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# ASCORBIC ACID AND PH LEVELS OF MATURED INDIGENOUS FRUITS IN SOUTH-EAST NIGERIA

**Adumanya**, O.C.U [a].,
.**Onyeme**, A.C [b].,
**Umensofor**, G.A [c].
**Nwinee**, S.A [d]
[a] Biochemistry Unit, Imo State Polytechnic, Umuagwo-Ohaji, Nigeria.
[b]Department of Nutrition & Dietetics, Imo State Polytechnic, Umuagwo, Imo State
[c] Ministry of Agriculture, Imo State Local Government
[d]Department of Science Laboratory Tech. Petroleum Training Institute, Effurun, Delta State

## Abstract

Fruits are known to be rich in ascorbic acid and may be acidic or alkaline. The ascorbic acid levels and the pH of fruits may alter the system pH when digested or metabolized in the body thereby posing a health concern. Therefore survey of these fruits indigenous to south-East Nigeria and their ascorbic acid *cum* pH levels were assayed. Survey methods were used to identify the fruits via visitation to the popular markets in the area. The identified healthy ones were procured. Titrimetric method using 2, 6 dichlorophenol-indophenol and potentiometric method using pH meter were used in the assay. The result of the ascorbic acid contents of the fruits in these states shows that the citrus family had the highest ascorbic acid content ranging from 39.3mg/100ml to 73.0mg/100ml while riped paw-paw in Imo state had the highest ascorbic acid levels of 91.2mg/100ml followed by bush mango 69.4mg/100ml. The pH result also indicated that the citrus family had the lowest values ranging from 2.24 to 3.87. Therefore, the citrus family from these locations is rich in ascorbic acid content and had pH values that suggest acidity. The result of the ascorbic acid contents of the fruits in these states shows that the citrus family had the highest ascorbic acid content ranging from 39.3mg/100ml to 73.0mg/100ml while riped paw-paw in Imo state had the highest ascorbic acid levels of 91.2mg/100ml followed by bush mango 69.4mg/100ml. The pH result also indicated that the citrus family had the lowest values ranging from 2.24 to 3.87. Therefore, the citrus family from these locations are rich in ascorbic acid content and had pH values that suggest acidity. The result also shows that these fruits may supplement for ascorbic acid need when ingested

***Keywords:*** Indigenous Fruits, pH level, ascorbic acid, south-East Nigeria

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## INTRODUCTION

Indigenous fruits are those fruits which are native to the people in that geographical area, where they have originated and evolved over centuries. Abia, Anambra, and Imo States have varieties of indigenous fruits. In rural locations where exotic species are scarce, they are significant providers of vitamins and minerals. Fruits meet some of the nutrient requirements in some cultures. These fruit trees can be found in the wild, and some have been cultivated. Fruits are reproductive organs in botany (ripened ovaries containing one or many seeds). Morris (1977) defines fruits as the ripened ovary or ovaries of a seed bearing plant, coupled with accessory parts holding the seeds, occurring in a broad range of forms, and an edible, usually sweet and fleshy type of plant. Tutare (2002) on the other hand defined fruit as the soft juicy parts of a plant that contain seed. Hornby (2005) defined fruit as the part of a plant that can be eaten as food and usually tastes sweet. Ifeanacho (2009) opined that fruits are the fully developed ovaries of flowering plants, containing one or more seeds that have developed from fertilized ovules and sometimes including associated structures such as the receptacle .The fruits provide a valued source of vitamins and minerals, but often they are underutilized. Fruits are amongst the first food items known to human beings, in fact, they have been in existence since the inception of mankind (even Adam and Eve ate apple the forbidden fruit). Apples, oranges, grapes, strawberries, and bananas are examples of fruits, which are fleshy seed-associated structures of a plant that are delicious and edible in their raw state. Many structures that are not typically named fruits, such as bean pods, corn, kernels, wheat, grains, and tomato, are included in the botanical definition of fruits (Mauseth, 2003). Fruits are divided into three categories by plant scientists: simple fruits, aggregation fruits, and composite or many fruits (Singh, 2004). The groupings reflect how the flower organs are rearranged and how the fruits develop. Fruit consumption has health benefits; those who consume more fruits as part of a healthy diet are less likely to develop chronic diseases. All fruits contain carbohydrates mainly in the form of sugar dextrin and acids. Fruits, whether eaten whole or in juice form, have a hydrating impact on the body when consumed. They restore the body's water supply as well as numerous nutrients. In fact, water consumed in the form of fruit juice has the added benefit of supplying sugar and important minerals to the body. Low fruit consumption can lead to nutrient deficiencies in potassium, vitamin C, foliate, and dietary fiber. Lack of fruits in the body may increase risks of bone lose, diabetes, cancer, stroke, heart diseases or kidney stones, because fruits, help reduce the risks of those conditions. Nutritional deficiencies and imbalanced diets can also cause mental and physical effects, such as a lack of energy, trouble with focus and woodiness.

Ascorbic acid, commonly known as Vitamin C, is a water-soluble vitamin naturally present in some foods, added to others, and available as a dietary supplement. Vitamins, generally help the human to maintain a healthy diet (Rahman *et al*., 2006). As a reducing agent, ascorbic acid is extremely important in biological reactions (Moeslinger et al., 1995; Rahman et al., 2006; Wonsawat, 2006; Fadhel, 2012). Vitamin C is the L-enantiomer of ascorbic acid, it is a water-soluble vitamin used by the body for several purposes also known as a "wonder worker" since it performs majority of functions. In addition to its role in the formation of collagen and other life-sustaining functions, it serves as a key nutrient for the immune system, and a potent fighter of free-radicals. It has been shown to prevent many illnesses, from everyday ailments such as the common cold to devastating diseases such as cancer (Carr and Frei, 1999; Hwang, 1999; Ohio State University, 2004). It is reported to lower cancer risk, regenerate vitamin E supplies, improve iron absorption and in high doses, protects the eye against cataracts (Robertson et al., 1991; FAO, 2004). Many parts of our metabolic functioning rely on ascorbic acid; nevertheless, humans are one of only a few animal species that cannot create their own supply of vitamin C. (FAO, 2004). Its deficiency leads to scurvy.

The pH of a fruit is a direct function of the free hydrogen ions present in that fruit. Acids present in fruits release these hydrogen ions which give acid fruits their distinct sour flavor. Thus, pH must be defined as a measure of free acidity. In more technical terms, pH is defined as the negative log of hydrogen ion concentration in the base of ten (measured in units of moles per liter). Therefore, if a fruit has a pH value of 3.0,then the concentration of hydrogen ion present in that fruit is equal to $10^{-3}$(0.001)mol/L and if the pH value is 6.0,then the concentration of hydrogen ion (0.000001)mol/L. This shows that the concentration of hydrogen ion decreases as the pH value of the fruit increases. The pH scale is used in chemistry to determine how acidic or basic a water-based solution is. The pH of acidic and basic solutions differs. Acidic solutions have a lower pH, whereas basic solutions have a higher pH. Solutions with a pH less than 7 are acidic, whereas those with a pH more than 7 are basic at 25 °C. The pH neutral value changes with temperature, becoming less than 7 as the temperature rises. For highly strong acids, the pH value can be less than 0 and for very strong bases, it can be larger than 14. (Lim, 2006). The pH scale can be traced back to a collection of standard solutions whose pH has been agreed upon internationally (Covington, 1985). pH measurements are useful in chemistry, agronomy, medicine, water treatment, and a variety of other fields.

Therefore this work aimed to

- Identify the indigenous fruits consumed in South Eastern states of Nigeria.
- Assay the ascorbic acid and pH levels of the fruits.

## MATERIALS AND METHODS

### MATERIALS

Glass wares (Burette, Test tubes, Test tube racks, Measuring cylinder, Beakers, Conical flask)
Retort stand, Knife, Cheese cloth
Blender, Weighing balance, Bowl
pH meter (Ohaus pH meter ST 2100,USA)

**REAGENTS**

2% oxalic acid.

DCPIP solution (2, 6-Dichlorophenolindophenol)
Distilled water
Ascorbic acid standard solution

**EXTRACTION OF FRUIT JUICE SAMPLES**

Twenty-four (24) fresh healthy indigenous fruits were bought from vendors in Owerri, Imo state, Twenty-five (25) fresh indigenous fruits were bought from vendors in Aba, Abia state and Twenty-two (22) fresh indigenous fruits were bought from vendors in Ekwulobia, Anambra state. The fruits were washed and peeled. After removing the peels, juicy fruits such as citrus were divided transversely into two, and their juices were squeezed into different bowls. Then a clean sieve was used to separate the seeds from the juice into well labeled 100ml beakers. Chopping and grinding was the method adopted in extraction of juices from hard fruits like walnut, cola nut, garden egg, alligator pepper, bitter cola ,unripe pawpaw ,unripe mango, coconut and unripe avocado. Once the fruits have been reduced to pulp, 10ml of distilled water was used to strain each of the fruit; the juices were strained differently in well labelled 100ml beakers using a sieve which was rinsed after each strain. While fruits like, sour sop, ripe pawpaw and mango (minus seeds), pineapple and banana fruits were blended into fine pastes and were strained using a cheese cloth.

**pH METER CALIBRATION and pH ANALYSIS OF THE FRUIT JUICE SAMPLES**

All the standards and the samples were allowed to reach room temperature for precise measurements, since pH measurements are temperature sensitive.

The pH meter was calibrated using 4.01 buffer, buffer 7, and buffer 10.01 as described in the Calibration Standard Preparation section via manufacturer’s guide by placing the electrode into the buffer solution.

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After the calibration, the meter probe was rinsed thoroughly with deionized water and excess solution was removed from the electrode by gently blotting with a lint-free tissue ensuring that the sensing bulb on the pH electrode was not wiped or rubbed. 50mls of the prepared samples were measured using a measuring cylinder and the electrode of the pH meter was immersed in the sample.

The "MEASURE Key" on the meter was pressed and reading displayed on the screen of the pH meter was recorded when a stable reading was achieved. The electrode was rinsed with deionized water. The same procedure was repeated for other fruit juice samples.

**PREPARATION OF STANDARD ASCORBIC ACID SOLUTION**

Ascorbic acid (0.05g) was weighed out and was dissolved in 100ml of distilled water.
The concentration of the ascorbic acid solution was calculated using the formula below:

$$\text{Concentration of ascorbic acid} = \frac{\text{Mole}}{\text{Volume}} = \frac{\frac{\text{Mass}}{\text{Molar mass}}}{\text{Volume}}$$

**PREPARATION OF DCPIP SOLUTION**

DCPIP (0.1g) was weighed out and dissolved in 500ml of distilled water.
The concentration of DCPIP solution was calculated by using the formula below:

$$\text{Concentration of DCPIP solution} = \frac{\text{Mole}}{\text{Volume}} = \frac{\frac{\text{Mass}}{\text{Molar mass}}}{\text{Volume}}$$

The titration apparatus was set-up and the burette was rinsed with the titrant (DCPIP solution), then it was filled to the zero mark.
30ml of standard ascorbic acid solution was measured out and transferred into a conical flask using a measuring cylinder.
The ascorbic acid solution was titrated rapidly with the DCPIP solution in the burette and the solution was vortexed well. Colour of DCPIP solution changed to pink when the solution came in contact with the ascorbic acid solution and then became colourless after shaking well. The titration was continued by adding the DCPIP in drops until the pink colour persisted for 10 to 15seconds and the burette reading was recorded.
The titration was repeated following the same procedure. The average titre of the results obtained was calculated.

The concentration of the DCPIP solution is calculated by using the formula below:

CV (Ascorbic acid) = CV (DCPIP)

* C refer to concentration
* V refer to volume

**Determination of the Vitamin C Concentration in Fruit Juice**

10ml of 2% oxalic acid was added to all the fruits samples immediately to avoid oxidation of the fruit juice.

5ml was used in the titration of some fruit juice and 2ml of some fruit juice was also used. The volume of fruit juice was measured and poured into a 250ml conical flask, and 50 ml of distilled water was added. The fruit juice solution was titrated with the DCPIP solution in the burette following the same procedure used in the titration of the standard. The test was repeated and the average results were calculated.

The vitamin C concentration in the fruit juice was calculated using the following formula.

Mole (Vitamin C) = CV (DCPIP solution)

$$\frac{\text{Mass}}{\text{Molar mass}} = CV$$

Mass = Mr (Vitamin C) X C (DCPIP) X V (DCPIP)

* Mr refer to molar mass
* C refer to concentration
* V refer to volume

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**RESULTS**

**Table 1a:** The Ascorbic acid levels of fruit juice sample in Owerri, Imo state

| **S/N** | **Fruits** | **Ascorbic acid concentration in the fruit juice (mg/100ml)** |
|---|---|---|
| 1 | Unripe Avocado Pear | 12.1±3.05 |
| 2 | Ripe Avocado Pear | 20.4±3.96 |
| 3 | Cucumber | 6.5±2.24 |
| 4 | Orange | 69.0±7.28 |
| 5 | Unripe Pineapple | 13.7±3.24 |
| 6 | Ripe Pineapple | 19.2±3.8 |
| 7 | Mango | 12.1±3.04 |
| 8 | Lime | 73.0±7.48 |
| 9 | Lemon | 19.5±3.87 |
| 10 | Unripe Local Banana | 6.7±2.27 |
| 11 | Bush pear | 7.7±2.43 |
| 12 | Bitter cola | 24.0±4.29 |
| 13 | Bullet pear | 15.0±3.40 |
| 14 | Velvet tamarind | 5.6±2.07 |
| 15 | Ripe Sour sop | 30.6±4.85 |
| 16 | Monkey kola | 5.0±1.95 |
| 17 | Cola nut | 4.4±1.84 |
| 18 | Alligator pepper | 4.6±1.87 |
| 19 | Pepper fruit | 2.4±1.36 |
| 20 | Bush mango | 69.4±7.30 |
| 21 | Grape | 61.0±6.83 |
| 22 | Ripe Pawpaw | 91.2±8.73 |
| 23 | Unripe Pawpaw | 31.5±4.91 |
| 24 | Coconut water | 9.8±2.74 |
| 25 | Coconut | 14.3±3.32 |

**Table 1b :** The Ascorbic acid levels of fruit juice sample in Aba, Abia state

| S/N | Fruits | Ascorbic acid concentration in the fruit juice (mg/100ml) |
|---|---|---|
| 1 | Unripe Avocado Pear | 8.9±2.62 |
| 2 | Cucumber | 5.7±2.09 |
| 3 | Orange | 51.6±6.30 |
| 4 | Unripe Pineapple | 4.8±1.92 |
| 5 | Ripe Pineapple | 13.6±3.16 |
| 6 | Mango | 6.5±2.24 |
| 7 | Lime | 39.3±5.09 |
| 8 | Lemon | 15.7±3.47 |
| 9 | Bush pear | 5.3±2.02 |
| 10 | Bitter cola | 5.1±1.97 |
| 11 | Bullet pear | 7.4±2.39 |
| 12 | Velvet tamarind | 4.0±1.75 |
| 13 | Garden egg | 7.6±2.41 |
| 14 | Ripe Sour sop | 8.5±2.54 |
| 15 | Unripe Sour sop | 3.4±1.61 |
| 16 | Monkey kola | 4.2±1.79 |
| 17 | Cola nut | 2.7±1.43 |
| 18 | Alligator pepper | 6.1±2.16 |
| 19 | Tangerine | 45.6±5.9 |
| 20 | Rose apple | 5.1±1.99 |
| 21 | Guava | 48.6±6.11 |
| 22 | Grape | 59.5±6.76 |
| 23 | Unripe Pawpaw | 20.4±3.96 |
| 24 | Coconut water | 4.5±1.8 |
| 25 | Coconut | 6.6±2.25 |

**Table 1c :** The Ascorbic Acid levels of fruit juice sample in Ekwulobia, Anambra State

| S/N | Fruits | Ascorbic acid concentration in the fruit juice (mg/100ml) |
|---|---|---|
| 1 | Unripe Avocado Pear | 7.4±2.38 |
| 2 | Cucumber | 3.0±1.52 |
| 3 | Orange | 50.8±6.24 |
| 4 | Ripe Pineapple | 5.7±2.09 |
| 5 | Mango | 3.8±1.70 |
| 6 | Lime | 32.0±4.95 |
| 7 | Lemon | 18.9±3.80 |
| 8 | Bitter cola | 17.5±3.67 |
| 9 | Bullet pear | 5.5±2.06 |
| 10 | Velvet tamarind | 2.4±1.36 |
| 11 | Garden egg | 7.4±2.40 |
| 12 | Ripe Sour sop | 3.9±1.73 |
| 13 | Unripe Sour sop | 5.9±2.13 |
| 14 | Monkey kola | 2.5±1.38 |
| 15 | Cola nut | 2.7±1.43 |
| 16 | Alligator pepper | 7.4±2.39 |
| 17 | Pepper fruit | 2.4±1.36 |
| 18 | Tangerine | 53.7±6.41 |
| 19 | Rose apple | 3.4±1.61 |
| 20 | Grape | 57.5±6.64 |
| 21 | Unripe Pawpaw | 26.37±4.5 |
| 22 | Coconut water | 4.0±1.75 |
| 23 | Coconut | 4.5±1.86 |

**Table 2a:** pH levels of the fruit juice samples in Owerri, Imo state

| S/N | Fruits | pH levels |
|---|---|---|
| 1 | Unripe Avocado Pear | 6.10 |
| 2 | Ripe Avocado Pear | 5.8 |
| 3 | Cucumber | 5.62 |
| 4 | Orange | 3.82 |
| 5 | Unripe Pineapple | 3.73 |
| 6 | Ripe Pineapple | 3.60 |
| 7 | Mango | 4.40 |
| 8 | Lime | 2.26 |
| 9 | Lemon | 2.30 |
| 10 | Unripe Local Banana | 5.70 |
| 11 | Bush pear | 4.21 |
| 12 | Bitter cola | 5.64 |
| 13 | Bullet pear | 4.28 |
| 14 | Velvet tamarind | 3.30 |
| 15 | Ripe Sour sop | 4.14 |
| 16 | Monkey kola | 6.65 |
| 17 | Cola nut | 6.04 |
| 18 | Alligator pepper | 6.32 |
| 19 | Pepper fruit | 5.50 |
| 20 | Bush mango | 5.56 |
| 21 | Grape | 3.53 |
| 22 | Ripe Pawpaw | 3.20 |
| 23 | Unripe Pawpaw | 6.00 |
| 24 | Coconut water | 5.70 |
| 25 | Coconut | 6.35 |

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**Table 2b:** pH levels of the fruit juice samples in Aba, Abia state.

| S/N | Fruits | pH levels |
|---|---|---|
| 1 | Unripe Avocado Pear | 6.05 |
| 2 | Cucumber | 5.64 |
| 3 | Orange | 3.87 |
| 4 | Unripe Pineapple | 3.76 |
| 5 | Ripe Pineapple | 3.62 |
| 6 | Mango | 3.55 |
| 7 | Lime | 2.37 |
| 8 | Lemon | 2.24 |
| 9 | Bush pear | 4.25 |
| 10 | Bitter cola | 5.60 |
| 11 | Bullet pear | 4.22 |
| 12 | Velvet tamarind | 3.29 |
| 13 | Garden egg | 5.99 |
| 14 | Ripe Sour sop | 4.16 |
| 15 | Unripe Sour sop | 6.09 |
| 16 | Monkey kola | 6.67 |
| 17 | Cola nut | 6.09 |
| 18 | Alligator pepper | 5.81 |
| 19 | Bush mango | 5.52 |
| 20 | Tangerine | 3.23 |
| 21 | Rose apple | 3.51 |
| 22 | Guava | 4.06 |
| 23 | Grape | 3.60 |
| 24 | Unripe Pawpaw | 5.78 |
| 25 | Coconut water | 5.56 |
| 26 | Coconut | 6.50 |

**Table 2c:** The pH levels of the fruit juice samples in Ekwulobia, Anambra state.

| S/N | Fruits | pH levels |
|---|---|---|
| 1 | Unripe Avocado Pear | 6.16 |
| 2 | Cucumber | 4.12 |
| 3 | Orange | 3.29 |
| 4 | Ripe Pineapple | 3.54 |
| 5 | Mango | 4.91 |
| 6 | Lime | 2.28 |
| 7 | Lemon | 2.35 |
| 8 | Bitter cola | 5.78 |
| 9 | Bullet pear | 4.33 |
| 10 | Velvet tamarind | 3.41 |
| 11 | Garden egg | 6.02 |
| 12 | Ripe Sour sop | 4.16 |
| 13 | Unripe Sour sop | 5.73 |
| 14 | Monkey kola | 6.68 |
| 15 | Cola nut | 5.86 |
| 16 | Alligator pepper | 6.39 |
| 17 | Pepper fruit | 5.51 |
| 18 | Tangerine | 3.23 |
| 19 | Rose apple | 3.48 |
| 20 | Grape | 3.50 |
| 21 | Unripe Pawpaw | 6.15 |
| 22 | Coconut water | 5.82 |
| 23 | Coconut | 6.09 |

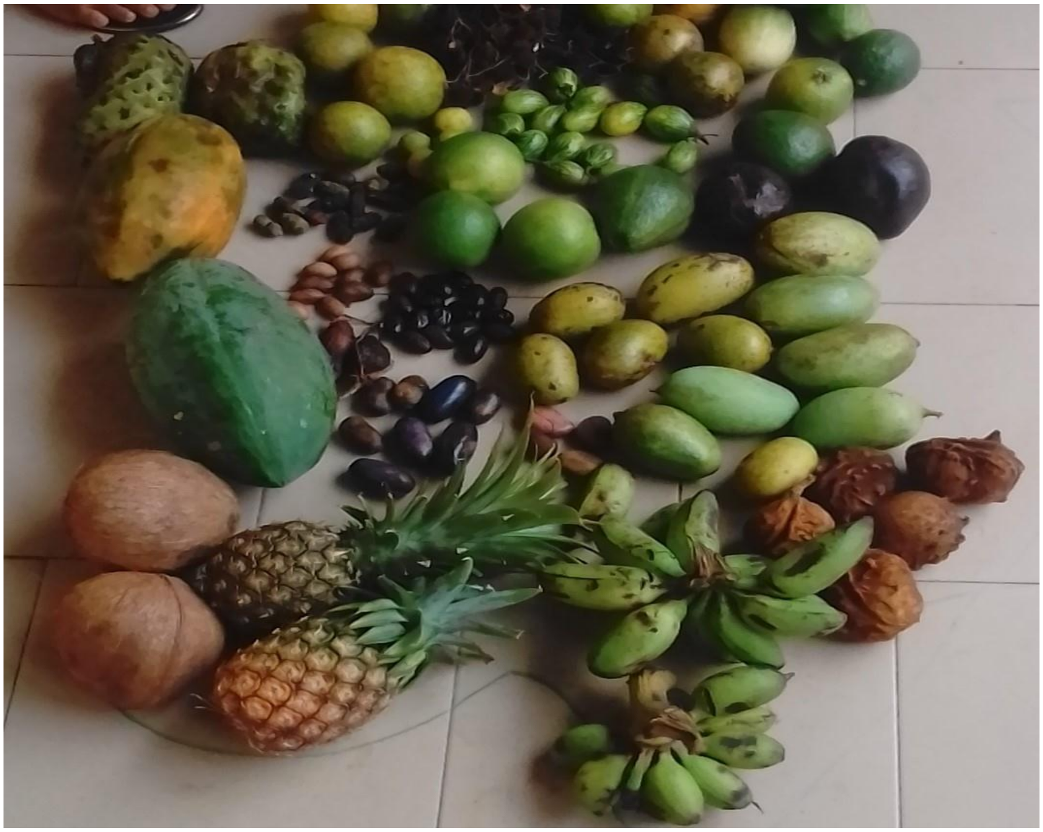

**Figure 1:** Samples of the fruits Assayed

## DISCUSSION

*Ascorbic acid*

Table 1a shows the ascorbic acid contents in fruits obtained from Imo state while Table 1b shows the ascorbic acid content in fruits obtained in from Abia state and Table 1c shows the ascorbic acid content in fruits selected from Anambra respectively. The result in Table 1a shows that papaya has the highest ascorbic acid(91.2mg/100ml) followed by lime(73.0mg/100ml), bush mango (69.4mg/100ml),orange(69.0mg/100ml), grape(61.0mg/100ml), ripe sour soup (30.6mg/100ml). However, the result obtained in some of the fruits assayed differs from similar work carried out by Sani *et al.*,(2015) and

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Ikewuchi *et al.*,(2011) who reported lower values as well as higher values of the assayed fruits than the ones obtained in this work. Sani *et al.*,(2015) reported that the ascorbic content of paw-paw was 86.51mg/100ml, orange 78.92mg/100ml, and grape 41.13mg/100ml while Ikewuchi *et al.*,(2011), reported that the ascorbic acid content of paw-paw was 91.04mg/100ml, orange 75.00mg/100ml, grape 70.345mg/100ml and lime 44.138mg/100ml. According to Romeo and Rodringurz (1992), any fruit that gives about 15.3 ml/100ml of ascorbic acid is considered to be a very good source of vitamin C (ascorbic acid) while that which contained above 30ml/100ml is said to be an excellent source of vitamin C. The fruits which had the lowest ascorbic acid content were; velvet tamarind (5.6mg/100ml), monkey kola(5.0mg/100ml), alligator pepper(4.6mg/100ml), cola nut(4.4mg/100ml) and pepper fruit. The result obtained in this study differs from the similar work carried out by Onyeneke (2018) who reported higher ascorbic acid values (Kola nuts 7.24mg/100mg, alligator pepper 8.6mg/100ml, and pepper fruit 15.46mg/100ml) than the ones obtained in this work.

The result in Table 1b shows that grape had the highest ascorbic acid (59.5mg/100ml) followed by orange (51.6mg/100ml), guava (48.6mg/100ml), tangerine(45.6mg/100ml), lime (39.3mg/100ml), unripe paw-paw (23.6mg/100ml) and lemon(15mg/100ml). This result differs from that obtained in the previous studies of Fatin and Azrina (2017); Ikewuchi *et al.*,(20011) and Olumayiwa *et al.*,(2003) who observed higher as well as lower values of ascorbic acid content of the assayed fruits in this study. Fatin and Azrina (2017) reported that orange had an ascorbic acid content of 58.304mg/100ml, grape 49.145mg/100ml, lemon 43.956mg/100ml and lime 27.77mg/100ml; Ikewuchi *et al.*, reported that tangerine had an ascorbic acid content of 98.85mg/100ml, grape 70.345mg/100ml, lime 44.138mg/100ml,and orange 75.00mg/100ml and Olumayiwa *et al.,* also reported that orange had an ascorbic acid content of 55.3mg/100ml, grape 45.4mg/100ml,lime 29.4mg/100ml and pineapple 11.7mg/100ml. The fruits which had the lowest ascorbic acid content were bullet pear (7.4mg/100ml), bush pear

(5.3mg/100ml), rose apple (5.1mg/100ml),unripe sour sop (3.4mg/100ml) and cola nut (2.7mg/100ml).The result obtained is quite different from that reported from the similar work carried out by Ehrim *et al.*, (2015) (bullet pear 13.78mg/100ml); and Onyeneke (2018) (cola nut 7.24mg/100ml) who reported higher values of ascorbic acid content than the ones obtained in this work.

The result in Table 1c shows that grape has the highest ascorbic acid content of 57.5mg/100ml followed by tangerine 53.7mg/100ml,orange 50.8mg/100ml, lime 32.0mg/100ml, unripe paw-paw 26.37mg/100ml,lemon 18.9mg/100ml, and bitter cola 17.5mg/100ml.The result obtained differs from the previous work carried out by Ikewuchi *et al.*,(2011) (tangerine 98.85mg/100ml, orange 75.00mg/100ml, grape 70.345mg/100ml, and lime 44.138 mg/100ml); and Mazi *et al.*,(2018) (bitter cola 12.6mg/100ml). The mentioned researchers reported higher values of the assayed fruits. The fruits which had the lowest ascorbic acid content are cucumber 3.0mg/100ml, monkey cola 2.5mg/100ml, velvet tamarind 2.4mg/100ml and pepper fruit 2.4mg/100ml.The difference in the results obtained may be as a result of different methods of determining ascorbic acid used. The difference may be as a result of different Processing methods employed in his work, which may alter the concentration of ascorbic acid in fruits. The variation could also be as a result of difference in geographical location of the samples analyzed, which might be responsible for the differences in the range of values. Also, soil condition, exposure of the fruit juice to air, storage of fruits and over ripening of the fruit samples used in the research work might be responsible for the variation in ascorbic acid contents.

*pH*

Table 2a shows the pH levels of fruits obtained in Imo state while Table 2b shows the pH levels of fruits obtained in Abia state and Table 2c shows the pH levels of fruits obtained in Anambra state respectively.

The pH values of fruit samples obtained in Table 2a indicates that eight (8) fruits had high acid values ranging from 2.24 – 3.82, and fifteen (15) fruits had mild acid value ranging from 4.14 – 6.65. The pH values of fruit samples obtained in Table 2b indicates that ten (10) fruits had high acid values ranging from 2.4 – 3.87, and sixteen (16) fruits had mild acid value ranging from 4.06 – 6.67. The pH values of fruit samples obtained in Table 2c indicates that eight (8) fruits had high acid values ranging from 2.28 – 3.54, and fifteen (15) fruits had mild acid value ranging from 4.12 – 6.68. These result are similar with that obtained in the previous study conducted by Olumuyiwa, *et al.*,(2003). This variation in result could be as a result of location, soil constituents (manure used), laboratory conditions, and the stage of ripening of the fruits.

## CONCLUSION

The result of the ascorbic acid contents of the fruits in these states shows that the citrus family had the highest ascorbic acid content ranging from 39.3mg/100ml to 73.0mg/100ml while riped paw-paw in Imo state had the highest ascorbic acid levels of 91.2mg/100ml followed by bush mango 69.4mg/100ml. The pH result also indicated that the citrus family had the lowest values ranging from 2.24 to 3.87. Therefore, the citrus family from these locations are rich in ascorbic acid content and had pH values that suggest acidity. The result also shows that these fruits may supplement for ascorbic acid need when ingested

Conflict of Interest: None

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