

## DAILY INTAKE OF ANTHOCYANINS AND POLYPHENOLS PROVIDED BY THE CONSUMPTION OF BILBERRY-BASED JUICES

Darija Sazdanić, Mira Mikulić, Ljilja Torović,  
Jelena Cvejić, Milica Atanacković Krstonošić

University Novi Sad - Faculty of Medicine, Department of Pharmacy, Novi Sad,  
Serbia

Health benefits from bilberry consumption are mostly associated with presence of phenolic compounds, especially anthocyanins, which have antioxidant, anti-inflammatory and cardioprotective properties. As a result of many suggested health-promoting effects, fresh raw and commercially available bilberry juices are nowadays becoming a part of a healthy lifestyle. Therefore, the aim of this study was to examine anthocyanin and polyphenol composition of eight commercially available bilberry-based juices and to estimate daily intake of anthocyanins and polyphenols provided by the consumption of these juices. Six 100% bilberry juices, one 55% bilberry juice (with 35.1% of *Melissa officinalis* extract and 9.9% agave syrup) and one sample with 35% of bilberry pulp and 65% of apple juice were obtained from the market and subjected to analyses. The HPLC-UV method was employed in the quantification of phenolic compounds and anthocyanins. The daily intake of anthocyanins and polyphenols provided through consumption of target amount of bilberry-based juice (0.2 L/day; USDA recommendations) was calculated. Fifteen individual anthocyanins were determined. Glucosides and galactosides of malvidin and delphinidin as well as cyanidin-glucoside were predominant in the samples, with the concentrations up to 53 mg/L. A total of ten phenolic compounds, including phenolic acids, flavan-3-ol, flavonols, flavanon and stilbene, were detected in the analyzed bilberry juices. Phenolic acids accounted for more than 90% of total content of individual phenolics, with the chlorogenic acid being the most abundant in all samples, in the range from 49 mg/L to 487 mg/L. The concentration of flavan-3-ol catechin ranged between 0.7 mg/L and 6 mg/L while the content of predominant flavonol quercetin ranged between 0.8 mg/L and 12 mg/L in the samples. 100% bilberry juices are generally the most abundant in anthocyanins and polyphenols while the sample with only 35% bilberry contained the lowest concentration of the analyzed components. When the target daily juice intake is reached, bilberry juices investigated in our study provide the anthocyanin intake in the range from 0.3 mg/day to 63.5 mg/day, as well as the phenolics intake in the range from 13 mg/day to 106 mg/day. This study showed that commercially available bilberry-based juices can be important sources of various phenolic compounds and anthocyanins in a human diet. Moreover, the results indicate that juice selection greatly affects the intake of specific antioxidant compounds.

### References

1. Pires T, Caleja C, Santos-Buelga C, Barros L, Ferreira I. *Vaccinium myrtillus* L. fruits as a novel source of phenolic compounds with health benefits and industrial applications – a review. *Curr Pharm Des* 2020; 26: 1917-1928.
2. Konić-Ristić A, Šavikin K, Zdunić G, Janković T, Juranić Z, Menković N, Stanković I. Biological activity and chemical composition of different berry juices. *Food Chem* 2011; 125: 1412-1417.

## DNEVNI UNOS ANTOCIJANA I POLIFENOLA KOJI SE OBEZBEĐUJE UPOTREBOM SOKOVA NA BAZI BOROVNICE

**Darija Sazdanić, Mira Mikulić, Ljilja Torović,  
Jelena Cvejić, Milica Atanacković Krstonošić**

Univerzitet u Novom Sadu - Medicinski fakultet, Katedra za farmaciju, Novi Sad,  
Srbija

Zdravstvene koristi od konzumiranja borovnice uglavnom su povezane sa prisustvom fenolnih jedinjenja, a posebno antocijana, koji ispoljavaju antioksidativna, antiinflamatorna i kardioprotektivna svojstva (1). Zahvaljujući brojnim pozitivnim efektima koje borovnica ima na zdravlje ljudi, sveži i komercijalno dostupni sokovi od borovnice postali su sastavni deo zdravog načina života (2). Stoga, cilj ove studije je bio određivanje sadržaja pojedinačnih antocijana i polifenola u komercijalno dostupnim sokovima na bazi borovnice, kao i procena dnevnog unosa antocijana i polifenola, koji se obezbeđuje upotrebom ovih sokova. Analizirano je osam uzoraka komercijalno dostupnih hladno ceđenih sokova borovnice: šest uzoraka je sadržalo 100% sok borovnice, jedan uzorak je imao 55% soka borovnice (35,1% je činio ekstrakt *Melissa officinalis* i 9,9% agavin sirup) i jedan uzorak 35% kaše borovnice i 65% soka jabuke. HPLC-UV metoda je korišćena za kvantitativnu analizu pojedinačnih antocijana i polifenola. Dnevni unos antocijana i polifenola kroz sokove na bazi borovnice je izračunat na osnovu preporučenog unosa prirodnog soka (0,2 l/dan; preporuke USDA). U uzorcima je određeno 15 pojedinačnih antocijana. Najzastupljeniji antocijani su glukozidi i galaktozidi malvidina i delfinidina, kao i cijanidin-glukozid, sa koncentracijama do 53 mg/l. U sokovima je određeno ukupno deset fenolnih jedinjenja, uključujući fenolne kiseline, kao i jedinjenja iz grupa flavan-3-ola, flavonola, flavanona i stilbena. Fenolne kiseline su činile više od 90% ukupnog sadržaja pojedinačnih fenolnih jedinjenja, pri čemu je hlorogenska kiselina najzastupljenija u svim uzorcima, sa koncentracijom od 49 mg/l do 487 mg/l. Koncentracija flavan-3-ola katehina je bila između 0,7 mg/l i 6 mg/l, dok se sadržaj najzastupljenijeg flavonola, kvercetina, kretao između 0,8 mg/l i 12 mg/l. 100% sokovi borovnice generalno sadrže najveće koncentracije antocijana i polifenola, dok je uzorak sa 35% kaše borovnice sadržavao najmanju koncentraciju analiziranih komponenti. Kada bi unos prirodnog soka borovnice bio jednak preporučenim vrednostima, obezbedio bi se unos antocijana od 0,3 mg/dan do 63,5 mg/dan, kao i unos polifenola u rasponu od 13 mg/dan do 106 mg /dan. Ova studija je pokazala da komercijalno dostupni sokovi na bazi borovnice mogu biti značajni izvori različitih polifenola i antocijana u savremenoj ishrani ljudi. Pored toga, rezultati pokazuju da odabir soka u velikoj meri utiče na unos pojedinih antioksidanasa.

### Literatura

1. Pires T, Caleja C, Santos-Buelga C, Barros L, Ferreira I. *Vaccinium myrtillus* L. fruits as a novel source of phenolic compounds with health benefits and industrial applications – a review. *Curr Pharm Des* 2020; 26: 1917-1928.
2. Konić-Ristić A, Šavikin K, Zdunić G, Janković T, Juranić Z, Menković N, Stanković I. Biological activity and chemical composition of different berry juices. *Food Chem* 2011; 125: 1412-1417.