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Temperature Effects on Vitamin C Content in Citrus Fruits

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Abstract: Loss in vitamin C contents of some fruit juice namely, orange, lemon, lime and grape stored under different conditions was investigated. The juices from the samples were extracted, stored at room temperature in plastic bottles. The juices were all analyzed for their vitamin C content by oxidation and reduction method. Results revealed that vitamin C concentration is more in orange juice as compared to grape, lemon and lime juice respectively in this order: at 20°C, 612.15 > 454.47 > 305.57 > 270.75 ..... 80°C, 550.87 > 380.16 > 248.85 > 222.58 and the rate at which vitamin C is loss during storage depends on the type of storage method employed, for example, handling and storage; oxygen is the most destructive ingredient in juice, causing degradation of vitamin C. Juice should be discouraged from being display in the hot weather above room temperature in order to maintain production concentration. The citrus fruits were found to follow a similar pattern of loss.

Key words: Citrus fruits, fruit juices, vitamin C

INTRODUCTION

Ascorbic Acid or Vitamin C, a food substance needed by humans to prevent scurvy, a disease of the gums, bones and blood vessels and to increase the body's resistance to infection. Ascorbic acid acts as an antioxidant, a nutrient that chemically binds and neutralizes the tissue-damaging effects of substances in the environment known as free radicals. As a result, ascorbic acid is vital for the growth and maintenance of healthy bones, teeth, gums, ligaments and blood vessels. Because of its role in the formation of collagen, the body's major building protein, ascorbic acid is a central component of all body organs.

Ascorbic acid occurs naturally in many fruits and vegetables, particularly in tomatoes, citrus fruits, 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. A healthy diet generally contains sufficient quantities of ascorbic acid, but the body requires more of the vitamin after serious injury, major surgery, burns and when exposed to extremes of temperature. At risk for ascorbic acid deficiency are smokers, women taking contraceptives containing the female sex hormone estrogens and people who live in cities with high levels of carbon monoxide from traffic. There is conflicting evidence that taking large doses of ascorbic acid will either prevent the common cold or reduce the severity of its symptoms.

Ascorbic acid is an organic compound of carbon, hydrogen and oxygen. Pure ascorbic acid is a white solid and is made synthetically from the sugar dextrose. It is used both in vitamin supplements and as a food preservative.

Vitamin C (also referred to as L-ascorbic acid) is the lactone 2, 3, - dienol- L- gluconic acid and is an odourless, white solid having the chemical formula $C_6H_8O_6$. Vitamin C is mainly found in fruits and vegetable. Vitamin C is the L-enantiomic form of ascorbic acid which also encompasses the oxidation product of dehydroascorbic. It participates in numerous biochemical reactions, suggesting that vitamin C is important for every body process from repair (Rickman *et al*., 2007). The only established role of the vitamin C appears to be in curing or preventing scurvy, antioxidant within the body.

Vitamin C or L-ascorbic acid or L-ascorbate is an essential nutrient for humans and certain other animal species, in which it function as a vitamin. In living organisms, ascorbate is an antioxidant since it protects the body against oxidative stress (Schorah *et al*., 1996). Factors that affect the vitamin C contents of citrus fruits include production factors and climate conditions, maturity stage of fruits (species and variety), handling and storage, type of container (Naggy, 1980).

Ascorbate (an ion of ascorbic acid) is required for a range of essential metabolic reactions in all animals and plants. It is made internally by almost all organisms; notably mammalian group exceptions are most or all of the order chiroptera (bats) and one of the two major primate suborder Anthropoidea. Ascorbic acid is also not synthesized by guinea pigs and some species of birds and fish. All species that do not synthesize ascorbate require it in the diet (Goodman *et al*., 1998).

Deficiency in this vitamin causes the disease scurvy in humans (Murcia *et al*., 2000) Scurvy has been known since ancient times. People in many parts of the world assumed it was caused by a lack of fresh plant foods.

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The British Navy started giving sailors lime juice to prevent scurvy in 1775. Ascorbic acid was finally isolated in 1932 and commercially synthesized in 1934.

MATERIALS AND METHODS

Sample collection and preparation: Fresh fruits of *Citrus sinensis* (Orange), *Citrus limon* (Lemon), *Citrus aurantifolia* (Lime) and *Citrus paradisi* (Grape) were purchased from retail outlets at Omoku in Ogba Egbema Ndoni, Local government area of Rivers State. The study was carried out in water lab, of Nigerian Agip oil Company at OB/OB gas plant in Rivers State. These fruits were washed thoroughly with water and the juices were extracted manually using juice squeezer. Samples was filtered to remove pulp and seed and stored in already labeled plastic containers.

Vitamin C determination by iodine titration: Oxidation-reduction method described by Helmenstine (2008) (http://www.chemistry.about.com) was used.

Standardizing solution and titration of juice samples: Vitamin C solution (25 ml) was titrated into 100 ml conical flask and 10 ml conical flask and 10 drops of starch solution was added. This will be until the first blue colour which persisted for about 20 sec was observed. Juice samples (25 ml) were titrated. The initial and final volume of iodine solution required to produce the colour change at the end point was recorded triplicate in all cases.

RESULTS AND DISCUSSION

The retention of vitamin C is often used as an estimate for the overall nutrient retention of food products because it is highly sensitive to oxidation and leaching into water-soluble media during storage (Davey *et al*., 2000). It begins to degrade immediately after harvest and degrades steadily during prolonged storage (Murcia *et al*., 2000). Results for the freshly squeezed fruits shows that oranges had the highest vitamin C content, followed by grapes, lemons and limes. This is consistent with reports that, climate, especially temperature affect vitamin C level. Areas with cool nights produce citrus fruits with higher vitamin C levels. Hot tropical areas produce fruit with lower levels of vitamin C (Padayatty *et al*., 2003). Also environment conditions that increase the acidity of citrus fruits also increase vitamin C levels.

Therefore, vitamin C concentration is more in Orange as it is shown in Table 1 followed by Grape, Lemon and least is Lime. Increase in temperature generally reduces the concentration of vitamin C as it is also evidence from pH values of Orange of 3.6 compared to Lime, Lemon and Grape of 2.35, 2.45 and 3.01 respectively.

Table 1: Concentration of vitamin C (mg/l) in all the fruit juice at varying temperature

Temperature (°C)	Lime	Grape	Orange	Lemon
@ 20°C	270.73	454.57	612.15	305.75
@ 30°C	261.98	441.44	599.02	301.37
@ 40°C	261.98	432.69	577.14	275.11
@ 50°C	261.98	432.69	577.14	275.11
@ 60°C	235.71	380.16	577.14	275.11
@ 70°C	222.58	380.16	550.87	248.85
@ 80°C	222.58	380.16	550.87	248.85

Table 2: % Reduction in concentration as temperature increases

%	Lime	Grape	Orange	Lemon
20	270.73	454.57	612.15	305.75
30	3.2	2.9	2.1	1.4
40	0.0	2.0	3.7	8.7
50	0.0	0.0	0.0	0.0
60	10.0	12.1	0.0	0.0
70	5.6	0.0	4.6	9.5
80	0.0	0.0	0.0	0.0
Total	18.8	17.0	10.3	19.7

Conclusion: It can be seen from analytical results that the lower the temperature the better the concentration of Vitamin C in fruit juice. Higher temperature does not favour Vitamin C. it is better to maintain or store Vitamin C in a place below the room temperature. The different in percentage reduction in concentration as evident in Table 2 can go a long way to affect medical prescription, thereby making/frustrating the job of the physician.

REFERENCES

Davey, J.S., J.C. Rickman, D.M. Barret and C.M. Bruhn, 2000. Review: Nutritional Comparison of fresh and frozen fruits. Sci. Food Agric., 87: 930-944.

Goodman, M.P., C.A. Czelusniak, S.L. Page, H. schnerder, J. Shoshani, G. Gunnell and C.P. Groves, 1998. Toward Phylogenetic classification of primates based on DNA evidence complemented by fossil evidence. Moleculer Phylogenetics and Evolution; 9: 585-598.

Helmenstine, 2008. Oxidation and reduction method of determining Vitamin C in fruits juice, 5: 25-29.

Murcia, M.A., B.L.A. Opez-Ayerra, M. Martinez-TomA and A.M. Vera, 2000. Industrial processing of broccoli in fruits. Sci. Food Agric., 80: 1882-1886.

Naggy, S., 1980. Vitamin C contents of citrus fruits and their product: A review. J. Agric. Food Chem., 15: 632-640.

Padayatty, S.J., A. Katz, Y. Wang, P. Eck and O. Kwon, 2003. Vitamin C as an antioxidant: Evaluation of its role in disease control. J. Am. Nutr., 22: 18-35.

Rickman, J.C., D.M. Barret and C.M. Bruhn, 2007. Review: Nutritional comparison of fresh and frozen fruits. J. Sci. Food. Agric., 87: 930-944.

Schorah, C.J., C. Downing and A. Piripitsi, 1996. Total vitamin C, ascorbic acid and dehydroascorbic acid concentration in plasma of critically ill patients. Am. J. Clin. Nutr., 63: 760-765.