ASSESSMENT OF PHYSICOCHEMICAL CHARACTERISTICS AND STABILITY OF BIOACTIVE COMPOUNDS IN SOME FRUITS AND COFFEE JELLY DURING THE PROCESSING

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Abstract. *This study provides data on the physicochemical characteristics and stability of bioactive compounds in jelly with kiwi, sour cherry, raspberry and coffee during the processing. The experimental results obtained for physicochemical characteristics showed that the jellies moisture was in range of 30,7-32,8%, acidity between 0,1% citric acid and 0,6% citric acid, total soluble substances among 66-70% Sucrose and vitamin C content was in range of 0,016-0,052g/L with the highest level in jelly with kiwi and lowest level in jelly with coffee. The thermal treatment applied during the technological process has a significant impact on the DPPH free radical scavenging activity and the polyphenols content of all studied jellies, which were below the detection limit.*

Key words*: jelly, antiradicalic activity, total polyphenol content, vitamin C content*

INTRODUCTION

Jelly is the product processed by heating a mixture from fruits (fresh, frozen, pulp, purée, juice, or concentrates), sugar and pectin followed by their gelatinization. Jellies are semisolid consistency, a clear appearance, a firm texture, maintain their shape and should have the Total Soluble Solids over 65% [3,18]. The high water content of the fruit allowed the jelly microbial contamination [10]. The moisture content of the jelies depend on the quantity of pectin used in the manufacturing recipe [1,17]. Also, the pectin content and acidity of fruits determine the formation of jelly texture. In case of the pectin content of fruits is lower than 1% and pH< 3,0 at the jelly processing are used different gelling agents as gums or pectin with lower degree of esterification. In order to facilitate the formation of network pectin-sugar the process of obtaining the jelly takes place under the heat. Nevertheless, the high temperature and the time of exposure to it may cause the loss of some nutrients in the fruit [11,15,16]. The most of fruits contain a plenty of bioactive compounds which are considered responsible for their antioxidant and antiradical activity, but they are sensitive to thermal treatments [7,8,13]. The previous studies showed that the preservation of antioxidant properties and total polyphenol content during tchenological process depends mainly on variety of fruit, pH, sugar content, type and concentration of pectin, process applied [6,16]. Many jelly varieties have been developed and studied over time, but most of them were from different kind of fruits. The main goal of this study was the assessment of physicochemical characteristics and stability of bioactive compounds in kiwi, sour cherries and coffee jelly during the processing. Sour cherries, raspberries and kiwi are very tasty fruits which are rich in bioactive compounds with valuable antioxidant properties [9,13]. The coffe has a strong very pleasant flavor, antioxidant and nutraceutical properties [12].

MATERIALS AND METHODS

Material

The raw materials used to prepare jellies were sour cherry, raspberry, kiwi, coffe Arabica, sugar, water and gelatin.

Sample preparation

There were prepared 4 samples of jelly: with sour cherry, raspberry, kiwi, coffe Arabica using the same formulation and technological steps:

- obtaining the pure fruit by grinding them;
- obtaining the liquid coffee;
- boiling sugar-water mixture;
- adding pure fruit or liquid coffee;
- add the gelatin and homogenize the mixture with continuous stirring;
- pouring the fluid jelly into shapes;
- solidification and storage of the jelly at 4ºC.

Water content was determined according to STAS 2213/4-86.

The acidity of the jellies was carry out using titrimetric method according to the STAS 2213/8 – 86.

Total soluble substances of the jellies were determined by the refractometric method according to STAS 3750 – 66.

Determination of vitamin C content was performed using the iodometric method consisting of the color reaction between starch and Lugol solution (iodine-potassium iodide). Dosage of vitamin C was done with potassium dichromate in the presence of potassium starch iodide. The iodine released in the reaction coloring the starch in blue. The quantification of the vitamin C content was made according to: 1 mL of potassium dichromate 0.1N corresponds to 0.008806 g of vitamin C [4,5].

Determination of the total content of polyphenols by the method FOLIN - CIOCÂLTEU

Extracts preparation

The extract samples used to assess the total polyphenols content and antiradicalic activity of jellies were prepared by extraction as following: 1g of jelly was mixed with 20 ml ethanol/water (70:30, v/v) at room temperature for 2 hours. The total polyphenol content (TPC) was performed by spectrophotometry, using gallic acid as standard and a UV–VIS spectrophotometer (Analytic Jena Specord 205). The absorbance of the samples was measured at 750 nm. Obtained results were expressed as mg gallic acid equivalents (GAE)/g jelly [2].

Determination of antioxidant activity by the DPPH method

Radical scavenging activity of jellies was determined by the reduction of DPPH in toluene [14]. In order to perform the analysis, 4 mL toluene solution of DPPH 0.004% (w/v) were added at 1 mL solution of jelly in toluene (5, 10, 15, 20 and 25 mg/ml). The obtained mixture was vortexed for 10 s and then was mentained for 30 minutes at room temperature. 1 mL toluene from each concentration of solutions of BHT used as standard (50, 100, 200, 300 and 400 μg/ ml), were mixed with 4 ml toluene solution of DPPH. The fading of DPPH was measured at a UV–VIS spectrophotometer (SPECORD 205, Analytic Jena). Radical scavenging activity (RSC) of the jellies, expressed as a percentage, was calculated with equation:

$$RSC\ (\%) = 100 \times (A_{blank} - A_{sample} / A_{blank})$$

where Ablank represents the absorbance of the control and Asample represents the absorbance of the jelly extract [14].

RESEARCH RESULTS

The results of the experimental analysis corresponding to humidity, acidity and soluble substances of the jelly samples are represented in figure 1 and vitamin C content of jellies in figure 2.

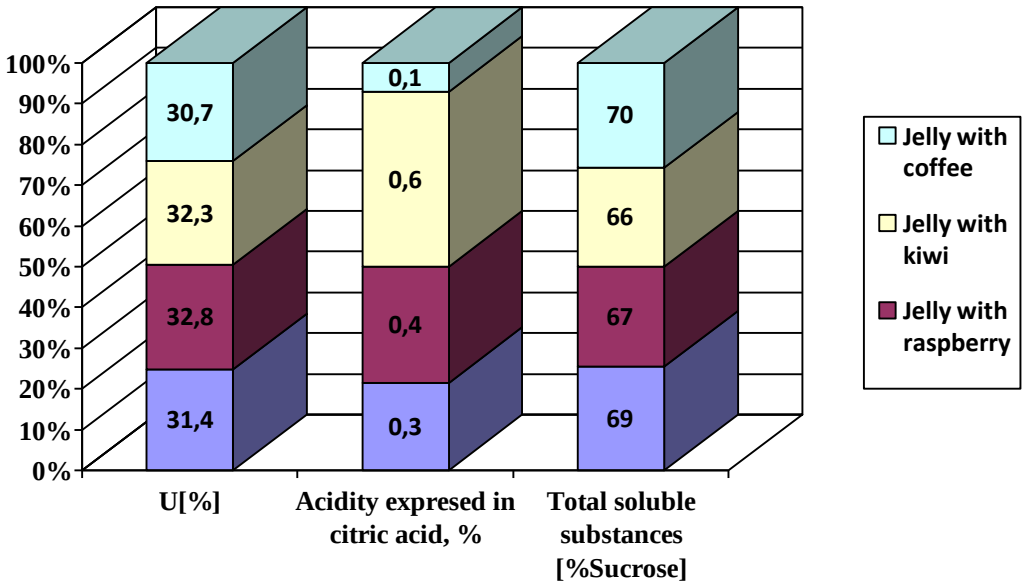

Figure 1. Graphic representation of water, sugar and acidity content of jellies

The graphical representation (figure 1) of the humidity, acidity and sugar corresponding to jelly samples and their dynamics according to the assortment leads to the following statements.

Humidity

The water content of the jelly samples was similar for the 4 samples analysed, with the highest yield in the case of raspberry jelly (32,8%), on average by 4,3% higher than the other samples. The lowest water content was determined in the jelly with coffee sample (30,7%), lower on average by 4,7% compared to the value determined in the other 3 samples. Because the amount of water used in the manufacturing recipe was the same for all assortments, the small differences recorded can be attributed to the moisture content of each crude fruit.

Acidity expressed in citric acid

The citric acid values determined experimentally have been situated in range of 0,1-0,6%, and the relatively large differences being associated with the different acidity of the fruit used in the jelly composition. The highest acidity was recorded for kiwi jelly (0,6%), followed in descending order by raspberry jelly, sour cherry jelly and jelly with coffee respectively. The experimental results show that the kiwi jelly acidity was 6 times higher than the jelly with coffee, 2 times higher than the jelly with sour cherry, and 1,5 times higher than the jelly with raspberry. However, all assortments were within the limits of this parameter based on it's legal admissibility provided by the legislation [STAS 2213/8 – 86].

Total soluble substances

The sugar content expessed as %sucrose determined experimentally for the four samples was similar, the similarity of values being attributed to the same amount of sugar accessed in their manufacturing formula. Coffee jelly was characterized by the highest sugar content (70%Sucrose), which was on average 4% higher compared to the other 3 assortments.

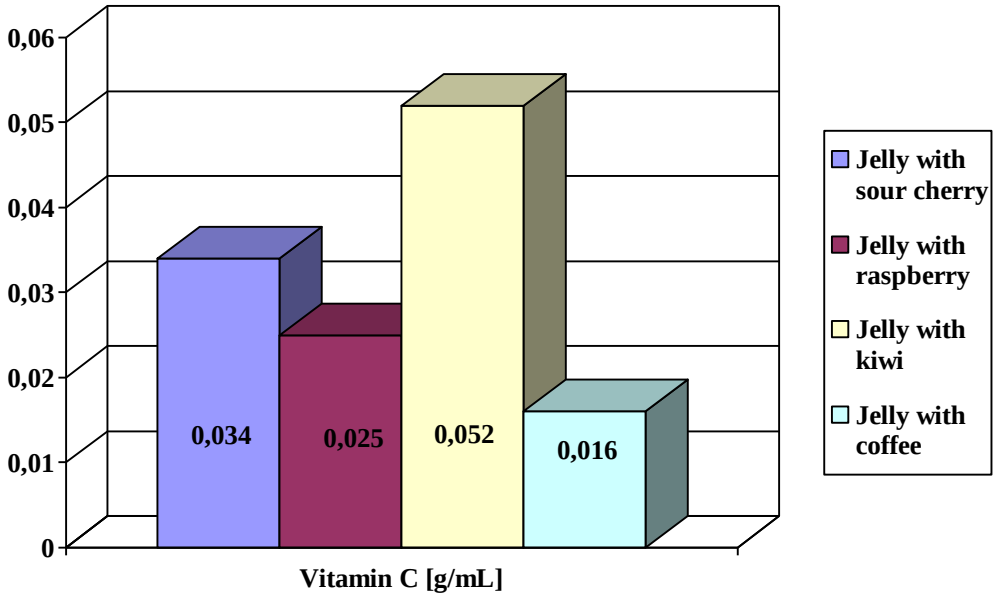

Figure 2. The vitamin C content of the jellies

Vitamin C content

Ascorbic acid content experimentally determined in the samples is correlated with the vitamin C amount of each fruit from the jelly composition, in the case of adding identical quantities of fruit pure in the manufacturing formula. The recorded values were in range of 0,016-0,052g vitamin C/mL, with the highest registered value for jelly with kiwi and the lowest value for jelly with coffee. The thermal treatment applied in the technological process affected dramatically the ascorbic acid content of the finished products, knowing that this compound is thermolabile.

The experimental results obtained for DPPH free radical scavenging activity and total polyphenol content of the jelly samples are presented in table 1.

Table 1

Antioxidant activity and total polyphenol content of fruits, liquid coffe, fruits jelly and coffee jelly

Sample code	DPPH (µM TE/g)	Poliphenol (mg GAE/g)
Coffee	18,64±1.133	0,192±0.0123
Kiwi	16,38±0.045	4,98±0.012
Sour cherry	9,69±0.033	198,382±0.041
Raspberry	78,62±0.055	96,73±0.112
Jelly with coffee	n.d.	n.d.
Jelly with kiwi	n.d.	n.d.
Jelly with sour cherry	n.d.	n.d.
Jelly with raspberry	n.d.	n.d.

n.d. undetectable

The undetectable antioxidant activity and total content of polyphenols in fruits jelly and coffee jelly (table 1) show the inhibitory effect of heat treatment applied during the technological process on the antioxidant properties of jelly samples. The antioxidant activity of liquid coffee and kiwi fruit were closed. The lowest value of DPPH free radical scavenging activity was registred for sour cherry fruits (9,69 µM TE/g), whereas the highest level was determined in case of raspberries (78,62 µM TE/g).

All fruits and coffee evaluated showed polyphenols content, but the differences are quite high, the values being in range of 0,192 mgGAE/g (liquid coffee)-198,382mgGAE/g (sour cherry fruits). Very small amounts of polyphenols were determined in liquid coffee and kiwi fruits compared to the value recorded for raspberries, whereas in sour cherries fruits was registred the highest level of polyphenols.

CONCLUSIONS

The experimental results obtained in the study provides information regarding the physicochemical characteristics and stability of bioactive compounds in jelly with kiwi, sour cherry, raspberry and coffee during the processing. The thermal treatment applied in the technological process has a high impact over the ascorbic acid content of the finished products, knowing that this compound is thermolabile. The DPPH free radical scavenging activity and the polyphenols content of the jelly were below the detection limit, as a consequence of applying heat treatment during jelly production.

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