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STUDY ON L-ASCORBIC ACID CONTENTS FROM EXOTIC FRUITS

Maria CIOROI*
Dunărea de Jos University of Galați

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ABSTRACT *– Four commonly consumed exotic fruits from market were analysed for their Vitamin C content. Extracts of fruits were investigated at different temperatures. In order to evaluate the Vitamin C from fruit extracts, the redox iodometric titration with iodine/iodide method was used. The redox titration was preferable to acid-base titration, because of the number of other species present into citrus extract, which could act as acids, but relatively few interfered with the oxidation of ascorbic acid by iodine. The content of Vitamin C depended on the variety, location of cultivation and growing season. The effects of cooking were also noticed in this experimental work. Cooking processes have commonly destroyed the large quantities of ascorbic acid. Frozen fruits presented low differences as concerns the Vitamin C content. The fruits stored at 10° C have shown stability for Vitamin C.*

Key Words: exotic fruits, L-ascorbic acid, iodometric titration, iodine/iodide

REZUMAT – Studiu privind conținutul de acid ascorbic din fructele exotice. *În lucrare au fost analizate cele mai comune fructe exotice de pe piață privind continutul lor in Vitamina C. Extractele din fructe au fost analizate la diferite temperaturi. S-a folosit, pentru evaluarea Vitaminei C din extractele de fructe, metoda redox de titrare iodometrica cu soluție de iod/iodură. Titrarea redox este preferabilă titrării acido-bazice din cauza unui număr din alte specii prezente în extractul citric, care poate acționa ca acid, dar care nu interferează cu oxidarea acidului ascorbic în iodură. Conținutul de Vitamina C depinde de tipul fructelor, de zona de cultivare şi de sezonul de creştere. Efectele prelucrării termice sugerează că aceasta poate afecta doar o parte din acidul ascorbic. Fructele congelate au prezentat diferențe mici privind conținutul de Vitamina C, în comparație cu fructele proaspete. Fructele păstrate la 10° C au prezentat, în general, o stabilitate a cantității de Vitamina C.*

Cuvinte cheie: fructe exotice, titrare iodometrică, ascorbic acid, iod/iodură

* E-mail: Maria.CIOROI@ugal.ro

INTRODUCTION

L-ascorbic acid (AsA) occurs in fruits and many vegetables. In plants, L-ascorbic acid (AsA) is essential for photosynthetic activity during the detoxification of superoxide and hydrogen peroxide in chloroplasts, in the absence of catalase. AsA is also involved in the regeneration of α-tocopherol. L-Ascorbic acid is an anti-darkening substance in food, because of its antioxidation properties.

Vitamin C plays a major role in the manufacture and defense of our connective tissue, the elaborate matrix that holds the body together. It serves as a primary ingredient of collagen, a glue-like substance that binds cells together to form tissues (Gaby and Singh, 1991).

Vitamin C helps the immune system to fight against foreign invaders and tumour cells. Vitamin C also supports the cardiovascular system by facilitating the metabolism of fats and protecting tissues from free radical damages, and it assists the nervous system by converting certain amino acids into neurotransmitters (Schectman et al., 1991).

The skin, teeth and bones also benefit from Vitamin C collagen-forming and invader-resisting properties. This Vitamin contributes to the maintenance of healthy bones, prevention of periodontal diseases and healing of wounds. It even serves as a natural aspirin, by controlling inflammation and pain (Valnet, 2002).

Vitamin C contributes to a variety of other biochemical functions. These include the biosynthesis of the amino acid carnitine and the catecholamine that regulate the nervous system. It also helps the body to absorb iron and to break down histamine, the inflammatory component of many allergic reactions.

The deficiency condition related to Vitamin C is scurvy, which is characterized by gum disease, pain in muscles and joints, skin lesions, fatigue, and bleeding. An adult needs 10 milligrams of Vitamin C per day to prevent scurvy. Some studies have shown that a daily dose of 100 mg or more is necessary to maintain or maximize the body pool of Vitamin C (Kronhausen et al., 1989).

Elderly people are known to lack Vitamin C, primarily because their diet is poor. In a 1978 survey, elderly people had only half the level of ascorbic acid in their blood plasma, as did younger subjects. According to research studies, men and women over age 65 need daily doses of 150 mg and 75 to 80 mg, respectively, to maintain a plasma level of 1.0 mg/dl.

As an antioxidant, Vitamin C's primary role is to neutralize free radicals. Since ascorbic acid is water soluble, it can work both inside and outside the cells to control free radical damages. The purpose of our work is to evaluate the content of Vitamin C from some exotic fruits as orange, lemon, grapefruit and kiwifruit.

MATERIALS AND METHODS

The fruits were analysed in fresh, refrigerate and boiled state. Vitamin C was determined by using an oxidation-reduction reaction. The redox reaction is preferable to an acid-base titration, because a number of other species in juice can act as acids, but relatively few interfere with the oxidation of ascorbic acid by iodine (Bettelheim, Landesberg, 2001). The solubility of iodine is increased by reaction with iodide to form triiodide. It was used the Q-test to check for bad data (Cioroi et al., 2006).

Materials used: standardized iodine solution with sodium thiosulphate solution (0.1N) that was firstly standardized with potassium dichromate solution 0.1N, starch indicator, sodium thiosulphate solution (0.1N), potassium dichromate solution 0.1N, the Vitamin C standard solution (0.01136M).

As laboratory tools we have used analytical balance (+/- 0.1 mg/L), small weighing bottle (< 5 mLs), 250 mL Erlenmeyer flask, 100 mL volumetric flask, 50 mL burette, magnetic stirrers for mixing, and to facilitate the reaction of iodine with ascorbic acid.

Preparation of biological matter: the pulps of citrus fruits (lemon, orange, grapefruits, and kiwifruits) were weighted, then they were squeezed to obtain the juice to be titrated; they were filtered and passed into water solution, and diluted to volume in a 100 mL volumetric flask. In order to evaluate the Vitamin C content from citrus fruits, we have used a redox titration, involving an iodometric method (Peller, 1998). As titrant solution, we have used iodine solution. Potassium iodide must be added in excess to keep iodine dissolved. Iodine is combined with iodide to form triiodide, as in the following reaction:

$$I_2(aq) + I^- \rightleftharpoons I^-_3$$

Triiodide then oxidizes Vitamin C to dehydroascorbic acid:

$$\underset{\text{ascorbic acid (Vitamin C)}}{C_6H_8O_6} + I^-_3 + H_2O \rightleftharpoons \underset{\text{dehydroascorbic acid}}{C_6H_6O_6} + 3I^- + 2H^+$$

The endpoint is indicated by the reaction of iodine with starch suspension, which produces a blue-black complex. When all the Vitamin C has been oxidized, the excess triiodide (in equilibrium with iodine) reacts with starch to form the expected blue-black colour.

RESULTS AND DISCUSSION

Our purpose was to find the Vitamin C content in some exotic fruits and a correlation between the content of Vitamin C and the state of fruits (stored fruits at normal temperature, low temperature and 100^{o}C).

The exotic fruits (lemon, orange, grapefruits and kiwifruits) were analysed in fresh, stored, refrigerate and boiled state (Boyer, 2000). The Vitamin C content was determined by using an oxidation-reduction reaction. The results obtained from investigation of fresh fruits are presented in *Table 1*. The experimental amounts of Vitamin C were different from the values of literature data.

Table 1

The content of Vitamin C from analysed fresh exotic fruits

Fresh exotic fruits	Literature data mg / 100 g	Our Experimental data Vitamin C*, mg / 100g
Lemon	65	51.78
Grapefruit	50 – 100	48.01
Kiwifruit (green)	98 -190	242.05
Orange	50 – 100	56.02

* The values are averages of three determinations

Table 2 shows that the highest content of Vitamin C was found in kiwifruit. It seems that the green kiwifruit is the most important Vitamin C source on the market now.

Table 2

The content of Vitamin C from analysed refrigerated exotic fruits

Refrigerated exotic fruits	Vitamin C*, mg/100g
Lemon	49.19
Orange	53.22
Kiwifruit	232.37
Grapefruit	46.57

* The values are the averages of three determinations

The refrigerated fruits have lost 3% - 5% of Vitamin C. The bounds into the pulp of fruits were destroyed and the ascorbic acid content was damaged.

Table 3

The content of Vitamin C from analysed boiled exotic fruits

Boiled exotic fruits	Vitamin C*, mg/100g
Lemon	46.6
Orange	50.42
Kiwifruit	218.12
Grapefruit	43.21

* The values are averages of three determinations

The boiled fruits have lost about 10% Vitamin C content, because the high temperature affected the structure of ascorbic acid.

The values from *Table 4* were obtained by analysing fruits at 10 degree Celsius, the temperature of fruits storing in the market. As concerns the values of Vitamin C, we have noticed that on a six-month period, the values of Vitamin C were constant. The differences from *Table 1* and *Table 4* were insignificant for all exotic fruits. The quantity of Vitamin C was practically constant if the fruits reached maturity.

Table 4

The content of Vitamin C from analysed exotic fruits preserved at 10 degree Celsius

Preserved exotic fruits	Vitamin C*, mg/100g
Lemon	52.05
Orange	57.63
Kiwifruit	242.05
Grapefruit	49.73

* The values are averages of three determinations

CONCLUSIONS

The effects of cooking were mainly observed in the early stages of the incubation procedure, suggesting that cooking could destroy only a part of ascorbic acid.

The refrigerated fruits have shown very few differences as concerns the content of Vitamin C, comparatively to fresh fruits.

The stocked fruits are, generally, stable regarding the content of Vitamin C. They can loss water, and the concentration of Vitamin C per fruit increases insignificantly (see *Table 4*). Generally, these exotic fruits are rich in ascorbic acid, and they are studied for their importance on body health.

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