

Antioxidant activity of some rhubarb (*Rheum rhabarbarum*) and strawberries (*Fragaria ananassa*) jam varieties

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Abstract

The purpose of this paper is to analyze in terms of antioxidant activity, vitamin C content and polyphenols, two varieties of rhubarb and strawberry jam, obtained in the laboratory: one with white sugar from sugar beet and one with raw sugar from sugar cane. Of the raw and auxiliary materials used, strawberries had the highest antioxidant activity (11.82 mg Trolox/g), followed by lemon juice (9.46 mg Trolox/g). White sugar did not show an antioxidant activity, whereas raw sugar had a value of 4.52 mg Trolox/g. Of the two types of jam obtained, the one with raw sugar had the strongest antioxidant activity (18.23 mg Trolox/g). As for the content of ascorbic acid and total polyphenols, the jam obtained with raw sugar had a higher concentration (21.82 mg ascorbic acid/100g, respectively 6.14 mg gallic acid/g) than that obtained with white sugar (14.27 mg ascorbic acid/100g, respectively 5.35 mg gallic acid/g).

Keywords: rhubarb, jam, antioxidant activity, vitamin C, polyphenols

1. Introduction

Rhubarb (*Rheum rhabarbarum*) is a plant species of the *Polygonaceae* family. For culinary purposes are used fresh strains of fresh leaves, with a strong sour taste. Most commonly, strains are cooked with sugar and used in pies, sweets and other desserts [2]. Rhubarb is known and used since antiquity for its benefits in the prevention and treatment of inflammation, constipation and cancer [3]. Until the present over 200 chemical compounds have been identified and isolated in rhubarb. Phytochemical analysis on rhubarb has shown that the main bioactive substances are phenolic compounds, including anthraquinones (physion, chrysophanol, emodin, aloe-emodin and reine, respectively their glucosides), anthocyanins, catechin, quercetin - 3-O-rhamnoside [8].

It is an important source of vitamin C, A, niacin, thiamine, riboflavin, phosphorus and potassium [3]. Strawberry (*Fragaria ananassa*) is a perennial plant of the *Rosaceae* family. Strawberries are particularly appreciated by consumers, both fresh and in different food preparations, being very aromatic and also bringing multiple health benefits. The most important vitamin that contains strawberry is vitamin C. Strawberry is also considered a good source of β -carotene, thiamine, riboflavin and nicotinic acid [5]. The most representative phenolic components in strawberries are anthocyanins, mainly cyanidine and pelargonidine 3-glucosides. Elagic acid is a natural phenolic component present in fruits, especially in strawberries and other forest fruits. Strawberries, a rich source of phytochemicals and vitamins, are considered as functional foods for their preventive and therapeutic health benefits [1].

Scientific studies have found their antioxidant, antiinflammatory, antihyperlipidemic, antihypertensive or antiproliferative effects [4,7].

The purpose of this paper was to analyze the content of ascorbic acid, total polyphenols, as well as the antioxidant activity of two variants of rhubarb and strawberry jam, obtained in the laboratory, one with the addition of raw sugar from sugar cane and the second with the addition of white sugar from sugar beet.

2. Materials and Methods

The following raw and auxiliary materials (purchased from the local market) were used to obtain the rhubarb and strawberry jam: fresh rhubarb petioles, fresh strawberries, white sugar from sugar beet, raw sugar from sugar cane, fresh lemon juice, powder of cardamom.

Obtaining of rhubarb and strawberry jams: Two assortments of rhubarb and strawberry jam have been made (RS1 and RS2), following the following recipes:

- Assortment RS1: 690 g cut rhubarb, 510 g strawberries, 520 g of beet white sugar, 20 g lemon juice;
- Assortment RS2: 690 g cut rhubarb, 510 g strawberries, 520 g of raw sugar from sugar cane, 20 g lemon juice.

The strawberries were cleaned and washed, rhubarb washed and cut into approx. 1 cm thick pieces, after which they were weighed and placed in the saucepan. Afterwards, pre-weighed sugar and lemon juice was added and allowed to stand for 10 minutes to melt the sugar. The mixture was then boiled in small heat for 20 minutes without mixing, just by moving the saucepan from time to time. The hot jam was poured into jars which sealed with a threaded cap. The jars were allowed to cool, tipped down, then the labels were applied and stored in a cool, dark space.

From the obtained jams and from raw and auxiliary materials were taken samples to determine the content of vitamin C, total polyphenols and antioxidant activity.

Ascorbic acid, total polyphenols and antioxidant activity determination: The iodometric method was used to determine the vitamin C concentration of the samples, and for the analysis of the total polyphenols content, the Folin Ciocalteu assay.

The antioxidant activity of the samples was evaluated by the CUPRAC method. The working methods used was identical to that presented by Dumbrava *et al.*, [6].

3. Results and Discussions

Ascorbic acid content: The results on the vitamin C concentration of the two strawberry jam assortments (RC1 and RC2) obtained, as well as in the fresh rhubarb, fresh strawberries and lemon juice are presented in Figure 1.

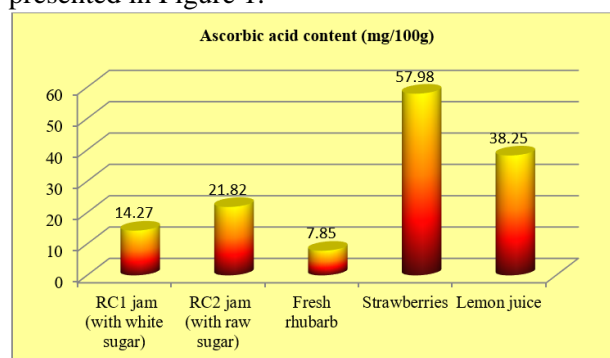


Figure 1. Ascorbic acid content of the samples

From the experimental values we find that in the raw sugar jam (RC2) variant there is a higher concentration of ascorbic acid (21.82 mg/100g) than in the white sugar jam (RC1) variant; 14.27 mg/100g. This shows that raw sugar from sugar cane exert some protection for ascorbic acid during the boiling of the jam. Of the raw and auxiliary materials used, the strawberries showed the highest concentration of vitamin C (57.98 mg/100g), followed by lemon juice (38.25 mg/100g). Rhubarb had the lowest content of ascorbic acid (7.85 mg/100g).

Total polyphenols content: Determination of the total polyphenol content of the two jam assortments as well as of the raw materials and the lemon juice led to the results presented in figure 2.

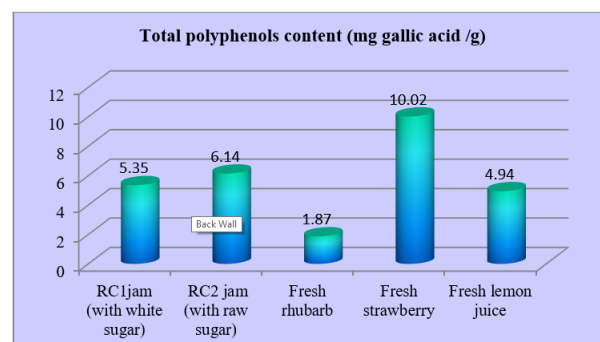


Figure 2. Total polyphenol content in jam samples, raw materials and lemon juice

It can be seen that, of the two finished product assortments, the brown sugar jam (SC2) also had a slightly higher total polyphenol content (6.14 mg gallic/g) than the white sugar jam (5.35 mg gallic/g).

Analyzing the total polyphenol concentration of rhubarb, strawberries and lemon juice, the highest value is recorded for fresh strawberries (10.02 mg gallic acid/g), followed by lemon juice (4.94 mg gallic acid/g). Fresh rhubarb has the lowest total polyphenol content (1.87 mg gallic acid/g).

Antioxidant activity: The antioxidant activity of the two assortments of rhubarb and strawberries jam, of the raw materials, sugar and lemon juice is shown in figure 3.

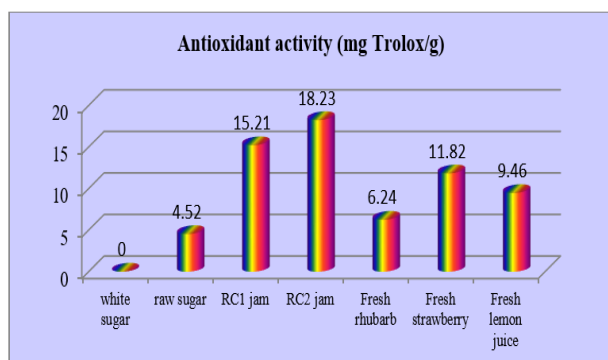


Figure 3. Antioxidant activity of jam samples, raw materials, sugar and lemon juice

Of the two finished products, the raw sugar jam (RC2) showed the best antioxidant activity (18.23 mg Trolox/g); it also has the highest concentration of ascorbic acid and total polyphenols, compounds with strong antioxidant action. In terms of raw materials, strawberries had the highest antioxidant activity (12.51 mg Trolox/g), almost twice as high as rhubarb (6.24 mg Trolox/g).

Conclusions

Based on the experimental results of this paper, the following conclusions can be drawn:

- An innovative food product was obtained in the laboratory: rhubarb jam with strawberry, in two assortments: SC1 with white beet sugar and SC 2 with raw cane sugar.
- Analysis of the vitamin C content of the two assortments of jam showed that the raw sugar jam (SC2) variant is richer in this vitamin than that with white sugar (SC1).

- Among the raw and auxiliary materials used, strawberries had the highest ascorbic acid concentration, followed by lemon juice, rhubarb being poorer in this vitamin.
- The total polyphenols, determined by the Folin-Ciocalteu method, were present in higher concentration in the jam with raw sugar, but the differences between the two jams were very small.
- Among the raw and auxiliary materials strawberries also recorded the highest total polyphenols content, followed by lemon juice, while rhubarb was the poorest in these compounds.
- The analysis of antioxidant activity showed that the SC2 jam with raw sugar assortment had the best value and among the raw and auxiliary materials: strawberries.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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