

Influence of Processing on Vitamin C Content of Rosehip Fruits

Ana Leahu*, Cristina Damian, Mircea Oroian, Sorina Ropciuc, Ramona Rotaru

Stefan cel Mare University of Suceava, Romania, Faculty of Food Engineering,
13th University Street, Suceava, Romania

Abstract

Tests carried out on rosehip tea, respectively syrup and jam have aimed at assessing quality of products processed by drying and pasteurization. For investigation of the contents of ascorbic acid, total soluble solids, pH values and the antioxidant capacity, samples were taken after different stages of production to determine the effects of processing.

Vitamin C content was determined by separating samples of rose-hip and dosage in a HPLC SHMADZU system coupled with UV-VIS detector (DAD).

Ascorbic acid values of rosehip fruits dried tea and syrup were determined as 0.72 and 2.18 mg/100g, respectively. In addition, ascorbic acid contents of the rosehip fruits and jam were established as 415.86 and 37mg /100g, respectively.

The colour changing from the different juice samples was measured by lightness values (L*), redness values (a*) and yellowness (b*) values. The result indicated the change in Hunter parameters, L* and b*.

The results from the present study prove that the loss of vitamin C depends on the method of processing.

Keywords: ascorbic acid, colour rosehip fruits, syrup fruit.

1. Introduction

The edible part of the fruit is rarely consumed directly as fresh, they are mostly eaten dry and form of marmalade, pulp, nectar, wine, tea, syrup.

The consumption of rosehip fruits, flowers, leaves and buds prevents and combats the cardiovascular, renal, gastrointestinal diseases and increases the level of vitamins in the human body. Fruits (hips) have long been used in the traditional prevention and therapy of common cold and other infections, as a diuretic agent and for the treatment of various inflammatory diseases [1-4].

Natural oxidants in the main feature, the ability to capture free radicals are used successfully in relieving and improving the health of patients with arthritis [5, 6].

Studying the anti-inflammatory property of *Rosa canina* L, Lattanzioa F. Et al., 2011, have shown that the anti-inflammatory power is similar to that of indomethacin and suggesting its potential role as adjuvant therapeutic tool for the management of inflammatory-related diseases [7]. Rosehip extracts may serve as an alternative or compliment to current chemotherapeutic regimens for glioblastomas [8].

High vitamin C content (300-4000 mg/100g) of fruit of rosehip and other substances ensure the normal functioning of the endocrine glands, brain, heart and liver. Ascorbic acid has an important role in the absorption of iron in the body in the biosynthesis of collagen. Due to the presence of vitamin C, fruit of rose hips are traditionally are used as a tea in cold weather to prevent and fight fevers and colds [9].

Rosehip fruits are used in medical and food industry due to the presence of phenols, essential oils, carotenoids. Fruit pulp, ground is used as a diuretic, astringent in the treatment of

* Corresponding author: Ana Leahu, Email analeahu@fia.usv.ro

osteoarthritis [9,10]. The results of studies use rosehips as a folk remedy to treat diabetes in Turkey [11].

The food rosehip pulp is used predominantly in the manufacture of canning. Through its thermal processing to obtain marmalade, jelly, rosehip pulp, juices, syrups, wine and liquor are important sources of citric acid, malic acid, pectin, carbohydrates, vitamins and minerals [12, 13].

Previous research leading to appreciation of the importance of using rosehip powder as a source of natural fiber, minerals, vitamins, enzymes in the baking industry [14]. By mixing flour with rosehip powder improve the nutritional value of the flour through the intake of vitamins, fiber, carotene, and rheological characteristics of dough by increasing elasticity and strength of gluten [15].

Due to the carotenoid content, minerals, pectin and carbohydrates, dairy industry uses rosehip powder in the manufacture of yoghurt, changing the value and sensory characteristics of food products especially products aimed at children. Thus obtained Rosalact probiotic containing Rosehips extract and *Glycyrriza glabra* L. extract product rheological and sensory characteristics as highly valued by consumers [16].

Ganhão R., et al, 2010, evaluate the effect of added to burger patties (3% of total weight) the extract dog roses (*Rosa canina* L.) and evaluated as inhibitors of protein oxidation and color and texture changes. The extracts of dog roses was most suitable for use as a functional ingredient in processed meats since it enhanced oxidative stability, color and texture properties of burger patties with no apparent drawbacks [17].

The content of vitamin C may vary under conditions of high humidity and low temperature [18].

Therefore, the proposed research focused towards to evaluate the effects of processing on selected quality parameters (contents of ascorbic acid, total soluble solids, pH values and the antioxidant capacity), rosehip were processed to syrup, jam and dried fruits tea.

2. Materials and methods

Plant material:

Mature fruit samples, approximately 1 kg each was collected from Cotu-Băii, Suceava in September 2012 and kept in a freezer at -20°C . A

tea samples (dried fruits), rosehips syrup and fruit jam was purchased at a commercial establishment in Suceava in the spring 2013, and are from different companies.

Chemical analyses

The determination of moisture in fruits was effectuated according to the European Standard EN ISO 665/2000 by the drying process in a drying chamber at the temperature of 103°C .

Protein content was analyzed by Kjeldahl method.

Ascorbic acid determination was done on acid extracts of samples.

Extraction of ascorbic acid from samples

The extracts were obtained following the next protocol: 4 gram of rosehip as extracted with 12 ml of acidified solutions (Perchloric acid and o-Phosphoric acid 1%) using a ceramic mortar and a pestle. The residue was re-extracted until the extraction solvents remained colorless (the total solvent volume was 50 ml). The extract was filtered through a Whatman no. 5 filter paper.

The extracts were kept at -20°C until further analysis.

Ascorbic acid separation, identification and dosage

The ascorbic acid in the samples was separated, identified and dosed in a HPLC SHIMADZU system coupled with UV-VIS detector (DAD). ZORBAX - C18 column ($5\mu\text{m}$, 250×4.6) was used. For ascorbic acid identification standard L-ascorbic acid (Sigma 99% standard L ascorbic acid) was used. For dosage of ascorbic acid in the samples, a calibration curve was constructed using dilutions of standard L-ascorbic acid in bidistilled water.

Total ash composition was obtained by calcinations of 5g of sample at 600°C for 240 min.

The pH of the samples was evaluated using a digital pH meter at 25°C .

Total soluble solids (TSS) and were determined using the refractometric method, with an Abbe refractometer and corrected to the equivalent reading at 20°C (AOAC, 1995).

Colour measurements of the samples was conducted using a Minolta Chroma Meter (Model CR 310, Minolta Camera Co. Ltd., Japan), based on the by Hunter L* (whiteness/darkness), a* (redness/greenness), and b* (yellowness/blueness) system [19].

Chemicals

All chemicals used for experiments were of analytical grade and procured from Sigma Merck, Aldrich and Fluka. Deionizer water was used.

Statistical analysis

Statistical analysis of the variables was determined by the correlation matrix Person, depending on the intensity of the correlative links (in the range-1, 1).

3. Results and discussion

Physico-chemical indicators of fruits

Table 1 shows the values obtained for physico-chemical characteristics of fruit. The level of the compounds was determined per the total weight of rose hips (hypanthia and achenes).

Table 1. The results of the analyzes physico-chemical on the fruit species *Rosa canina* L.

Botanical name	Common name	M ¹ %	CP ² %	AA ³ mg/100g	Ash %
<i>Rosa canina</i> L.	Rose hips	46.76	2.68	415.86	2.14

¹Moisture, ²Crude protein, ³Ascorbic acid

Moisture (M), crude protein (CP), the content of ascorbic acid (AA) and ash content of rose hips, harvested in September 2012 and kept in a freezer at -20°C, were determined in the course of this study.

Protein was found in low levels 2.68 g/100 g in rose fruits

The level of ascorbic acid was found 415.86 mg/100g is in agreement with the other studies [20]. Our results illustrated that ascorbic acid should be responsible for the effective antioxidant properties of the rose hips extract. Comparatively, Craita C.M. et al., 2011 found the ascorbic acid content of various species of *Rosa* from northeastern region of Romania ranged between 866.91 mg/100g fw (*Rosa rubiginosa*) and 816.77 mg/100 g fw (*Rosa vosagiaca*) [21].

The amount of ash (2.14%) was lower than that of Yildiz, (2012) [23], of 3.2%, the difference is explained by losses due to storage in the frozen state.

Physico-chemical indicators of tea, syrup and fruit jam

Were formed 6 samples, and Table 2 shows the values obtained for physico-chemical characteristics.

Barros L. et al., 2011, concludes in his research that other antioxidants, such as reducing sugars or ascorbic acid, might be present in the methanolic extracts being also responsible for the antioxidant activity observed in *Rosa canina* L. samples [22].

Table 2. pH, ascorbic acid content(mg/100g), the total soluble solids of samples

Samples	pH	¹ AA mg/100g	² TSS %
S1 Tea (dried fruits)	4.12	0.72	0.22
S2 Tea (dried fruits)	3.92	0.22	0.34
S3 Fruit syrup	2.74	1.5	24
S4 Fruit syrup	3.12	2.18	18
S5 Fruit jam	3.27	37	52
S6 Fruit jam	3.49	32.25	54

¹Ascorbic acid, ²The total soluble solids

The content of vitamin C in tea, prepared as indicated on the label, is very low, being 3.27 times higher in the manufacture of S1 (0.72 mg/100 g) than those obtained in S2 (0.22 mg/100 g).

Syrups without a high intake of vitamin C, its content in the two types (S2 and S3) varies significantly. S3 product syrup containing vitamin C 2.06 times less in comparison with that made from Sample 3.

Rosehip jam is rich in vitamin C, the products analyzed ranging from 37 mg/100 g (samples 5) and 32.25 mg/100 g (samples 6). Values were lower than Yildiz study (2012) [23] on the vitamin C content of commercially purchased marmalades (125.5 mg/100 g), it fits somewhere between that of marmalade using evaporator vacuum and that obtained by the classical method, ie 45.4-25.05 mg/100 g.

pH values teas are the highest in the samples analyzed and syrup were recorded the lowest values. Rosehip Easter presents pH values roughly similar to those of marmalades from the study of Yildiz O., 2012 [23].

The correlation value for the parameters total soluble solids and ascorbic acid measured in selected samples is 0.92430 revealed a stronger correlation between these two parameters (table 3).

Table 3. Pearson correlation matrix for the variables of pH, ascorbic acid and the total soluble solids

	pH	AA mg/100g	TSS %
pH	1		
AA	-0.14976	1	
TSS	-0.48288	0.92430	1

We notice a significant negative correlation between total solids and pH.

Pearson correlation matrix for the variables of pH, ascorbic acid, and soluble solids content determined in the samples of tea, rose hip syrups and paste shows in table 4.

Samples analyzed are strongly positively related to each other, teas and syrups environmental correlates negatively, as indicated by correlation indices between - 0.5562 and -0.4277 (table 4).

Table 4. The correlation matrix for the samples analyzed

	S1	S2	S3	S4	S5	S6
S1	1					
S2	0.9896	1				
S3	-0.5562	-0.4313	1			
S4	-0.5529	-0.4277	0.9999	1		
S5	-0.9820	-0.9447	0.7031	0.7003	1	
S6	-0.9483	-0.8931	0.7910	0.7886	0.9912	1

Strong negative correlation between the samples of tea stands and paste Person correlation indices indicate this (between -0.9820 and -0.8931).

Color index is one of the most important factors in the quality of fruit products such as products obtained by heat treatment. The processes during the manufacture, dilution, drying and baking may affect the color of the final product.

Table 5. Color variation in samples of tea, rosehip syrup and pulp

Samples	L*	a*	b*
S1 Tea (dried fruits)	154.9	0.9	-14.8
S2 Tea (dried fruits)	152.6	1.1	-12.4
S3 Fruit syrup	104.4	1.2	-6.1
S4 Fruit syrup	118.5	1.3	-8.2
S5 Fruit jam	124.3	1.3	-83.5
S6 Fruit jam	128	1.3	-84.3

Evaluation using colorimetry trichromatic color that shows chromaticity coordinates defined by the system CIE is a quick and relatively easy to apply. Table 5 presents the experimental results on its own objective assessment of the color of the 3 types of products studied. Color parameters in the same product range values are roughly similar. Processing methods are different parameter values L *, b * varies significantly from one range to another. Only for values of (a *) is observed linearity due reddish roughly similar to the 3 types of products rosehip.

4. Conclusions

The relationship between food and health is becoming increasingly important, customers are now demanding healthy, tasty, natural and functional, which were grown in uncontaminated environments.

Rosehip is known as having a high content of vitamin C (300-4000 mg/100 g) in relation to the other fruits and vegetables. In addition, contain other vitamins, minerals, carotenoids, tocopherols, bioflavonoids, tannins, pectin, sugars, organic acids, amino acids and essential oils.

The results of the measurements indicate that the rosehip extracts preserved by freezing the contents of vitamin C is reduced to extracts obtained from syrup and jam. The protein and ash drops significantly in the samples preserved by freezing, which are affected by low temperature. Rosehip syrup and jam has the highest content of vitamin C and soluble solids. Extracts color differs depending on the heat treatment. Syrup and jam significant difference in values close to the rosehip tea made from dried fruit

Reference

1. Orhana D. D., Hartevioglu A., Kupeli E and Yesilada E., In vivo anti-inflammatory and antinociceptive activity of the crude extract and fractions from *Rosa canina* L. Fruits, Journal of Ethnopharmacology, 2007 112: 4-400.
2. Roman I., Stănilă A. and Stănilă S., Bioactive compounds and antioxidant activity of *Rosa canina* L. biotypes from spontaneous flora of Transylvania, Chemistry Central Journal 2013, 7:73.
3. Hvattum, E., Determination of phenolic compounds in rose hip (*Rosa canina* L.) using liquid chromatography coupled to electrospray ionisation

- tandem mass spectrometry and diode-array detection, Rapid Commun, Mass Spectrom, 2002, 16:655-662.
4. Machmudah, S. et al., Process optimization and extraction rate analysis of carotenoids extraction from rosehip fruit using supercritical CO₂ J. of Supercritical Fluids, 2008, 44:308–314.
 5. Wenzing E.M. et al., Phytochemical composition and in vitro pharmacological activity of two rose hip (*Rosa canina* L.) preparations, Phytomedicine, 2008, 15(10):35.
 6. Türkben C., Uylaşer V., Bige İnceday B., and Çelikkol I., Effects of different maturity periods and processes on nutritional components of rose hip (*Rosa canina* L.), Journal of Food, Agriculture & Environment, 2010, Vol.8 (1): 26 - 30.
 7. Lattanzio F., Grecob E., Caretta D., Cervellatib R., Govonic P. and Speronia E., In vivo anti-inflammatory effect of *Rosa canina* L. Extract, Journal of Ethnopharmacology, 2011 137(1), 880–885.
 8. Patrice C., Ombeni I., Janelle C, Radiah M., Ipek G., et al., Effect of Rosehip (*Rosa canina* L.) Extracts on Human Brain Tumor Cell Proliferation and Apoptosis Journal of Cancer Therapy, 2012, 534-546.
 9. Chrubasik C, Duke RK and Chrubasik S., The evidence for clinical efficacy of rose Hip and seed: a systematic review, Phytother Res. 2006.
 10. Stralsjo, L. et al., Total folate content and retention in rosehip (*Rosa* Ssp.) after drying, Journal of Agricultural Food Chemistry, 2003, 51:28-39.
 11. Orhan, N. et al., Antidiabetic effect and antioxidant potential of *Rosa canina* fruits, Pharmacognosy Magazine 5, 2009, 309–315.
 12. Nowak R., Fatty acids composition in fruits of wild rose species, Acta Societatis Botanicorum Poloniae, 2005, 74(3): 229–235.
 13. Wenzing E.M. et al., Phytochemical composition and in vitro pharmacological activity of two rose hip (*Rosa canina* L.) preparations. Phytomedicine, 2008, 15(10):35.
 14. Modoran C., Modoran D. and Nicoara R., The use of herbal plants in bakery products., Journals USMAV CJ, 2007, 207 – 208.
 15. Biljana R. Cvetković , Bojana V. Filipčev, Marija I. Bodroža-Solarov , Željko M. Bardić and Marijana B. Saka, Chemical composition of dried fruits as a value added ingredient in bakery product, Food Processing, Quality and Safety, 2009, 15-1.
 16. Mocanu G.D., Rotaru G., Botez E. GiŃin L. Andronoiu, D. G. et al., Sensory evaluation and rheological behavior of probiotic dairy products with *Rosa canina* L. and *Glycyrriza glabra* L. Extracts, Innovative Romanian Food Biotechnology 2009, 32-39.
 17. Ganhão R., Morcuende D. and Estévez M., Protein oxidation in emulsified cooked burger patties with added fruit extracts: Influence on colour and texture deterioration during chill storage. Meat Science, 2010, 402–409.
 18. Ropciuc S., Cenuşă R., Caprita R., Creţescu I. and Tanase I., Influence of Climatic Factors on the Nutritional Value in *Cynosbati Fructus*, Animal Science and Biotechnologies, 2011, 44 -2.
 19. Tortoe C., Johnson, Paa-Nii T, Slaghek T., Miedema M. and Timmermans T., Physicochemical, Proximate and Sensory Properties of Pineapple (*Ananas* sp.) Syrup Developed from Its Organic Side-Stream, Food and Nutrition Sciences, 2013, 163-168.
 20. Ropciuc S., Ion Tănase I., Creţescu I. and Velicevici G., The variation of the acid ascorbic content in *Cynosbati fructus* influenced by stationary factors, Food and Environment Safety, 2011.
 21. Rosu C.M. , Manzu C. , Olteanu Z., Oprica L., Oprea A. , Ciornea E. and Zamfirache M.M., Several Fruit Characteristics of *Rosa* sp. Genotypes from the Northeastern Region of Romania, Not Bot Horti Agrobo, 2011, 203-208.
 22. Barros L., Ana Maria Carvalho, Isabel C.F.R. Ferreira, Exotic fruits as a source of important phytochemicals: Improving the traditional use of *Rosa canina* fruits in Portugal, Food Research International 2011, 2233–2236.
 23. Yildiz O. & Alpaslan M., Properties of Rose Hip Marmalades, Food Technol. Biotechnol, 2012 , 98–106.