



## **Comparison of Ascorbic Acid Content in Some Selected Fruits Samples from Makarfi Local Markets, Kaduna State, Nigeria**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author SAA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors IAA and SA managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

This study was carried out to determine the ascorbic acid content of some fruits samples sold in Makarfi local market. Six fruits samples were randomly selected and used for the study. The samples were thoroughly washed and rinsed with distilled water. 500 g of each fruit sample (Cucumber, Carrot and Garden egg) were analyzed for both fresh and cooked portions. The samples were crushed and suspensions were made using doubled-distilled water. The extract was filtered to obtained 100 ml from each fruit filtrate which was then placed in a 500 ml volumetric flask and diluted to the mark with distilled water. 25 ml of each solution were treated with 150 ml distilled water and 5 ml of 0.6 molar freshly prepared  $KI_{(aq)}$ . 5 ml of 1M HCl and 1 ml of starch solution was added to the mixture which was then titrated against a freshly prepared 0.002M potassium iodate solution. The results obtained were used to determine the concentration of ascorbic acid in each sample. The major findings revealed that, fresh cucumber fruit has the highest concentration of ascorbic acid ( $9.6 \times 10^{-1}$  mg/L) followed by garden egg ( $7.1 \times 10^{-1}$  mg/L)

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and cooked garden egg fruits ( $5.6 \times 10^{-1}$  mg/L). On the other hand, passion fruit ( $0.06 \times 10^{-1}$  mg/L) has the least quantity of ascorbic acid content followed by cooked carrot ( $1.3 \times 10^{-1}$  mg/L) and tamarind ( $2.9 \times 10^{-1}$  mg/L) respectively. Some recommendations were made amongst which is that farmers should be enlightened to avoid the use of excessive inorganic fertilizers as it may be the factors that degrade the ascorbic acid content of some edible fruits. Vitamin C content of food get reduced by prolonged storage and over cooking because ascorbic acid is water soluble and it is destroyed by heat. Therefore steaming or microwaving should be encouraged. The study was concluded by emphasizing the importance of the consumption of fruits and the advantages of this to human health and general well-being.

**Keywords:** Ascorbic acid (vitamin C); fruits; potassium iodate and Makarfi market.

## 1. INTRODUCTION

Ascorbic acid is a water-soluble group of vitamins which is necessary for the formation of intercellular substances that bind cells in tissues such as capillaries, bones and teeth [1]. Vitamin C is defined as the generic term for all compounds exhibiting the biological activity of L-ascorbic acid. Ascorbic acid is the principal biologically active form but L-dehydroascorbic acid, an oxidation product, also exhibits biological activity. Ascorbic acid (Vitamin C) is the most important vitamin in fruits and vegetables. Except human and other primates, most of the phylogenetically higher animals can synthesize vitamin C (L-ascorbate). Vitamin C is an important vitamin for human nutrition which is supplied by fruits and vegetables according to [2,3]. As a potent antioxidant, it has the capacity to eliminate several different free radicals [4]. More than 90% of the vitamin C in human diets is supplied by fruits and vegetables (including potatoes). Determination of ascorbic acid in food stuffs is relevant since they are an indicator of freshness [5].

Vitamin C is required for the prevention of scurvy and maintenance of healthy skin, gums and blood vessels. It functions in collagen formation, absorption of inorganic iron, reduction of plasma cholesterol level, inhibition of nitrosoamine formation, enhancement of the immune system, and reaction with singlet oxygen and other free radicals. As an antioxidant, it reportedly reduces the risk of arteriosclerosis, cardiovascular diseases and some forms of cancer [6].

The consumption of fruit juices and vegetables are beneficial and the health effects of fruits are ascribed, in part to ascorbic acid, a natural antioxidant which may inhibit the development of some major clinical conditions. The health

benefits of fruits have mainly been attributed to the presence of bioactive compounds, such as ferulic acid, hydrocinnamic acid, cyanidin 3-O-glucoside, hesperidin, vitamin C, carotenoid and naringin content amongst others [7,8]. Maintenance of daily dietary intake of vitamin C leads to the prevention of scurvy which has been shown to be high in children and the elderly [9].

Botanically, fruits contain seeds and come from the flower of a plant, while the rest of the plant is considered as vegetable. In cooking, fruits are considered to be sweet while vegetables are savoury. However, there are several plants that are technically fruits, though they are often classified as vegetables because of their taste. For example, tomatoes fit the definition of a fruit, but, they are still commonly referred to as vegetables because of their flavor profile. Fruits and vegetables have a lot of similarities in terms of nutrition because both are high in fiber as well as antioxidants and plant compounds. They are full of vitamins and minerals for good health and contains no artificial colours or flavours. Eating a variety of fruit and vegetables everyday can help prevent overweight, obesity and constipation. They are also naturally low in sodium and fat [10].

This present study tends to determine the ascorbic acid (Vitamin C) content of cooked and uncooked nine different fruit samples sold in Makarfi local market from Kaduna State, Nigeria using titrimetric method of analysis.

## 2. MATERIALS AND METHODS

### 2.1 Sample Collection

The samples were collected from local markets within Makarfi local government area from different locations.

**Table 1. Results of titrimetric analysis of the fruits samples**

S/No	Fruit sample	Average volume (cm <sup>3</sup> )	Amount of ascorbic acid in (moles)	Concentration of ascorbic acid in (mg/L)
1.	Cucumber	2.03	$1.22 \times 10^{-5}$	$9.561 \times 10^{-1}$
2.	Cucumber cooked	11.55	$6.93 \times 10^{-5}$	$5.440 \times 10^{-1}$
3.	Carrot	6.45	$3.87 \times 10^{-5}$	$3.038 \times 10^{-1}$
4.	Carrot cooked	2.95	$1.77 \times 10^{-5}$	$1.389 \times 10^{-1}$
5.	Garden egg	1.50	$0.9 \times 10^{-5}$	$7.065 \times 10^{-1}$
6.	Garden egg cooked	11.80	$7.08 \times 10^{-5}$	$5.558 \times 10^{-1}$
7.	Passion fruit	1.40	$8.4 \times 10^{-5}$	$0.065 \times 10^{-1}$
8.	Santol fruit	11.10	$6.66 \times 10^{-5}$	$5.228 \times 10^{-1}$
9.	Tamarind	6.20	$3.72 \times 10^{-5}$	$2.920 \times 10^{-1}$

## 2.2 Samples and Reagents Preparations

The samples and reagents used for this study were prepared using standard analytical procedure as described by USEPA [11]. All the reagents used are analytical grade purchased from Sigma-Aldrich Germany and Merck representative in Lagos.

## 2.3 Sample Treatment

Each fruit sample solution was titrimetrically analyzed using iodometric method with 0.002 mol/dm<sup>3</sup> Potassium iodate solution and starch indicator. The average values obtained from each sample solutions after titration was used to calculate quantitatively the amount of ascorbic acid present in each fruit sample. The results obtained are presented in the Table 1.

## 3. RESULTS AND DISCUSSION

Table 1 shows the average volume and moles of ascorbic that reacted from each sample after titration, which revealed that a fresh cucumber fruit contains  $9.6 \times 10^{-1}$  mg/L of ascorbic acid, which is less than the expected standard value of 10.0 mg/L according to (W.H.O. 2000). This indicated that fresh cucumber fruits sold in Makarfi local market as at the period the samples were collected does not contain much of ascorbic acid. Cooked cucumber contains  $5.44 \times 10^{-1}$  mg/L of ascorbic acid when calculated and related to the molar concentration and molecular weight of ascorbic acid. The value obtained is also less than the standard values (10.0 mg/L) in either sample of cucumber fruits. However, when compared to the amount of ascorbic acid in fresh cucumber and cooked cucumber fruit sample, it was noticed that the quantity is a

bit higher than that of the fresh cucumber sample.

The results also showed that fresh and cooked sample solution of carrot fruit has  $1.4 \times 10^{-1}$  and  $3.04 \times 10^{-1}$  mg/L of ascorbic acid respectively. These values are lower than the recommended dietary intake values for fruits. A freshly crushed sample of garden egg solution has ascorbic acid concentration of  $7.07 \times 10^{-1}$  mg/L while cooked garden egg has a concentration of  $5.56 \times 10^{-1}$  mg/L. These values are also far lesser than the (W.H.O) standard values of vitamin C (ascorbic acid) in fresh and cooked fruits. The depletion in the values may be due to handling and other associated factors. These findings in respect to the study area (Makarfi local Markets) indicates that the fruits have less values as they contain little ascorbic acid needed for healthy growth and body protections against germs (bacteria/fungi).

All the samples used for the study indicated that cooked fruit samples contains lower values of vitamin C compared to the fresh sample solution. This result is in accordance with the expectations that; when fruits are cooked, the amount of vitamin C contained decreases due to thermal destruction by heat. The amount of ascorbic acid obtained from the sample is very low compared to the recommended values of 10.0 mg/L, [12].

Similarly, fresh passion fruits sample has  $0.065 \times 10^{-1}$  mg/L ascorbic acid which is less than the standard values of 10.0 mg/L [12]. Fresh tamarind fruits sample solution has  $2.92 \times 10^{-1}$  mg/L. This shows that, fresh sample of Tamarind also has lesser amount than the standard recommended amounts of ascorbic acid. However quantity of  $7.065 \times 10^{-1}$  mg/L ascorbic acid contained in garden egg fresh samples is

higher than that of carrot sample but less than the values of fresh cucumber fruits cultivated within the same study area.

#### 4. SUMMARY

Based on the results obtained from the study, it is summarized as follows that;

- Fresh Cucumber fruit sample has the highest concentration of ascorbic acid content than all the other fruit samples used for the study.
- Garden egg sample has the second highest value of ascorbic acid content, followed by sample of cooked garden egg, then cooked cucumber, santol fruit and fresh carrot in that order. Finally, passion fruit sample contained the least quantity of ascorbic acid (vitamin C) than all the samples used for the study.
- From the results, it was shown that solution of freshly crushed garden egg fruit consumed more iodate solution than the other samples during titration, followed by solution of cooked cucumber fruits and santol fruit sample respectively. However, solution of passion fruits sample consumed least volume of  $KIO_{3(aq)}$  but has the highest amount of ascorbic acid content among all the nine (9) fruits samples used for the study.

#### 5. CONCLUSION

The result of the findings shows that, fresh cucumber fruit has the highest concentration of ascorbic acid content followed by garden egg and cooked garden egg fruits. On the other hand, fresh passion fruit has the least concentration of ascorbic acid content followed by cooked carrot fruit and tamarind respectively. The consumption of fruits by individuals and the advantages inherent in the supply of Vitamin C from fruits to the human health cannot be underestimated. Hence, the study has revealed that cucumber fruit has a lot of Vitamin C and as such should be consumed without hesitation.

#### 6. RECOMMENDATIONS

1. This research work is limited to only qualitative analysis of ascorbic acid in fruits samples. A quantitative determination should be carryout to estimate the actual amount of ascorbic acid in the samples.

2. The study only analyzed six edible fruits samples, other fruits cultivated and sold within the study area can also be investigated by other researchers to make valid generalization about ascorbic acid found in plants grown in the area.
3. The study shows that ascorbic acid functions as an antioxidant and plays a vital role in immune system; it also helps prevent and/or treat numerous health conditions. Therefore fruits used as source of food should not be over cooked in other to prevent the destruction of their vitamin C content since it is a water soluble compound and cannot withstand strong heating.
4. Farmers should be enlightened to avoid excessive use of inorganic fertilizers as it may be one of the factors that degrade the ascorbic acid content of some edible fruits.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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