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Acute intake of Juçara (Euterpe Edulis) and Açai (Euterpe Oleracea) beverages have similar effect on appetite

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Abstract

To evaluate the effect of the consumption of juçara and açai beverages on appetite. A randomized pilot double-blind and crossover study was conducted with sixteen healthy adults who were submitted to two trials, a beverage with acai or juçara. Immediately after ingestion, we assessed the satiation, hunger, and desire to eat using the Visual Appetite Scale (VAS) and the Overall Appetite Score (OAS). After seven days of washout, the trials were crossed over. We found no difference in satiation (p=0.35), hunger (p=0.88), and OAS (p=0.83) between the beverages. Acute of açai and juçara ingestion has similar effect on appetite.

Keywords: Appetite; Hungry; Fullness; Food intake; Euterpe.

Introduction

The interest in the scientific investigation of native Brazilian fruit trees has contributed to the appreciation of the country's biodiversity [1]. Among these fruit trees, we highlight in this study the açai (v.) and the juçara (Euterpe edulis Mart.), which are palm trees from the Amazon and Atlantic Forest, respectively [2].

Açai and Juçara fruits are physically similar, being small, spherical, purple, if processed, yield 5 to 15% of pulp [3,1]. This pulp can be used as a raw material to produce liqueurs, yogurts, sweets, juices, jellies, smoothies, and ice cream [3,1]. Despite the similarity, brazilian legislation distinguishes the fruits, however, so that juçara can benefit from the commercial popularity of açai, its fruits can be called açai from juçara, which leads the market, most of the time, to the misunderstanding that are a single product [4].

Concerning to açai and juçara it is a fact that: a) are fruits of different species but of the same botanical family; b) both have rich nutritional composition; c) they are similar in terms of physical appearance and use of the pulp, however, still, there are gaps in scientific research on these fruits about their characteristics and effects [5]. For example, as far as we know, there are no studies evaluating the effect of açai and juçara on appetite.

Appetite, conceptually, is the system that influences energy intake (food consumption) and associated motivational states, such as hunger [6]. Different methods have been validated to assess appetite, such as hunger, satiety, desire to eat, and prospective food consumption [7]. Appetite assessment for these domains has been performed in different conditions and populations [8-10].

Satiation has been less explored than satiety, and these terms have been confused with each other. In this study, we highlight satiation, which, according to [11], is the end of the meal, generally determined by fulness; while satiety is characterized by the decrease in hunger observed between meals. A widely used tool to subjectively assess appetite is the Visual Analog Scale (VAS), an effective, simple, and low-cost method [12].

The nutritional composition of foods is a determinant of appetite, especially fat and dietary fiber because they are capable of altering and modulating satiety hormones [13-15]. Likewise, açai and juçara are rich in nutrients providing high energy density and satiety sensations [3,16]. Furthermore, both fruits being rich in antioxidant compounds could give them the designation of super fruits [17,4]. However, no studies assessed the effects of acai and juçara on appetite.

Therefore, we hypothesized that the similarity in the nutritional composition of açai and juçara can provide the same effect on appetite in healthy adults. Thus, this pilot study aimed to evaluate the effects of açai or juçara beverages on appetite.

Material and methods

Study design and sample

This was a randomized, pilot double-blind and crossover study three weeks study. Approved by the Research Ethics Committee of the Federal Institute of Education, Science and Technology Goiano, Brazil, CAAE 40814120.3.0000.0036.

Sample was non-probabilistic and for convenience. Participants were recruited through social media and previous form, this one was used for evaluated the interest and availability of the volunteers, in addition to their eligibility given the inclusion criteria of the study.

Eligibility criteria were age between 18 and 60 years, Body Mass Index (BMI) ≥18.5 and ≤29.9 kg/m^2, being able to participate in the three weeks of the study and having good acceptance açai or juçara. Exclusion criteria were having an inflammatory/infectious disease of the gastrointestinal tract, chronic use of alcohol or chronic smoker, and use of hypercaloric supplements. Were excluded participants who did not fast or missed one of the tests.

Eligible individuals were randomized 1:1 to one of the sequences: consuming the açai drink and after juçara or vice and versa (Figure 1).

For each test, the participants had to fast for 8 hours before the intervention, and at the time of the intervention, they were encouraged to consume the entire content of the drink offered. After the first test, a seven-day washout was performed, followed by the second test with the drink from the previously defined randomization sequence. Both participants and researchers were blinded during the test.

Test beverages: Two beverages were offered I) açai: 200 g of açai pulp + 67 g of banana + 33 g of water, results in 170.7 kcal or II) juçara: 200 g of juçara pulp + 90 g of banana + 10 g of water results in 169.8 kcal (Table 1). The two drinks had a content of 300 grams.

Data collection: The participants performed a 24-hour Food Recall (R24h) to assess the possible interference of the previous day's caloric intake on appetite. This occurred in the first and second tests, totaling two R24h per participant during the study period.

To assess appetite, we considered the following variables: Hunger, satiation, and desire to eat, which were evaluated immediately after consuming the drinks. Under the conditions of this study, we consider that: hunger is a conscious desire to eat, and, to analyze it, we asked the participants after ingesting the entire contents of the drink: "How hungry are you now?", where 0 - none and 100 - I've never been so hungry. We consider satiation as a decline in hunger after consuming the drink, to assess this variable we ask: "How satiated do you feel now?", ranging from 0 - I feel empty to 100 - I feel very full. And finally, we consider the desire to eat as prospective thinking about food, to assess this item we asked two questions: "Would you like to eat something sweet right now?" and "Would you like to eat something salty now?", with the participant being able to answer from 0 - no to 100 - yes. For the desire to eat, the average between the desires for sweet and salty food was considered.

These variables were also observed together by the General Appetite Score (GAS). The score was adapted, since, in this case, it only has three variables, satiation, hunger, and desire to eat, and was calculated as follows: GAS = [satiation + (100-hunger) + (100-desire to eat)] /3, where 100 indicates more appetite and 0 indicates less appetite [18-20].

Statistical analysis

Data normality was examined using the Kolmogorov-Smirnov test. Differences between açai and juçara tests were evaluated by paired Student's test, which was measured by mean and standard deviation. Pearson's coefficient of variation was used to evaluate the variables of mean total energy (kcal/day) and Overall Appetite Score. The dynamic between the two variables was considered weak when r=0.1-0.3; moderate when r=0.3-0.6; strong when r=0.6-0.9 and very strong when r=0.9-1.0. Statistical analysis was performed using the R software version 4.2.1 and $p<0.05$ was considered statistically significant.

Results

Seventy-seven adults were eligible to participate in the study. Of these, fifty-seven (57) did not volunteer. Thus, 20 adults were randomized for the intervention (açai and juçara). However, during the study, four (4) participants abandoned the protocol (Figure 2).

Sixteen (13F/3M) participants completed the three-week study, aged between 19 and 27 years and BMI within the normal range (Table 2). These participants declared they were healthy, not smokers or alcoholics, and reported not using food supplements regularly or at the time of the study. The R24h analysis revealed average of energy consumption before the interventions of 1209 kcal/day (Table 2).

Immediately after consumption, beverages of the açai and juçara provided respectively 66 and 72% of satiation, 37 and 36% feeling of hunger, 36 and 39% of desire to eat. However, we found no differences between beverages containing açai or juçara pulp (Table 3). As expected, the appetite shown by the OAS also did not differ between drinks but was above 66%.

In addition, we found weak correlations (r=<0.3) between the average calorie intake (kcal/day) after consumption of the açaí (Figure 3A) or the juçara beverages (Figure 3B), which demonstrates that food consumption in the last 24 hours did not interfere on appetite of the participants.

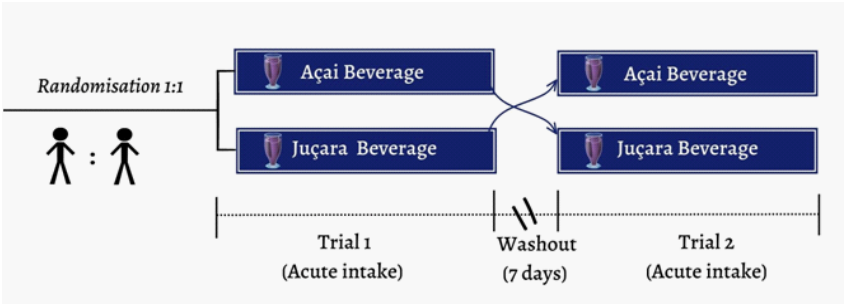

Figure 1: Experimental design.

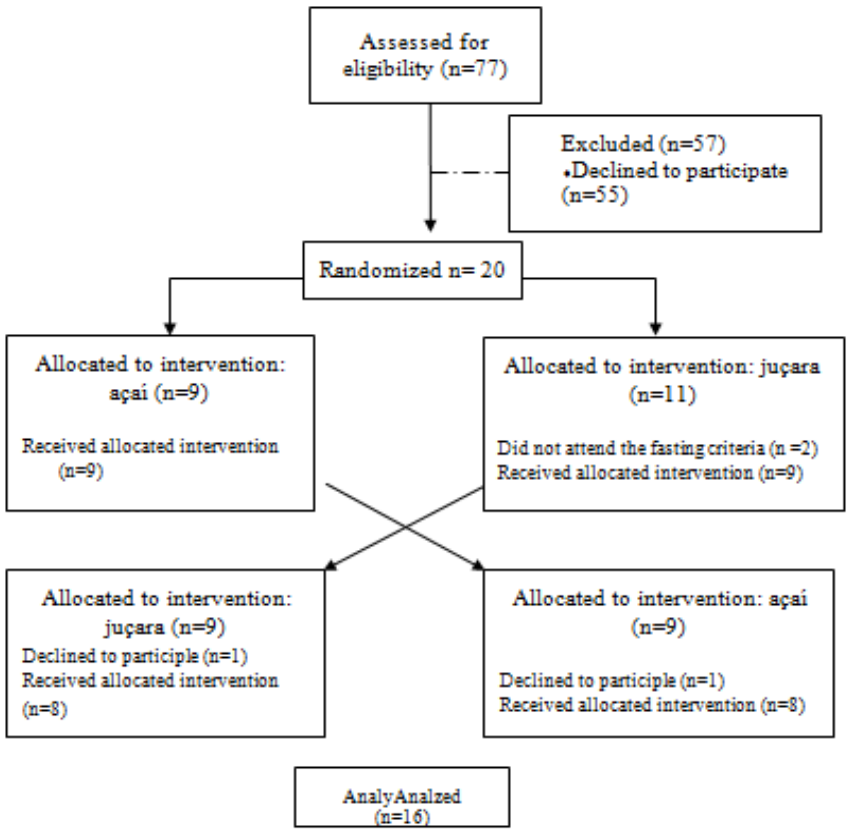

Figure 2: Flowchart in the study protocol.

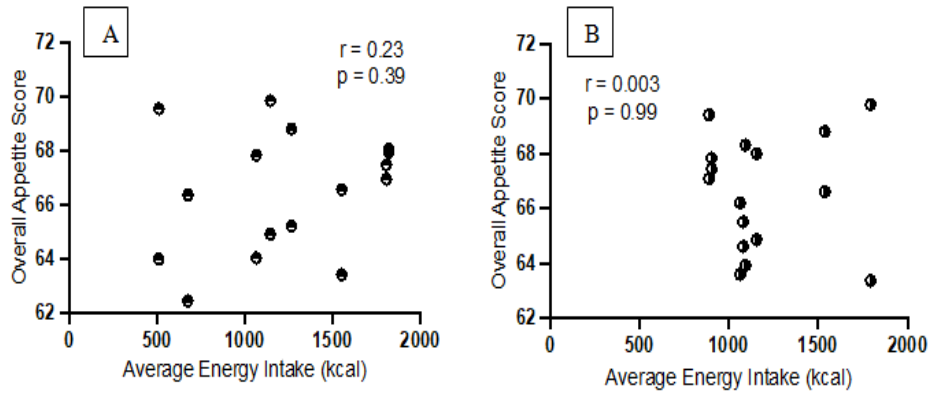

Figure 3: Pearson correlation between energy intake (kcal/day) and overall appetite score. **A)** Açai trial. **B)** Juçara trial.

Table 1: Nutritional composition of beverage for a 300 mL.

Nutrients	Juçara beverage (300 mL)	Açai beverage (300 mL)
Carbohydrates	23.4	17.5
Fiber	13.4	12.9
Protein	3.3	3.7
Ashes	0.99	0.94
Lipids	7.2	9.4
Total Energy Value	170.7	169.8

Table 2: Individual characterization.

Variables*	Participants (n=16)
Sex (n, %) Female Male	 13 (81.2) 3 (18.8)
Age	20.7±2.3
Weight (kg)	66.6±20.7
Height (m)	1.63±0.08
Body mass index (kg/m^2)	24.7±6.0
Energy (kcal/day)	1209.2±115.7

n= number of participants; *Mean ± standard deviation.

Table 3: Hunger, satiation, desire to eat and overall appetite score for açai and juçara beverages.

Variables	Açai	Juçara	p*
Hunger (mm)	36.6±28.7	35.8±30.2	0.88
Immediate satiety (mm)	66.5±26.5	72.0±18.9	0.36
Desire to eat (mm)	35.5±21.6	38.5± 22.3	0.69
Overall Appetite Score (%)	66.4±2.5	66.5±2.0	0.84

*p-value obtained using paired sample t-test at a significance level of 5%

Discussion

This pilot study shows up unexplored issues in studies with açai and juçara. First, we confirmed the hypothesis that there is a similarity regarding the appetite following beverages containing açai or juçara. Furthermore, we verified that the food intake, before 24 hours the trials, did not influence the appetite.

In studies with fiber-enriched orange juice, with a caloric value of 118 kcal, satiation was close to 40% soon after consumption, hunger sensation was around 70%, as well as the desire to eat (Bosch-Sierra et al. 2019). In another study, 240 mL smoothies with a caloric value of 471 to 486 kcal were evaluated and the results were 71 to 77% satiety, 21 to 34% satiety, and 71 to 77% desire to eat [21]. Comparing the data from the present study with those recently published evaluating smoothies [21], the satiation of açai and juçara drinks was as high as that of drinks with caloric values about three times higher. Satiety was also about three times higher than other drinks [22] with similar caloric value and enriched with fiber. The feeling of hunger and the desire to eat were consistent with the satiation data, being reduced as satiation increased. The positive appetite results of the drinks in the present study can be attributed to a nutritional composition of the raw materials, that resulted in an OAS greater than 60%.

The lipid composition of açai and juçara ranges from 46 to 48% and fiber from 20 to 31% [23]. These fruits stand out compared to other Brazilian purple fruits such as Bactris setosa, Eugenia brasiliensis, Eugenia involucrata, Myrcianthes pungens, Myrciaria cauliflora and Myrciaria jaboticaba with lipid content ranging from 0.41 to 6.86% and fiber content ranging from 7.65 to 50.38 [1]. These data were converted to a dry basis for comparison.

It should be noted that the lipid quality of açai and juçara is due to the higher content of monounsaturated fat acids such as oleic and palmitic acids, despite also containing provisions of polyunsaturated fat acids such as linoleic and linolenic acids [23]. As for the carbohydrate content, the fruits differ, as can be seen in the review by [3], in which the total carbohydrate content is almost nine times higher in açaí (in 100 g^{-1} of fresh pulp). However, in the present study, this difference was compensated by the use of banana fruit in the beverages.

Hunger and satiety sensations reported using the VAS are considered subjective measures and highly influenced by the hedonic component of eating behavior. Therefore, we analyzed the appetite also, using the adapted OAS score. This assessment involves other parameters in addition to satiation, such as hunger and desire to eat. However, even after adding an assessment endpoint, we found no difference between trials.

The strengths and weaknesses of our study must be considered. To the best of our knowledge, this is the first study comparing appetite sensations after consuming juçara and açai beverages. We had a reliable sample size, similar to an even larger than other studies [10,21,22]. This is the most robust design to assess the appetite with individuals of both sexes. The use of fresh fruit pulp is considered a positive point, given the full use of the properties of the fruit.

The limitations of the study, we highlight that we did not evaluate the satiety using the hormonal analysis related to hunger and satiety.

Conclusion

Under the conditions of this study, there is no difference in the perception of appetite between the açaí and juçara drinks and both were able to promote a satiating power of around 60%. Further studies are needed to investigate the hormones and different formulations using the Euterpe family.

Declarations

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Statement of ethics: The study was conducted in accordance with the Declaration of Helsinki. This study protocol was reviewed and approved by the Ethical Committee at the Federal Institute of Education, Science and Technology Goiano, Brazil, CAAE 40814120.3.0000.0036. The written informed consent was obtained from participants before starting the experimental procedures.

Conflict of interest statement: The authors have no conflict of interest to declare.

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Authors contributions: APSS. and GDP. contributed to study design. APSS. NO. DTC. MPL. JMS. GM and GDP wrote the man-

uscript. All authors read and approved the final version of the article.

Data availability statement: Data are not publicly available due to ethical reasons. Further inquiries can be directed to the corresponding author.

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