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COMPARATIVE PROXIMATE COMPOSITION OF THE FRUIT JUICE OF JACKFRUIT (*Artocarpus heterophyllus*) AND SOURSOP (*Annona muricata*)

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Abstract
Understanding the nutritional nuances of plants contributes valuable insights for dietary planning and underscores their potential in promoting health and well-being. Therefore, this research was designed to evaluate the nutritional properties of Jackfruit and Soursop juice comparatively. Samples were procured from Eke Oko Market, Orumba North Local Government Area of Anambra State, and analysed using methods endorsed by the Association of Official Analytical Chemists (AOAC). The nutritional composition of Jackfruit juice and soursop juice revealed percentages of moisture 85.00% and 87.90%, fat0.50% and 0.40% , crude protein 0.75% and 0.41%, ash 0.89% and 0.55%, crude fibre 0.43% and 1.30%, and carbohydrate5.66% and 2.74%. This study underscores the high nutritional value of both jackfruit and soursop juice, confirming their potential as functional fruits. Soursop juice exhibited higher moisture content, whereas jackfruit demonstrated higher ash, fat, fibre, protein and carbohydrate. The comparative analysis provides valuable insights into the distinct nutritional profiles of these two important juice. It lays a foundation for further exploration into the medicinal and nutritional aspects of jack fruit and soursop juice, offering implications for both traditional and contemporary applications.

Key words: Soursop, Proximate, Jackfruit, Juice.

Introduction
Artocarpus heterophyllus (Jackfruit) tree is well-suited to tropical lowlands and is widely cultivated throughout tropical regions of the world, including India, Bangladesh, Sri Lanka, and the rainforests of the Philippines, Indonesia, Malaysia, and Australia (Morton, 2017)..The tree bears the largest fruit of all trees, reaching as much as 55 kg (120 pounds) in weight, 90 cm (35 inches) in length, and 50 cm (20 inches) in diameter (Hag, 2016). A mature jackfruit tree produces some 200 fruits per year, with older trees bearing up to 500 fruits in a year. The jackfruit is a multiple fruit composed of hundreds to thousands of individual flowers, and the fleshy petals of the unripe fruit are eaten. The ripe fruit is sweet (depending on variety) and is commonly used in desserts (Elavitch, 2016). Canned green jackfruit has a mild taste and meat-like texture that lends itself to being called "vegetable meat" (Ve and Paul, 2011). Jackfruit is commonly used in South and Southeast Asian cuisines. Both ripe and unripe fruits are consumed. It is available internationally, canned or frozen, and in chilled meals, as are various products derived from the fruit, such as noodles and chips (Boning, 2016).

Some medicinal pharmacological properties include: antioxidant phytonutrients, such as caroteriods that act as antioxides, jackfruit has anti inflammatory properties. *Annona muricata* (Soursop) has found its uses in many areas. It is consumed as a desert fruit and it is made into fruit beverages, ice creams and syrups Florence, *et al*., (2014). The fruit makes an excellent drink or ice cream after straining. The seeds are flat, hard and contain all that can be used for paint or insecticide (Ellen *et al*.,

2015). A number of medical properties are attributed to the leaves and juice of the soursop. (some medicinal uses and pharmacological properties) include the seeds compact parasitic infections, the fruit is used for the treatment of arthritis, nervous disorders antiulcer, anticancer. Toxic and insecticidal characteristics are reported for different parts of the tree and fruit (Ellen *et al*., 2015).

The seed is about 4% of the whole fruit Badrie and Schauses, (2012) and much has not been reported about the chemical and nutritional contents of the seed in recent times. Some publications and review about *Annona muricata* have been conducted, Badrie and Schauses, (2012) to integrate the available scientific studies on this plant with special interest on acetogenins as principal bioactive compounds. Other bioactive compound have been identified, more bioactivities have been evaluated and medicinal uses have been extended. On the other hand jackfruit possess aphrodisiac properties (Jagsap *et al*.,, 2012). The fruit pulp are believed to be effective in treatment of some diseases such as ring worm infestation, asthma, diabetes etc.

MATERIALS: The samples, jackfruit and soursop used in this study were obtained from Eke market Oko, Orumba North L.G.A.

METHODS

Sample Preparation

The fruit samples of jackfruit and soursop were washed, peeled and cut with a kitchen knife and seeds removed. Two hundred grams (200g) of each sample mesocarp were squeezed with squeezer. The juices were squeezed out separately and used for the analysis.

Proximate Composition Analysis

The method employed in this exercise was the procedure described by AOAC (2019)

Moisture Content Determination

The method is based upon the removal of water from the sample and its measurement by loss of weight. A clean crucible was weighed and dried in the oven (W_1).Then 1.0g of each sample was weighed into the crucible (W_i) and dried at 100°C for some minutes. Each crucible was then transferred from the oven to a desiccator, cooled and reweighed

The percentage (%) moisture content was calculated from the expression:
% Moisture Content =

Fat Content Determination

A clean, dried 500ml round bottom flask containing few anti-bumping granules was weighed (W_1) and 150ml ethanol and normal hexane was weighed and transferred into the flask fitted with Soxhlex extraction apparatus. The round bottom flask and a condenser was connected to the Soxhlet extractor and cold water circulation was put on. The heating mantle was switched on and the heating adjusted until the solvent was refluxing at a steady rate. Extraction was carried out for an hour. The round bottom flask was cooled and the weighed (W_2).
% crude fat content =

Determination of Crude Fibre

About 2.0g of the finely ground samplewas weighed out into a round bottom flask. Then 100ml of 1.25% sulphuric acid solution was added and the mixture boiled under a reflux for 50 mins. The hot solution was quickly filtered under suction. The insoluble matter was washed several times with hot water until it was acid free. It was quantitatively transferred into the flask and 100ml of hot 1.25% sodium hydroxide (NaOH) solution was added and the mixture boiled again under reflux for 30minutes and was quickly filtered under suction. The soluble residue was dried to constant weight in the oven at a 105°C cooled in a desiccator and weighed sample furnance at 300°C for about 30 mins cooled in the desicators and reweighed (€2)The loss in weight of sample of incineration = C_1 - C_2

% crude fibre =

Determination of Carbohydrate

The total carbohydrate content was determined by difference. The sum of the percentage moisture, ash, crude fat, crude protein, crude fibre was subtracted from 100 (Mutter and Tobin, 2012)

Total carbohydrate = 100 - (% moisture + % Ash+% fat + % protein + % fibre).

Determination of Ash content

The AOAC (2019) method no. 942.05 was used. Clean dry crucible was weighed on an electric balance and 5g of each sample was weighed into the crucibles. The samples were dried in the oven until constant weights are obtained.

Then, the samples were transferred into the muffle furnace with a pair of tongs and ashed at 550^0c for 4 hours until a white ash was obtained. The sample was removed from the furnace and cool in desiccators and re-weighed. The percentage ash was calculated as follows:

% ash content: $\frac{\text{weight of ash X 100}}{\text{Weight of sample (after oven drying)}}$

Determination of protein content

Method no. 955.04C called the kjeldhal method was used. This method was divided into three namely; digestion, distillation and titration.

Digestion: Approximately 0.1g of ground sample was weighed into clean dry kjedhl flask for digestion and 0.1g copper tetraoxosulphate iv crystals, 0.5g sodium tetraoxosulphate iv crystal and 25ml of concentrated H_2S_O4 acid was added into the flask and some glass beads was added into the flask content as anti bumping agents. The kjeldahl flask and its content was transferred to the digesting chamber in a fume cupboard and digest. Digestion continued with constant rotation of the digestion flask until the sample change colour (that is from black to light blue).

The digestion flask was removed from the digesting chamber and allows cooling. The digest was made up to 100ml using distilled water and shaken vigorously to a homogenous solution.

Distillation: out of the homogeneous solution of the digest, 20ml was transferred into a distillation flask using a pipette. Then 20ml of 40% sodium hydroxide solution was added carefully down the side of the flask through a funnel.

Then 50ml of 2% boric acid solution was pipette into a receiving flask and two drops of methyl red indicator was added. The distillation until was fitted such that the condenser was connected to the receiving flask with a glass tube, and the condenser was cooked with constant supply of cold water from tap. Also, the tip of the glass was immersed in the boric acid distillation until was heated on a heating mantle for 35 minutes until the pink solution of boric acid turns blue and the volume was increased to about 100ml by the distillate.

Titration: Ten milliliters of the distillate was titrate against 0.1N hydrochloric acid to a colourless end point. A black solution was titrated to get any trace of nitrogen in the blank.
All the titre volumes was recorded; the percentage crude protein was calculated as follows:
% crude protein = % nitrogen X 6.25

Results
The results of comparative proximate composition of the fruit juice of Jackfruit and soursopindicate, the presence of moisture 85.00 and 89.90, fat 0.50 and 0.40, Ash 0.89 and 0.55, fibre 0.43 and 1.30, protein 0.75 and 0.41, carbohydrate 5.66 and 2.74, and sugar 6.77 and 6.70.

Table 1: Results of comparative proximate composition of the fruit juice of Jackfruit and soursop.

Parameter	Jackfruit(%)	Soursop(5)
Moisture	85.00	87.90
Ash	0.89	0.55
Fat	0.50	0.40
Fiber	0.43	1.30
Protein	0.75	0.41
Carbohydrate	5.66	2.74

Discussion
The results of the proximate compositions of jackfruit and soursop juice are displayed in Table 1
The moisture content of the two juices ranged between 85.00% and 87.90%, with soursop juice having the highest (87.90%) with the moisture content of jackfruit juice being the least (85.00%). The values obtained are, on the one hand, above those found by Loizzo and Tundis (2021), which are between 70.62 and 72.50 for the two juices, as well as those found by Doe *et al.*, (2019) for soursop juice (66.40%) and jackfruit juice (60.48%). On the other hand, these values are above those obtained by Dewole *et al.*, (2013), which were 69.73% for soursop juice and 67.2% for jack fruit juice (Adesuyi *et al.*, 2012). This variation of moisture content in the different studies would be related to the processing time of the samples before analysis because Lowor *et al.*, (2010) showed in their study that the moisture content of a sample varies by the processing time of the latter. The high moisture content is an index of spoilage. Too much moisture in any food sample can make the sample viable for microorganism growth (Mukprasirit and Sajjaanantakul, 2012). This accounts for most of the biochemical and physiological reactions in the juice (Guisseppe and Baratta, 2019). Indeed, the high

moisture content of the two juices is not good for their short preservation as it will not prevent early spoilage of the juices (Bhashar and Bhantaram, 2014).

The protein contents of the two juices range from **0.41** (soursop juice) to **0.75%** (jackfruit juice). Other research also showed the proximity between soursop juice and jackfruit juice protein content. For both juices, our results were, on the one hand, higher than those obtained by Arogba (2018) with soursop juice (0.45%) and Berumen-varela *et al.* (2019) in Niger, who obtained 0.70% for jackfruit and 0.71% for soursop juice. Conversely, the study's findings were not as high as those with soursop juice (0.95 percent). In Nigeria reported 0.87 percent with soursop juice and 0.89 percent with jackfruit juice. The ecological and pedological differences between this researches could be the reason of the discrepancy, as the juice's supply of nitrogen is influenced by the water deficit (Odebumi *et al*., 2018**)**.Furthermore, a juice's physiological traits that provide increased tolerance to water deficiency and nitrogen supply are also genetically changeable (Odebumi and Bratta 2016). Because proteins—another food class sometimes referred to as "Nitrogen-containing natural products"have been shown to be crucial for both human and animal survival, the protein contents of the juices may be able to supplement the body's demand for these vital nutrients for growth and development (Raiz-Montanez *et al.*, 2014). In addition, we report that our statistics on jackfruit juice (**0.75%**) and soursop juice (**0.41%)** were greater than those of Adesuyi *et al*., (2012), whoreported 0.39 percentof protein in sourcop juice and 0.65 in jackfruit.

Jackfruit juice presents a higher fat content (0.50%), while soursop juice has the lowest (0.40%). This result can be comparable to the 0.37% obtained by Ajai *et al*., (2012). Contrary to our study, Odebunmi *et al.*, (2019) have shown that the fat content of jackfruit juice (0.51%) was lower than those obtained with soursop juice (0.61%). The low lipid content of these juices is predictable because these juices are not greasy (Dandao, 2019). For the two juices, the ash contents **(**0.89% and 0.55%) are higher than those obtained by Dewole *et al.,* (2013). Still, comparable results were obtained by Ajai*et al. (*2012), Mutakin *et al.,* (2022) and Swami *et al*., (2012) for soursop juice.

The ash content of foodstuff is the inorganic residue remaining after the inorganic matter has been burnt away. Therefore, the 0.89% and 0.55% ash contents of jackfruit juice and soursop juice, respectively, indicate some inorganic material needed in the body.

They also have small quantities of fibre (0.43% and 1.30%), respectively, as presented in Table 1.

Among the two juices, jackfruit juice has a higher total sugar content (6.77%) than soursop juice (6.70%). Rahman *et al*., (2012) reported high carbohydrate content in their study. Furthermore, the results show that jackfruit juice has the highest energy value (5.66%) while soursop juice has the lowest (2.74%).The varying composition reported by different authors may imply that the proximate composition of these juices varies with season, environment and condition or time of evaluation.

Conclusion

In conclusion, it has been noted that

(1) Jackfruit and soursop juices have low protein, ash, fat, fibre and protein contents but high levels of moisture and sugar contents, all of which may benefit consumers nutritionally.
(2) These juices may be useful in the manufacture of medications and foods.

(3) Extensive research ought to be conducted regarding the pharmacological application of the compounds present in jackfruit and soursop juice.

Recommendations

Based on the findings, the following recommendations were made:

1. Further studies on the topic could include comparative evaluation of the identified compounds to determine their extract concentration in jackfruit juice and soursop juice.
2. Further studies could also investigate the specific pharmacological activities and mechanisms of the action of these compounds in jackfruit juice and soursop juice as well and the potential toxicity and safety profiles of jackfruit juice and soursop juice for human use.
3. Comparative studies among different varieties and geographical locations jackfruit juice and soursop juice could also provide more insight into the variation its proximate analysis.

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