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Iodometric Determination of the Ascorbic Acid (Vitamin C) content of some Fruits consumed in Jimma Town Community in Ethiopia

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Abstract

The objective of this study was to determine the ascorbic Acid (Vitamin C) Content of Some Fruits Consumed in Jimma Town Community in Ethiopia. Representative commercial fruits such as orange, lemon, papaya, mango and tomato were purchased randomly from local market found in Jimma Town community in Ethiopia and brought to Chemistry Department in Jimma University and preserved in Refrigerator. The fruit samples were first washed with water; the juice from each fruit was squeezed out, and filtered. Then, the obtained juice was centrifuged until a clear sample was obtained, which was subsequently analyzed for Ascorbic acid content of fresh fruit juices by volumetric method. The results of present study indicated that the concentration of ascorbic acid in each fruits found to be: Papaya (1673.018 ±136.1096 mg/100 mL), Orange (141.34 ± 22.07 mg/100 mL), Lemon (199.8133 ± 126.5819 mg/100 mL), Mango (1104.459±204.5954 mg/100 mL) and Tomato (542.002± 101.55 mg/100 mL). From the results it can be concluded that the ascorbic acid content of fruits juice (fruit pressing) were found to be in the order of Papaya> Mango > Tomato > Lemon > Orange.

Keywords: Ascorbic acid, Jimma fruit samples, Iodometric titration.

Introduction

Vitamin C is defined as hexuronic acid, cevitamin acid or xiloascorbic acid. The term vitamin C is generally used to describe all these compounds although the representative of which is ascorbic acid[1]. Vitamin C (Ascorbic acid) is the most important mainly found in fruits and vegetables[2]. Except human and other primates most of the phylogenetically higher animals can synthesize vitamin C (L-ascorbate)[3]. More than 90% of the vitamin C in human diets is supplied by fruits and vegetables (including potatoes)[4-6]. Citrus fruits and juices are particularly rich sources of vitamin C but other fruits including cantaloupe and honeydew melons, cherries, kiwi fruits, mangoes, papaya, strawberries, tangelo, tomatoes, and water melon also contain variable amounts of vitamin C[7]. Vitamin C is an essential nutrient that plays a vital role in protecting the body from infection and disease. It is needed for the formation of collagen, the protein that makes up connective tissue, and is essential to muscles, bones cartilages, blood vessels, capillaries, tissues, skin and teeth[7-9]. It is also functions in 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, infectious diseases, asthma, cataract, Diabetes Mellitus and some forms of cancer[2,4-8].

Numerous analytical techniques are available for the determination of vitamin C in different matrices. Some of the techniques include: direct titration[10-13] fluorometric methods, chromatographic methods, and Electrochemical[7,14-18]. However, some of these methods are time-consuming, some are costly, some need special training operators, or they suffer from the insufficient sensitivity or selectivity[7]. In this research titration method was used because it is accurate and precise method to determine vitamin C compared other methods as high pressure liquid chromatography (HPLC) method and enzymatic methods[10].

Ascorbic acid which is an effective reducing agent belongs to endiol group and has two alcoholic groups with acidic character. It can be quantitatively and reversibly oxidized by different oxidizing agent in aqueous solutions[19]. It is a labile substance, as it is easily degraded by enzymes and atmospheric oxygen. Its oxidation can be accelerated by excessive heat, light, and heavy metal cations[7,20]. To our knowledge so far there is no coordinated investigation of the levels of Ascorbic acid in various types of fruits items including orange, papaya, lemon, mango and tomato Commercial Available in Market of Jimma Town. Therefore, this study was carried out with aim of determination and comparison of ascorbic acid contents of some natural freshly prepared fruit juices purchased from local market in Jimma Town, Oromia Regional State.

Material and Methods

Chemicals and Apparatus: All the chemicals used for the experimental purposes were of analytical grade and used without further purification. The chemicals used for this experimental purpose include: Distilled water, 1M potassium iodide KI(Scharlau), 0.5 M Sulphuric acid (H_2SO_4), Sodium Thiosulphate ($Na_2S_2O_3$), Iodine (NICE, India) and fresh starch

indicator or solution . Beam balance, titration apparatus, beaker, volumetric flask, measuring cylinder and test tube.

Experimental Procedure: **Sampling:** The commercial fruits such as orange, lemon, papaya, mango and tomato were purchased from local market found in Jimma town community in Ethiopia and brought to chemistry department in Jimma University and preserved in Refrigerator.

Sample Preparation: Various fruits (orange, lemon, papaya, mango and tomato) were bought from fruit markets available in Jimma Town, Ethiopia and freshly prepared fruit juices were obtained by fruit pressing. The fruit samples were first washed with water, the juice from each fruit was squeezed out, and filtered. Then, the obtained juice was centrifuged until a clear sample was obtained, which was subsequently analyzed[9].

Determination of Vitamin C Content of the Fresh Fruit Juice: Using standardized sodium thiosulphate solution, vitamin C content of the fresh fruit juice was determined. The methods adopted were from[21].

Results and Discussion

The concentration of ascorbic acid in five fruits consumed in Jimma town community in Ethiopia were calculated and found to be different in each fruits; Papaya (1673.018 ±136.1096 mg/100 mL), Orange (141.34 ± 22.07 mg/100 mL), Lemon (199.8133±126.5819 mg/100 mL), Mango(1104.459±204.5954 mg/100 mL) and Tomato (542.002± 101.55 mg/100 mL). Ascorbic acid content was high in papaya and low in orange fruits were found. The results of the determination of ascorbic acid contents of orange, papaya, lemon, mango and tomato fresh fruit juice by iodometric titration with sodium thiosulphate summarized in figure-1.

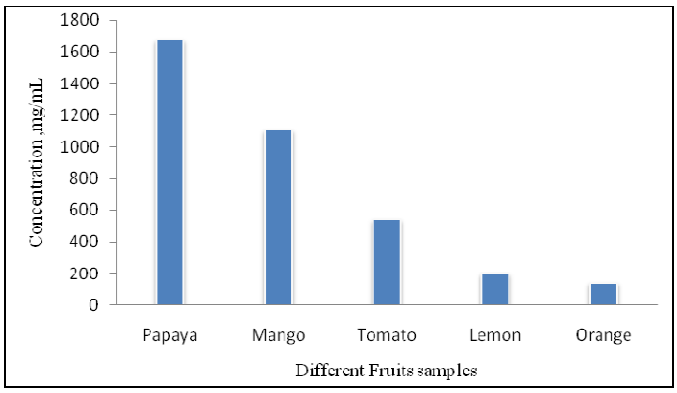

Figure-1
Concentration of ascorbic acid in different fruits samples(n=3)

One of the study conducted in Ethiopia reported that the ascorbic acid content of freshly prepared Orange juice (Ethiopian, partially yellow) and Orange juice (Ethiopian, green) were 41.4 ± 1.50 mg/100 mL and 32.4 ± 1.30 mg/100 mL respectively[22]. The Other study indicated that a vitamin C content of 33–50 mg/100 mL for orange juice (Valencia) obtained by squeezing the fruits[23]. A study conducted by Razmi and Harasi using a cadmium pentacyanonitrosylferrate film modified glassy carbon electrode obtained ascorbic acid values of 4924 mg/100 mL for orange. Melo et al[24] using 2,6-dichlorophenolindophenol (DCIP) in the titrimetric method, reported the following values of ascorbic acid in mg/100g for orange (37.34), papaya 'Hawaii'(141.97). While in present study the ascorbic acid content of orange was found to be 141.34 ± 22.07 mg/100 mL. Aurelia M. P. et al.[18], using Voltammetry Performed at Pt and Carbon Paste Electrodes, reported an ascorbic acid content of Lemon juice (fruit pressing) 54.74 mg/100 and Orange juice (fruit pressing) 39.25 mg/ 100 mL. Okiei W. et al[25] reported that the ascorbic acid content of freshly prepared lemon juice is 48.61 mg/100 mL. However in the present study the ascorbic acid content of Lemon juice (fruit pressing) was found to be 199.81 ± 126.58 mg/100 mL. In present study the ascorbic content of mango juice (fruit pressing) was found to be 1104.459±204.595 mg/100 mL. It was reported that the ascorbic acid contents of freshly prepared mango juice were obtained to be 14.65±0.151 mg/100 mL. Md kanafe and shamsul Azri (2009) reported that the ascorbic acid contents of freshly prepared mango juice was about 28 g/100mL for nature fruit[26]. Gunjan Kashyap and Mangla Dave Gautam[10] reported that the ascorbic acid content of freshly prepared Mango fruits 26 g/100mL for nature fruit pulp. However, there are significant differences in the values of ascorbic acid obtained in this study with those reported by some other studies for some fruit juice samples. The observed differences in the contents of vitamin C studied in the same method may be as a result of differences in maturity stage and regional varieties of fruits. The amount of vitamin C could even vary between different samples of the same species. Different techniques of measuring and squeezing process may also affect the vitamin C content of fruit juices. Factors including climate, temperature and amount of nitrogen fertilizers used in growing the plant and climatic conditions such as light can affect the concentration of AA in fruits. For instance, increasing the amount of nitrogen fertilizer from 80 to 120 kgha-1 decreased the vitamin C content by 7% in cauliflower. The amount of vitamin C content in fruit juices can also be affected by the type of storage. Fruit juices must be stored at cool temperature. When the fruit juices are stored at cool temperature, the vitamin C content does not loss, however, storing fruit juices at higher temperature result in loss of vitamin C content. This is because vitamin C is more sensitive to temperature and it can easily oxidize[7].

Conclusion

From the results it can be concluded that the ascorbic acid content of fruits juice (fruit pressing) papaya > mango > tomato > lemon > orange were determined by Iodometeric titration.Vitamin C or ascorbic acid is important for the human body. Inadequate intake will result in the symptoms of scurvy,

gingival bleeding, and so on; excess AA intake will also lead to urinary stone, diarrhea and stomach convulsion. That is why ascorbic acid content of foodstuffs and beverages represents a relevant indicator of quality which has to be carefully monitored, regarding its variation during manufacturing and storage.

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