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Comparison of Ascorbic Acid Content of some Selected Fresh and Dried Tropical Vegetables

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ABSTRACT

Ascorbic acid (Vitamin C) was determined in four different tropical vegetables (Cucumber, Cabbage, Spinach and Tomatoes) sourced from Yankaba market, Kano state. Colorimetric method was used for the determination. The ascorbic acid content in the cucumber, cabbage, spinach and tomatoes ranged from 51.67mgL^{-1} to 395.45mgL^{-1}. Tomatoes were found to have the highest concentrations (395.45mgL^{-1}) while cucumber has the lowest (181.82mg^{L-1} for the fresh and 60.00mgL^{-1} and 51.67mgL-1 respectively) for the dried vegetables. The deficiency of ascorbic acid is believed to result in scurvy, a disease characterized by spongy and sore gum, loose teeth, anaemia, swollen joint, fragile blood vessels. Frequent intake, therefore of these vegetables rich in vitamin C (especially tomatoes) will help prevent these problems in human being. This indicated that although the vegetables are rich in ascorbic acid content, their dried forms have grossly inadequate amount to ensure the provision of required dietary intake (RDI) of vitamin C for humans.

Keywords: Ascorbic acid, Comparison, Vegetables, Vitamins

Introduction

The word vitamine, later shortened to vitamin, was coined by a polish-American chemist Casimir Funk in the early 20th century. Funk was searching for the then unknown substance in foods that prevents such diseases as beriberi, rickets, and scurvy (http//www.Ascorbicacid.org/2009). The body requires vitamin in rather small amounts to maintain health and function properly. Children additionally need vitamins to grow. Most vitamins come from plant foods, but a few are found only in animal products. Vitamins are also manufactured for sale as supplements for people who need additional vitamins to meet their bodyôs requirements (Ihekoronye and Ngoddy, 1985). Scientists have classified 13 compounds as vitamins. They have given most of these vitamins letter or letter plus number names, such as A, B_{12}, C and D (http//www.Ascorbicacid.org/2009).

Vegetables and fruits offer the most rapid and lowest cost method of preventing vitamin C to the people who lived in the tropic (http//www.vitamin.org/2009). Although often there is a confusion in distinguishing between some vegetables and fruits, vegetables are understood to reach the leafy outgrowth of plants used as food and include those plants and parts of plants used in making soups or served as integral parts of the main source of tree (Koranye and Ngoddy, 1985 (b); Ngoddy, 1975).

Spinach (*Spiracia oleracea*) is an edible flowering plant in the family of Amaranthaceae. It has a high nutritional value and is extremely a rich source of vitamin C (Rahman et al., 2007).

Cabbage (*Brassica olaracea*) is used as a leafy green vegetable. Cabbage is a very good source of vitamin C (Rahman et al., 2007).

Cucumber (*Cucumis salisbus*), with the least content of ascorbic acid, is a widely cultivated plant in the ground family of Cucurbitaceae. Botanically speaking, cucumber is classified as fruits. However, much like tomatoes and squash they are usually perceived, prepared and eaten as vegetables (Rahman et al., 2007).

Tomatoes are the fruits of the plant *Lycopersicon esculentum* and are one of the most widely grown of the tropical vegetables. They are consumed as the fresh product, as well as processed products such as canned whole tomatoes, tomato juice,

tomato puree, tomato paste, ketchup and chilli sauce (Rahman et al., 2007).

Vitamin C, also known as ascorbic acid, is important in the formation and repair of bones, teeth and collagen- the bodyôs major building protein. It is an essential vitamin needed by human to prevent scurvy and to increase the bodyôs resistance to infection. Vitamins help heel wounds and increases body resistance to infection. It also helps the body absorb iron from plant foods (Chopra and Kanwar, 2007). Vitamin C acts as an antioxidant, a nutrient that chemically binds and neutralizes the tissue-damaging effects of substances in the environment known as free radicals. Vitamin C deficiency can lead to weakness and fatigue, inflamed or bleeding gums, greater likelihood of infection and poor ability to heal. Scurvy is the classic manifestation of severe vitamin C deficiency (http//www.Ascorbicacid.org/2009).

Ascorbic acid ï an organic compound of carbon, hydrogen and oxygen, occurs naturally in many fruits and vegetables, particularly in tomatoes, citrus, cantaloupe, broccoli, spinach, green peppers, cabbage and potatoes. The vitamin is easily destroyed by cooking or canning foods and by exposure to air and light (Ihekorenye and Ngoddy, 1985). Most plants and animals are able to synthesize their own vitamin C, through a sequence of four enzyme-driven steps.

Vitamin C is soluble in water, slightly soluble in alcohol, insoluble in ether, fats and oils. Its molecular formula is $C_6H_8O_6$ with molecular weight of 176 and a melting point of 192^oC (Pauling, 1970).

Numerous analyses have been reported for the determination of vitamin C in different materials. These include titrimetric (Ejoh, 2005; Lim, 2006), potentiometric (Rahman et al., 2007), colorimetric. Others are HP liquid chromatography, spectrometric and enzymatic (Arya *et al.*, 1998; Casella, 2006; Chopra and Kanwar, 2007).

This research set to examine the quantitative amount of vitamin C in some locally available tropical vegetables using colorimetric method with the view to compare vitamin C content of fresh and dried samples.

Materials and methods

Sampling

Four different samples of cabbage, cucumber, spinach and tomatoes, were purchased from óYan kaba vegetable market, in Kano. Part of these vegetables were sliced and dried in the sun.

Extraction of ascorbic acid

Ten (10) grams each of both dried and fresh vegetables samples were ground in mortar with 10g weight its pure washed sand in 10cm^3 of 8% acetic acid. The extraction was repeated twice, using a total volume of 20cm^3 of acid for each 10g vegetable sample. The combined extract was then centrifuged at high speed and this clear fluid was made to 15cm^3 each, with citric acid (Arya *et al*., 1998).

Preparation of standard

Hundred (100) mg of ascorbic acid is dissolved in 100cm^3 of 2% HPO_3. To 4cm^3 of this solution, 20% HPO_3 is added to make 100cm^3 (Chopra and Kanwar, 2007).

Determination of ascorbic acid content

Measured volumes of 0.5, 1, 2, 3, 4 and 4.5cm^3 of ascorbic acid were placed in different test tubes in triplicates and volumes made to 5cm^3 each accordingly using 2% HPO_3. Ten (10) cm^3 of dye solution as prepared by Chopra and Kanwar (2007) was added and the absorbance measured at 518nm using 5cm3 of 2% HPO_3 as blank. A plot of absorbance against concentration was made.

Three (3) cm^3 of each of the extract were measured and made to 5cm^3 with 2% HPO_3 and the absorbance were measured which was followed by the solution to 10cm^3 dye solution and the corresponding concentration were extrapolated using the standard curve.

The ascorbic acid content for the four vegetables investigated in both fresh and dry forms, in mgL-1 were obtained using the following relation;

Mg of ascorbic acid per100cm^3 of sample = $\frac{\text{ascorbic acid content X vol. made X 100}}{\text{cm}^3 \text{ of solution taken X 1000 X Sample vol.}}$

(Chopra and Kanwar, 2007)

Statistical Analysis

The results obtained will be subjected to statistical analysis using chi-square test to determine whether significant difference exists in the vitamin C content between fresh and dried vegetables (Mukhtar, 2008).

Results and Discussion

The results are as shown in Tables 1 for the fresh and dried vegetable samples respectively.

From the results obtained in Table 1, tomatoes had the highest content of ascorbic acid (395.45mgL^{-1} for fresh and 60.00mgL^{-1} for dried) while cucumber had the lowest (182.82mgL^{-1} for fresh and 51.67mgL^{-1} for the dried) respectively. The high content of ascorbic acid obtained in tomatoes is in agreement with observation earlier-on made by Ngoddy (1975) that the general composition of fresh tomatoes indicates high content of ascorbic acid as a part of its micro-nutrients. There exist significant difference in Vitamin C content of fresh

and dried vegetables since the calculated values 145.734, 77.493, 166.411 and 112.547 for Cucumber, Cabbage, Spinach and Tomatoes respectively were higher than the table value (11.07) at P=0.05 and 5% confidence interval. This agrees with the report of Ndawula *et al*. (2010) that methods of drying plant materials caused a significant loss of vitamin C with open sun drying causing the greatest loss.

From the results obtained it is clearly established that drying, among the vegetables studied, to a greater extent results in a significant reduction in ascorbic acid contents. This is in line with earlier findings that all methods of drying plant materials caused a significant loss of vitamin C with sun drying causing the greatest loss. This is because high temperature destroys the vitamin C (Nwadula *et al.*, 2010). And this also, is as opined by Ihekoronye and Ngoddy (1985), that losses in vitamin C may occur as it is labile to heat, light and air

Table1: Ascorbic Acid content of fresh and dried vegetables

	Fresh		Dried	
Sample	Absorbance	Concentration (mgL^{-1})	Absorbance	Concentration (mgL^{-1})
Cucumber	0.40	181.82	0.31	51.57
Cabbage	0.42	190.91	0.32	53.33
Spinach	0.66	300.45	0.34	56.67
Tomatoes	0.87	395.45	0.36	60.00

Conclusion

From the results obtained in this study, it can be concluded that the vegetable samples analysed are rich and cheap sources of Vitamin C but its concentration is grossly reduced by drying which is the most common means of preservation employed for these vegetables.

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(http//www. Ascorbicacid.org/2009)Ascorbic acid

(http//www.vitamin.org/2009)Vitamin.