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CONVERSION OF ROSEHIP, CRANBERRY, GOJI AND COCONUT FRUITS INTO A FUNCTIONAL TEA RICH IN BIOLOGICALLY ACTIVE PRINCIPLES

MUREŞAN Elena Andruţa[1], Romina Alina VLAIC[1], Vlad MUREŞAN[1]*, Constantin Gheorghe CERBU[2], Simona CHIŞ[1], Melinda FOGORAŞI[1], Simona MAN[1], Sevastiţa MUSTE[1]

[1] University of Agricultural Science and Veterinary Medicine Cluj-Napoca, Faculty of Food Science and Technology, Cluj-Napoca, Romania;
*Corresponding author, e-mail: vlad.muresan@usamvcluj.ro
[2] University of Agricultural Sciences and Veterinary Medicine, Faculty of Veterinary Medicine, Cluj-Napoca, Romania.

Abstract: Nowadays, the development of the food industry relies heavily on the valorisation of some products with a high content of beneficial compounds for the human body.

Through the studies and research, but following the results, it was intended to obtain tea enriched with various natural compounds (antioxidants, vitamins, minerals) by harvesting the fruits of rose, cranberry, goji and coconut, naturally sweetened with steviol.

Subsequent to obtaining, we performed physicochemical laboratory tests, in which we tracked the antioxidant capacity, total polyphenol content, vitamin C content, and acidity. As a result, we have traced the qualities of each fruit in order to achieve a better combination of taste, colour and nutritional properties.

Keywords: goji, coconut, rosehip, cranberry, tea

Introduction

Tea is a popular drink around the world. For this reason, cultivation of tea plants is economically important in many countries (Wanda *et al.*, 2017).

Whether Chinese, Indian, from fruits or plants, hot or cold, tea is a perfect natural drink that does not contain artificial additives and has been part of our life for thousands of years.

Besides being a tasty drink, tea is obtained from different plant or fruit blends, with different therapeutically effects, thus consuming teas can

greatly contribute to preserving our health and vitality or treating various diseases.

Apart from water, many of us consume tea, much more than any other drink, thus satisfying our taste and enhancing our health. It has undergone intense publicity over the years, especially since stress has played such a significant role in the emergence of health problems nowadays.

The genus *Rosa canina* includes more than 100 species which are widely distributed across Europe, Asia, and North America. Roses have been cultivated since antiquity, but some of them can still be found growing in the wild. Fleshy red fruits of different shape and size are known as rosehip. Leaves, flowers, and fruits of rosehip were used for years for their medicinal benefits. The leaves present antioxidant and anti-inflammatory properties. The flowers show antibacterial, astringent, tonic, and antioxidant effects used for mild inflammation of the skin, mouth and throat lining (Cunja *et al.,* 2014). Even if the fruits might be consumed fresh, they are usually mostly prepared as tea, syrup, jam, jelly, or wine.

Rosehip is traditionally used against a wide range of pathologies due to its high biological activities: anti-inflammatory, anti-arthritic, immunosuppressive, antioxidant, anti-diabetic, cardioprotective, analgesic, antimicrobial, gastroprotective, and skin ameliorative effects (Mármol *et al.*, 2017). Among fruits and vegetables, rosehip fruits contains the highest amount of vitamin C , and contains also vitamin A, B1, B2, B6, D, E, and K (Tumbas *et al.,* 2012). Citric and malic acid are characteristic organic acids, besides ascorbic acid (Demir *et al.,* 2014). Rosehip contains also carotenoids: lycopene, ß-carotene, rubixanthin, ß-cryptoxanthin, gazaniaxanthin, and zeaxanthin being identified as its major components. Pectin and sugars, mainly glucose and fructose, might be considered also rosehip active ingredients (Koczka *et al.,* 2018).

Cranberry (*Vaccinium vitis-idaea),* known also as cowberry, lingonberry, or partridgeberry is native to the Northern Hemisphere (boreal forest), from North America to Eurasia. Cranberry, bilberry and blueberry are related as members of the *Vaccinium* species. Popular in northern, central and eastern Europe are the fruits of the berries bought at the local markets or collected from wild plants growing on publicly accessible lands . They can be consumed raw and cooked in the form of juice, jam, compote, or syrup. Similar to other *Vaccinium* species, the wide beneficial biological properties spectrum of lingoberries is related to their polyphenol constituents (Paredes-López *et al.,* 2010). Fresh fruits and derived products provide bioactive compounds and essential dietary micronutrients including

polyphenols vitamins, and minerals, with several benefits for human health. Polyphenolic compounds show high antioxidant activity while acting as reducing agents, hydrogen donors, singlet oxygen quenchers as well as chelators of metal ions, preventing metal catalyzed formation of free radicals (Drózdz *et al.,* 2017).

Goji berries *Lycium* is one of the genera in the *Solanaceae* family, comprising 80 species, seven of which are found in China. Showing a highly similar morphology and structure, these species are all deciduous shrubbery. In Southeast Asia, especially in China, the *Lycium* genus has been an important source of nutrient supplements and medicines for years. *Lycium barbarum* and *Lycium chinense*, were used widely as traditional Chinese medicinal herbs for years, while *L. barbarum* is currently cultivated widely in China (Zhang *et al.,* 1994).

Goji berries and Cortex Lycii present therapeutic effects in chronic diseases, such as diabetes, hectic fever, cough, night sweats, and hemoptysis. In the last years, medical research has indicated that these fruits and root bark have many pharmacological functions, such as blood sugar level reducing activity, immunoregulatory, antiglaucoma, antitumor, antiaging, antioxidant, and neuroprotective activities (Qian *et al.,* 2017).

The coconut palm is considered one humanity's principal vegetable resources, being also named the tree of life. Roots, leaves, husk, inflorescence and fruit can be utilized. The fruit of green dwarf coconut palm is cultivated for its liquid content, whereas the giant coconut palm and the hybrids fruits are cultivated for albumin, which can be used naturally or processed into grated dried parts or coconut milk. Depending on the stage of maturation of the fruit, different flavors may appear (Vigliar *et al.,* 2006).

The aim of this paper was to obtain complex products, rich in active principles, with high antioxidant capacity, by using the fruits of rose, cranberry, goji and coconut.

Materials and methods

A number of 4 different fruits were used for making the tea: rose, cranberry, goji and coconut. Drinking drinking water was boiled for 6-8 min. After boiling, the infusion was made for 10 minutes or 20 minutes. After cooling, the tea was sweetened with natural sweetener from patience doc (Steviol); 1 ml for each 250 ml of tea.

The total phenolic assay

Total polyphenol content of sauce and horseradish was determined according to the method described by (Mureşan *et al., 2016*; Semeniuc *et al.,* 2016). An aliquot of 25µL sample was transferred into a glass test tube. Then, 1.8 mL of distilled water and 120 µL of Folin–Ciocalteu phenol reagent were added. After 5 min, 340 µL of sodium carbonate aqueous solution (7.5%, w/v) was added to the mixture. After incubation for 90 min at room temperature, in dark, the absorbance was read at 750 nm, using a Shimadzu UV-1700 Pharma Spec spectrophotometer, against the blank, in which the sample was replaced with methanol. Standard curve was performed using different con-centration solution of Gallic acid and the results were expressed as mg of GAE/100 g sample.

Antioxidant capacity assessment by DPPH method

The antioxidant activity was determined using the 2.2- diphenyl-1-picrylhydrazyl (DPPH) method according to (Mureşan *et al.,* 2014; Odriozola-Serrano *et al.,* 2008). An amount of 30µl of the methanol extract was transferred into a glass test tube with a screw cap, then 270 µL of distilled water and 11.7 mL of DPPH solution in methanol (0.025 g/l) were added. The incubation of the test sample was carried out in dark, at room temperature for 30 min. The absorbance value was read at 515 nm against methanol with a double-beam UV-VIS spectrophotometer (Shimadzu 1700 UV-VIS). The positive control was prepared using a gallic acid solution (0.5 mg/mL). The negative control was prepared using methanol. Results were expressed as percent over standard DPPH absorbance according to Eq.(1).

$$RSA\ \% = \frac{A_{DPPH-}\ A_P}{A_{DPPH}} \times 100 \qquad \text{Eq.(1)}$$

where, DPPH is the absorbance of DPPH free radical in methanol and Ap – sample is the absorbance of DPPH free radical solution mixed with the sample.

Total acidity

The total acidity was performed by neutralization with sodium hydroxide solution (0.1 N) in the presence of methylene blue as indicator Eq. (2).

Total acidity = m x 0,0067 x 2 x V g % acid malic Eq.(2).

where: m - the weight of the sample , V– volume of NaOH 0.1N used for titration; 0.0067 conversion factor: 1 ml 0.1 N sodium hydroxide corresponds to 0.0067 g malic acid

Determination of Vitamin C

The chemical methods used for vitamin C dosing are based on its reducing properties. Ascorbic acid is converted by oxidation into dehydroascorbic acid. Various oxidizing agents may be used. The iodometric method is based on the oxidation of ascorbic acid with excess iodine.

As the oxidant, we used the iodine generated *in situ* by the reaction between iodide and K iodine, according to the reaction:

$$KIO_3 + 6\,HCl + 5\,KI \longrightarrow 6\,KCl + 3\,I_2 + 3\,H_2O$$

The vitamin C content is generally calculated in mg/100 g of material Eq.(3).

$$\text{vitamin C mg\%} = \frac{V \cdot 0.0008 \cdot 5 \cdot 176}{G \cdot 100} = \frac{V \cdot 70.4}{G} \quad \text{Eq.(3)}$$

V = ml KIO_3 0.0008 M used for titration;
G = mass in g of the material used for analysis

Results and Discussion

Nowadays, fruit teas, have been introduced as a low-caffeine alternative to conventional black tea. The erosive potential of agents such as acidic drinks or foodstuffs depends on chemical factors (e.g., pH, titratable acidity,) and on its calcium-chelation properties. In this study, we compared the potential erosive effects and phenolic compounds exhibit antioxidant activity of the most-consumed fruit teas found on Romanian market. This was assessed by determining the neutralisable and acidity vitamin C. The results demonstrate that fruit teas are slightly acidic and important content in vitamin C in Table 1. In this study, the acidity of fruits teas was found to be higher for tea made from rosehip fruit followed by tea made from joji fruit, while the lowest acidity was recorded for tea obtained from coconut, Table 1. Akyuz *et al* (2010) reported that both conventional rosehip tea and fruits (apples, blackberry) tea have recorded acidity values similar to those we get. They also stated that the the baseline acidity is a major factor for the determination of erosive potential, but titrable acidity is generally accepted to be a better indicator than pH value. The ascorbic acid contents of rosehips,

goji, coconut, cranberry tea it was of and fruit mix infused for 10 minutes respective 20 minutes with or without sweetener are given in Table 1.

Phenolics are naturally occurring compounds widely distributed in the vegetable kingdom and interest for beneficial components of human daily diet. They are important constituents of fruits with multiple functions and as dietary phytochemicals for human they display a broad range of functional and biological activities.

Phenolic compounds exhibit antioxidant activity by inactivating lipid free radicals or preventing decomposition of hydro peroxides into free radicals. The Folin- Ciocalteu method is a rapid and widely-used assay, to investigate the total phenolic content but it is known that different phenolic compounds have different responses in the Folin-Ciocalteu method (Kahkonen *et al*., 1999).

As a result, the tea produced from the fruit mix has not only the highest content of phenolic compounds but also the highest antioxidant capacity (Table 2). These values reflect the sum of the compounds present in the fruits but especially in the rosehip and goji.

Table 1 Total acidity and vitamin C of fruits tea and fruit mix infused

Samples	**Acidity (g% malic acid)**	**Vitamin C (mg %)**
Goji tea infusion 10 minutes	0.48 ± 0.02	51.34 ± 0.12
Goji tea infusion 20 minutes	0.52 ± 0.03	52.91 ± 0.21
Coconut tea infusion 10 minutes	0.06 ± 0.00	25.81 ± 0.10
Coconut tea infusion 20 minutes	0.07 ± 0.00	25.01 ± 0.12
Rosehip tea infusion 10 minutes	0.65 ± 0.04	74.04 ± 0.23
Rosehip tea infusion 20 minutes	0.61 ± 0.05	84.21 ± 0.33
Cranberry tea infusion 10 minutes	0.31 ± 0.02	39.65 ± 0.17
Cranberry tea infusion 10 minutes.	0.21 ± 0.01	39.07 ± 0.16
Fruit mix infused for 10 minutes with sweetener	0.42 ± 0.03	83.12 ± 0.32
Fruit mix infused for 20 minutes with sweetener	0.33 ± 0.02	85.36 ± 0.44
Fruit mix infused for 10 minutes without sweetener	0.42 ± 0.02	76.71 ± 0.32
Fruit mix infused for 20 minutes without sweetener	0.33 ± 0.03	84.21 ± 0.41

Table 2 Total polyphenols and antioxidant capacity of fruits tea and fruit mix infused

Samples	Antioxidant capacity (RSA% inhibit)	Polyphenol content (mg GAE/100ml)
Goji tea infusion 10 minutes	51.91 ± 0.34	32.14 ± 0.21
Goji tea infusion 20 minutes	52.34 ± 0.21	35.41 ± 0.22
Coconut tea infusion 10 minutes	25.34 ± 0.23	4.52 ± 0.10
Coconut tea infusion 20 minutes	25.81 ± 0.22	4.30 ± 0.11
Rosehip tea infusion 10 minutes	74.04 ± 0.42	29.65 ± 0.21
Rosehip tea infusion 20 minutes	84.21 ± 0.45	41.20 ± 0.22
Cranberry tea infusion 10 minutes	39.65 ± 0.21	11.20 ± 0.11
Cranberry tea infusion 10 minutes.	39.07 ± 0.24	9.39 ± 0.10
Fruit mix infused for 10 minutes with sweetener	83.12 ± 0.45	29.77 ± 0.21
Fruit mix infused for 20 minutes with sweetener	85.36 ± 0.41	41.20 ± 0.23
Fruit mix infused for 10 minutes without sweetener	76.71 ± 0.32	29.88 ± 0.21
Fruit mix infused for 20 minutes without sweetener	84.21 ± 0.35	37.01 ± 0.21

Conclusions

The tea of rose, cranberry, goji and coconut is a complex product with a high antioxidant capacity that could generate an intake of beneficial active substances in our body.

Conservation of final products is influenced by water content, sugar content, temperature and boiling time. No changes occurred during storage; the fruit tea retained its clarity, fruit colour, taste and aroma.

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