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ROMANIAN WALNUTS, SOURCE OF IMPORTANT NUTRIENTS

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Abstract

Walnut is a good source of macronutrients and micronutrients and other bioactive substances. Romania presents a long tradition being one of the leading walnut producers of EU. The aim of the study was to evaluate the mineral content and total polyphenols of the Romanian walnuts kernel originated from Banat region (western Romania). The study results show that the analyzed walnuts samples presents a high content of minerals (average value) like: potassium (404.50 mg/100 g kernels F.W.), magnesium (221.17 mg/100 g kernels F.W.), manganese (6.12 mg/100 g kernels F.W.), iron (3.67 mg/100 g kernels F.W.) and copper (2.28 mg/100 g kernels F.W.), but also high levels of total polyphenols 9.19 mg GAE/ g nuts kernel extract. Based on mineral composition and polyphenols content a database can be created for walnuts fingerprint profiles that can be used to identify the origin of undeclared walnuts cultivars.

Keywords: Juglans regia L., polyphenols, minerals, fingerprint

INTRODUCTION

Among common foods and beverages, nuts are one of the most important sources of polyphenols, therefore, their effect on human health draws attention. In 2017, Romania was the leading walnut producer in the European Union and among the world's top-ten producers (FAS Europe Offices). The main production regions are in the Carpathian Mountains, as well as northwestern, northeastern, and southern regions of Romania. (https://agfstorage.blob.core.windows.net/misc/FP_com/2019/04/05/Nuts00 2.pdf)

Walnut is a good source of macronutrients and micronutrients and other bioactive substances. The nut kernel contains 15.8% protein, 13.7% carbohydrate, 4.1% water and 1.8% ashes (NUTS and HEALTH).

Nuts contain relevant micronutrients, such as folic acid, niacin and vitamins E and B6, gamma tocopherol, choline, and minerals such as magnesium, copper, zinc, selenium, phosphorus and potassium (USDA Database). They are also an excellent source of flavonoids, pectic substances, sterols, polyphenols and phenolic acids (TABASUM F., UMBREEN S. and HUSSAIN, S. Z., 2018).

Walnuts have well-known properties of antioxidant and antiinflammatory bioactivity and several studies have evaluated the potential role of walnuts against cancer, cardiovascular and neurodegenerative diseases. Walnut kernels represent a high source of protein, fat, vitamins, minerals and polyphenols, which makes them indispensable for human nutrition. The diet that involves regular consumption of walnuts is associated with a reduced risk for both fatal coronary heart disease and nonfatal myocardium, heart attack (CHRZANOWSKI et al, 2011).

Other results showed that people who consumed nuts five or more times a week had a 50% lower risk of coronary heart disease compared to those who never consumed nuts (DAVIS et al, 2007).

Although walnuts are high in fat, a diet supplemented with nuts has a beneficial effect on blood lipids, lowering blood cholesterol and lowering the ratio of serum concentrations of low-density lipoproteins: high-density lipoprotein by 12%. Nuts contain about 10% α -linolenic acid that has been associated with an antithrombotic effect. Other benefits of walnuts include high magnesium, copper, folic acid, protein, potassium, fiber and vitamin E (TABASUM F., UMBREEN S. and HUSSAIN, S. Z., 2018).

The Romanian walnut varieties present rich mineral composition, especially high content of potassium, phosphorus, magnesium and iron (COSMULESCU et al, 2009).

Walnuts contain about 65% fat by weight, which makes them dense and calorie rich. However, even though nuts are high in fat and calories, studies specify that they do not increase the threat of obesity when replacing other foods in the diet. (https://www.healthline.com/nutrition/foods/walnuts)

The aim of the study was to generate the fingerprint of the analyzed walnuts assortments cultivated in Banat region, based on mineral and polyphenols content

MATERIAL AND METHODS

The walnuts kernels used for the study investigation were sampled from different private producers from Banat region. All the weighed samples were dried at 105 °C and grinded. The mineral content were determined by flame atomic absorption spectrometry as described by Bordean et al, 2014. All analysis were performed in triplicate (BORDEAN, et al, 2014).

The determination of the total content of polyphenols is based on the Folin Ciocalteau method. Spectrophotometric reading of the absorbance is performed at 750 nm after 2 hours of reaction. A calibration curve was constructed using gallic acid as standard, as described by Figueroa et al, 2016 and total polyphenols content (Pph) was expressed as milligrams of

gallic acid equivalents (GAE) per gram walnuts extract. The extraction was performed with 50% ethanol solution (FIGUEROA et al, 2016)

All reagents were of Ultra pure grade.

Statistical analysis

The statistical evaluation of the experimental data was done using MVSP 3.22 and PAST 2.14 software. (HAMMER et al, 2001)

The Simple linear correlation is used as a method to evaluate the degree to which two variables vary together, or a measure of the strength of the association between two variables. (https://www.ndsu.edu/faculty/horsley/Corr_revised.pdf)

The correlation coefficient "r" appreciates "the strength and direction of a linear relationship between two variables on a scatterplot" (RUMSEY et al, 2016)

RESULTS AND DISCUSSION

Table 1 shows that the mineral elements form the series: K> Mg> Mn> Fe> Cu, depending on their content in the walnut kernel, which is confirmed, also , by the research of Boaghi. 2018. (BOAGHI E., 2018).

Table 1.

Walnut	Pph	Minerals					
samples	[mg GAE/	[mg/100 g nuts kernel F.W.]					
	g nuts	K	Mg	Fe	Cu	Mn	
	kernel						
	extract]						
WA1	7.79 ± 1.13	435 ± 2.26	191 ± 2.16	3.12 ± 0.15	1.88 ± 0.12	4.23 ± 1.12	
WA2	9.67 ± 1.35	357 ± 2.53	251 ± 1.88	3.45 ± 1.19	2.89 ± 0.88	7.63 ± 1.64	
WA3	9.82 ± 1.88	389 ± 2.66	247 ± 1.08	3.61 ± 0.84	2.31 ± 0.57	4.56 ± 2.05	
WA4	9.98 ± 1.65	410 ± 2.19	263 ± 1.75	4.10 ± 0.77	1.98 ± 0.55	7.42 ± 1.17	
WA5	9.19 ± 1.03	441 ± 1.56	201 ± 2.13	3.85 ± 1.27	2.05 ± 1.05	5.99 ± 1.66	
WA6	8.69 ± 1.12	395 ± 1.79	174 ± 3.22	3.90 ± 0.85	2.55 ± 1.84	6.87 ± 1.58	

Mineral composition and polyphenol content of studied walnut kernel samples

Legend: WA1, WA2, WA3, WA4, WA5, WA6 – walnut samples from Banat region; Pph = total polyphenol content, mg GAE = milligram Gallic Acid Equivalent; F.W. = fresh weight

Based on the linear correlation r of the experimental data, presented in table 2 we can affirm that both minerals, K and Mg present strong positive relationship with Fe, while Mg shows also, high positive relationship with Cu and moderate correlation with Mn. Pph shows moderate positive relationship with Cu. Applying the graphic fingerprint profiling using MVSP we can observe that WA1 (using mineral and Pph content values) can be used as a basis to describe the mineral composition of the walnuts cultivated in the western part of Romania, WA2-WA6 presenting similar trend and small variations (Figure 1).

Table 2

0	Pph	K/10	Mg/10	Fe	Cu	Mn
Pph	0	0.30227	0.035992	0.22862	0.54936	0.3092
K/10	-0.50915	0	0.33118	0.96319	0.015212	0.33034
Mg/10	0.84082	-0.48357	0	0.72815	0.78382	0.54967
Fe	0.57893	0.024543	0.18328	0	0.9468	0.21997
Cu	0.3104	-0.89753	0.14514	-0.03548	0	0.28611
Mn	0.50294	-0.4843	0.31016	0.58767	0.52384	0

The linear correlation	n r of the ex	xperimental	data
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Fingerprint (Figure 2) relay usually on spectroscopic analysis and when it to compare and interpret huge amount of data or to identify the origin of different analysed product samples. The data of samples of unknown origin can be compared with the profiles existing in the database for simplifying the identification (BRERETON, 2013)



Fig. 1. Walnuts fingerprint profile based on Pph and mineral composition
Legend: WA1, WA2, WA3, WA4, WA5, WA6 – Walnut samples from Banat region; Pph
= total polyphenol content [mg GAE/ g nuts kernel extract], mineral composition =
concentration of K, Mg, Fe, Cu, Mn [mg/100 g nuts kernel F.W.]



Fig. 2. Banat Region Walnut Fingerprint based on mineral composition and total polyphenol content

Legend: WA1, WA2, WA3, WA4, WA5, WA6 – Walnut samples from Banat region; Pph = total polyphenol content [mg GAE/ g nuts kernel extract], mineral composition = concentration of K, Mg, Fe, Cu, Mn [mg/100 g nuts kernel F.W.]

CONCLUSION

Romanian walnut samples represent a high source of minerals and polyphenols, which recommend them for daily use. The polyphenol content of the analyzed walnut samples is very high. There are possibilities to identify the origin of undeclared walnuts cultivars based on fingerprint profiles and fingerprints database, which reduces the number of timeconsuming analysis.

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