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FILE: ▪ Açaí (*Euterpe oleracea*)
▪ Anthocyanins
▪ Antioxidants

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RE: Açaí Anthocyanin Content and its Absorption and Plasma Antioxidant Effects in Humans Differ with Fruit Pulp Ingestion Compared to that Juice

Mertens-Talcott SU, Rios J, Jilma-Stohlawetz P, et al. Pharmacokinetics of anthocyanins and antioxidant effects after the consumption of anthocyanin-rich açaí juice and pulp (*Euterpe oleracea* Mart.) in human healthy volunteers. *J Agric Food Chem*. Sep 10, 2008;56(17):7796-7802.

A variety of açaí (*Euterpe oleracea*) fruit products have become very popular in recent years, but more research is needed to determine their effects on human health.[1] Açaí fruit ise harvested by hand from wild açaí palms in the Amazon River Basin. They contain large amounts of polyphenols, natural products that are potent antioxidants. Polyphenols may also modulate cellular signaling. Pre-clinical research on whole açaí fruit has demonstrated antioxidant and anti-inflammatory effects. In this small clinical study, the authors examine the absorption and kinetics of anthocyanins from açaí pulp and its clarified juice and the effects on plasma antioxidant activity.

Healthy subjects (aged 21-31) were recruited at the University of Florida in Gainesville, Florida. Out of 11 subjects who completed the açaí pulp, açaí juice, and applesauce phases of the study, 7 also completed the non-antioxidant beverage control phase. No adverse side effects were observed during the study. Pasteurized, frozen açaí pulp from Brazil (Bossa Nova Beverage Group, Los Angeles, California) was used in the study. Clarified açaí juice was produced from the pulp using centrifugation and filtration. The non-antioxidant control beverage was made from deionized water. Applesauce (manufacturer not stated) was used as an anthocyanin-negative control food; no other information regarding the applesauce is provided. Sucrose was added to the acai pulp, juice, and control beverage to adjust the soluble solids content to match the applesauce. Following a 72-hour wash-out phase in which the subjects followed a diet low in antioxidants and polyphenols, they fasted for 8 hours before the study day. On study days, the subjects received 7 mL/kg of the study treatments.

Phytochemical analysis of the açaí fruit pulp revealed that it contained high concentrations of anthocyanins. The methanol extract contained 972±27 mg/kg total anthocyanidins as cyandin-3-glucoside, while the water-soluble extract from the clarified juice contained only 531±0.2 mg/L. This difference indicates that a large portion of the anthocyanins in the pulp are bound to its insoluble fiber. The subjects' plasma anthocyanin concentrations were significantly higher 0.5-4

hours following ingestion of the açaí pulp compared to the açaí clarified juice ($P \leq 0.05$). The authors write that this indicates "that anthocyanins bound or trapped within the water-insoluble cellular matrix of the pulp were liberated in the intestinal tract and available for absorption." They also write that this was demonstrated by the slightly higher time of maximum concentration (t_{max}) for açaí pulp (2.2 hours) compared to the açaí juice (2.0 hours). The maximum concentration (C_{max}) was 2321 ng/L for açaí pulp and 1138 ng/L for açaí juice. The açaí fruit pulp also had higher values for half-life (pulp: 6.56 hours, juice: 3.00 hours) and area under the curve (AUC) (pulp: 8568 ng/L, juice: 3314 ng/L) compared to açaí juice. Statistical analysis (nonlinear mixed effect modeling) showed a low oral bioavailability for açaí anthocyanidins, with the relative bioavailability actually decreasing as the dose increased.

All treatments caused a statistically significant increase in plasma antioxidant capacity 0.50-4.0 hours following consumption compared to the non-antioxidant control beverage ($P<0.01$ for all). Açaí pulp and applesauce caused higher plasma antioxidant levels than açaí juice ($P<0.05$). There was not a significant overall difference between the treatments' effects on the antioxidant capacity of the subjects' urine. Urine antioxidant capacity was significantly higher for the açaí juice and pulp and the applesauce than for the nonantioxidant control beverage 9-12 hours following treatment ($P<0.05$). The authors write that higher doses may be necessary to obtain more significant results on urine antioxidant capacity. None of the treatments produced significant effects on the subjects' plasma uric acid levels, which indicates that fructose was probably not a major contributor to differences in antioxidant effects. The generation of reactive oxygen species (ROS) in the subjects' peripheral blood mononuclear cells was also not significantly affected by any of the treatments.

In this study, anthocyanins from açaí fruit juice and pulp were shown to be bioavailable in healthy humans following oral consumption, and consumption of açaí products was shown to increase plasma antioxidant capacity. The authors write that further studies are needed on the metabolism of açaí polyphenols and to confirm açaí's antioxidant effects and potential health benefits. The study does contain weaknesses including the fact that characterization data of the açaí pulp are not included in the article beyond identification of its commercial source. Without more precise information, the study cannot be accurately duplicated. It is unclear how the researchers determined that subjects did indeed follow a diet low in antioxidants and polyphenols during the wash-out phase, though the 8-hour fast prior to treatment should have eliminated most confounding factors. The authors have unfortunately limited their focus to açaí's polyphenols which is another weakness of the study. This fruit is unique among fruits because of its unusually high mono- (MUFA) and poly-unsaturated (PUFA) fatty acid concentration, higher than olives or avocadoes. This attribute in itself may be contributing to its various observed properties in vitro and in vivo. Unfortunately, clarification and filtering of açaí pulp is a common practice and, as noted by the authors, reduces the concentrations of the lipid MUFAs and PUFAs and other constituents found in the fruit juice, further reducing the juice's potential health.

These weaknesses do not negate the reported antioxidant capacity of açaí pulp described by the authors. The real value that comes from the study is the clear-cut suggestion that clarifying and filtering out açaí pulp from an açaí juice beverage may significantly reduce its health benefits. The data argue that giving the whole fruit, in this case açaí fruit, is demonstrably better than its clear filtered juice.

—Marissa Oppel, MS

References

1.Glenn L. Popularity vs. clinical studies - açaí berries have the popular vote. *HerbClip News*. April 13, 2007.