

MINERAL COMPOSITION OF WALNUT KERNEL AND WALNUT OIL CAKE

Carolina GROSU,
Academia de Studii Economice a Moldovei
e-mail: gcarol@mail.ru

Walnuts are extremely nutritious. Concerning minerals walnuts are a source of calcium, magnesium, and potassium, which are part of their benefits to the cardiovascular system. This study was conducted to evaluate the mineral concentration of Walnut (*Juglans regia L*) and walnut oil cake. The walnuts of Călărași variety was used in this study. Mineral levels were analyzed by Atomic absorption spectroscopy. The mineral contents of walnut and walnut oil cake were K (356,6/528,3), Na (1,33/1,65), Mg (146,6/268,1), Ca (136,1/248,9) Fe (7,09/8,59), Zn (2,91/5,25), Cu (1,56/2,96) mg/100g respectively. There are high amounts of K, Na, Mg, Ca, Fe, Zn, and Cu in Walnut kernel and oil cake so that these products have high nutritional value and their daily consumption can supply some of the needed dietary mineral intake.

Keywords: walnut kernel, walnut oil cake, minerals, Atomic absorption spectroscopy.

Introduction

The walnut fruits grown in our country come into a large morphological variety in terms of size, shape, color, valve surface, thickness, hardness, endocarp ornamentation etc. Walnuts are considered to be a good source of dietary minerals [3]. They are known to be excellent source of nutrients such as minerals and vitamins. The walnut oil cake is a byproduct obtained after oil pressing process. Growing interest in technologies of identifying and quantifying by-products is due to the desire to understand and monitor environmental waste in developed and developing countries. Not much yet has been published on walnut oil cake as a by-product. One of the objectives of the study is to evaluate the mineral content of walnut oil cake.

Analysis of micronutrients in foods, a prominent area in food chemistry, is of great interest not only regarding nutrition but also regarding the commercial aspects. Mineral ions are of prime importance in determining the fruit nutritional value. Potassium, calcium, and magnesium are the major ones. The importance of minerals such as potassium, calcium, sodium etc. to human health is well known. Required amounts of these elements must be in human diet to pursue good healthy life [5]. In this study the main objective is to determine the mineral composition in walnut kernel and walnut oil cake from Moldova.

Materials and methods

Plant material

Walnut fruits were collected in Moldova. Healthy and disease free fruits selected and dried them under shade so as to prevent the decomposition of chemical compounds present in them. Walnut oil cake was obtained after the cold pressing process. All the dried material powdered for further study.

Atomic absorption spectrometry

The contents of mineral elements, including zinc, calcium, magnesium, potassium, sodium, iron and copper in walnut kernel and oil cake lines were determined by flames atomic absorption spectrometry (FAAS), after dry ashing of the samples. Each ash sample was transferred quantitatively into a conical flask and dissolved in 10 ml of 3 N HCl and the mixture was heated on a hot plate. The solution was then filtered into a 100 ml volumetric flask and made up to the mark with distilled water. The mineral contents (K, Na, Ca, Mg, Fe, Zn, and Cu) of the solutions were determined using atomic absorption spectrophotometer.

Results and discussion

Nuts contain significant amounts of essential micronutrients that are associated with an improved health status when consumed at doses beyond those necessary to prevent deficiency states. Minerals have pivotal roles in human health. They provide structure in forming bones and teeth, helping to maintain normal heart rhythm, muscle contractility, neural conductivity, and acid-base balance [3]. They regulate cellular metabolism by becoming part of enzymes and hormones that modulate cellular activity. There have been numerous studies on the analysis of micronutrient levels of nuts in some countries such as USA, Spain, China, Turkey and Romania. In table 1 are presented some data concerning mineral content in walnuts fruits.

Table 1
Copper, iron and zinc content (mg/100 g) in walnuts, according to different authors and food composition tables

Mineral	Region	Republic of Moldova [obtained results]	Romania[6]	Turkey [3]	UK [2]	USA [1]
K		356,3	414,6	462,7	328,0	441,0
Na		133	6,74	4,5	2,0	2,0
Mg		146,6	216,6	108,9	132,0	158,0
Ca		136,1	61,9	110,8	108,0	98,0
Cu		1,56	2,2	0,4	0,1	1,6
Fe		7,09	4,6	3,2	2,9	2,9
Zn		2,91	2,6	2,6	2,7	3,1

The presented data show that the mineral elements content is different from a region to another, these differences of cultivars minerals may be due to growth conditions, varieties, genetic factors, harvesting time, soil properties, geographical variations and analytical procedures [4].

Minerals are required for every function, from activating muscles and nerves, to digestion, energy production and all healing and body regeneration. Fe is an important element in hemoglobin, myoglobin, and a large number of enzymes; therefore it is an essential mineral in daily diet. About 30% of iron in human body is as the storage form or ferreting and just a small level is associated with blood transport protein transfer. Zn as an essential element is a constituent of metabolic enzymes.

According to the specialty researches in others regions [3, 2, 1, 6], the order of mineral content in walnut kernel ($K^+ > Mg^{+2} > Ca^{+2}$) is the same as the obtained values for Moldavian walnut kernel. The values concerning Na^+ , Fe^{2+} , Zn^{+2} , Cu^{+2} are different if we compare them with Moldavian walnuts analyzed. For Romanian and Turkish walnut kernel the Na^+ content is higher than Fe^{2+} while for USA, UK and Moldova the Fe^{2+} content exceeds the same value for Na^+ .

Comparing the data presented above (table 1) and the obtained results is obvious that Moldavian walnuts have a very high content of potassium and magnesium surpassing the values of the same minerals in walnuts growing in other regions. Calcium, iron and zinc also exist modestly. They also contain small amounts of cuprum and sodium as well.

In the current study the mineral contents of Moldavian walnut kernel and walnut oil cake were analyzed by using atomic absorption technique. The sequence of mineral contents in the two products was $K^+ > Mg^{+2} > Ca^{+2} > Fe^{2+} > Zn^{+2} > Cu^{+2} > Na^+$. The values concerning mineral contents in walnut kernel and oil cake are presented in table 2.

Table 2

Walnut kernel and walnut oil cake mineral content, mg/100g product

Product Mineral	Content, mg/100 g product		
	Moldavian walnut oil cake	Moldavian walnut kernel	USDA
K	528,3±31,69	356,3±21,3	441
Na	1,65±0,09	1,33±0,07	2
Mg	198,8±11,92	146,6±8,7	158
Ca	180,9±10,8	136,1±8,1	98
Fe	8,59±0,51	7,09±0,42	2,91
Zn	3,79±0,22	2,91±0,17	3,1
Cu	1,96±0,11	1,56±0,09	1,6

The obtained results about the walnut kernel and walnut oil cake showed that there is a difference between mineral content values of studied two products. The difference is due to passage of minerals in oil during the pressing process. However the oil cake is still a rich source of minerals and can be used as a supplementation product.

Conclusions

Walnut kernel and oil cake samples analyzed have recorded rich mineral composition. The mineral elements content was different in kernel and oil cake, being higher in walnut kernels. The reduced value of minerals in oil cake can be explained by mineral passing in oil during the pressing process. The data reported in this paper confirmed that walnuts were a rich source of important nutrients that would be very beneficial to human health.

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