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Antioxidant properties of some dietary chocolate specialties with raspberries

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Abstract

Chocolate is certainly an important ingredient for consumers all over the world. Although it good taste, in very large quantities it has a negative effect on human consumption due to the presence of sugar in ingredients. Replacement the sugar with stevia (Stevia rebaudiana) is justified by its properties; it has a glycemic index of zero making it a sweetener for those who suffer from various diseases like diabetes. Our objective was to produce of some dietary chocolate specialties with different percentages of raspberries: 10%, 20% and 30% (w/w) and the control sample (without raspberries). The innovative character of these products consists in the organic ingredients quality (cocoa, cocoa butter, stevia powder and raspberries) used in the recipe.

The chocolate samples were evaluated in terms of sensory properties and antioxidant properties like antioxidant capacity and total polyphenol content. For evaluation of total polyphenols were used Folin-Ciocalteu method and for measuring the antioxidant activity of samples were used the reducing power method by FRAP assay. The highest values of total polyphenol content were found in control sample (110.24 mg GAE/g DM) and of total antioxidant capacity were obtaining in the chocolate sample with 10% raspberries (65.6 mM Fe^{2+}/g DM). Our data showed that, in all chocolate samples, the increasing the percentage of raspberries causes a decrease in the antioxidant capacity associated with a lower content of total polyphenols

Keywords: chocolate, raspberries, antioxidant properties

1.Introduction

Chocolate is a very unique product, often avoided due to its high calorific value, but is also a functional food with potential health benefits, attributed to its rich bioactive profile [1]. Chocolate was consumed purely for pleasure, but in the last 20 years researches have shown that dark chocolate and cocoa could have beneficial effect on human health due to high content of polyphenols [2]. During the last times, the changes in modern life style and food habits like excessive sugar intake have resulted in obesity and diabetes of people [3].

Stevia has been used ancient times for various purposes as a sweetener and a medicine. Stevia has been used as a bio-sweetener [4] and sugar substitute derived from the leaves of the plant species *Stevia rebaudiana*, native to Brazil and Paraguay. The active compounds are steviol glycosides (mainly stevioside and rebaudioside), which have 30 to 150 times the sweetness of sugar [5] uses as to lower blood sugar. The leaves of Stevia plants have functional and sensory properties superior to those of many other high-potency sweeteners, Stevia is a major source of high-potency sweetener for the growing natural food market in the future [4].

Raspberries (*Rubus ideaus* L.) are grown in many parts of the world and constitute an important high-value horticultural industry in many European countries [6]. They are one of nature's super fruits [7], full of goodness for heart health; the high polyphenols content reduces the risk of cardiovascular disease and reducing blood pressure [8]. Studies have shown everything from anti-cancer benefits to helping reduce obesity and diabetes [7].

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Red raspberry contains numerous phenolic compounds with potential health benefit; are soft, juicy with a distinct aroma and are a good source of natural antioxidants. In addition to vitamins and minerals, raspberries are also rich in anthocyanin, phenolic acids, and other flavonoid [6].

Our purpose was to obtain of some chocolate specialties with different percentages of fresh raspberries using the organic ingredients and to investigate their antioxidant properties.

2. Materials and Methods

2.1. Chocolate formulas

The organic ingredients quality (cocoa powder, cocoa butter, stevia powder and raspberries) used in the recipe gives a sweet dietetic food product with high antioxidant characteristics. It was obtained, in homemade condition, the some dietary chocolate specialties with different percentages of raspberries. It was obtained the simple chocolate (no added) – CS (control sample) and the chocolate with fresh raspberries addition in different percentages: 10, 20 and 30% (w/w) of total cocoa weight - noted: CR10, CR20 and CR30. Sugar has been replaced completely by a sweetener extract from the Stevia plant. The cocoa powder content decreased proportionally with the percentage of raspberries added in the chocolate formulas. Recipes for some dietary chocolate specialties with raspberries are shown in Table 1.

Table 1. The ingredients used to make chocolate specialties

Ingredients	CS	CR10	CR20	CR30
cocoa butter [g]	70	70	70	70
cocoa [g]	70	55	40	25
stevia powder [g]	10	10	10	10
fresh raspberries [g]	0	15	30	45

The cocoa butter is melted on the bain-marie, remove from heat and add the mixture of cocoa powder and stevia powder. Mixed continuously, added the fresh fruit (raspberries) and stir until smooth. Pour the melted chocolate in silicone molds. After 1 hour removed the chocolate from the molds, packaged and remained at 18°C.

2.2. Chemical analysis

All samples were mashed into small pieces. Then 5 g of chocolate samples was extracted with 30 mL of 45% ethanol (v/v). After 30 minutes, the samples was filtered and centrifuged for 10 min at 5000 rpm with Mikro 200 Microliter Centrifuges by Hettich Lab Technology / Germany and the supernatant was used for measurements.

The ***total antioxidant capacity*** was measured by FRAP assay (Benzie and Strain 1996) [9]. FRAP reagent was prepared freshly: 10 mM TPTZ (2,4,6-Tris(2-pyridyl)-s-triazine) solution, diluted in HCl 40 mM; 20 mM $FeCl_3 \cdot 6H_2O$ solution and 300 mM sodium acetate buffer at pH 3.6 in the ratio of 1:1:10. Was added 1 mL hydroalcoholic extract samples diluted in the ratio 1:10 (v/v) in distilled water and 2.5 mL FRAP reagent. After keeping to room temperature for 30 minutes, the absorbance was read at 593 nm. Correlation coefficient for calibration curve was r^2=0.9993; using an aqueous solution of $FeSO_4$ as standard. Total antioxidant capacity was expressed as mM Fe^{2+}/g DM (dry matter).

The ***total polyphenol content*** was measured by Folin-Ciocalteu method (Singleton and al., 1999) [10]. Briefly, 0.5 mL of hydroalcoholic extract samples, diluted in the ratio 1:10 (v/v) in distilled water, was mixed with 2.5 mL of Folin-Ciocalteu reagent (diluted 1:10 in distilled water) and 2.0 mL Na_2CO_3 sol.7.5%. After 2 hours of resting at room temperature, the absorbance was read at wavelength λ = 750 nm using gallic acid for calibration curve (r^2=0.9982). Was used UV-VIS Spectrophotometer SPECORD 205 by Analytik Jena. The results were expressed as milligrams of gallic acid equivalents per g dry matter (mg GAE/g DM).

All experiments were carried out in three replicates.

3.Results and Discussion

The sensory properties of chocolate formulas are presented in Table 2.

Table 2. The chocolate sensory properties

The sensory properties	Appearance-exterior	Polished surface, without stains, scratches or air gaps;
	Appearance- interior	Chocolate with added fresh fruits; Are they evenly distributed and homogeneous consistency;
	Color	Brown;
	Consistency	Hard and brittle;
	Taste and Smell	Pleasant, with taste and flavor of fresh raspberries;
	The finesse	The product is unctuous.

It was found that the antioxidant capacity of the CS chocolate (no added) is lower (52.16 mM Fe^{2+}/g DM) than the specialties with raspberries addition.

The total antioxidant capacity values and total polyphenol content of dietary chocolate specialties analyzed were higher in CR10 chocolate sample (with 10% addition of raspberries). The addition of more raspberries quantity gives a decreasing of all values from antioxidant properties with the percentage of fresh fruit (Figure 1). The loss, in terms of FRAP test, was uniform between CR10 and CR30 from 65.6 mM Fe^{2+}/g DM to 49.52 mM Fe^{2+}/g DM.

The total polyphenol content of the CS chocolate is higher (110.24 mg GAE/100 g DM) than the specialties with raspberries addition and decreases with the increase the percentage of raspberries added. It is known that these fruit has a high content of total polyphenols. This is demonstrated in literature of several studies [11, 12]. The content of polyphenols can vary tremendously depending on the source of beans, primary and secondary processing conditions and process of chocolates making [13]. The process of chocolate production is complex and depends on many factors; most polyphenols undergo degradation during high-temperature processes [14]. Due to these factors, the ratio and types of polyphenols found in cocoa beans are unlikely to be the same as those found in the finished products [8].

Thus, the total polyphenol content is higher in CS to contains 70 g cocoa and decreases in the specialties CR10 (contain 55 g of cocoa), the assortments CR20 (contain 40 g of cocoa) and the CR30 (contains only 25 g of cocoa). We can say that the total polyphenol content decrease is due to the quantity of cocoa added to the manufacturing recipe.

The high polyphenol content in cocoa gives in the chocolate not only antioxidant properties, but also affect sensory properties such as color and taste [14].

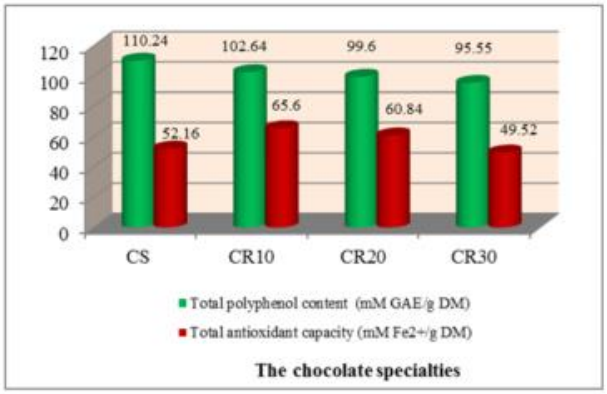

Figure 1. The antioxidant contents of some dietary chocolate specialties with raspberries

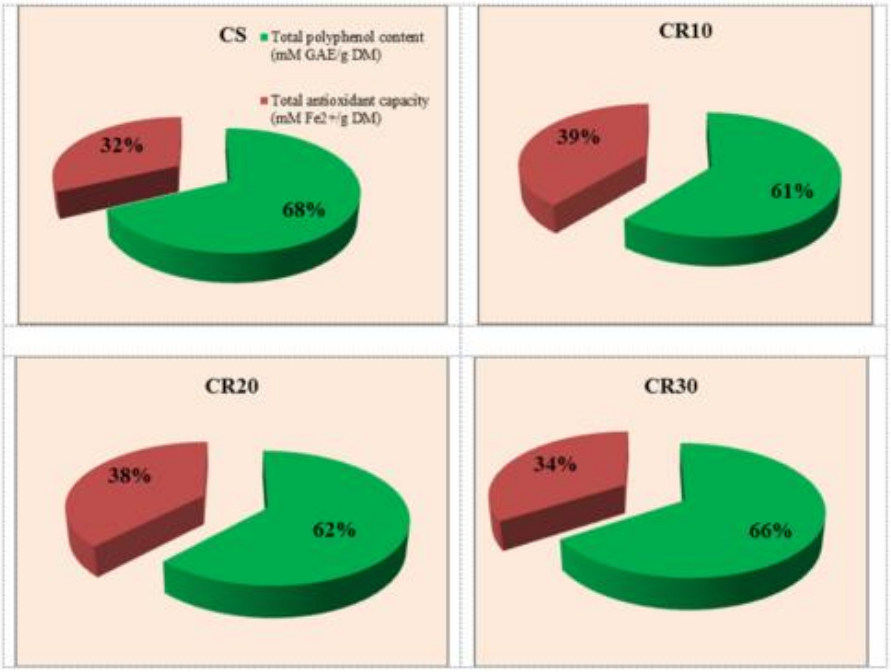

Figure 2. The percentage of antioxidant contents of some dietary chocolate specialties with raspberries

From statistical terms (Figure 2), the total antioxidant capacity and total polyphenol content are directly correlated to percentage of raspberries added in chocolate specialties.

4. Conclusion

The innovative character of these products consists in the organic ingredients quality used in the recipe.

Sugar has been replaced completely by a sweetener solution with a sweet extract from leaves the stevia *(Stevia rebaudiana).* Stevia extract does not compromising on the taste, texture and aroma of chocolate.

The increasing the percentage of raspberries causes a decrease in the antioxidant capacity associated with a lower content of total phenols.

We consider that by using the organic ingredients, with no sugar added chocolate we obtain high-quality chocolate specialties with high antioxidant properties.

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.

References

1. Belscak-Cvitanovic, A.; Komes, D.; Durgo, K.; Vojvodic, A.; Busic, A., Nettle (*Urtica dioica* L.) extracts as functional ingredients for production of chocolates with improved bioactive composition and sensory properties, *Journal of Food Science and Technology* **2015**, 52(12), 7723-7734, doi: 10.1007/s13197- 015-1916-y.
2. Ackar, D.; Valek Lendic, K.; Valek, M.; Subaric, D.; MiliIevic, B.; Babic, J.; Nedic, I., Cocoa polyphenols: can we consider cocoa and chocolate as potential functional food?, *Hindawi Publishing Corporation Journal of Chemistry* **2013**, Article ID 289392, 7 pages, http://dx.doi.org/10.1155/2013/289392.
3. SabithaRani, A.; Satyakala, M.; Murty, U.S.N, Stevia rebaudiana, bio-sweetener of the future: a review, *Asian Journal of Microbiology Biotechnology and Environmental Science* **2004**, 6, 453-460.
4. Goyal, S.K.; Samsher, Goyal, R.K., Stevia (*Stevia rebaudiana*) a bio-sweetener: a review, *International Journal of Food Sciences and Nutrition* **2010**, 61(1), 1-10, doi: 10.3109/09637480903193049.
5. Cardello, H.M.A.B.; Da Silva, M.A.P.A.; Damasio, M.H., Measurement of the relative sweetness of stevia extract, aspartame and cyclamate/saccharin blend as compared to sucrose at different concentrations, *Plant Foods for Human Nutrition* **1999**, 54(2), 119–129.
6. Gulcin, I.; Topal,F.; Cakmakc, R.; Bilsel, M.; Goren, C.A.; Erdogan, U., Pomological features, nutritional quality, polyphenol content analysis, and antioxidant properties of domesticated and 3 wild ecotype forms of raspberries (*Rubus idaeus* L.), *Journal of Food Science* **2011**, 76(4), C585-C593.
7. https://www.thefarmbetween.com/nursery/raspberries/
8. Cooper, K.A.; Campos-Gimenez, E.; Alvarez, D.J.; Nagy, K.; Donovan, J.L.; Williamson, G., Rapid reverse-phase ultra-performance liquid chromatography analysis of the major cocoa polyphenols and inter-relationship of their concentration in chocolate, *Journal of Agricultural and Food Chemistry* **2007**, 55, 2841-2847.
9. Benzie, I.F.F.; Strain, L., Feeric reducing ability of plasma (FRAP) as a measure of antioxidant power: The FRAP assay, *Analytical Biochemistry* **1996**, 239, 0-76.
10. Singleton, V.L.; Orthofer, R.; Lamuela-Raventos, R.M., Analysis of total phenols and other oxidation substances and antioxidants by means of Folin-Ciocalteu reagent, *Methods in Enzimology* **1999**, 299, 152-178.
11. Kostecka-Gugala, A.; Ledwozyw-Smolen, I.; Augustynowicz, J.; Wyzgolik, G.; Kruczek, M.; Kaszycki, P., Antioxidant properties of fruits of raspberry and blackberry grown in central Europe, *Open Chemistry* **2015**; 13: 1313–1325.
12. Wang, S.Y; Lin, H.S., Antioxidant activity in fruits and leaves of blackberry, raspberry, and strawberry varies with cultivar and developmental stage, *Journal of Agricultural and Food Chemistry* **2000**, 48(2):140-6.
13. Jalil Mhd A.M; Ismail, A., Polyphenols in cocoa and cocoa products: is there a link between antioxidant properties and health?, *Molecules* **2008**, 13, 2190-2219, doi: 10.3390/molecules13092190.
14. Urbanska, B.; Kowalska, J., Comparison of the total polyphenol content and antioxidant activity of chocolate obtained from roasted and unroasted cocoa beans from different regions of the world, *Antioxidants* **2019**, 8, 283, doi:10.3390/antiox8080283.