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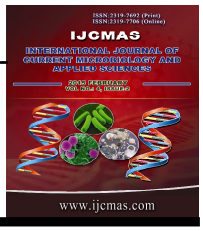

Original Research Article

Profile of Ascorbic Acid, Beta-Carotene and Lycopene in Guava, Tomatoes, Honey and Red Wine

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A B S T R A C T

Honey, red wine and fruits from guava and tomatoes (raw and cooked), were analyzed for their antioxidants activity. The ascorbic acid content was analyzed using the AOAC official titrimetry method while the carotenoid assay was analyzed using the modified method of Shigeaki Takagi as described in the determination of green leaf carotenoids. The levels of ascorbic acid in the samples ranged from <0.0001 to 216.05 mg/100g with guava having the highest value of 216.05±9.64 and red wine with the least value of <0.0001 mg/100g. Beta - carotene content in the samples had the highest value of 0.43±0.10mg/100g in raw tomatoes and the least value of 1.78×E-7mg/100g in honey samples. Similarly, lycopene content was highest (5.10±0.85mg/100g) in guava samples and least in red wine (3.12×E6mg/100g). From the results obtained, abundance of lycopene and ascorbic acid in guava could suggest their relevance in boosting the immune system as well as in cancer prevention. Effect of heat on ascorbic acid was evident in their levels in cooked and raw samples of tomatoes, as heat treatment gave marked reduction in observed values.

Keywords

Antioxidant activity, Ascorbic acid, Beta – carotene, Fruits, Lycopene

Introduction

Consumption of fruits and vegetables containing antioxidants has been reported to provide protection against a wide range of degenerative disease including ageing, cancer, diabetes and cardiovascular disease (Ulbricht and Basch, 2005). The defensive effect of these natural antioxidants in fruits and vegetables are related to three major groups, vitamins, phenolics and carotenoids. Beta carotene and lycopene are carotenoids and they are known as lipophilic antioxidants (Halliwell, 1996). Food is composed of several groups of constituents including carbohydrates, protein, fat, inorganic mineral components and organic substances presents in very small amount. The organic components generally functions as flavour, pigments, enzymes, emulsifier, acids, oxidant and antioxidants (Saniah, 2005). Increasing emphasis on health maintenance is in part due to hiked cost of health care and has led to greater awareness on the effect of diet on health and longevity. Oxidation is essential to many living organisms for the production of energy to fuel biological processes. However,

uncontrolled production of oxygen derived free radicals is involved in the onset of many diseases such as cancer, rheumatoid arthritis, and arteriosclerosis as well degenerative processes associated with aging (Halliwel and Gutteridge, 2007). Antioxidants scavenge radicals by inhibiting initiation and breaking of chain reaction, suppressing formation of free radicals by binding to the metal ions, reducing hydrogen peroxide and quenching superoxide and single oxygen (Shi and Maguer, 2001 as cited by Lim *et al.* (2007)) and reduce ageing (Feskanich *et al.*, 2000). Given the less side effects (Saniah, 2005) with natural antioxidants over their artificial counterparts, investigations on local fruits may offer availability, affordability and acceptability as a health advantage.

Guava with the scientific name *Psidium guajava* is one of the species of tropical shrubs in the myrtle family Myrtacea. The fruit contains 74–78% moisture, 13–26% dry matter, 05-1% ash, 0.4-0.7% fat and 0.8–1.5% protein (Chin and Yong, 1980). A fair of amount of phosphorus, calcium, iron, potassium and sodium has been reported by Lim *et al.* (1993). Tomatoes (*Solanum lycoperssian*)are consumed in diverse ways, including raw, as an ingredient in salads, sauces, many dishes and in drinks. It contains vitamin A (5%), vitamin C (17%), and vitamin E (4%), potassium (5%) (USDA nutrient data base, 2010). Tomato consumption has been associated with decreased risk of breast cancer (Zhang *et al.*, 2009), head and neck cancers (Freedman *et al.*, 2008). Honey is a natural substance produced by honey bees (*Apis mellifera*) and is a mixture of sugars and other compounds. With respect to carbohydrates, honey is mainly fructose (about 38.5%) and glucose (about 31.0%) making it similar to the synthetically produced inverted sugar syrup which is approximately 48% fructose, 47% glucose and 5% sucrose. Honey's remaining constituents include maltose, trace amounts of several vitamins and minerals (Blassa *et al.*, 2006). Honey also contains tiny amounts of several compounds thought to function as antioxidants, including chrysin, pinobanksin, vitamin C, catalase and pinocebrin (Gheldof *et al.*, 2002). Red wine is a type of wine made from dark-coloured (black) grape varieties. Carr and Frei (1999) reported the presence of a polyphenol, resveratrol, an antioxidant in red wine and described their relevance in protecting the lining of blood vessels in the heart. This research work seeks to evaluate the levels of ascorbic acid, β carotene and lycopene in Guava, tomatoes, honey and red wine and to make necessary comparisons.

Materials and Methods

Collection of samples

Guava, honey and tomato samples used were bought at the fruit market in Port Harcourt while the red wine (3 bottles) was bought from a supermarket in Choba, Rivers state Nigeria.

Ascorbic acid assay

Ascorbic acid was determined using the AOAC (1990) official titrimetry method.

Extraction

The samples were frozen in liquid nitrogen and stored at -80°C until the analyses were carried out. A 2.5g of the frozen homogenized samples were then weighed and mixed with 2.5ml of the extractant solution (3% Metaphosphoric acid and 8% acetic acid for MPA-acetic acid extraction). The mixture was then homogenized in a politron PT 6000 (Kinematical AG, Switzerland) high-speed blender.

This procedure was repeated and the two resulting supernatants were mixed together. All extractions were carried out in quintuplicate. Precautions were taken in order to perform all the operations under reduced light and at 4°C.

Analysis

Two millimetres of the 3% MPA-8% acetic acid extracts were titrated with indophenols solution (25% 2,6-dichloroindophenol and 21%$NaHCO_3$ in water) until a light but distinct rose pink colour appears and persist for more than 5 seconds. The indophenols solution was standardized with ascorbic acid solution.

Carotenoids assay

The carotenoids extraction was carried out using the modified method of Shigerka *et al.* (2002).

Analysis

The samples were pulverized and then weighed. At room temperature, 5.0g of the pulverized sample were homogenized in 75mlof acetone and kept for 1hour in the dark. Using filter paper, the homogenate was filtered by suction. Extraction was repeated thrice with the same volume of acetone. The extracts were combined and evaporated under reduced pressure and the residue was re-extracted by a mixture of diethyl ether and petroleum ether in equal ratio.

The extract was poured into the round bottom flask of the rotator evaporator and was concentrated by evaporation. The concentrated extract was dried using the anhydrous sodium sulphate before gas chromatographic (HP 6890 Powered with HP Chem Station Rev. A 09.01) analysis. Nitrogen was employed as the carrier gas and FID detector.

Result and Discussion

This study evaluated the levels of lycopene, ß-carotene and ascorbic acid in honey, tomatoes (raw and cooked), guava and red wine. It is noteworthy that antioxidants combat oxidation and constitute the major defense system of organisms against reactive oxygen species and free radicals and may be water soluble or fat soluble (Halliwell and Gutteridge, 2007). Analytical data showed that Guava has the highest lycopene (5.10 mg/100g) and ascorbic acid (216.05 mg/100g) content while tomatoes gave the highest β-carotene level in their raw state (Table 1) and was significant ($p<0.05$) from those of cooked samples. This high ascorbic acid content in raw tomatoes and guava could be explored to boost immune system with minimal toxic effects as recorded by Saniah (2005). It has been found that vitamin C plays an important role in preventing the development of cardiovascular disease.

Honey has marked low levels of ascorbic acid and β-carotene but significantly highest levels of lycopene in comparison to other studied samples. Non – detectable levels of ascorbic acid in red wine may have arisen from extended treatment from wine processing.

Also, raw tomato gave the highest ß-carotene value (0.425± 0.10mg/100g) when compared with Guava, cooked tomatoes, honey and Red wine. Beta - Carotene is a carotenoid compound responsible for giving fruits and vegetables their orange pigment.

Table.1 Ascorbic Acid content, Lycopene and β- Carotene content (mg/100g) in Guava, Tomatoes (Raw and Cooked), Honey and Red Wine

Samples	Ascorbic acid	Lycopene	β-carotene
Guava	216.05±9.64a	5.10±0.85e	0.38±0.11i
Raw tomatoes	21.14±1.00b	2.45±0.14f	0.43±0.10i
Cooked tomatoes	15.53±1.00c	3.00±0.05e	0.33±0.00j
Honey	0.48±0.01d	5.13×E6±0.01g	1.78×E-7k
Red Wine	<0.0001	3.12×E6±0.00gh	9.93×E-4l

A powerful antioxidant, beta carotene has been found to help protect against cancer and aging. Beta-carotene is a fat soluble vitamin, so eating the foods that are rich in ß- carotene is very suitable. ß- Carotene is a potent antioxidant and singlet oxygen quencher (Rao and Rao, 2007). A Pearson correlation value of 0.98 showed near perfect positive correlation between ascorbic acid and ß- Carotene for raw and processed tomatoes.

Furthermore, results showed that Guava recorded a high lycopene value (5.10 ± 0.85 mg/100g) while red wine has the least value (3.12×E-6 ±0.00). Lycopene is a bright red carotene and carotenoid pigment and phytochemical found in tomatoes and other red fruits and vegetables, such as red carrots, red bell peppers, watermelons, gac, and papayas. This phytonutrient has been shown to fight prostate cancer (Ellinger *et al.*, 2006). Guava gave the highest value of lycopene compared to tomatoes which has been reported by Shi and Maguer (2000) to have the highest value of lycopene and therefore posed a deviation. Levels observed in honey and red wine far outweighed reported amounts by Chandrika (2009) in guava and those of recorded guava and heat - processed tomatoes from this experiment.

From this study, Guava and tomatoes gave high values of Vitamin C, ß- Carotene and lycopene. Heat treatment reduced observed ascorbic acid and ß- Carotene content but improved lycopene content. A strong positive association was observed between ascorbic acid and ß- Carotene content in raw and processed tomatoes and could be utilized both in herbal and conventional medicine. Availability of study fruits may offer economic advantage. High levels of lycopene in honey and red wine are noteworthy both in their current patronage and as tools for the future as dietary antioxidant foods for impartation of health benefits.

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