COMPARATIVE ANALYSIS OF NUTRITIONAL AND VITAMIN CONTENT OF SWEET ORANGE, WATERMELON AND PINEAPPLE FRUITS.

Abstract

The aim of this study is a comparative analysis of the nutritional and vitamin composition of sweet orange, watermelon and pineapple fruits. The fruit samples used in the study were purchased from eke Awka market and the standard AOAC method was utilized in the determination of the proximate compositions while spectrophotometer was used in determining the vitamin and mineral concentrations. The result showed moisture content as 94.00, 92.50 and 95.00%, ash (2.33, 3.62 and 2.50%), crude fiber (0.00, 0.03 and 0.00%), protein (0.64, 0.24 and 0.80%), fats and oil (0.35, 0.15 and 0.47%) and carbohydrates (2.68, 3.46 and 1.23%), calcium as 26.05, 66.70 and 65.93mg/100g), iron (3.11, 0.91 and 1.77mg/100g), magnesium (28.5, 24.32 and 46.21mg/100g), phosphorus (172.80, 181.00 and 179.30mg/100g) and zinc (3.50, 4.80 and 7.05mg/100g), vitamin A content as (0.13, 0.77 and 1.40mg/100g), vitamin C (28.92, 20.74 and 14.25mg/100g), vitamin D (3.44, 2.18 and 7.50mg/100g) and vitamin E (21.60, 13.30 and 37.50mg/100g) for sweet orange, watermelon and pineapple fruit juice. The result showed that sweet orange, watermelon and pineapple fruits contain enough vitamin C which is an antioxidant vitamin essential for human health and thus there is need to increase the consumption of these fruits by all household and also industrial utilization of the fruitsin the production of food and drug products are recommended**.**

Keywords: Sugar contents, Vitamins, Pineapple, Sweet orange and Watermelon.

1. INTRODUCTION

Watermelon and pineapple fruits are the major fruits consumed in our locality. Their nutritive significance is their richness in minerals and vitamins which is essential is the maintenance of human health. The importance and awareness of nutrition is public health issues has resulted in the increase demand of knowledge of the biochemical nutrients of foods. They are good sources of carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron, and phosphorous. The fruits also contain phytochemical which are nutritionally and medicinally useful but times reduce the bioavailability of nutrients in human system Vegetable are eaten raw or processed (Hillary *et al.*, 2013).

Watermelon (*Citrulluslanatus*) is one of the fruits whose seeds are not routinely eaten with the pulp. *Citrulluslanatus*is one of the most popular species with high water content as high as 92% of the total weight and it plays a very important role in Africa as it is used to quench thirst when there is shortage of water (Ejimofor and Oledibe, 2021).

The crops are primarily harvested for juice and juice concentrate as an excellent source of vitamin C and vitamin A. Watermelon is expectedly high in citrulline (an amino acid the body make use of to make another amino acid), arginine (used in the urea cycle to remove ammoniacal from the body). Watermelon is a thirst-quencher which helps to quench the inflammable that contributes to conditions like asthma, atherosclerosis, diabetes, colon cancer and arthritis (Anyaegbu*et al*., 2019).

Pineapple (*Ananascomosus*), a leading member of the family *Bromeliaceae*comprises about 2,000 species mostly epiphytic and many strikingly ornamental and varies from nearly white to yellow in Color (Omole et al., 2013). Pineapples are sliced and eaten fresh in the homes, or processed into fruit juices for consumption or concentrates for future use. Pineapple as a fruit crop has a lot of economic, nutritional, medicinal, and industrial importance. Pineapples contain good sugar proportion which makes it suitable for wine making. Pineapple as food for human consumption contains about 81.2 – 86.2% moisture, 13-19% total solids of which sucrose, glucose, and fructose are the main components, 2-3% fibre and rich source of vitamin C. Lipids and nitrogenous compounds constitute 0.1% of which 25-30% of nitrogenous compounds are true proteins. The fruit is also rich in calcium (Ca) which has proteolytic activity due to the enzyme bromelin. Also consumption of pineapple enhances the detoxification of the human and prevents blood clothing. It also prevents kidney problems, protects the heart and regulates stomach acidity and help prevents constipation (Martinez, 2018).

Orange in Nigeria and other parts of the world, citrus is cheaply available, and it, thus, serves as a major source of vitamins in diets. Citrus fruit and its juice have several beneficial, nutritive and health properties. They are rich in vitamins especially ascorbic and folic acids. Over the last decade, many other virtues and medicinal benefits of citrus fruits have been discovered beside their anti-scurvy properties.

Orange fruit consists of an outer peel, which includes epidermis, flavedo, oil glands, albedo and vascular bundles. The flavedo is outer yellow sub epidermal layer containing carotenoids pigments and numerous oil glands filled with aromatic essential oils (Oledibe et al., 2022).

Vitamin C (ascorbic acid) is a water soluble antioxidant which is found in variable quantities in fruits and vegetables and has been found to prevent tissue damage. It has been identified to prevent sperm agglutination thus making them more motile with resultant improvement in male fertility. It also enhances sperm quality. Several doctors in Nigeria routinely prescribe vitamin C to aid recovery in several ailments and diseases including cold, cough, influenza, sores, wounds, gingivitis, skin diseases, diarrhoea, malaria and bacterial infections (Verbeke, 2018).

Ascorbic acid also known as vitamin C is the most important vitamin for human nutrition that is supplied by fruits and vegetables. It is a valuable nutritional component because of its antioxidant and therapeutic properties. It helps the body in forming connective tissues, bones, teeth, blood vessels and plays a major role as an antioxidant that forms part of the body defence system against reactive oxygen species and free radicals, thereby preventing tissue damage (Anyaegbu et al., 2019). Ascorbic acid is also reported to be an important ingredient for the synthesis of dopamine, noradrenaline and adrenaline in the nervous system or in the adrenaline glands. Ascorbic acid is also reported to be an essential antioxidant that helps protect against cancers, heart disease and stress (Omole, 2013). It is also part of cellular chemistry that provides energy, it is essential for sperm production and for making the collagen protein involved in the building and health of cartilage, joints, skin and blood vessels. Ascorbic acid helps in maintaining a healthy immune system, it aids in neutralizing pollutants, is needed for antibody production, acts to increase the absorption of nutrients (including iron) in guts, and thins the blood (Sundararaju,2017).

The most important and prominent source of ascorbic acid or vitamin C is the plants and particularly, sweet orange, watermelon and pineapple fruits. These fruits are abundant and mostly consumed by the people of the community to serve as their source of vitamin C. However, the availability of these fruits depends on their sources and storage time, which could also affect the levels of concentration of vitamin

C in these fruits. It has been reported that the amount of vitamin C in fruits depends on the precise variety, the soil and climate in which it grew and the length of time it was picked (Okigbo and Anyaegbu, 2021).

The human body cannot synthesize ascorbic acid by itself, and so has to get its source of the essential nutrient from its diet. In this research work, the levels of ascorbic acid in the three available citrus fruits were determine at two phases of fruit development, ripped and unripe (Ejimofor and Oledibe, 2022)

1.2 Statement of problem

In Nigeria, fruit consumption is substantially lower and qualitatively different from consumption in other western countries, because most consumers of this fruits (watermelon, pineapple and orange) do not know the actual amount of vitamin C content of these fruits. With recent wave of economic depression and its attendant effect on the purchasing power of the population of less developed natopns, the fruits in our environment such as pineapple, watermelon and orange will play an increasing role in the vitamin C nutrition and healthy security of the industry, the rural people and the increasing urban nutrition.

1.3 Objectives of the Study

The objective of this study is to determine and to compare the vitamin C content of sweet orange, watermelon and pineapple fruits.

1.4 Significance of the Study

1. The result from this work will be significance as it will help determine the vitamin C contents in the widely consume sweet orange, watermelon and pineapple fruits within us.
2. This result will aid the nutritionist and pharmaceutical industries in producing vitamin C drugs from natural sources

3. Finally this work will enlighten the public on the vitamin C contents of these fruits and hence their nutritional and health benefits.

1.5 Scope of the Study

The scope will cover the determination of vitamin C content in sweet orange, watermelon and pineapple fruits collected from Awka, Anambra State.

2.0MATERIALS AND METHODS

2.1 Reagents used for this study

Watermelon fruits

Orange fruit

Pineapple fruit

Distilled waterAll these are fruits not reagents, these should be present in separate heading of **Fruits**

6% EDTA/TCA solution

30% KT solution

1% starch solution

$CUSO_4$ solution

2.2 Apparatus used for this study

Titration set (Burette, stand, clamp and trle)

250ml conical flask

Buchner funnel and filter paper

2ml measuring cylinder

250ml Beaker

Pipette

Weighing balance

Blender

Spatula

Knife

2.3 Collection and Preparation of Samples

Fresh sweet orange, watermelon and pineapple fruits will be purchased from Eke Awka market.The fruits will be peeled and blended into a liquid form. The juice of each of this fruits will be filtered into a conical flask and 2g of each of the samples will be weighed, using a weighing machine respectively.

2.4 Determination of Vitamin C content of each of the samples namely- Watermelon, Orange and Pineapple.(Reference required)

The weighed sample of each of this fruit juice will be homogenized in 20ml of 6% EDTA/TCA solution. 20ml of 30% KI solution will be added to the homogenate followed by 100ml of distilled water. 1ml of 1% starch solution will be added to it and will be titrated against 0.1m $CUSO_4$ solution. The titration and poit will be marked by a black colouratio. A reagent blank will also be titrated using 20ml of EDTA/TCA solution added to 100ml of distilled water in a beaker. 20ml of 30% KI solution and 1ml of 1% starch solution will be added into the beaker and titrated against 0.1m $CUSO_4$ solution. The end point will be marked by a black colouration.

Vitamin C content will be calculated based o the relationship below:

$$\textbf{Vitamin C mg/100} = \frac{\textbf{100 x 0.88 x (Titre – blank)}}{\textbf{W (Weight of sample)}}$$

1ml of 0.1 mole of $CUSO_4$ = 0.88mg (Vit. C Standard)

3. RESULTS AND DISCUSSION

PROXIMATE COMPOSITION

The result of the proximate composition of the sweet orange, watermelon and pineapple fruit juice are shown in table 1.The result showed moisture content as 94.00, 92.50 and 95.00%, ash (2.33, 3.62 and 2.50%), crude fiber (0.00, 0.03 and 0.00%), protein (0.64, 0.24 and 0.80%), fats and oil (0.35, 0.15 and 0.47%) and carbohydrates (2.68, 3.46 and 1.23%) for sweet orange, watermelon and pineapple fruit juice

Table 1: Proximate composition of sweet orange, watermelon and pineapple fruit juice

SAMPLE	MOISTURE	ASH	FIBER	PROTEIN	FATS	CARBOHYDRATE
PINEAPPLE JUICE	94.00	2.33	0	0.64	0.35	2.68
ORANGE JUICE	92.5	3.62	0.03	0.24	0.15	3.46
WATERMELON JUICE	95	2.5	0	0.8	0.47	1.23

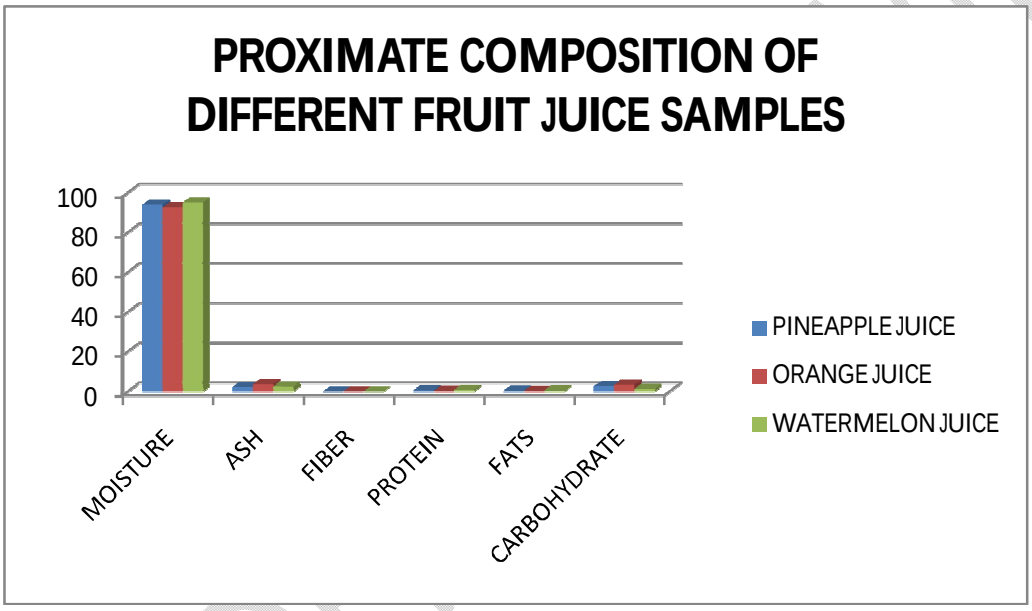

Fig 1: **Proximate composition of sweet orange, watermelon and pineapple fruit juice**

MINERAL COMPOSITION

The mineral composition of thesweet orange, watermelon and pineapple fruit juiceare presented in table 2. the result showed calcium as 26.05, 66.70 and 65.93mg/100g), iron (3.11, 0.91 and 1.77mg/100g), magnesium (28.5, 24.32 and 46.21mg/100g), phosphorus (172.80, 181.00 and 179.30mg/100g) and zinc (3.50, 4.80 and 7.05mg/100g)for watermelon, sweet orange and pineapple fruits respectively.

Table 2:Mineral composition (Mg/100g)of sweet orange, watermelon and pineapple fruit juice

SAMPLE	CALCIUM	IRON	MAGNESSIUM	PHOSPHORUS	ZINC
PINEAPPLE JUICE	65.93	1.77	46.21	179.3	7.05
ORANGE JUICE	66.7	0.91	24.32	181	4.8
WATERMELON JUICE	26.05	3.11	28.45	172.8	3.5

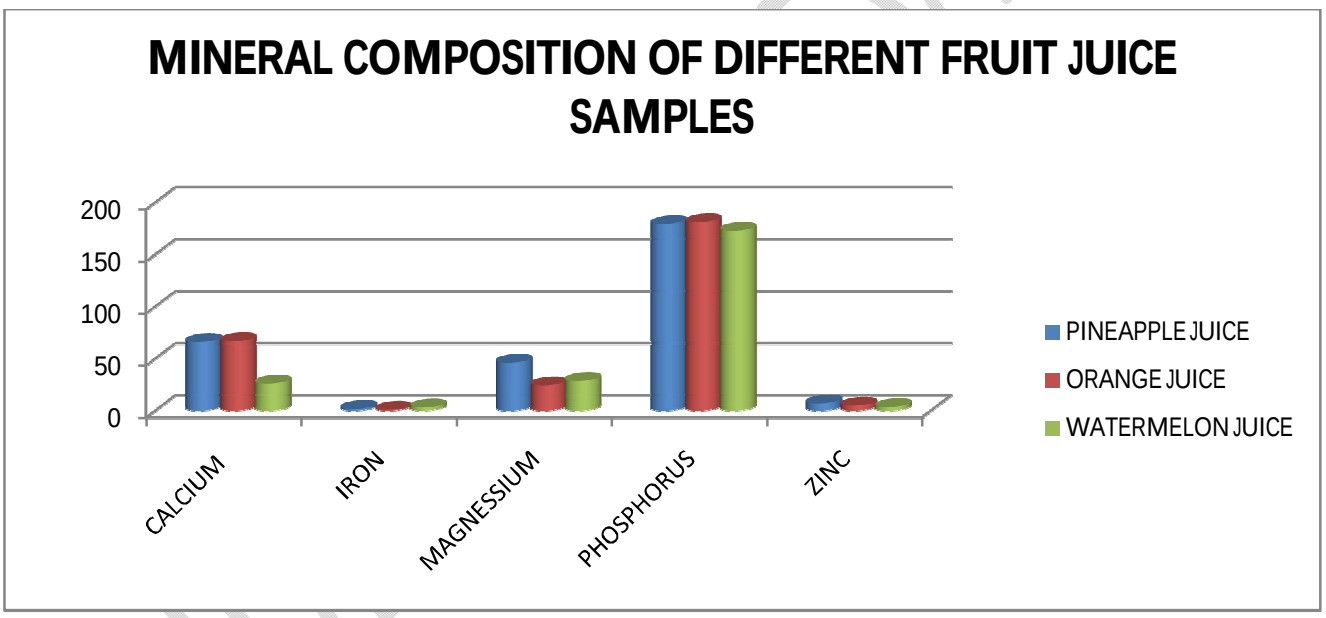

Fig 2: Mineral composition (Mg/100g)of sweet orange, watermelon and pineapple fruit juice

The vitamin compositions of sweet orange, watermelon and pineapple fruit juice are presented in table 3. the result showed vitamin A content as (0.13, 0.77 and 1.40mg/100g), vitamin C (28.92, 20.74 and 14.25mg/100g), vitamin D (3.44, 2.18 and 7.50mg/100g) and vitamin E (21.60, 13.30 and 37.50mg/100g) for sweet orange, watermelon and pineapple fruit juice

Table 3:Vitamin composition(Mg/100g)of sweet orange, watermelon and pineapple fruit juice

SAMPLE	VITAMIN A	VITAMIN C	VITAMIN D	VITAMIN E
PINEAPPLE JUICE	0.13	28.92	3.44	21.6
ORANGE JUICE	0.77	20.74	2.18	13.3
WATERMELON JUICE	1.4	14.25	7.5	37.5

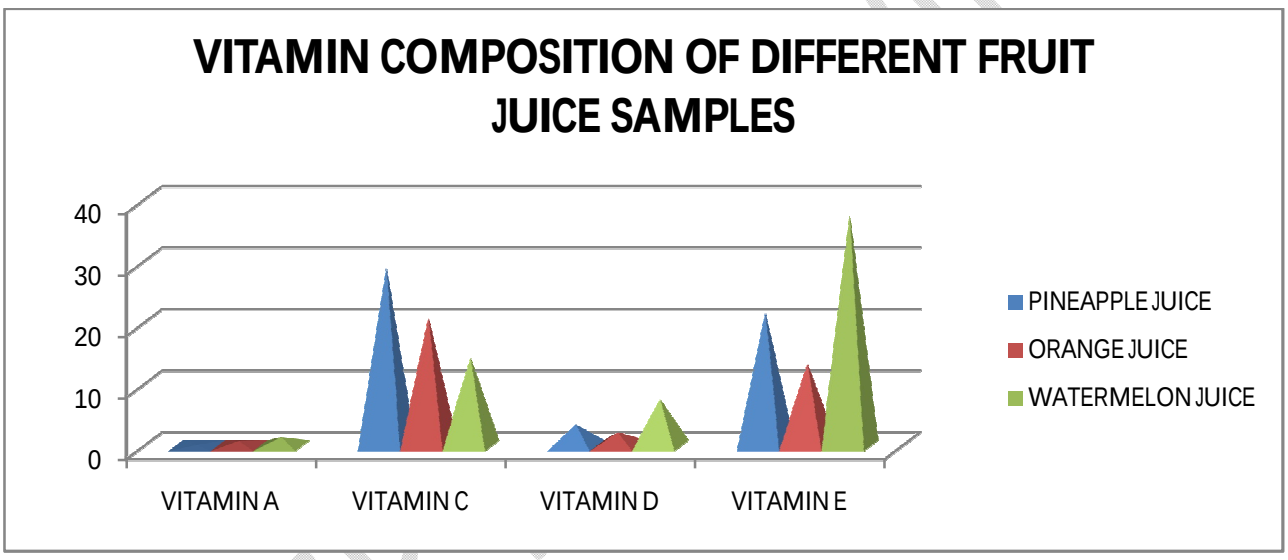

Fig 3:Vitamin composition (Mg/100g)of sweet orange, watermelon and pineapple fruit juice

4. DISCUSSION

Table 1 shows the proximate composition of the sweet orange, watermelon and pineapple fruit juice investigated. Moisture determination followed the following trend Watermelon>Pineapple>Sweet Orange These values are comparable to the work of Anyaegbu et al.,(2019). All the fruits studied had high moisture content which is typical of fresh fruits at maturity. The ash value ranged from 0.3% to 2.50% and had mean value of 1.32%. The ash content value compared favourably with most fruits value

(Oledibe et al., 2022) but lower than those reported by (Verbeke, 2018). The percentage ash of the sample gives an idea about the inorganic content of the samples from where the mineral content could be obtained. This study shows that *Citrus lanatus* had the highest ash value (2.50%). Samples with high percentages of ash contents are expected to have high concentrations of various mineral elements, which are expected to speed up metabolic processes and improve growth and development (Nwakoby et al., 2022) The observed wide range in moisture and dry matter in the fruits are similar to those reported by (Anyaegbu et al., 2019) and this accounts for rapid deterioration of fruits if left unprocessed for long after harvesting. The carbohydrate content of the fruits are low (7.50% to 18.60%). Samples with low carbohydrate content might be ideal for diabetic and hypertensive patients requiring for low sugar diets. The protein concentration ranged from 0.29% to 1.28% for Malusdomistica and Psidiumguajava. Proteins are essential component of diet needed for survival of animals and humans, their basic function in nutrition is to supply adequate amounts of required amino acids in nutrition (Ejimofor and Oledibe, 2022). Protein deficiency causes growth retardation, muscle wasting, edema, abnormal swelling of the belly and collection of fluids in the body(Ejimofor et al., 2021).

Table 2 (figure 2) shows the result of the mineral composition of the nine fruits studied. Iron (Fe) is said to be an important element in the diet of pregnant women, nursing mothers, infants,convulsing patients and the elderly to prevent anaemia and other related diseases, (Ejimofor and Oledibe, 2021). Fe is required for energy and endurance because it delivers oxygen throughout the body. Butit is necessary only in small amounts for optimal health. The fruits with the highest iron content waswatermelon (1.99mg/g). The recommended daily allowance of iron for men is 7mg /day and 12-18 mg/day forwomen during pregnancy (Sundararaju, 2017). Magnesium (Mg) is needed for over 300 of our bodies ‘most important biological processes, not the least of which is ATP energy production and muscular contractions. Nonetheless, it is most typically used by active individuals to prevent muscle cramping; to enhance muscle and nerve functioning; to relieve tight sore muscles; and to help improve bone density. Mg plays a major role in relaxing muscles along the airway to the lung thus allowing asthma patients to

breathe easier. The daily value for Mg is 400mg. It plays fundamental roles in most reactions involving phosphate transfer, believed to be essential in the structural stability of nuclei acid and intestinal absorption while deficiency of magnesium in man is responsible for severe diarrhoea, migraines, hyper-tension, cardiomyopathy, arteriosclerosis and stroke (Musdja et al., 2017). The highest magnesium content was obtained from pineapple and the least is from watermelon.

Sweet orange contained the lowest concentration of zinc while Citrus lanatus had the highest. Zinc is involved in thousands of bodily functions, such as proper cell growth and testosterone production (Martinez, 2018). Zinc is said to be an essential trace element for protein and nucleic acid synthesis and normal body development. It plays a central role in growth and development, vital during periods of rapid growth such as infancy, adolescence and during recovery from illness. Zinc deficiency has been largely attributable to the high phytic acid content of diets leading to poor growth, impaired immunity, and increased morbidity from common infectious diseases and increased mortality (Musdja et al., 2017).

The result from table 3 showed that all the both the watermelon, sweet orange and pineapple fruits contain enough vitamin C which is an antioxidant vitamin essential for human health. Generally, vitamins are essential, but in small amounts, for the regulation of normal metabolism and as an antioxidant. The orange fruits had higher composition value for Vitamin Cthan most fruits reported in the literature. These imply higher quantity of antioxidant vitamins in and possibly higher supply from, the tomato samples than green pepper.

According to Ejimofor et al., (2022), vitamin contents of fruits are influenced by a number of factors and prominent among them include varietal differences and pre-harvest environmental conditions. Any of these factors may have contributed to the variations in the ascorbic acid contents of the samples from that of the stated reports.

Vitamins C and E in foods has been associated with antioxidant activity and therapeutic effects including maintenance and protection of skin and teeth as well as the prevention of scurvy (Amina, 2014). However, vitamins must be supplied daily with a recommended allowance of 60 mg. Although Okigbo and Anyaegbu(2021) suggested it is present in appreciable quantities in other food sources such as green

vegetables and potatoes, they also reported it is easily deactivated by heat and exposure to the atmosphere, because of its strong reducing properties. Thus, their presence in fruits and vegetables that do not require heating is preferred. All the four vitamins analyzed in this study are an important water-soluble vitamin already implicated in most of the life processes but principally function as an antioxidant. It is present abundantly in fruits and vegetables where the common man in the developing countries receives most of their daily intake

5. Conclusion

The study have showed the proximate, mineral and vitamin compositions in mostly consumed fruits in Nigerian market (watermelon, sweet orange and pineapple). These essential elements are needed for growth, production of bones, teeth, hair, blood, nerves, skin, vitamins, enzymes and hormones. The healthy function of nervous transmission, blood circulation, fluid regulation, cellular integrity, energy production and muscle contraction are influenced by essential elements and too little of any essential element can lead to deficiency disease and too much of it any can be toxi. The result shows that the watermelon, sweet orange and pineapple fruits used in this study are better source for the antioxidant vitamins. The preponderance of these nutrients in the samples, may be of nutritional and physiological importance. They may thus be incorporated into diets as cheaper and/or more accessible source of nutrients to curtail some nutritional deficiencies. Moreover, the relatively high antioxidant activities of orange juice due to presence of vitamin C indicate the potential health benefits of the fruits. This study rather reports the presence of inherent health beneficial constituents, most of which are associated with the treatment of some chronic diseases. Also, the orange fruits can significantly supplement the dietary fibre needs of the populace (especially that of urban-dwellers) when incorporated into diets as raw-eaten snacks. The fruit mesocarps may also be used as alternative vitamin A and C sources in solving the challenges associated with the monotony of the traditional commercial ones.

6. Recommendations

1. Therefore, from this work, it's seen that there is a way forward for the utilization of the underutilized watermelon, sweet orange and pineapple fruits so as to avoid its losses conserve its huge nutritional composition in stable products and create varieties.
2. Due to the challenges encountered during the course of this study on procuring and keeping fruits till when needed for processing; it is therefore recommended that research on how to preserve watermelon, sweet orange and pineapple fruits in a dried stable form should be carried out as this will enable the availability and the utilization of the pineapple all the year round.
3. Finally, there is also need for a study on shelf stability of watermelon, sweet orange and pineapple fruit juice and the best packaging material that may contribute to its stability.

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