EVOLUTION OF ASCORBIC ACID CONCENTRATION FROM *ROSA CANINA* AND *HIPPOPHAE RHAMNOIDES* FRUITS TO JAM

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Abstract

This article presents a comparative study of the variation of the concentration of ascorbic acid (vitamin C) in the fruits of Rosa Canina and Hippophae Rhamnoides species, but also in their fruits paste and their jams obtained by boiling of the fruit pasta for one hour. The study found that the concentration of ascorbic acid was higher in fresh fruits of Rosa canina than in Hippophae Rhamnoides. This difference was maintained throughout the study. The concentration of ascorbic acid in fruits decreased over time and was favored by the presence of light and increasing of temperature. Even in fruits kept at 5 ℃ in the dark, the concentration of ascorbic acid slowly decreased over time. In fruit paste ascorbic acid was in a lower concentration compared to that in fruit, and in jams, the decrease in ascorbic acid concentration was critical. All these changes in the concentration of ascorbic acid are due to its very easy oxidation, especially by oxygen in the air, but not only because of it.

Key words: *Rosa canina, Hippophae Rhamnoides, ascorbic acid, fruits, jam*

INTRODUCTION

Rosa canina L. is a very widespread species from the Black Sea coast to 1700 meters in the mountain regions. In the spontaneous flora of our country we find 30 species of rosehips (Pârvu, 2002). The chemical composition of *Rosa canina* fruits varies depends by several factors such as the stages of growth and both geographical and climatic characteristics (Tiță, 2005). This plant is a species that does not need excessive light and heat to grow, and is very resistant to low temperatures of up to -30 ℃, grows well in bright places, has moderate pretensions to water, easily withstands pedological drought and trophicity low in the soil due to the deep reticular system (Mihaylova et al., 2015). *Rosa canina* fruits have been used over time in human and veterinary medicine for the treatment of various diseases and due to the high intake of vitamin C (Donea, 2003). *Rosa canina L* products have a pleasant and aromatic taste, are easy to administer and have a mild laxative effect (Bojor, 2012).

Hippophae Rhamnoides L. is a bushy shrub, found on the banks of rivers, from the coastal region to the mountain region. *Hippophae Rhamnoides L*. needs a lot of light, it has good resistance to temperatures between -40 ℃ and + 45℃ (Tiță, 2005). The fresh fruits have a pleasant and aromatic smell, with a juicy yellow-orange pulp, but they cannot be eaten with pleasure, being sour and astringent, and if harvested after freezing they have a much more special aroma (Yao Y, 1993). The fruit has a great importance for human and veterinary medicine (Bojor O., 2012). It is a general tonic, has antitumor properties and can be used in diets because it inhibits appetite, but at the same time vitaminizes the body (Constantinescu. et al., 2004).

Ascorbic acid (vitamin C) is needed by the body for the synthesis of collagen, L-carnitine and other amino acids, folic acid and neurotransmitters like dopamine, norepinephrine and adrenaline, regulates redox processes, is a powerful antioxidant and intervenes in the regeneration of other antioxidants, such as vitamin E. Vitamin C also plays an important role in autoimmune defense and promotes iron absorption, increases the body's resistance to infections by activating leukocytes, helps detoxify the body and increases wound healing, ensures the proper functioning of the endocrine glands, the brain, heart and spleen.

In this paper we aimed to monitor how the concentration of ascorbic acid varies in different stages of preparation of fresh fruit from jam. The analyzed samples were the fruits of *Rosa Canina* and *H. Rhamnoides*, from the Beiuș area, Bihor county, their fruit paste and jam, keeping in different environmental conditions.

MATERIAL AND METHOD

The samples were made from healthy fruits with a homogeneous appearance by *Rosa Canina* and *H. Rhamnoides* collected, washed, dried and weighed. Some of fruits were analyzed immediately, and others were dried in an oven at 105 ℃ for one hour. Other fruits samples from each species were kept for 3 days in the air at 22 ℃ or in the fridge at 5 ℃. The concentration of ascorbic acid was determined from fresh fruit paste or boiled for 10 and 30 minutes in a closed saucepan to minimize the oxidative action of the air. Both *Rosa Canina* and *H. Rhamnoides* jams were prepared from 1 kg of fresh fruit paste mixed with 500 g of sugar, boiled for one hour. The *Rosa Canina* samples are shown in Fig. 1, and those of *H. Rhamnoides* in Fig. 2.

Fig. 1. *Rosa canina* samples (fresh and dried fruits, fruits pasta and jam)

Fig. 2. Hippophae Rhamnoides samples (fresh and dried fruits, fruits pasta and jam)

The iodine used to oxidize ascorbic acid was obtained from an iodate/iodide mixture in an acid medium (Satpathy L et al, 2021). The amount of ascorbic acid was determined indirectly by titration with sodium thiosulphate of excess unreacted iodine with ascorbic acid (Ikewuchi C. J et al., 2011):

$$KIO_3 + 5KI + 3HCl \rightarrow 3I_2 + 3KCl + 3H_2O \ (1)$$

$$C_6H_8O_6 + I_2 \rightarrow C_6H_6O_6 + 2I^- + 2H^+ \ (2)$$

$$I_2 + 2Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6 \ (3)$$

All reagents used in these experiments were high chemical purity. Only bidistilled water was used for preparation of all solutions. 1mg/mL ascorbic acid standard solution, 0,002 M KIO_3, 0,6 M KI, 1M HCl, 0,002M $Na_2S_2O_3$ and 1% starch solutions were prepared.

Samples were prepared from 100 g of crushed fruit, fruit paste or jam dissolved in 50 mL of bidistilled water with stirring and filtered. The filtrate was diluted to 100 mL with bidistilled water in volumetric flasks.

To determine the concentration of ascorbic acid in the 20 mL sample, 5 mL 0.6 M KI solution, 5 mL 1M HCl solution and 1 mL 1% starch were added. The mixture was titrated with 0.002 M KIO_3 potassium iodate solution to indigo blue. The resulting excess iodine was titrated with a 0.005 M $Na_2S_2O_3$ solution.

RESULTS AND DISCUSSION

In Fig. 3 it can be seen that the highest concentration of ascorbic acid was recorded in fresh fruits of *Rosa canina* (284.01 mg/100 g) and decreased almost 10 times in the jam (29.93 mg/100 g) (Poiana M.-A et al., 2011). The concentration of ascorbic acid decreased after 3 days after harvest, and this decrease was more drastic when sample was kept in the light, at 22 °C (Inegedu Audu S. et al., 2020). A greater decrease of vitamin C was recorded in dried fruits at 105 °C (Mieszczakowska-Frac M. et al., 2021). In the fruits paste, the concentration of vitamin C was lower than that in the fruit kept intact for 3 days in the air, and when the pasta was boiled, the amount of vitamin C decreased critically with the cooking time (Herbig A.-L. et al., 2017). Loss of vitamin C was also recorded when storing the fruit paste for 3 days, especially in the air, at 22 °C. In Fig. 4 it can be seen that the behavior of ascorbic acid in *H. Rhamnoides* samples under environmental factors action presented closely similarities.

In Figs. 3 and 4 it can be seen that in all the analyzed samples the concentration of ascorbic acid was lower in the fruits of Rosa Canina than in those of H. Rhamnoides (Oprica L. et al., 2015). A similar situation was encountered in the fruit paste and jam of *Rosa Canina* and *H. Rhamnoides* (Shivembe A. et. al, 2017).

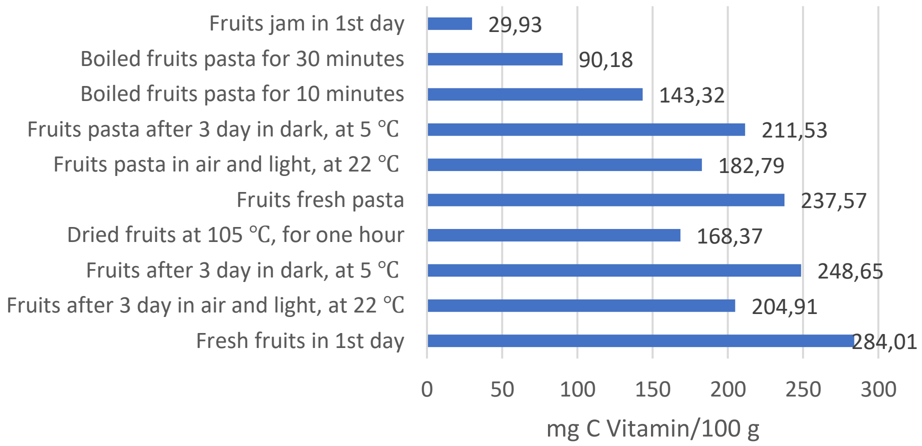

Fig. 3. Vitamin C concentration in *Rosa Canina* samples (fresh and dried fruits, fruits pasta and jam) in different stage of study

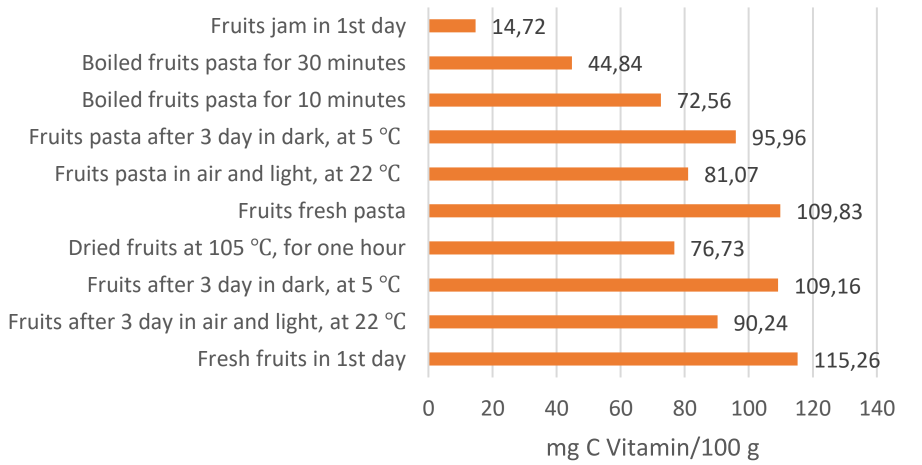

Fig. 4. Vitamin C concentration in *H. Rhamnoides* samples (fresh and dried fruits, fruits pasta and jam) in different stage of study

CONCLUSIONS

In all studied samples , the concentration of ascorbic acid was higher in the fruits of *Rosa Canina* than in those of *H. Rhamnoides*. Higher concentrations of vitamin C in whole fruits compared to fruits paste was determined by the fact that the protective role of the outer epicarp of the fruit that prevented oxidants to degrade ascorbic acid. The presence of light favored the photochemical degradation of vitamin C, but this degradation was much accentuated by the increase in temperature and the prolongation of the exposure time to high temperatures (Stešková A. et al, 2006). Even at 5 °C, in the dark, a process of degradation of vitamin C, slow, over time was recorded. A drastic decrease of the ascorbic acid concentration was obtained in the jam preparation, which once again showed a negative influence of the high temperatures, like the boiling point. All these changes in the concentration of ascorbic acid are due to its very easy oxidation, especially by oxygen in the air, but not only because of it.

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