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Evaluation of bioactive compounds from anew dietetic and functional sorbet

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Abstract

The purpose of this paper was to identify the effect of the addition of blueberries in the finished dietary and functional product, sorbet with isomalt and maltitol, regarding the content in polyphenols and antioxidant activity.

Total polyphenols were determined by the Spectrophotometric method Folin-Ciocalteu using Spectrophotometer (UV-1700, Pharma Spec, Shimadzu).

Antioxidant capacity was determined by evaluating the Free Radical Scavenging effect on the 1,1-difenyl-2-picrylhydrazyl (DPPH) radical. The absorbance of the samples was measured at 515 nm (UV-1700, Pharma Spec, Shimadzu).

In the case of atomized blueberries, the content of polyphenols decreases significantly compared to whole blueberries fruit ("362,26/339,55 mg/100g; 575,00/636,01 mg/100g; 642,65/985,00 mg/100g") and the functional product ("222,54/310 mg/100g; 421,05/573,90 mg/100 g; 600,91/780,65 mg/100 g"), which means that by atomization the total surface of oxygen in the air increases, increasing the risk of oxidation of phenolic compounds, and it would be desirable for the blueberries to be added whole.

There are no significant differences in the determination of antioxidant activity between the blank samples (57.82%, 72.79%, 83.99%, 72.20%, 75.88%, 83.84) and dietary product variants (61.72%, 74.33%, 84.58%, 77.43%, 82.59%; 87.53%), also there are no significant differences between samples with the whole and atomized blueberries.

Keywords: antioxidant capacity, polyphenols, dietary and functional sorbet, blueberries

1. Introduction

For the first time in 1980, in Japan, the term "functional foods" was used for products with specific constituents with physiological effects. The use of functional foods helps to reduce the risk of sickness, improve general body conditions and can be used to heal certain diseases [1].

Polyols (isomalt and maltitol) are hydrogenated carbohydrates that can replace sugar. The interest in replacing sugar with these polyols is due to health benefits. An important role in the use of polyols is the glycemic index (GI) in terms of health, of foods with low GI content.

They are important due to non-cariogenic characteristics, are osmotic carbohydrates (laxatives and purifiers), have low glycemic index (useful in diabetes and cardiovascular diseases), and low energy (useful for people with weight problems) [2].

The functional properties of maltitol makes it a sweetener of natural origin with excellent organoleptic and functional properties. The taste profile is close to that of sucrose, being an excellent substitute for sugar in sugar-free confectionery products, with good solubility and low hygroscopicity.

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The fact that maltitol does not cause unpleasant after taste has an advantage over other synthetic sweeteners [3]

Blueberries (*Vaccinium corymbosum L.*) are considered to be a good source of phenolic compounds [4] being appreciated for their antioxidant capacity [5]. The interest in the consumption of blueberries has increased due to the health benefits of some nutrients from their composition [6,7]. Consumption of these fruits is beneficial in inhibiting the growth of cancer cells, maintaining memory function, preventing atherosclerosis as well as gastrointestinal disorders [8].

In this study two product assortments were developed. For classical sorbet (the blank), were used as raw materials: sugar, glucose, whole dry blueberries and atomized blueberries and for dietetic and functional sorbet, were used as raw materials: isomalt, maltitol, inulin, whole dried blueberries and atomized blueberries. Blueberries have been added in different proportions to improve flavour, colour and content of vitamin C, anthocyanins, flavonoids, polyphenols, and implicitly the antioxidant activity.

The purpose of this study was to determine the influence of polyols replacing sugars on the total polyphenolics and antioxidant activity of different types of sorbets with blueberries.

2. Materials and Methods

The amount of added isomalt was in the proportion of 60%, maltitol 40% and 2% inulin, for the dietary and functional sorbet, and for the blank, the following proportions were used: 75% sugar and 25% glucose.

The main stages of obtaining the products are the preparation of the syrup, the fondant, the processing of the fondant.

2.1. Determination of total polyphenol content.

Using the Folin-Ciocalteu spectrophotometric method, described by Socaci et al., (2013) [9], quantification of the total polyphenols from the assayed samples was performed.

By preparing 0.25, 0.50, 0.75, 1 mg / ml gallic acid solutions, the calibration curve was performed using gallic acid as the reference standard.

An amount of 100 µl methanolic extract were homogenized with 6 ml of distilled water and 0.5 ml of Folin-Ciocalteu reagent, resting for 4 minutes in the dark. After 1.5 ml Na_2CO_3 solution (7.5%) was added to create basic conditions (pH ~ 10), for the reaction between the phenolic compounds and the Folin-Ciocalteu reagent and then 1.9 ml of distilled water was added. The samples were left in dark at room temperature and after 2 hours, the absorbance was read at a wavelength of 750 nm on a spectrophotometer (UV-1700, Pharma Spec, Shimadzu). For the blank sample, 100 µl of the sample (methanolic extract) was replaced with methanol.

The total polyphenol content was expressed in gallic acid equivalents as mg GAE / 100 g FW.

2.2. Determination of antioxidant capacity by DPPH method

This determination was based on the method adapted after Huang et al., (2012) [10] by evaluating the Free Radical Scavenging effect on the 1,1-difenyl-2-picrylhydrazyl radical (DPPH).

An amount of 100 µl of the methanolic extract for the blank products and dietary and functional sorbet, were mixed with 90 µl of distilled water. The samples to be analyzed were further homogenized with 3900 µl DPPH solution (0.025 g/l) and kept in the dark for 30 minutes. The absorbance of the samples was measured at 515 nm (UV-1700, Pharma Spec, Shimadzu). The blank sample consisted of methanol.

The results were expressed as a percentage of the radical inhibition of the standard DPPH solution.

$$RSA[\%] = \frac{A_{DPPH} - A_p}{A_{DPPH}} \times 100$$

unde: RSA [%] - Radical Scavenging Activity;
A_{DPPH} – absorbanţa DPPH;
A_p – absorbanţa probei.

Statistical analysis

The ANOVA analysis of variance was used to compare the mean values, using the SPSS 19.0 statistical analysis (IBM, Armonk, New York, USA) and a Turkey HSD test with a confidence interval of 95% or 99%. Differences were considered to be significant at $p < 0.05$.

Table 1. Products to be analyzed

The blank (sugar and glucose)		Variants of dietary and functional sorbet (isomalt, maltitol, inulin)	
M1f -5%	M1a -5%	V2.1f -5%	V2.1a-5%
M2f -10%	M2a -10%	V2.2f -10%	V2.2a -10%
M3f -15%	M3a -15%	V2.3f -15%	V2.3a -15%

(Mf - the blank with fruit dry blueberries)
(Ma - the blank atomised blueberries)
(Vf - the dietetic and functional product variant with fruit blueberries)
(Va - variants of product dietetic and functional with atomized blueberries)

Table 2. Statistical results of two clases of compounds

Sample	Polyphenols (mg/100 g)	Antioxidant (%)
M1f-5%	339.55 ± 0.64^{i}	57.82 ± 2.50^{c}
M2f-10%	636.01 ± 0.15^{d}	72.79 ± 1.35^{b}
M3f-15%	985.00 ± 0.73^{a}	83.99 ± 0.31^{a}
M1a-5%	362.26 ± 0.82^{h}	72.20 ± 1.35^{b}
M2a-10%	575.00 ± 1.41^{f}	75.88 ± 1.77^{b}
M3a-15%	642.65 ± 0.64^{c}	83.84 ± 0.10^{a}
V2.1f-5%	310 ± 0.92^{j}	61.72 ± 1.25^{c}
V2.2f-10%	573.90 ± 0.99^{f}	74.33 ± 1.87^{b}
V2.3f-15%	780.65 ± 0.77^{b}	84.58 ± 0.31^{a}
V2.1a-5%	222.54 ± 0.75^{k}	77.43 ± 0.83^{b}
V2.2a-10%	421.05 ± 0.77^{g}	82.59 ± 0.2^{a}
V2.3a-15%	600.91 ± 0.75^{e}	87.53 ± 0.31^{a}

3.Results and Discussion

Table 2 shows the results as an average of two replicates. The different letters in the same column indicate statistically significant differences (Tukey's test, where $p < 0.05$).

The blank samples with the whole blueberries (339.55 mg / 100 g, 636.01 mg / 100 g, 985.00 mg / 100 g) and the atomized blueberries (362.26 mg / 100 g, 575.00 mg / 100 g, 642.65 mg / 100 g) have the higher polyphenol content compared to the dietary product variants, with the whole blueberries (310 mg / 100 g, 573.90 mg / 100 g, 780.65 mg / 100 g) and the atomized blueberries (222.54 mg / 100 g, 421.05 mg / 100 g, 600.91 mg / 100 g).The content of polyphenols in the blank samples decreases significantly in the case of the atomized blueberries as against the whole blueberries fruit (362.26 / 339.55 mg / 100g, 575.00 / 636.01 mg / 100g, 642.65 / 985.00 mg / 100g) as well as in the functional product (222.54 / 310 mg / 100g; 421.05 / 573.90 mg / 100g; 600.91 / 780.65 mg / 100g).

The fact that atomization increases the total surface of oxygen in the air increases the risk of oxidation of polyphenols. It would be desirable to add the blueberries to the whole.

In the case of antioxidant activity it was observed that insignificant differences were obtained between the blank samples (57.82%, 72.79%, 83.99%, 72.20%, 75.88%, 83.84) and the variants of the dietary product with natural functional ingredients (61.72%, 74.33%; 84.58%; 77.43%; 82.59%; 87.53%). Between the blank with the whole blueberries (57.82 %; 72.79%; 83.99%) and the atomized blueberries (72.20%; 75.88%; 83.84) there were no significant differences, between variants of the dietary product with the whole blueberries (61.72%; 74.33%; 84.58%;) there are insignificant differences compared to the variants of the dietary product with atomized blueberry (77.43%; 82.59%; 87.53%).

4.Conclusions

Since the differences are not significant between the blank and the achieved product, regarding the polyphenol content and the antioxidant activity, it results that the functional quality of the product is not influenced by sugar and glucose replacement with isomalt and maltitol.

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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