THE IMPORTANCE OF BEETROOT CONSUMPTION IN EVERYDAY LIFE

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Abstract

There is a growing worldwide demand for healthy foods, such as fruit and vegetables, including beetroot (*Beta vulgaris* L. ssp. *esculenta* convar. *crassa* provar. *rubra),* with its extremely valuable content. During the measurements (amino acids, betanin and vulgaxanthin, polyphenol content, antioxidant capacity), the peel and flesh of commercially available spherical and oblong morphology beets as well as 4 organic beetroot juices of different origins (some with additional components) were examined. Based on the results, it was established that carrot root and biojuices have different amino acid compositions. It has been proven that the peel of beets is extremely rich in valuable components, which is also worth considering when consuming. When examining beetroot juices, added supplements, e.g. lemon juice, have an influencing effect on the measured parameters.

Introduction

Beetroot (*Beta vulgaris* L. ssp. *esculenta* convar. *crassa* provar. *rubra)* belongs to the *Chenopodiaceae* family, which includes about 1400 species [1,2,3]. It is rich in nutritional components, e.g. vitamins C, B1, and B2, due to its minerals (Fe, Mg, Ca, K), valuable amino acids (e.g. cysteine, methionine, glutamic acid), significant folic acid content, polyphenolic compounds [4,5,6,7,8,9.] and other bioactive components (betanin, vulgaxanthin) [10], it has a very beneficial physiological effect, e.g. on cardiovascular diseases, colon cancer, Alzheimer's disease and the list could go on [11,12,13,14,15.]

Materials and methods

For measurements, spherical and elongated morphological beets (*Beta vulgaris* L. ssp. *esculenta* convar. *Crassa* Provar. *rubra)* and organic beetroot juices were used, obtained commercially, and the following markings were used during measurements (Table 1). The chemicals used were purchased from Sigma-Aldrich.

Analytical methods

Sample preparation

The beets were peeled, then the peel and carrot root were homogenised separately (amino acid determination) and lyophilised (analytical measurements). From the lyophilised samples, a 20 mg/ml solution was prepared with distilled water. The solutions were placed in a cooled ultrasonic water bath for 1 hour, then after centrifugation (6000 rpm, 20 min10°C), the clean supernatants were stored in a refrigerator at -32°C until measurements. There was no sample preparation for beetroot juices.

Table 1: Markings used in measurements

Marking	Meaning
CHK	Elongated beetroot peel
CHB	Elongated beetroot carcass
CGK	Spherical beetroot peel
CGB	Spherical beetroot carcass
C1	dm bio rote bete saft (100% beetroot juice)
C2	Nature's Blessing with Organic Beetroot Juice (99% beetroot juice, 1% lemon juice)
C3	Spar Natur Pur Bio Rote Rübe (100% beetroot juice)
C4	Biopont Organic beetroot juice (99% beetroot juice, 1% cherry puree)

Determination of amino acids: AAA 400 Automatic Amino Acid Analyzer operating on the principle of ion exchange column chromatography. Results are given in mg/kg.

The extraction of samples was done with 10% trichloroacetic acid during 1 h agitation on a shaker at room temperature. After filtration through a 0.2 µm pore membrane filter, the detection of samples was done by an automatic amino acid analyser (Ingos Ltd., Czech Republic) equipped with an Ionex Ostion LCP5020 cation exchange column. The Li^+-citric buffer system (Ingos Ltd., Czech Republic) was used for the stepwise separation of free amino acids.

Determination of total phenolic contents (TPC) by Folin-Ciocalteu method: The Folin-Ciocalteu spectrophotometric method by Singleton and Rossi [16], at 760 nm is an electron transfer based on assay and shows the reducing capacity, which is expressed as phenolic content. Gallic acid (GA) was used to prepare the standard curve. The results were expressed as µM GA/g of dry matter (DM).

Determination of antioxidant capacities by FRAP (Ferric Reducing Antioxidant Power) method: Measurement of ferric reducing antioxidant power of the peel extracts was carried out based on Benzie and Strain's procedure [17], at 593 nm. Ascorbic acid (AA) was used as a standard to prepare the calibration solutions. Results were expressed as µMAA/g DM.

Determination of betanin- and vulgaxanthin: by spectrophotometric method (λ = 476, 538, 600 nm) by Joachim [18]. Results were expressed as mg/g dry matter and mg/L.

Results and discussion

There is no significant difference between in the % distribution of the flesh and peel of different form beetroots (Table 2).

2. Table: Flesh-peel ratio of different varieties of beets

	Flesh %	Peel %
Long	84,80±1,89	14,88±1,85
Spherical	81,54±4,22	18,11±4,23

In total free amino acid content, the spherical and the C2 beetroot juice showed the best results (Figure 1). Based on the distribution of individual amino acids, cysteine and its precursor, cystathionine, are examined together, and based on the results, it can be stated that an average of 10.3 mg is contained in 1 kg of beetroot and 7.36 mg in 1 litre of beetroot juice.

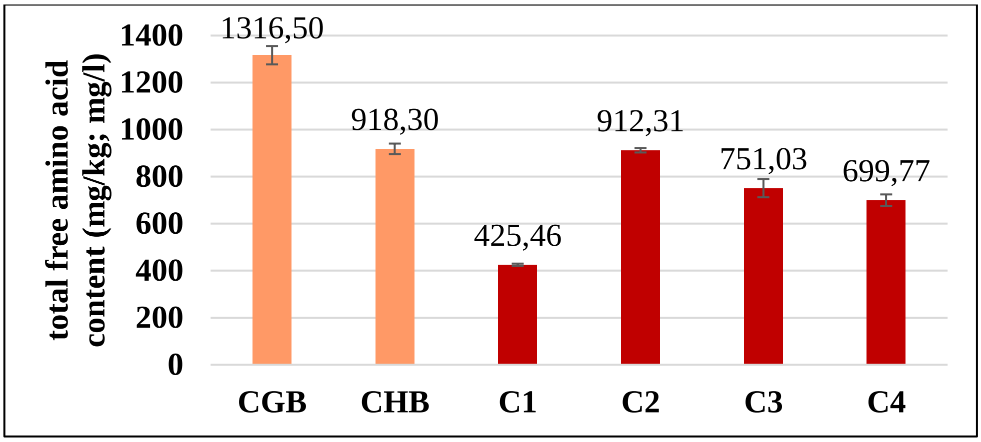
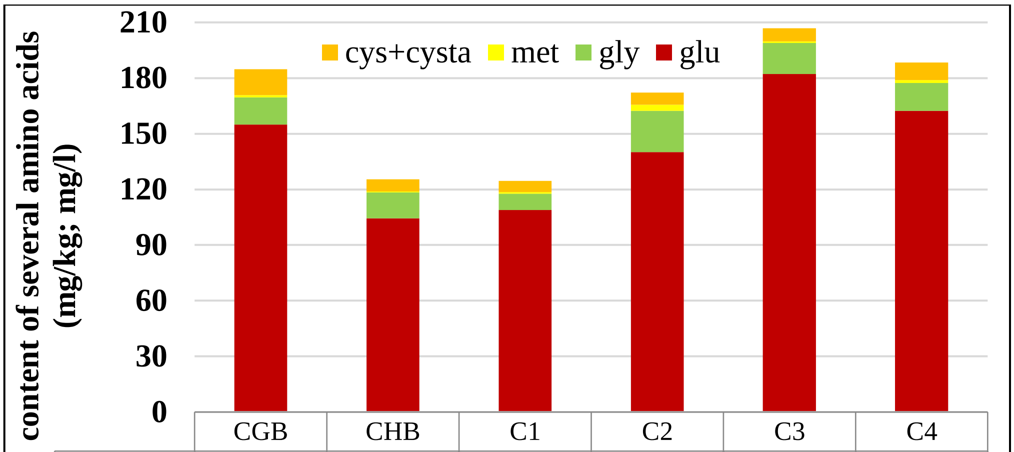


Fig. 1. Total amino acid content of beetroot beets and organic beetroot juices



	CGB	CHB	C1	C2	C3	C4
cys+cysta	14,113	6,476	6,127	6,647	7,087	9,596
met	1,195	0,547	0,821	3,274	0,853	1,409
gly	14,614	14,002	8,849	22,138	16,759	14,991
glu	154,927	104,374	108,820	140,166	182,100	162,428

Fig. 2. Distribution of some amino acids in beetroot beets and organic beetroot juices

Examining the data of individual amino acids statistically, it can be seen that during the examination of beets, only the glycine content of the samples does not show significant differences (p=0.298). In the case of beetroot juices, samples C3 and C4 differ the least in glutamic acid, glycine and methionine content (p=0.239; p=0.185; p=0.183), while in cysteine content, they show even less significant difference, as we did not notice any significant difference at 95% significance level in samples C1-C2 (p=0.723), C1-C3 (p=0.281) and C2-C3 (p=0.809).

When examining the total polyphenol content (Figure 3), it can be stated that there is no significant difference between the corresponding parts of the two samples in the polyphenol content measured in the beet root and measured in the peel. Still, there is also a significant amount in the peel, which must be taken into account during kitchen processing.

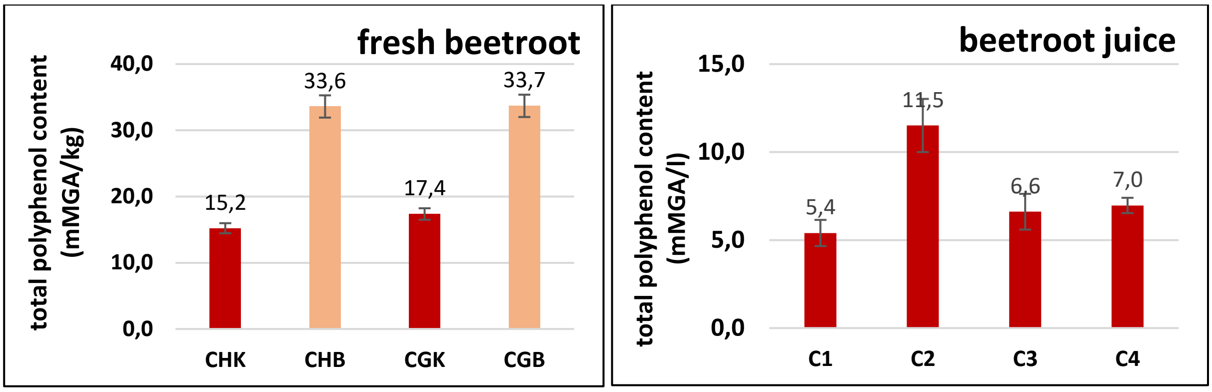


Fig. 3. Total polyphenol content of the various parts of beetroot and beetroot juices

In the case of organic beetroot juices, it can be stated that sample C2 has a significant polyphenol content compared to samples C1 (p=0.005), C3 (p=0.022) and C4 (p=0.028). This outstandingly high value can be attributed to the 1% lemon juice content.

Regarding the antioxidant capacity examined with FRAP (Figure 4), the carrot roots show a completely identical course as we saw for the polyphenol content.

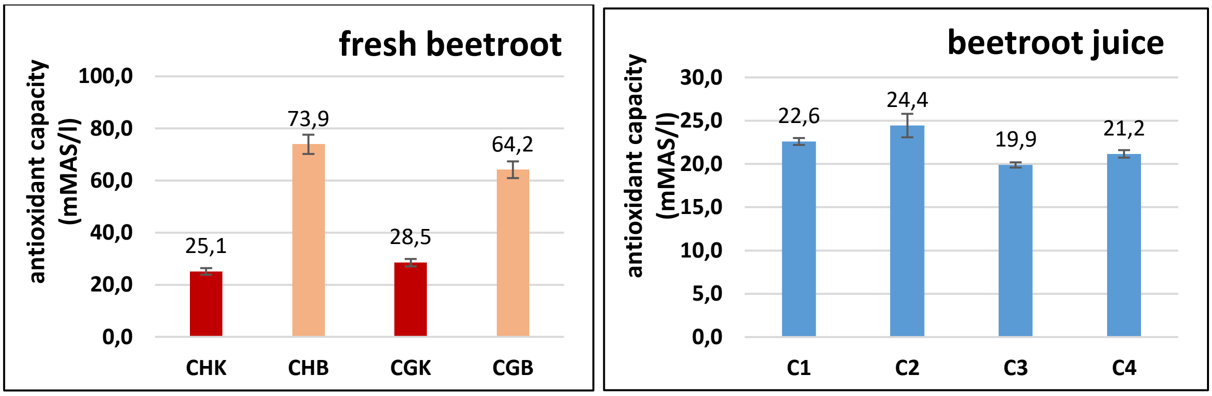


Fig. 4. Antioxidant capacity of beet carcasses and beetroot juices

In the case of beetroot juice (Figure 4), beetroot juices show balanced antioxidant capacity. Among the colouring substances, betanin is present in higher amounts in all samples (carrot root and organic beetroot juice), which in some cases can mean a 4-fold difference. The betanin content in peels is much higher, about twice as high as in carrot roots (Figure 5).

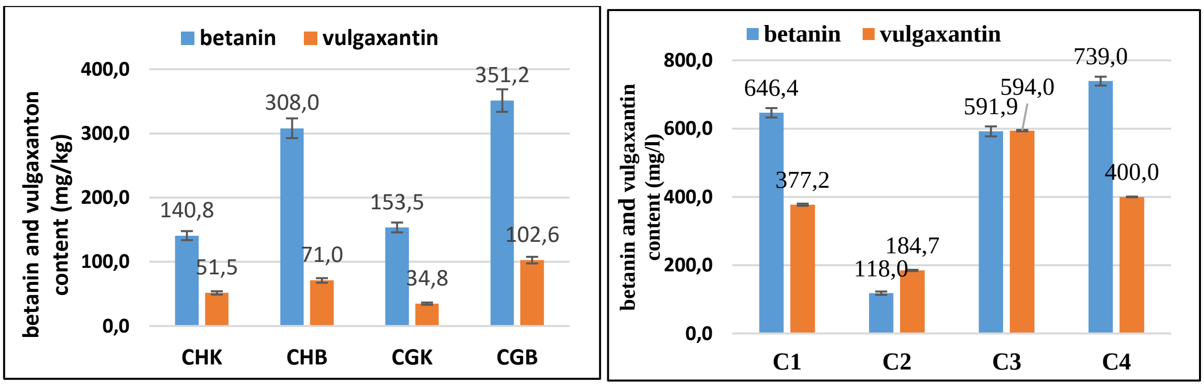


Fig. 5. The formation of betanin and vulgaxanthin in beet carcasses and beetroot juices.

Such a difference in vulgaxanthin content can not be observed; only in the case of the peel of the oblong beetroot sample an outstanding result can be observed. While in the case of peel, there was a significant difference between the measured values in the case of betanin ($p=0.017$) and vulgaxanthin ($p<0.001$) content, on the contrary, no significant difference was observed in the case of carrot roots ($p=0.079$; $p=0.228$). However, if we take into account the peel-to-flesh ratio as before, it can be seen that the carrot body of the round sample has the highest value, both in the case of betanin and vulgaxanthin content. This is followed by the beet fleshpeel of the long beetroot and then the peels, with values about half as large.

When examining organic beetroot juice samples (Fig. 4), interestingly, the C2 sample has the lowest value for the two colours, which is due to the dosed lemon juice.

Conclusion

During the examination of beetroot varieties and organic beetroot juices, it was proven that the peel of beets is extremely rich in valuable components, which should also be taken into account when consuming them and possibly incorporating them into our diet with proper processing. The study of organic beetroot juices showed that it is worth knowing the exact composition of the product at the time of purchase or before consumption since the added additives can significantly influence the individual favourable development of nutritional values.

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