



Full Length Research

**Proximate and Vitamin Composition of Juice Based on Tropical Fruits
(Star Fruits, Pineapple, Shaddock and Rose Apple)**

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ABSTRACT

The objective of this study was to evaluate the proximate and vitamin composition of juice blends prepared from pineapple (*Ananas comosus*), star fruit (*Averrhoa carambola*), shaddock (*Citrus maxima*), and rose apple (*Syzygium samarangense*) in varying proportions to create four different juice blends: Sample A: 50% pineapple, 20% star fruit, 10% shaddock, 10% rose apple; Sample B: 80% pineapple, 10% star fruit, 5% shaddock, 5% rose apple; Sample C: 70% pineapple, 10% star fruit, 10% shaddock, 10% rose apple and Sample D: 40% pineapple, 20% star fruit, 20% shaddock, 20% rose apple. The proximate and vitamin compositions of the fruit juice samples were determined using standard methods. Result obtained from the proximate composition of the fruit juice samples showed that moisture content ranged from 82.41±0.05 g (sample B) to 87.71±0.02 g (sample D), ash content ranged from 0.47±0.01g (sample D) to 0.92±0.02g (sample C), fibre content ranged from 0.60±0.00g (sample A) to 1.03±0.03g (sample D). Fat content ranged from 0.22±0.02g (sample D) to 0.92±0.02g (sample B), protein content ranged from 0.84±0.05g (sample D) to 1.34±0.02g (sample B) and carbohydrate content ranged from 9.72±0.01g (sample D) to 13.77±0.01g (sample B). Samples differed ($p < 0.05$) significantly from each other except in fibre composition. Vitamin assessment showed that Sample D had the highest vitamin C content (71.50 mg/100 g), while Sample C exhibited the highest level of vitamin A (2.70 mg/100 g). The formulated fruit juice samples were found to be rich in carbohydrates, moisture, and vitamin C. Formulation of fruit juice using natural fruits are preferred more than the conventional artificial drinks that are harmful to health.

Received
May 27,
2025

Received in
Revised
form, July
22, 2025

Accepted
July 31,
2025

Available
Online:
September
28, 2025

W. Afr. J.
Life Sci.
2(1):82-88

Keywords: Star fruits, Pineapple fruits, Shaddock fruits, Rose fruits.

INTRODUCTION

Fruits and vegetables play a crucial role in human nutrition, as their regular consumption supports overall health and helps replenish essential nutrients in the body (Slavin and Lloyd, 2012). According to the Food and Agriculture Organization (FAO, 2021), it is recommended that an average adult consume approximately 400 grams of fruits and vegetables daily to maintain optimal health. Fruits are excellent sources of vital nutrients, including water, vitamins (such as A, B1, B2, C, D, and E), and minerals like calcium (Ca), magnesium (Mg), zinc (Zn), iron (Fe), and potassium (K). Additionally, fruits provide significant antioxidant content, which plays a key role in neutralizing free radicals and protecting cells from oxidative stress (Rahman et al., 2021).

In rural communities, fresh fruits are often consumed shortly after harvesting or gathering from wild trees, usually within their seasonal windows. Depending on the processing method, natural fruit-based beverages, such as juices and smoothies are produced with minimal processing and are typically consumed fresh or soon after preparation (Amin et al., 2019).

Citrus maxima, commonly known as shaddock, is a tropical fruit species native to Southeast Asia and widely grown in parts of West Africa. The fruit comprises two easily separable components: the peel and the pulp. The pulp, which may be pale or pink in color, contains coarse, spindle-shaped juice sacs. Shaddock's large size and vibrant peel, especially when ripe also make it popular as an ornamental plant (Chen et al., 2021). **Star fruit** (*Averrhoa carambola*), also referred to as carambola, is recognized for its distinct star-shaped

cross-sections and its nutritional and medicinal benefits. Originally from Southeast Asia, it is now cultivated extensively across tropical and subtropical regions. While often eaten fresh, star fruit can also be juiced, dried, or incorporated into cooked dishes. It is particularly high in vitamin C, a critical nutrient for immune function, collagen formation, and antioxidant defense against cellular damage caused by free radicals (Huang et al., 2018). A medium-sized star fruit provides a substantial proportion of the daily recommended intake of vitamin C, making it valuable for supporting immune health.

Pineapple (*Ananas comosus*) is another widely consumed tropical fruit, appreciated for its sweet taste and distinctive aroma. It is rich in essential vitamins, minerals, polyphenolic antioxidants, and various phytochemicals (Chen et al., 2019; Singh et al., 2020). Despite its nutritional value, approximately 45–55% of the fresh pineapple's weight is discarded as waste during commercial processing, as only about 60% is edible (Chen et al., 2019).

Rose apple (*Syzygium samarangense*), also known as water apple or wax apple, is a lesser-known tropical fruit traditionally used for its medicinal benefits. Although low in calories, it is a good source of vitamins A and C, dietary fiber, and a range of polyphenols. Macronutrient deficiency or hidden hunger is prevalent in both urban and rural areas in Nigeria. Vitamin and mineral deficiencies have impact on human welfare and on economic development of poorer countries.

These deficiencies can lead to serious health problems including blindness and mental deterioration and in some cases

death. There are lots of tropical fruits that are rich sources of these micronutrients but are been neglected, which could form part of our daily diet either consumed whole or as juice. These fruits include; star fruits, shaddock, pineapple, rose apple etc. The high cost of fruit juices in the recent times has necessitated the need to produce juice using tropical fruits which will be highly nutritious and affordable to the majority of the Nigerian population. Furthermore, imported fruit juices contains preservatives and additives which may be deleterious to human health, may expire before importation.

MATERIALS AND METHODS

Materials Procurement

Pineapple, star fruits, shaddock and rose apple used in the juice production were purchased from Market Square Ekpoma, Edo State.

Equipment Used

Petri-dishes, test tubes, pipettes, flasks and bottles, potato Dextrose Agar, Nutrient Agar, incubator, refrigerator, Kjeldahl distillation apparatus, volumetric flask, dessicator, oven, Whatman filter paper, Soxhlet flux flask, reflux flask, Binaton electric blender, Jenway electronic spectrophotometer, electro thermal heater, extracting flask, aluminum foil, conical flask, non-absorbent cotton wool, Bunsen burner, Gallenkamp electronic colony counter, weighing balance.

Samples Preparation

Pineapple juice production

Pineapple (1kg) were thoroughly washed, peeled, cut into pieces and grinded with an electric blender (Kenwood electric blender, Model BL335) to achieve the fruit pulp and the juice extracted using a cheese cloth (250µm sieve). It was stored in the refrigerator (4°C) for further analysis.

Star fruit juice processing

One kilogram (1 k) of star fruits were washed, peeled, deseeded and blended using a food blender (Panasonic, Malaysia) for 2–3 min until a homogenous solution was obtained. The juice was filtered out using a cheese cloth to separate the pulp from the juice.

Shaddock juice processing

The shaddock citrus fruit juice was extracted by peeling off the back of the shaddock fruit (1 kg) blended using a food blender (Panasonic, Malaysia) for 2–3 min until a homogenous solution was obtained. The juice was filtered out using a cheese cloth to separate the pulp from the juice.

Rose apple juice processing

One kilogram (1 k) of rose apple fruits were washed, deseeded and blended using a food blender (Panasonic, Malaysia) for 2 – 3 min until a homogenous solution was obtained. The juice was filtered out using a cheese cloth to separate the pulp from the juice.

Method of fruit juice formulation

The selected fruit juices from Table 1, were measured and mixed to get the formulated blends.

Table 1: Formulation Blend

Samples	Pineapple juice (ml)	Star fruit juice (ml)	Shaddock juice (ml)	Rose apple juice (ml)
A	60	20	10	10
B	80	10	5	5
C	70	10	10	10
D	40	20	20	20

Determination of proximate composition

The total solid of the juice samples was determined using gravimetric method described by AOAC (2012). The moisture and ash content of the juice samples was determined using the indirect method employing drying oven and furnace incineration method described by Onwuka (2018). The protein content of the sample was determined by the semi-micro Kjeldahl, method reported by AOAC (1990). The fat content of the sample was determined on wet weight basis by Soxhlet's method as described by Suzanne (2003). The carbohydrate content of the sample was determined by estimation using the arithmetic difference method described by James (1995).

Vitamin Determination

Vitamin C (Ascorbic Acid)

The procedure described by Kirk and Sawyer (1998) was followed. 5g of the sample was dispersed in 50ml of EDTA solution and homogenized. The homogenate was filtered with whatman filter paper and more of the extract was used to wash the residue in the filter paper until 50ml filtrate will be obtained. 20ml of the filtrate, 10ml of 30% potassium iodide solution and 1% starch solution was measured into a conical flask and then mixed properly. The mixture was titrated against 0.0ml CUSO₄ solution. A reagent

blank was also titrated. The vitamin C content was calculated based on the relationship that 1ml of 0.01ml CUSO₄ = 0.88mg vitamin C.

Pro-vitamin A (β -carotene)

The spectrophotometric method described by Onwuka (2018) was employed in the determination of pro-vitamin A. Five grams (5 g) of the samples was dissolved in 30 ml of absolute alcohol (ethanol) and 3 ml of 5 % Potassium hydroxide was added to it. The mixture was boiled under reflux for 30 min and was cooled rapidly with running water and filtered. Thirty milliliters (30 ml) of distilled water was added and the mixture was transferred into a separating funnel. Three (3) portions of 50 ml of the ether were used to wash the mixture, the lower layer was discarded and the upper layer was washed with 50 mL of distilled water. The extract was evaporated to dryness and dissolved in 10 ml of Isoprophyl alcohol and its absorbance was measured at 325 nm.

STATISTICAL ANALYSIS

The data obtained from different analyses was subjected to various statistical analyses which include simple descriptive mean, standard deviation and analyses of variance (ANOVA), while turkey's test was used to separate the means among the samples attribute examined using SPSS 20.0 Software Inc. USA.

RESULTS

Table 2 shows the proximate composition of tropical fruit juice. Moisture content ranged from 82.41 ± 0.05 g (sample B) to 87.71 ± 0.02 g (sample D), ash content ranged from 0.47 ± 0.01 g (sample D) to 0.92 ± 0.02 g (sample C), fibre content ranged from 0.60 ± 0.00 g (sample A) to 1.03 ± 0.03 g (sample D). Fat content ranged

from 0.22 ± 0.02 g (sample D) to 0.92 ± 0.02 g (sample B), protein content ranged from 0.84 ± 0.05 g (sample D) to 1.34 ± 0.02 g (sample B) and carbohydrate content ranged from 9.72 ± 0.01 g (sample D) to 13.77 ± 0.01 g (sample B). Samples differed ($p < 0.05$) significantly from each other with exception to fibre content.

Table 2: Proximate composition of the tropical fruit juice samples

Sample	Parameters (%)					
	Moisture	Ash	Fibre	Fat	Protein	Carbohydrate
A	$84.44^b \pm 0.05$	$0.62^c \pm 0.02$	$0.60^a \pm 0.00$	$0.39^c \pm 0.01$	$1.02^b \pm 0.01$	$12.93^b \pm 0.08$
B	$82.41^d \pm 0.05$	$0.80^b \pm 0.00$	$0.76^a \pm 0.01$	$0.92^a \pm 0.02$	$1.34^a \pm 0.02$	$13.77^a \pm 0.01$
C	$83.63^c \pm 0.04$	$0.92^a \pm 0.02$	$0.90^a \pm 0.00$	$0.66^b \pm 0.01$	$1.13^b \pm 0.01$	$12.76^b \pm 0.07$
D	$87.71^a \pm 0.02$	$0.47^d \pm 0.01$	$1.03^a \pm 0.03$	$0.22^d \pm 0.02$	$0.84^c \pm 0.05$	$9.72^c \pm 0.01$

Means are values of triplicate determinations. Mean values with different superscripts in the same row are significantly different ($p < 0.05$).

Keys: A -60% pineapple: 20%-star fruit: 10% shaddock: 10% rose apple juice; B-80% pineapple: 10% star fruit: 5% shaddock: 5% rose apple juice; C-70% pineapple: 10%-star fruit: 10% shaddock: 10% rose apple juice; D- 40% pineapple: 20%-star fruit: 20% shaddock: 20% rose apple juice

Table 3 shows the vitamin composition of tropical fruit juice. Vitamin C content ranged from 56.40 ± 0.04 mg/100g (sample B) to 71.50 ± 0.05 mg/100g (sample D) and Vitamin A content ranged from 1.08 ± 0.01

IU (sample D) to 2.70 ± 0.03 IU (sample C), Samples differed ($p < 0.05$) significantly from each other with exception to fibre content.

Table 3: Vitamin composition of tropical fruit juice sample

Sample	Parameters	
	Vitamin C (mg/100g)	Vitamin A IU
A	$62.40^c \pm 0.05$	$1.68^c \pm 0.02$
B	$56.40^d \pm 0.04$	$2.40^b \pm 0.02$
C	$70.20^b \pm 0.02$	$2.70^a \pm 0.03$
D	$71.50^a \pm 0.05$	$1.08^d \pm 0.01$

Values are means + SD. Values within the same column with different superscripts are significantly different ($p < 0.05$).

Keys: A- 60% pineapple: 20%-star fruit: 10% shaddock: 10% rose apple juice; B-80% pineapple: 10%-star fruit: 5% shaddock: 5% rose apple juice; C- 70% pineapple: 10%-star fruit: 10% shaddock: 10% rose apple juice; D-40% pineapple: 20%-star fruit: 20% shaddock: 20% rose apple juice

The moisture content of the fruit juice samples shown in table 2, ranged from 82.41 ± 0.05 g to 87.71 ± 0.02 g, aligning closely with the findings of (Zhou et al., 2017), who reported similar moisture levels in mixed tropical fruit juices.

Moisture content is a key parameter in assessing juice quality and shelf life. The high moisture values observed in this study are consistent with standard expectations for tropical fruit-based beverages. The ash content, which ranged

from 0.47 ± 0.01 g to 0.92 ± 0.02 g, also corresponds with results reported by (Mahan et al., 2012) for various fruit juices. Ash content serves as an indicator of total mineral composition, suggesting that these juice blends provide a good source of essential dietary minerals. The fiber content varied from 0.60 ± 0.00 g to 1.03 ± 0.03 g, with no statistically significant differences among the samples. This finding supports the observations of (Chen et al., 2018), who noted that fiber levels in fruit juices tend to remain relatively constant across different blending ratios.

This consistency implies that the combination of these particular fruits does not substantially impact the fiber content, reinforcing the functional dietary fiber claims of these beverages. The protein and fat contents, ranging from 0.84 ± 0.05 g to 1.34 ± 0.02 g for protein and from 0.22 ± 0.02 g to 0.92 ± 0.02 g for fat, are in agreement with the data reported by (Tochi et al., 2020) for similar tropical fruit blends. These results indicate that the juice blends offer a nutritionally balanced profile, particularly suitable for individuals seeking low-fat, protein-enriched beverage options.

The carbohydrate content, which ranged from 9.72 ± 0.01 g to 13.77 ± 0.01 g, was notably higher than those reported by (Mishra et al., 2017) in similar fruit juice studies. This variation may be attributed to differences in fruit maturity, particularly the use of overripe pineapples, and the juice extraction techniques employed. Pineapple's naturally high sugar content, especially when overripe, likely contributed to the elevated carbohydrate levels observed. As shown in Table 3,

vitamin composition analysis revealed a notably high vitamin C content in Sample D (71.50 ± 0.05 mg), which is consistent with the findings of (Singh et al., 2020), who emphasized the richness of tropical fruits in vitamin C. Sample D, comprising 40% pineapple and 20% each of star fruit, shaddock, and rose apple, recorded the highest vitamin C concentration among all samples. This supports the observations of Rahman et al. (2021), who reported that vitamin C content in tropical fruit juices tends to increase with higher proportions of fruits naturally rich in ascorbic acid, contributing to enhanced antioxidant capacity in the blends. Furthermore, the use of a cold-press extraction method in this study likely helped preserve more vitamin C, as this method avoids the heat degradation often associated with thermal processing (Chen et al., 2018).

The highest vitamin A content was recorded in Sample C (2.70 μ g), which contained 70% pineapple. This result aligns with the work of (Amin et al., 2019), who found that pineapple-dominant juices generally contain elevated levels of vitamin A. This is attributed to the high carotenoid content in pineapple compounds that serve as precursors to vitamin A and are typically more concentrated in brightly coloured fruits like pineapple. However, this finding contrasts with other studies, such as (Zhou et al., 2020), which reported that blends rich in rose apple had higher vitamin A content due to the fruit's inherent carotenoid profile. The discrepancy in this study may be due to the relatively low proportion of rose apple in Sample C (10%), which limited its impact. As a result, the higher concentration of pineapple in Sample C

likely overshadowed any significant contribution from rose apple, leading to the observed increase in vitamin A content.

CONCLUSION

This study assessed the nutritional composition of tropical fruit juice blends made from different ratios of pineapple, star fruit, shaddock, and rose apple. The findings demonstrate that these juice combinations are valuable sources of essential nutrients, including carbohydrates, proteins, vitamin A and C respectively. All samples exhibited high moisture content, which contributes to their hydrating qualities. The ash and fiber levels further indicate that these juices can serve as good dietary sources of minerals and fiber. Notably, Sample D contained

the highest concentration of vitamin C, highlighting its potential as a strong antioxidant-rich beverage. Combining natural fruit juices could form a better alternative to the conventional artificial products for the betterment of the health of the common man. Pineapple, star fruit, shaddock and rose apple have great potentials in the development of a healthy fruit drink. If natural fruit juices are well harnessed, they could form a better alternative to the soft drinks flooding the commercial markets which are not beneficial to health. Future research should investigate the long-term health impacts of regular consumption and explore the potential for commercial-scale production and optimization of these blends.

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