985.29 methods. The carbohydrate content was calculated by difference between 100 and the other components of chemical composition analysis. The number of replicates was n = 5 [38]. The injection was performed in split mode (10:1) and injection volume of 2 μL. Detector temperature (FID) was 285°C, gas flow was flow 30 mL·min^{-1} for Helium (carrier gas), 300 mL.min^{-1} of air and 25 mL.min^{-1} H_2. Oven temperature was 100oC and raised up to 240°C in 4 min at 3°C.min^{-1}. Pressure was 13.45 psi at the beginning of the constant flow analysis [39,40].

2.4. Análisis Antioxidante

Extracts were prepared from 0.2 g of lyophilized asai according to the methodology developed by Rojano *et al.* [16]. The sample was combined with 20 mL of water acidified with 1% acetic acid, homogenized in a Vortex Heidolph ®, stirred for 16 h, centrifuged at 3,000 rpm and 25 ° C for 20 min, mixed with n-hexane and finally the aqueous portion was removed for testing. The test was performed using the total phenol spectrophotometric method developed by Folin-Ciocalteu [41]. Antioxidant capacity was determined by the result of two chemical methods, DPPH and ABTS, using a standard curve with Trolox ® as a reference antioxidant.

3. Results and Discussion

3.1. Bromatological analysis

The bromatological analysis of asai is shown in Table 1. The ash content was lower than that reported for the species *E. oleracea* (2-7%), as reported by Rojano *et al.*.[16] y Rufino *et al*. [23]. However, Castillo *et al.* [42] y Sinchi *et al.* [43] found lower values of ash (1.5-4%) for *E. precatoria* sp.

The fat content in the asai pulp (53%) was higher than the 37% obtained by Sinchi *et al* [43] and the 49.4% obtained for *E. oleracea*, by Sanabria *et al*.. [18] with 49,4%. Asai fat was the main potential contributor compared with other asai pulp components (Table 1) to human diets and has an important proportion of saturated fatty acids (mainly palmitoleic and stearic acids) to the total fatty acid profile (Table 2), as expected for a palm fruit. It is also noteworthy that the largest contribution within the fat profile of the asai *precatoria* species corresponds to oleic acid (omega 9) at 70%. Other insaturated fatty acids are important (Table 2) such as linoleic acid (the parent compound of the omega-6 family of fatty acids) and linolenic acid (omega 3) at an approximate ratio of 4:1. Our results agree with Nascimento *et al.* [44], Pacheco Palencia *et al.* [29], Sanabria *et al*. [18] and Rufino *et al.* [23], who compare the fat of asai with that of the avocado, olive oil and canola oil, making consumption of this fruit significantly important from a nutrition and metabolic point of view.

Furthermore, the protein content of the *E. precatoria* variety asai pulp exceeded that mentioned by Castillo *et al.* [42] and Sinchi *et al* [43] but lower than the value reported in the scientific literature for *E. oleracea* variety, which showed a maximum value of 15.9% in a study by Sanabria *et al.*

[18]. The pulp of this fruit cannot be considered a food source of protein in the context of the recommended intake of fruits.

Finally, the carbohydrate content was similar to data reported by Sanabria *et al.* [18] for the *oleracea* variety, while different from that of Castillo *et al.* [42]. Meanwhile, the asai fiber content on was similar to that obtained by Castillo *et al.* for *precatoria* variety asai pulp without filtering. However, Clarke et al. reported higher fiber content than our data (Table 1) which also were lower than those reported for the *oleracea* variety (71.2%; Rufino *et al.* [23]).

3.4. Antioxidant analysis

Total phenol content (Table 3) was above previous results of 73.0 ± 4.8 and 31.2 ± 2.6 mg gallic acid / g of dw for the varieties *precatoria* and *oleracea* [10]. Also, Rojano *et al.* [16] and Gordon *et al*. [17] reported lower total phenol content (3172 ± 154 and 3437 ± 154 mg gallic acid/100 g of dw, respectively). This demonstrates the superior antioxidant content of the Colombian asai species *precatoria* as compared to studies conducted in *oleracea* type fruits of Brazilian origin and the area of the Colombian Pacific. Noratto *et al.* in 2011 [45] showed the anti-inflammatory effects of polyphenols from the asai and concluded that the fruit's polyphenols dose of 5-20 mg gallic acid equivalent/ L (5 to 20 fold lower than in asai pulp, Table 3) protect human vascular endothelial cells from oxidative stress induced by glucose and inflammation.

The DPPH antioxidant activity (Table 3) was below than those described by Kang *et al.* [10] for both varieties of asai (320.3 ± 23.8 and 133.4 ± 11.2 µmoles Trolox / g dry sample for *E. precatoria* and *E. oleracea*, respectively). The same trend was observed when comparing with data from Rojano *et al.* [16] (12420 µmoles Trolox/100g dw).

In terms of percentage of DPPH inhibition, the average result obtained was 74.5%, (data not shown) which was lower than that reported by Sanabria *et al.* [18]. The antioxidant activity obtained by ABTS method as compared with those reported by was again lower (Table 3) than the 40.3 µmoles Trolox/100g dw obtained by Rojano *et al.* [16]. However, the antioxidant power of asai was still superior to that found in other exotic fruits [13].

Pacheco-Palencia *et al.* 2008 [29] studied the antiproliferative effect of the polyphenols from extracts of asai pulp and oil on human HT-29 adenocarcinoma colon cells and found that the polyphenol fractions of both extracts at a dose of 0-12 µg gallic acid equivalent / L inhibited cell proliferation by about 90.7%. The dose used by the former author is far lower than the reported in asai pulp (Table 3).

4. Conclusions

The pulp of asai native to the Colombian Amazon could be a promising product for functional food studies because of its antioxidant capacity and content of bioactive compounds (particularly total polyphenols).

Acknowledgments

The authors wish to thank: "Proyecto de Inclusión de compuestos funcionales de origen amazónico en productos transformados y evaluación de su biodisponibilidad en consumidores." Colciencias RC 368-2012 – Colombia.

Conflict of Interest

The authors declare no conflict of interest

References and Notes

1. (WHO), W.H.O. Global status report on noncommunicable diseases 2010. In *WHO Library Cataloguing-in-Publication Data*, 1 ed.; Alwan, A., Ed. World Health Organization (WHO): Italy, 2011; p 176.
2. Goodman, M.; Bostick, R.M.; Kucuk, O.; Jones, D.P. Clinical trials of antioxidants as cancer prevention agents: Past, present, and future. *Free Radic. Biol. Med.* **2011**, *51*, 1068-1084.
3. Reiss, R.; Johnston, J.; Tucker, K.; DeSesso, J.M.; Keen, C.L. Estimation of cancer risks and benefits associated with a potential increased consumption of fruits and vegetables. *Food Chem. Toxicol.* **2012**, *50*, 4421-4427.
4. Burton-Freeman, B. Postprandial metabolic events and fruit-derived phenolics: A review of the science. *Br. J. Nutr.* **2010**, *104*, 14.
5. Shanmuganayagam, D.; Beahm, M.R.; Kuhns, M.A.; Krueger, C.G.; Reed, J.D.; Folts, J.D. Differential effects of grape (vitis vinifera) skin polyphenolics on human platelet aggregation and low-density lipoprotein oxidation. *J. Agr. Food. Chem.* **2012**, *60*, 5787−5794.
6. Lim, Y.Y.; Lim, T.T.; Tee, J.J. Antioxidant properties of several tropical fruits: A comparative study. *Food Chem.* **2007**, *103*, 1003-1008.
7. Stoner, G.D.; Wang, L.-S.; Zikri, N.; Chen, T.; Hecht, S.S.; Huang, C.; Sardo, C.; Lechner, J.F. Cancer prevention with freeze-dried berries and berry components. *Semin. Cancer. Biol.* **2007**, *17*, 403-410.
8. Heinrich, M.; Dhanji, T.; Casselman, I. Açai (Euterpe *oleracea* Mart.)—a phytochemical and pharmacological assessment of the species' health claims. *Phytochem. Lett.* **2011**, *4*, 10-21.
9. Sabbe, S.; Verbeke, W.; Deliza, R.; Matta, V.; Van Damme, P. Effect of a health claim and personal characteristics on consumer acceptance of fruit juices with different concentrations of açaí (Euterpe *oleracea* Mart.). *Appetite* **2009**, *53*, 84-92.
10. Kang, J.; Thakali, K.M.; Xie, C.; Kondo, M.; Tong, Y.; Ou, B.; Jensen, G.; Medina, M.B.; Schauss, A.G.; Wu, X. Bioactivities of açaí (Euterpe *precatoria* Mart.) fruit pulp, superior antioxidant and anti-inflammatory properties to Euterpe *oleracea* Mart. *Food Chem.* **2012**, *133*, 671-677.
11. Pacheco-Palencia, L.A.; Duncan, C.E.; Talcott, S.T. Phytochemical composition and thermal stability of two commercial açai species, Euterpe *oleracea* and Euterpe *precatoria*. *Food Chem.* **2009**, *115*, 1199-1205.
12. Devalaraja, S.; Jain, S.; Yadav, H. Exotic fruits as therapeutic complements for diabetes, obesity and metabolic syndrome. *Food Res. Int.* **2011**, *44*, 1856-1865.
13. Rufino, M.d.S.M.; Alves, R.E.; de Brito, E.S.; Pérez-Jiménez, J.; Saura-Calixto, F.; Mancini-Filho, J. Bioactive compounds and antioxidant capacities of 18 non-traditional tropical fruits from brazil. *Food Chem.* **2010**, *121*, 996-1002.
14. Kang, J.; Li, Z.; Wu, T.; Jensen, G.S.; Schauss, A.G.; Wu, X. Anti-oxidant capacities of flavonoid compounds isolated from acai pulp (Euterpe *oleracea* Mart.). *Food Chem.***2010**, *122*, 610-617.

15. Kang, J.; Xie, C.; Li, Z.; Nagarajan, S.; Schauss, A.G.; Wu, T.; Wu, X. Flavonoids from acai (Euterpe *oleracea* Mart.) pulp and their antioxidant and anti-inflammatory activities. *Food Chem.* **2011**, *128*, 152-157.
16. Rojano, B.A.; Vahos, I.C.Z.; Arbeláez, A.F.A.; Martínez, A.J.M.; Correa, F.B.C.; Carvajal, L.G. Polifenoles y actividad antioxidante del fruto liofilizado de palma naidi (açai colombiano) (Euterpe *oleracea* Mart). *Rev.Fac.Nal.Agr.Medellín.* **2011**, *64*, 6213-6220.
17. Gordon, A.; Cruz, A.P.G.; Cabral, L.M.C.; de Freitas, S.C.; Taxi, C.M.A.D.; Donangelo, C.M.; de Andrade Mattietto, R.; Friedrich, M.; da Matta, V.M.; Marx, F. Chemical characterization and evaluation of antioxidant properties of açaí fruits (Euterpe *oleracea*e Mart.) during ripening. *Food Chem.* **2012**, *133*, 256-263.
18. Sanabria, N.; Sangronis, E. Caracterización del acai o manaca (Euterpe olerácea Mart.):Un fruto del amazonas. *Arch. Latinoam. Nutr.* **2007**, *57*, 94-98.
19. Schauss, A.g.; Wu, X.; Prior, R.l.; Ou, B.; Patel, D.; Huang, D.; Kababick, J.P. Phytochemical and nutrient composition of the freeze-dried amazonian palm berry, Euterpe *oleracea*e Mart. (acai). *J. Agric. Food Chem..* **2006**, *54*, 8598-8603.
20. Schauss, A.G.; Wu, X.; Prior, R.l.; Ou, B.; Huang, D.; Owens, J.; Agarwal, A.; Jensen, G.S.; Hart, A.N.; Shanbrom, E. Antioxidant capacity and other bioactivities of the freeze-dried amazonian palm berry, Euterpe *oleracea*e Mart. (acai). *J. Agric. Food Chem..* **2006**, *54*, 8604-8610.
21. Pacheco-palencia, L.A.; Hawken, P.; Talcott, S.T. Phytochemical, antioxidant and pigment stability of açai (Euterpe *oleracea* Mart.) as affected by clarification, ascorbic acid fortification and storage. *Food Res. Int.* **2007**, *40,* 620-628.
22. Pacheco-Palencia, L.A.; Talcott, S.T. Chemical stability of açai fruit (Euterpe *oleracea* Mart.) anthocyanins as influenced by naturally occurring and externally added polyphenolic cofactors in model systems. *Food Chem.* **2010**, *118*, 17-25.
23. Rufino, M.d.S.M.; Pérez-Jiménez, J.; Arranz, S.; Alves, R.E.; de Brito, E.S.; Oliveira, M.S.P.; Saura-Calixto, F. Açaí (Euterpe *oleracea*e) 'brs pará': A tropical fruit source of antioxidant dietary fiber and high antioxidant capacity oil. *Food Res. Int.* **2011**, *44*, 2100-2106.
24. Jensen, G.S.; Wu, X.; Patterson, K.M.; Barnes, J.; Carter, S.G.; Scherwitz, L.; Beaman, R.; Endres, J.R.; Schauss, A.G. In vitro and in vivo antioxidant and anti-inflammatory capacities of an antioxidant-rich fruit and berry juice blend. Results of a pilot and randomized, double-blinded, placebo-controlled, crossover study. *J. Agric. Food Chem..* **2008**, *56*, 8326-8333.
25. Mertens-Talcott, S.U.; Rios, J.; Jilma-Stohlawetz, P.; Pacheco-Palencia, L.A.; Meibohm, B.; Talcott, S.T.; Derendorf, H. Pharmacokinetics of anthocyanins and antioxidant effects after the consumption of anthocyanin-rich acai juice and pulp (Euterpe *oleracea* Mart.) in human healthy volunteers. *J Agric Food Chem* **2008**, *56*, 7796-7802.
26. Pozo-Insfran, D.d.; Percival, S.S.; Talcott, S.T. Acai (Euterpe *oleracea* Mart.) polyphenolics in their glycoside and aglycone forms induce apoptosis of hl-60 leukemia cells. *J. Agric. Food Chem..* **2006**, *54*, 1222-1229.
27. Hogan, S.; Chung, H.; Zhang, L.; Li, J.; Lee, Y.; Dai, Y.; Zhou, K. Antiproliferative and antioxidant properties of anthocyanin-rich extract from açai. *Food Chem.* **2010**, *118*, 208-214.
28. Pacheco-Palencia, L.A.; Mertens-Talcott, S.U.; Talcott, S.T. In vitro absorption and antiproliferative activities of monomeric and polymeric anthocyanin fractions from açai fruit (Euterpe *oleracea* Mart.). *Food Chem.* **2010**, *119*, 1071-1078.
29. Pacheco-Palencia, L.A.; Talcott, S.T.; Safe, S.; Mertens-Talcott, S. Absorption and biological activity of phytochemical-rich extracts from acai (Euterpe *oleracea* Mart.) pulp and oil in vitro. *J. Agric. Food Chem..* **2008**, *56*, 3593-3600.
30. Ribeiro, J.C.; Antunes, L.M.; Aissa, A.F.; Darin, J.D.; De Rosso, V.V.; Mercadante, A.Z.; Bianchi, M.e.L. Evaluation of the genotoxic and antigenotoxic effects after acute and subacute treatments with açai pulp (Euterpe *oleracea* Mart.) on mice using the erythrocytes micronucleus test and the comet assay. *Mutat Res* **2010**, *695*, 22-28.

31. Oliveira de Souza, M.; Silva, M.; Silva, M.E.; de Paula Oliveira, R.; Pedrosa, M.L. Diet supplementation with acai (Euterpe *oleracea* Mart.) pulp improves biomarkers of oxidative stress and the serum lipid profile in rats. *Nutr* **2010**, *26*, 804-810.
32. de Oliveira, P.R.B.; da Costa, C.A.; de Bem, G.F.; Marins de Cavalho, L.C.R.; de Souza, M.A.V.; de Lemos Neto, M.; da Cunha Sousa, P.J.; de Moura, R.S.; Resende, A.C. Effects of an extract obtained from fruits of Euterpe *oleracea* Mart. In the components of metabolic syndrome induced in c57bl/6j mice fed a high-fat diet. *J. Cardiovasc. Pharmacol.* **2010**, *56*, 619-626.
33. Udani, J.K.; Singh, B.B.; Singh, V.J.; Barrett, M.L. Effects of açai (Euterpe *oleracea* Mart.) berry preparation on metabolic parameters in a healthy overweight population: A pilot study. *Nutr J* **2011**, *10*, 45.
34. de Moura, R.S.; Pires, K.M.P.; Ferreira, T.S.; Lopes, A.A.; Nesi, R.T.; Resende, A.C.; Sousa, P.J.C.; da Silva, A.J.R.; Porto, L.C.; Valenca, S.S. Addition of açaí (Euterpe *oleracea*) to cigarettes has a protective effect against emphysema in mice. *Food Chem. Toxicol.* **2011**, *49*, 855-863.
35. Horiguchi, T.; Ishiguro, N.; Chihara, K.; Ogi, K.; Nakashima, K.; Sada, K.; Hori-Tamura, N. Inhibitory effect of açaí (Euterpe *oleracea* Mart.) pulp on ige-mediated mast cell activation. *J. Agric. Food Chem..* **2011**, *59*, 5595–5601.
36. Stoner, G.D.; Wang, L.-S.; Seguin, C.; Rocha, C.; Stoner, K.; Chiu, S.; Kinghorn, A.D. Multiple berry types prevent n-nitrosomethylbenzylamine-induced esophageal cancer in rats. *Pharmaceut. Res.* **2010**, *27*, 1138–1145.
37. Peña, L.F.; B, B.G.; Barrera, J.A.; Hernández, M.S. Obtención de la pulpa de asaí (Euterpe *precatoria* Mart) en la amazonía norte colombiana. *Vitae* **2012**, *19*, 309-311.
38. AOAC. *Official methods of analysis of the association of official analytical chemists*. Washington, 2000.
39. Estandarización-ISO, O.I.p.l. Iso 5508 "Animal and vegetable fats and oils -- analysis by gas chromatography of methyl esters of fatty acids". **1990**, *67.200.10*, 7.
40. Estandarización-ISO, O.I.p.l. Iso 5509 "Animal and vegetable fats and oil - preparation of methyl ester of fatty acids". **2000**, *67.200.10*.
41. Kuskoski, E.M.; Asuero, A.G.; Troncoso, A.M.; Mancini-Filho, J.; Fett, R. Aplicación de diversos métodos químicos para determinar actividad antioxidante en pulpa de frutos. *Ciênc. Tecnol. Aliment.* **2005**, *25*, 726-732.
42. Castillo, Y.M.; Lares, M.; Hernández, M.S. Caracterización bromatológica y fisicoquímica del fruto amazónico asaí (Euterpe *precatoria* Mart). *Vitae* **2012**, *19*, 309-311.
43. (Sinchi)., I.A.d.I.C. Bogotá DC, 2011.
44. Nascimento, R.J.S.D.; Couri, S.; Antoniassi, R.; Freitas, S.P. Composição em ácidos graxos do óleo da polpa de açaí extraído com enzimas e com hexano. *Rev. Bras. Frutic.* **2008**, *30*, 498-502.
45. Noratto, G.D.; Angel-Morales, G.; Talcott, S.T.; Mertens-Talcott, S.U. Polyphenolics from açaí (*Euterpe oleracea* Mart.) and red muscadine grape (*vitis rotundifolia*) protect human umbilical vascular endothelial cells (huvec) from glucose- and lipopolysaccharide (lps)-induced inflammation and target microrna-126. *J. Agric. Food Chem..* **2011**, *59*, 7999–8012.

Figures and tables

Table 1. Nutritional composition of the asai pulp (*Euterpe precatoria* Mart.).

Nutrient	g/100g
Moisture	94.20 ±0.02
Ash*	0.46 ±0.02
Fat*	53.03 ±0.33
Protein*	1.62 ±0.30
Crude Fiber*	12.98 ±0.35
Carbohydrates*	31.90 ±0.44

*Calculated with dry basis

Table 2. Fatty acids profile of the asai pulp (*Euterpe precatoria* Mart.).

Fatty acids	Cn*	Average
Myristic	(C14:0)	0.1
Pentadecanoic	(C15:0)	<0.1
Palmitic	(C16:0)	16.7
Palmitoleic	(C16:1)	0.1
Heptadecanoic	(C17:0)	0.1
Stearic	(C18:0)	6.8
Oleic	(C18:1n9c)	70.0
Linoleic	(C18:2n6c)	3.3
Arachidic	(C20:0)	0.4
Linolenic	(C18:3n3)	0.8
Eicosenoic	(C20:1)	0.1
Behenic	(C22:0)	0.1
Lignoceric	(C24:0)	<0.1

* Carbon number

Table 3. Total polyphenols content and antioxidant capacity of the asai pulp (*Euterpe precatoria* Mart).

Chemical parameter	Lyophilized asai pulp
Total Phenols (mg gallic acid/g of dry weight)	104 ± 7
Antioxidant Capacity DPPH (µmoles Trolox/100g dry weight)	7782 ± 427
Antioxidant Capacity ABTS (µmoles Trolox/100g dry weight)	16236 ± 128