



Proximate and Mineral Properties of Smoothie Fortified with African Bread Fruit and Cashew Nut

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KEYWORDS

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ABSTRACT

This study assessed the proximate and mineral properties of different samples of smoothie processed with African bread fruit and cashew nut. The smoothie was produced from five different fruits, (Apple, Beetroot, Banana, Pineapple and Soursop) then fortified with African bread fruit and cashew nut. The fruits were sorted, washed, diced and blended together. The concentration of African bread fruits and cashew nut differs in each smoothie samples. The seven smoothie samples were examined for their proximate and mineral properties. The result for proximate analysis showed that ash content ranged from 1.80-2.90 %, moisture 35.00-50.00 %, fat 3.00-4.50%, fiber 0.75-1.35%, protein 23.10-33.75 % and carbohydrates 18.60-35.35 %. The mineral properties revealed that sodium content ranged from 108-120mg/100g, potassium 400.0-680.0mg/100g, zinc 1.60-3.00mg/100g, and calcium ranged from 12-27mg/100g respectively. The fortification of smoothie with African bread fruit and cashew nut increased the level of carbohydrates, protein, crude fibre and mineral.

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INTRODUCTION

Smoothies are thick beverage product prepared from raw fruit pulps and the blends (Danielle *et al.*, 2018). Smoothies may include other ingredients such as vegetables, water, crushed ice, fruit juice, sweeteners (such as honey, sugar, syrup), dairy products (such as milk, yoghurt, low fat or cottage cheese, whey powder), plant milk (such as coconut milk, tiger nut milk, almond nut milk, soy milk), seeds (such as celery seeds), spices (such as ginger, garlic), tea, chocolate, herbal supplements or nutritional supplements (Zavasta, 2009; Teleszko and Wojdyto, 2014). Smoothies contain dietary fiber from the fruit pulp and hence, thicker than fruit juices, with its viscosity resembling that of milkshake (Anon, 2023). Smoothies can be sub-divided into three main categories viz. fruit only, Fruit and dairy product and functional smoothie (Srivasta *et al.*, 2019). Fresh smoothies refreshes the body system by promoting balanced diet and improving the immune system (Victor-Aduloju *et al.*, 2020). Many of the vitamins and minerals are found in fruits and vegetables are strong antioxidants (Barba *et al.*, 2012). The important roles of fruits and vegetable in preventing chronic diseases such as cancer, stroke, heart disease, alzhemier have been reported (Andres *et al.*, 2016). African breadfruit (*Treculia africana*) is a grain legume which is currently being considered as several sources of nutrient (Okonkwo and Ubani, 2007). It contributes immensely to the diet of Nigerians (Iwe and Ngoddy, 2001). Umezuruike *et al.*, (2016) reported important contents of Alanine, Isoleucine, lysine, histidine, aseptidic acid, glutamic acid, glycine, proline, threonine, tyrosine, phenylannine, methionine and valine in African bread fruit. In Igbo it is called "Ukwa" which is the most popular tribal name. Other local names include "afon" by Yorubas, "ize" by Benin, "Ediang" by Efik, Ibibios and Annangs and "barafutu" in Hausa. It is a rich source of minerals such as potassium, calcium, sodium, copper, iron, magnesium and vitamins (Osabor *et al.*, 2009; Derbyshire, 2017). African bread fruit seed is a proficient alternative to animal protein in human diets and non-ruminant animal husbandry (Akande and Fabiyi, 2010). The defatted seed contains 19% protein, which is higher than that of cereals and similar to most pulses; and is particularly, high in aromatic amino acids, which makes

it a potential source of good quality protein. The raw seed contains 40 to 50% carbohydrate as well as, minerals and vitamins (Oyetayo and Omenwa, 2006).

Cashew nut (*Anacardium occidentale* L.) are excellent sources of nutrition. It is rich in unsaturated fatty acids, palmitoleic, vaccenic, linolenic, and gadoleic acids, and especially oleic and linoleic acids (Ogunwolu *et al.*, 2015). The nuts are also a good source of protein, carbohydrates, and dietary fiber (Soares *et al.*, 2013). The cashew nuts are majorly sold as export crop and few of kernels have beneficial effects on health, particularly on chronic diseases such as hypertension and obesity, coronary heart disease and diabetes (Tapsell, 2010).

The consumption of fruits and vegetables is getting pronounced in Nigeria. The desire to go for fresh fruit and vegetable that is healthy and nutritious than soda drinks that is high in caffeine and sugar by consumer is of high increase. Nigeria has many different fruits and nuts as a source of vitamins and minerals but due to lack of processing and good storage facilities, the fruits are been wasted and sometimes abandoned for insects to invade it and later rotten away. Smoothie have been mostly encouraged as beverage option for healthy life. The addition of African bread fruit and cashew nut into smoothie is well known but has not widely studied. Therefore this study aimed at the determination of proximate and mineral properties of smoothie fortified with African bread fruit and cashew nut.

MATERIALS AND METHODS

Source of Materials

The *Treculia africana* (African bread fruit) was purchased at Eke-awka market, Anambra state while, *Beta vulgaris* (Beetroot), *Ananas comosus* (Pineapple), *Musa* spp. (Banana), *Anona muricata* L.(Soursop) were purchased at Nkwo Amaenyi and *Malus domestica* (Apple) and *Anacardium occidentale* (Cashew nut) were purchased from Roban stores Awka, Awka South Local Government Anambra State.

Production of smoothie

All the fruits were washed thoroughly using good potable water. The bananas were peeled by using hand, the apples were cut open and seeds removed, pineapple were peeled with a clean knife and they were sliced and diced. The beetroots were peeled and diced and the soursop was cut open, seeds removed and then diced before blending. The fruits were blended with the African bread fruit and cashew nuts at different ratios with the aid of a smoothie blender (Binatone blender-grinder and smoothie maker BLG-585B- Black) which was switched on for 6 minutes to homogenized the samples and form a smoothie which was dispensed into sterile container. The samples were kept in the refrigerator at 20°C.

Proximate Analysis

Crude fibre, protein, moisture, ash and crude content of the samples were determined according to standard methods of AOAC, (2015). Carbohydrates were determined by estimation using the following formula:

$$\text{Carbohydrates (\%)} = 100 - (\text{Moisture} + \text{Protein} + \text{Fats} + \text{Crude fibre} + \text{Ash}).$$

Mineral Determination

The mineral analysis was determined by the method described by AOAC, (2015). The samples were ashed (Lenton muffle furnace AF11/6) at 550°C. The ash obtained was boiled with 10 mL of 20% hydrochloric acid in a beaker and filtered into a 100 mL standard flask. The filtrate was made up to the mark with de-ionized water. The minerals sodium, (Na) and potassium (K) were determined from the solution using the standard flame emission photometer. NaCl and KCl were used as the standards (AOAC, 2015). Phosphorus (P) was determined calorimetrically using the spectronic 20 (Gallenkamp, UK; Kirk and Sawyer, 1991) with KH_2PO_4 as the standard. Calcium (Ca) and Zinc (Z) were determined using an atomic absorption spectrophotometer (AAS, Model SP9, Pye Unicam Ltd, Cambridge, UK). All values were expressed in mg/100 g.

Statistical Analysis

The data obtained were analyzed according to a completely randomized design with three replicates. Data were subjected to one way analysis of variance and the difference between means were evaluated by Duncan's multiple range tests using SPSS statistical program version 23.0. Significant difference was expressed at $p < 0.05$.

RESULTS AND DISCUSSION

The effect of African bread fruit and Cashew nut addition on the proximate content of smoothie produced from the blends of Apple, Banana, Beetroot, Pineapple and Soursop is shown in Table 1. Crude fiber content of the samples ranged from 0.75-1.35%. The sample 7 had highest crude fiber content ($1.35 \pm 0.26\%$) and sample 6 had the lowest (0.75%). Samples 5 and Samples 6 are not significantly different ($p > 0.05$) while sample 3, sample 4 and sample 7 are significantly different ($p < 0.05$). This sample being high in

fibre could be due to an increase in the African bread fruit. The values were within the range of research findings of Brijesh *et al.*, (2021).

Crude protein content of the samples ranged from 22.70-33.75%. There were significant ($p < 0.05$) differences in the crude protein content within the samples. Sample 7 had the highest value of $33.75 \pm 0.03\%$. The differences in the protein contents among the samples could be due to biochemical characteristics of the different types of fruits and nuts used. Addition of African bread fruits and cashew nut which has been reported to be high in crude protein content (Armstrong *et al.*, 2012). The protein content obtained in this study is also significantly higher than previously reported protein contents for fruit juices/ beverages (Dima *et al.*, 2015). Moisture content of all samples ranged from 35.00-50.00 % but that of sample 1, sample 2, sample 3 and sample 6 differed significantly ($p < 0.05$) from other samples. However, no significant ($p > 0.05$) difference existed between the moisture contents of sample 4, sample 5 and sample 7. Sample 6 had the least moisture content. The control which is sample 1 had the highest moisture content ($50.00 \pm 2.65\%$) probably due to the absence of nuts and African bread fruit.

The Ash content of the smoothie sample ranged from 1.80- 2.90%, with all the samples having no significant difference ($p > 0.05$). Sample 1, has the highest ash content of 2.90% and sample 7 has the least ash content of 1.80%. The percentage of fat content of the smoothie ranged from 4.50-3.00% with the sample 7 (Apple, Banana, Beetroot, Pineapple and Soursop with 7:3% African bread fruit and Cashew nuts) having the least value of $3.00 \pm 0.26\%$ and sample 1 having the highest value of $4.50 \pm 0.26\%$. Fat is important in food because it promotes fat soluble vitamin absorption. (Borges *et al.*, 1994). There is a significant difference ($p < 0.05$) among all the samples of the smoothie.

The total carbohydrate of sample 1, sample 3, sample 4, sample 5, sample 6, has significant value ($p < 0.05$) while sample 2 and sample 7 has no significant difference. The smoothie without African bread fruit and cashew nut had the lowest carbohydrate content. The presence of carbohydrates in the body builds up macromolecules, carbohydrate breaks down fatty acids and prevent ketosis which will form adipose tissues in the food (Ayrkoyed and Doughty, 1964). The results shows that carbohydrate contents significantly increased ($p < 0.05$) with the addition of African bread fruit and Cashew nuts.

Table 1: Proximate analysis of smoothie samples (%)

Sample	Fibre	Protein	Moisture	Ash	Fat	Carbohydrate
S1	1.30 ^{ab} ±0.26	22.70 ^e ±0.03	50.00 ^a ±2.65	2.90 ^a ±0.10	4.50 ^a ±0.26	18.60 ^f ±1.00
S2	1.20 ^{ab} ±0.26	22.90 ^f ±0.03	48.00 ^{ab} ±2.65	2.70 ^b ±0.10	4.30 ^{ab} ±0.26	20.90 ^e ±1.00
S3	1.10 ^{abc} ±0.26	22.95 ^e ±0.03	44.00 ^{bc} ±2.65	2.40 ^c ±0.10	4.00 ^{bc} ±0.26	25.55 ^d ±1.00
S4	0.97 ^{bc} ±0.26	23.10 ^d ±0.03	42.00 ^c ±2.65	2.30 ^c ±0.10	3.80 ^{cd} ±0.26	27.90 ^c ±1.00
S5	0.78 ^c ±0.26	23.30 ^e ±0.03	40.33 ^c ±2.31	2.10 ^d ±0.10	3.50 ^{de} ±0.26	30.32 ^b ±1.00
S6	0.75 ^c ±0.26	23.70 ^b ±0.03	35.00 ^d ±2.65	1.90 ^e ±0.01	3.30 ^{ef} ±0.26	35.35 ^a ±1.00
S7	1.35 ^a ±0.26	33.75 ^a ±0.03	40.00 ^c ±2.65	1.80 ^e ±0.01	3.00 ^f ±0.26	21.10 ^e ±1.00

Values are means ± standard deviation of three (3) replicates. Data in the same column bearing different superscript differed significantly ($p < 0.05$).

Keywords: S1= Apple, Banana, Beetroot, Pineapple and Soursop, S2= Apple, Banana, Beetroot, Pineapple and Soursop with 5:7% African bread fruit and Cashew nuts' S3= Apple, Banana, Beetroot, Pineapple and Soursop with 6:2% African bread fruit and Cashew nuts' S4= Apple, Banana, Beetroot, Pineapple and Soursop with 6:5% African bread fruit and Cashew nuts' S5= Apple, Banana, Beetroot, Pineapple and Soursop with 7:4% African bread fruit and Cashew nuts' S6= Apple, Banana, Beetroot, Pineapple and Soursop with 7:5% African bread fruit and Cashew nuts' S7= Apple, Banana, Beetroot, Pineapple and Soursop with 7:3% African bread fruit and Cashew nuts.

The effect of African bread fruit and Cashew nut addition on the mineral content of smoothie produced from the blends of Apple, pineapple, banana, beetroot and soursop are presented in Table 2. The mineral content ranged from 108-120 for sodium, 400-680 for potassium and 1.60-3.0 for zinc and calcium 12- 27 respectively. There was no significant difference ($p > 0.05$) in the sodium content of all the samples except sample 6 and 7. The fruits with 7:3% African bread fruit and cashew nuts had the lowest sodium value of $108.00 \pm 2.65 \text{mg}/100\text{g}$. The control had the highest potassium value of $680.00 \pm 2.65 \text{mg}/100\text{g}$ while sample 7 had the lowest potassium value. Smoothie with 7:3% African bread fruit and cashew nut had highest zinc content and it is significantly different ($p < 0.05$) from all other samples. The zinc content of sample 1 to sample sample 5 are not significantly different. Sample 2 which was smoothie with 5:7 African bread fruit and cashew nut had the lowest amount of calcium ($15.00 \pm 1.00 \text{mg}/100\text{g}$). The highest calcium contents were recorded in sample 7. The values of sodium, potassium, zinc and calcium were in accordance with those values reported by Andres *et al.*, (2014) and Wall, (2006). Potassium happened to be the most abundant mineral followed by sodium then calcium and zinc respectively. Potassium is an essential nutrient that has a role in the synthesis of amino acids

Table 2: Mineral analysis of the smoothie samples (mg/100g)

Samples	Sodium	Potassium	Zinc	Calcium
S1	120.00 ^a ±2.65	680.00 ^a ±2.65	1.90 ^{bc} ±0.26	12.00 ^g ±1.00
S2	118.00 ^a ±2.65	670.00 ^b ±2.65	1.70 ^{bc} ±0.26	15.00 ^f ±1.00
S3	115.00 ^{ab} ±2.65	660.00 ^c ±2.65	1.60 ^c ±0.26	18.00 ^e ±1.00
S4	118.00 ^a ±2.65	560.00 ^d ±2.65	1.90 ^{bc} ±0.26	20.00 ^d ±1.00
S5	117.00 ^a ±2.65	549.00 ^e ±2.65	2.00 ^{bc} ±0.26	22.00 ^c ±1.00
S6	112.00 ^{bc} ±2.65	540.00 ^f ±2.65	2.20 ^b ±0.26	25.00 ^b ±1.00
S7	108.00 ^c ±2.65	400.00 ^g ±2.65	3.00 ^a ±0.26	27.00 ^a ±1.00

Values are means ± standard deviation of three (3) replicates. Data in the same column bearing different superscript differed significantly (p<0.05).

Keywords: S1= Apple, Banana, Beetroot, Pineapple and Soursop, S2= Apple, Banana, Beetroot, Pineapple and Soursop with 5:7% African bread fruit and Cashew nuts; S3= Apple, Banana, Beetroot, Pineapple and Soursop with 6:2% African bread fruit and Cashew nuts; S4= Apple, Banana, Beetroot, Pineapple and Soursop with 6:5% African bread fruit and Cashew nuts; S5= Apple, Banana, Beetroot, Pineapple and Soursop with 7:4% African bread fruit and Cashew nuts; S6= Apple, Banana, Beetroot, Pineapple and Soursop with 7:5% African bread fruit and Cashew nuts; S7= Apple, Banana, Beetroot, Pineapple and Soursop with 7:3% African bread fruit and Cashew nuts.

CONCLUSION

This result established the fact that smoothie produced from apple, banana, beetroot, pineapple and soursop fortified with African bread fruits and cashew nut had the higher values compared to the unfortified sample. Addition of higher African breadfruit and cashew nut significantly increased the protein, crude fibre, carbohydrates and minerals but it reduced the moisture and fat contents. The total nutrient present in the samples showed that it is a highly nutritious and delicious drink which will boost body immune system against diseases and it will support healthy living.

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