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Full Length Research Paper

Determination of β–Carotene & Vitamin C content of Fresh Green Pepper *(Capsicum annnum),* Fresh Red Pepper (*Capsicum annum*) and Fresh Tomatoes (*Solanumly copersicum*) Fruits

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ABSTRACT

The interest in the consumption of different varieties of pepper fruits, (*Capsicum annuum*) and also tomato fruit (*Solanum lycopersicum*) is to a large extent, due to their content of bioactive nutrients and their importance as dietary antioxidants. A laboratory experiment was carried out to determine the β–carotene and vitamin C content of green pepper fruit, red pepper fruit and tomato fruit. The β–carotene content of the methanolic extract of the three samples was determined spectrophotometrically. Vitamin C content of the fruits was measured as ascorbic acid by titrating the aqueous mixtures of the samples. The result showed that tomato has the highest β–carotene content (896μg/100ml of extract) and the lowest vitamin C content (54.12mg/100g) while red pepper has the highest vitamin C content (126.05mg/100g) and considerable high amount of β–carotene (592μg/100ml of extract). Green pepper on the other hand, has a considerable high amount of vitamin C (116.08mg/100g) and β–carotene content of 368μg/100ml of extract). From the nutritional point of view, the data in this report will serve as a useful guide to dieticians in the selection of plants which are rich in these antioxidants.

Key words: Pepper and tomato fruits dietary antioxidants, β-carotene and ascorbic acid content, spectrophotometrically using methanolic extract dieticians.

INTRODUCTION

Most countries like Nigeria have vegetation containing a diversity of leafy vegetables, fruits and spices such as spinach, lettuce, pepper, tomatoes that serve as indispensable constituents of the human diet. Vegetables, fruits and spices supply the body with minerals, vitamins, certain hormone precursors as well as proteins and energy (Ogunlesi *et al*., 2008). Bell pepper also known as pepper is a cultivar group of the species *Capsicum annuum* (chill pepper), native to Southern and Northern Americas (Lathan, 2009). The fruit is a berry which may be green, yellow or red when ripe. *Capsicum annuum* is more productive in warm and dry climate, and are used in medicine as well as food in Africa and other countries of the world. Compared to green peppers, red peppers have more vitamin and nutrients and contain the antioxidant lycopene. The level of carotene; like lycopene is nine times higher in red peppers. And contains twice vitamin C content than green peppers. Food containing peppers, especially chill peppers, often have a strong aftertaste which is due to the presence of capsinoids in pepper. Capsaicin, a chemical found in chill peppers creates a burning sensation which can last for several hours after ingestion.

The word tomato may refer to the plant *Solanum lycopersicum* or the edible red fruit that it bears; and originating in South Americas. Thought it is botanically a berry, a subset of fruit, the tomato is a vegetable for culinary purpose, because of its savory flavour. Tomato is eaten freely throughout the world; the consumption is believed to benefit the heart, and other organs. Tomato contains lycopene as the major carotene but it has no vitamin A activity (Venket Rao *et al;* 2000). In some studies, lycopene especially in cooked tomatoes has been found to help prevent prostate cancer (Dodukan *et al;* 2011) lycopene has also been shown to improve skin's ability to protect against harmful UV rays. A

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study done by researchers at Manchester and Newcastle Universities revealed that tomato can protect against sunburn and help keeping the skin looking youthful. Tomato consumption has been associated with decreased risk of breast cancer, (Cai-Xia Zhang *et al;* 2009) head and neck cancers and might be strongly protective against neurodegenerative diseases. Tomato consumption might be beneficial for reducing cardiovascular risk associated with type 2 diabetes (Shidfar, *et al*; 2011).

Consumption of pepper and tomato fruits in diet has been reported to protect the human body from degenerative diseases (HU *et al*., 2003). Pepper and tomato are important agricultural crop, not only because of its fruits, mainly to the fact that they are an excellent source of natural colors and antioxidant compounds (Howard *et al*., 2000; Aniakor, 2011).

Vitamin C also known as ascorbic acid is a water soluble antioxidant which is found in variable quantities in pepper and tomato fruits and has been found to prevent tissues damage (Ogunlesi *et al.*, 2010), chelates heavy metal ions (Namiki, 1990), reacts with singlet oxygen and other free radicals and suppress per-oxidation, reducing the risk of arteriosclerosis, cardiovascular diseases, and some forms of cancer (Harris, 1996). This work presents scientific data on the total β-carotene and vitamin C content in green pepper, red pepper and tomato fruits nutritional, in order to improve the management of this crop and obtain fruits of a higher nutritional value thus promoting healthy nutrition.

MATERIALS AND METHODS

The experiment was carried out in Applied Biochemistry Departmental Laboratory in Nnamdi Azikiwe University. The experiments were conducted in low light and temperatures, as carotenoids are sensitive to light, oxygen and heat.

Sample Analysis

Fresh samples of green pepper (*Capsicum annuum*), red pepper (*Capsicum annuum*) and tomato (*Solanum lycopersicum),* commonly consumed in Nigeria were obtained from a commercial nursery, Awka market and Amawbia market in Anambra. The samples were identified at the herbarium unit, by the Chief laboratory technologist of Botany Department of Nnamdi Azikiwe University, Awka.

Samples Preparation and Extraction for β–Carotene Determination

Fresh sliced sample, (3g each) of green pepper, red pepper and tomato fruits were weighed and added into 100ml methanol and stirred continuously for 48hrs. The mixture was filtered through whatman no 42 (125mm) filter paper. The residue was extracted with another 100ml of methanol for 24hrs and was filtered through whatman no 42 (125mm) filter paper. The resulting residue was further extracted with another 100ml of methanol for 24hrs and filtered through whatman no 42 (125mm) filter papers. The combined filtrate was evaporated to dryness using ovum at temperature 50^{o}C.

Determination of Total β–Carotene Content Principle

The concentration of β-carotene extracts was estimated spectrophotometrically (Nagata et al; 2007; Barros et al 2007). This simple is a rapid method, makes use of specific spectral properties of the carotenoids. The content of β-carotene was calculated from the equations given as follows:

$$\beta\text{-carotene (mg/100ml)} = 0.216A_{663} - 0.304A_{505} + 0.452A_{453}.$$

Procedure

0.0lg of dried methanol extract was vigorously shaked with 4ml acetone and 6ml hexane for one minute. This was filtered through whatman no 42 filter paper. Automatically, two phases separated, and an aliquot was taken from the upper solution for measurement of optical density (absorbance) at 663, 505 and 453nm in a spectrophotometer. Total β–carotene content of green pepper, red pepper and tomato were expressed as µg/100ml of extract.

Samples Preparation and Extraction for Vitamin C Determination

Fresh samples, (100g) of green pepper, red pepper and tomato fruits were weighed and

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blended in a grinder together with about 50ml of distilled water. After blending strain the pulp through cheese cloth, washing it with a few 10ml portions of distilled water, and make the extracted solution up to 100ml in a volumetric flask.

Total Vitamin C Content Determination Principle

This method is redox titration with potassium iodate in the presence of potassium iodide. The principle is that an oxidation-reduction reaction occurs, when iodate ions (IO_3) are added to an acidic solution containing iodide ions (I); the iodate ions are reduced to form iodine.

$I0_3^- + 6H^+ + 5e^- \longrightarrow 1/_2I_2 + 3H_20$

The iodide ions are oxidized to form iodine

$2I^- \longrightarrow I_2 + 2e^-$

Combining these half –equation demonstrates the reaction between iodate and iodide

$2I0_3^- + 10I^- + 12H^+ \longrightarrow 6I_2 + 6H_20$

The iodine formed then oxidizes the ascorbic acid present to dehydroascorbic acid as the iodine is ions.

Ascorbic acid $+I_2 \longrightarrow$ + dehydroascorbic acid. Once all the ascorbic acid has been oxidized, the excess iodine is free to react with the starch indicator; the excess iodine is free to react with the starch indicator, forming the blue-black starch-iodine complex. This is the end point of the titration.

Procedure

Pipette 20ml of the sample solution into a 250ml conical flask and add about 150ml of distilled water, 5ml, of 0.6 mol/L potassium iodide, 5ml of 1mol/L hydrochloric acid and 1ml of starch indicator solution.

Titrate the sample with the 0.002 mol/L potassium iodate solution. The end point of the titration is first permanent trace of a dark blue-black color due to starch iodine complex. Repeat the titration with further aliquots of sample solution until you obtain concordant results (titers agreeing within 0.1ml).

RESULTS

Table 1: Concentration of total β–carotene content of green pepper, red pepper and tomato in µg/100ml

S/No	Spice/vegetable	Total β-carotene content (µg/100ml)
1	Green pepper	368
2	Red pepper	592
3	Tomato	896

The values are presented as Mean $\pm$ SD or SEM of the triplicate sample.

Concentration of Vitamin C (mg/100ml)

The mean of the four titer values of the different samples was recorded. All analysis was done in quadruplicate. The values were used to calculate the concentration of the ascorbic acid in the samples.

Table 2: Concentration of Vitamin C in green pepper, red pepper and tomato.

S/No		Amount (mg/100ml)
	Green pepper	116.08mg/100ml
	Red pepper	126.05 mg/100ml
	Tomato	54.12 mg/100ml

The values are presented as Mean $\pm$ SD or SEM of the triplicate sample.

DISCUSSION

The data clearly outline that β–carotene and vitamin C are all contained in the three samples. The result show that tomato is a better source of β–carotene, containing 896µg/100ml of extract and red pepper is a better source of vitamin C, containing 116.08 mg100ml. In this condition, we can safely assume that tomato is richer in β–carotene than green and red pepper, and that red pepper is richer in vitamin C than green pepper and tomato, although green pepper has a considerable high amount of vitamin C (Aniakor 2011).

It is pertinent to relate the β–carotene and vitamin C content of these food samples to the alleged curative uses in herbal medicine. These samples are alleged to be useful in the treatment of sores, cuts, wound, cold, diseases and are said to be anti-inflammatory. These samples except tomato are often consumed in larger quantities and thus significant high quantities of β–carotene will be present in such menu. This result compares favourably with the work of Barros *et al*; (2007), in which total phenol, ascorbic acid, β-carotene and lycopene were estimated in Portuguese wild edible mushrooms and their antioxidant activities.

A known knowledge of this would enable us know if we are taking in adequate amounts of these antioxidants (β-carotene and vitamin C). The level of antioxidants in plasma is of great importance because of its correlation with certain pathological event at low levels. Antioxidants, map up free radicals in the body system (Collins, 2005; Dodukan *et al* 2011 and Josefa *et al* 2005).

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