Pol. J. Appl. Sci., **2018**, *4*, 47-50

LABELLED AND ANALYTICALLY DETERMINED NUTRITIONAL VALUE OF NUTS

Klaudia Kulik[1], Bożena Waszkiewicz-Robak[2]

[1] *Faculty of Human Nutrition and Consumer Sciences*
Warsaw University of Life Sciences, Warsaw, Poland
[2] *Faculty of Computer Science and Food Science*
Lomza State University of Applied Sciences, Lomza, Poland

E-mail: bwaszkiewicz@pwsip.edu.pl

Abstract: This paper compares the content of basic nutrients in various edible nuts available in the marketplace. The content of these nutrients was also determined analytically. The analytically determined fat content was similar to the declared values for three types of nuts (macadamia nuts, walnuts and hazelnuts), and in case of the other four types such correlation was not obtained. Among the seven types of nuts tested, five met the declared protein content, and the other two types of nuts (walnuts and hazelnuts) were characterized by a lower protein content than the values declared on the label. From the consumer's point of view, the energy value of nuts, resulting mainly from fat content, is important. In this respect, nuts can be divided into two groups: containing more than 55% fat (brazil nuts and pine nuts, hazelnuts and walnuts) and containing less than 50% fat (macadamia and cashews and pistachios). Virtually all the nuts tested can be considered a good source of vitamin E, thiamine (vitamin B_1) and magnesium. Pine nuts, pistachios and Brazil nuts proved to be the best sources of iron. The quite high content of phosphorus in all types of nuts should be noted as its presence in a diet is quite controversial.

Key words: nuts, nutritional value, energy value, analytical value, declared value.

DOI: 10.34668/PJAS.2018.4.2.01

Introduction

Nuts are mainly known as a high-energy product with high fat and protein content. However, from the nutritional point of view they also contain many other important nutrients, such as: magnesium, fiber, α-linolenic acid, l-arginine, antioxidants and mono-unsaturated fatty acids (MUFA) [1]. Nuts which are an inseparable part of traditional food patterns in many regions of the world are increasingly becoming an important factor that can significantly reduce the risk of developing diseases of affluence [2,3]. For this reason, they are increasingly often chosen and consumed by consumers.

Most consumers claim that nuts are an unhealthy snack containing too much fat. At the same time, however, their health-related effects related to the content of various bioactive components are increasingly discussed [4].

Many consumers indicate that they learn about the nutritional value of food products from information on the labels of individual packages [5]. Therefore, it is very important that this information is reliable and supported by analytical data.

The purpose of this study was to compare the basic nutritional value of various edible nuts listed by producers on the labels of individual packages with the values analytically determined by physico-chemical methods.

Material and methods

The research material consisted of seven types of nuts which were available in July 2016 in supermarkets located in Warsaw and Lomza. The nuts were labelled with the country of origin. The nuts were: pistachios (Greece), walnuts (Poland), brazil nuts (Bolivia), cashews (India), macadamia nuts (Australia), hazelnuts (Georgia) and pine nuts (China). The information given by the producers on the labels of unit packages was analyzed. In addition, the content of macronutrients was determined, such as: protein (as total nitrogen, conversion factor 6.25) [6], fat [7], water [8], total minerals – as total ash [9].

The analyses were carried out in the chemical analysis laboratory at the Lomza State University of Applied Sciences. Statistical analysis of the results was performed using the STATGRAPHICS Plus 5.1 computer program. The mean values and standard deviations (SD) were calculated, and the analysis of variance was performed by a group homogeneity test which assumed a level of significance $p = 0.05$

Results and discussion

Fig. 1 presents a graphic interpretation of a one-way analysis of variance determining the impact of the type of nuts on the content of basic nutrients, i.e. the total content of water, protein, fat and minerals. The presented data in-

dicate a significant differentiation of all nuts in terms of content of these macronutrients in a pictorial way.

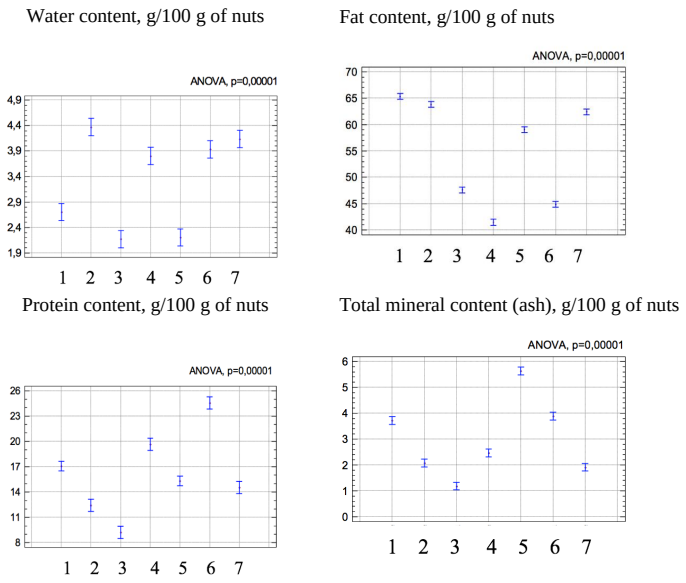

Fig. 1: Graphical interpretation of the one-way analysis of variance determining the influence of the type of nuts on the content of basic nutrients (Type of nuts: 1 – Brazil nuts, 2 – Hazelnuts, 3 – Macadamia nuts, 4 – Cashews, 5 – Pine nuts, 6 – Pistachios, 7 – Walnuts).

The highest fat content was found in Brazil nuts, walnuts and hazelnuts (over 60%). The lowest content was found in cashews, pistachios and macadamia nuts (less than 50%). The protein content ranged from 9.2g to 24.5g/100g. The lowest amount of protein was found in macadamia, pine nuts and Brazil nuts and significantly higher in pistachios, walnuts and hazelnuts. The total mineral content ranged from 1.2% (for macadamia nuts) to 5.6% (for pine nuts). Similar contents of ash characterized both walnuts and hazelnuts (about 2%) as well as Brazil nuts and pistachios (about 3.8%). Total ash content in other nuts was significantly different. Pine nuts, macadamia nuts and Brazil nuts contained significantly less water (about 2%), while the remaining nuts contained more than 3.5% water.

Table 1 shows the energy value of 100 g nuts. It is similar for all types and varies from 596 to 718 kcal (from 2472 to 3006 kJ).

The content of dietary fiber varies in nuts from 3 to 8.9 g / 100 g (according to the manufacturer's label) – Table 3.

Table 2 summarizes the content of selected vitamins and minerals in various nuts. The data indicate that nuts are a good source of vitamin E, thiamine, folic acid and such minerals as: phosphorus, iron, magnesium and zinc. These values were converted into percentage of the daily requirements for these components after ingesting 100 g of nuts (Table 3).

Ingestion of 100g of nuts fulfills the requirement for vitamin E in 32% in case of hazelnuts, 50% in case of cashews,

Table 1: Energy value and content of dietary fiber in edible nuts based on information declared on labels of unit nuts.

Type of nuts	Energy value for 100 g		Dietary fiber [g/100g]
	kJ	kcal	
Pistachio	2513	606	6,1
Walnuts	2751	666	6,5
Brazil nuts	2870	696	6
Cashews	2474	596	3
Macadamia nuts	3006	718	8
Hazelnuts	2794	666	8,9
Pine nuts	2672	637	3,7

Table 2: The content of vitamins and minerals in 100 g of various nuts based on information declared on the labels of unit nuts.

Vitamins and minerals	The content in 100 g of nuts						
	Hazelnuts	Pine nuts	Macadamia nuts	Cashews	Brazil nuts	Walnuts	Pistachios
Vitamin E, mg	38,7	9,3	0,5	6,0	0,7	2,6	5,2
Thiamine, mg	0,3	0,4	0,7	0,6	0,6	0,39	0,82
Folic acid, µg	72,0	34,0	11,0	22,0	25,0	66,0	58,0
Calcium, mg	186,0	16,0	70,0	175,0	40,0		135,0
Phosphorus, mg	333,0	575,0	190,0	700,0	500,0	332,0	500,0
Iron, mg	3,4	5,5	3,5	2,8	6,0		6,7
Magnesium, mg	140,0	251,0	125,0	350,0	260,0	99,0	158
Zinc, mg	2,44	6,4	1,3	4,5	5,4	2,72	-

Source: Own study based on information contained on the label

Table 3: Percentage of realization of the recommended daily norm for vitamins and minerals after the consumption of 100 g nuts.

Vitamins and minerals	Realization of daily requirement (%) after consumption of 100 g of nuts						
	Hazelnuts	Pine nuts	Macadamia nuts	Cashews	Brazil nuts	Walnuts	Pistachios
Vitamin E, mg	32	7	4	50	6	22	43
Thiamine, mg	27	37	64	55	55	35	75
Folic acid, µg	36	20	6	11	13	33	29
Calcium, mg	23	2	9,0	22	5		17
Phosphorus, mg	48	82	27	100	71	47	71
Iron, mg	24	39	25	20	43		48
Magnesium, mg	37	66	33	93	69	26	42
Zinc, mg	24	64	13	45	54	27	

43% pistachios and 22% walnuts. Other nuts contain small amount of this vitamin. It can be assumed that all the analyzed nuts are a good source of thiamine (B1), providing 27 to 75% of its daily requirement after ingesting 100g. Nuts are also a very good source of magnesium ensuring the fulfillment of daily requirements in the amount of 33 to 93% depending on the type of nuts (Table 3).

Figures 2-4 compares the content of protein, fat and carbohydrates according to the manufacturers' labels and their analytical determination. The data indicate that in the case of protein and fat, the information on the labels was often different from the values determined analytically (Fig. 2 and 3). However, the biggest discrepancies were found in the total carbohydrate content (Fig. 4).

The analytically determined fat content was similar to the declared content in case of macadamia nuts, walnuts and hazelnuts (Fig. 2). However, a significant difference was observed in the fat content of pine nuts, which contained 9.4% less fat than compared to the declared value. In cashews (by approx. 5%), in pistachios (by approx. 3.5%) and

in brazil nuts (by approx. 2%) there was less fat than indicated on the label.

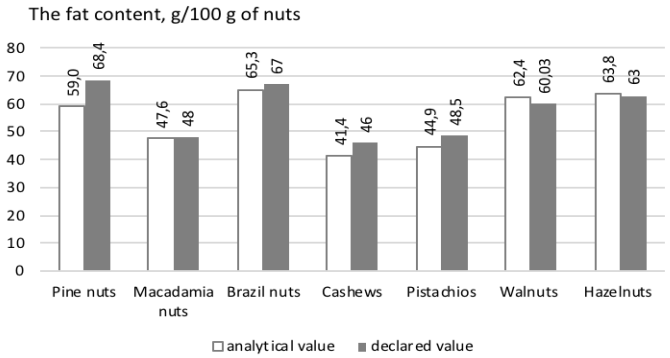

Fig. 2: Comparison of fat content in various nuts declared on the labels by the producers and determined analytically.

Among the seven types of nuts tested, five satisfied the declared protein content (the analytically determined content was about 1-4% higher than the information given on the label), while the two types of nuts (walnuts and hazelnuts) were characterized by lower value of analytically determined protein than declared on the label (Fig. 3).

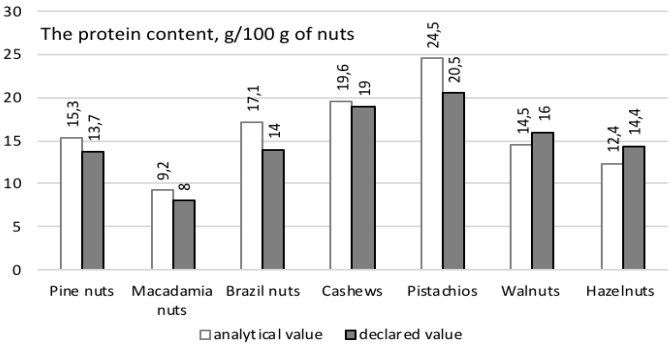

Fig. 3: Comparison of protein content in various nuts declared on the labels by the producers and determined analytically.

In case of carbohydrates (Fig. 4), in each type of nut, the declared value was significantly lower than the findings, which should not raise any concerns from the point of view of accurately informing consumers about the content of nutrients. However, in the case of macadamia nuts, the difference between the analytically determined and the manufacturer's labelled amount was too great (it amounted to as much as 34.9g/100 g), which in turn may be regarded as misleading the consumer. A fairly large difference between the value determined analytically (32.6%) and on the manufacturer's label (9%) was also observed in the case of cashews. Also, hazelnuts were characterized by a significant difference in the provided and established values.

Nutrition-labeled food products should contain at least as much of the given nutrient as is declared on the label. For

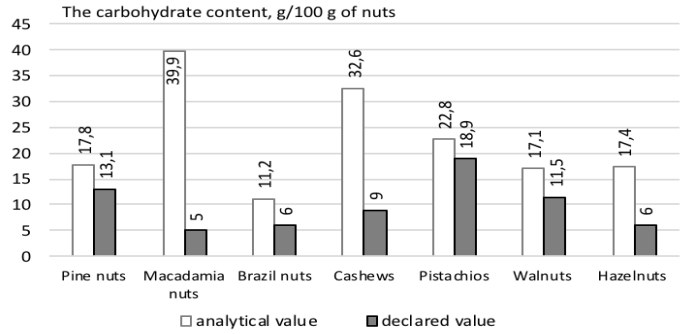

Fig. 4: Comparison of the total carbohydrates content in various nuts declared on the labels by the producers and marked analytically.

safety, the content of each analytically determined component should be slightly higher than the declared content, so that during storage there will be no changes in the nutritional density resulting, for example, from the process of the product drying. The lower content determined analytically than declared on the label should not take place in case of nutrients.

The basic reason for obtaining different content of basic nutrients in nuts (water, protein, carbohydrates, fat or ash) is their specie, type, variety of nuts as well as geographical origin [10–12]. The analyzed walnuts are an example as they contain about 60% fat, but the published data shows that depending on the variety, the place of growth or hydration status, this value can range from 50 to 70% [13]. The protein content of nuts is also very varied depending on the variety. According to studies conducted in this inquiry, pine nuts contain about 15% of protein, and according to studies by Evaristo et al. [14], these values can reach up to over 30%.

The differences in the basic composition of nuts may also depend on agricultural practices, genotype and soil quality [15]. The harvesting date (nut maturity level) also affects the nutrient content of nuts. An example of this may be research on four varieties of pistachio nuts, which were collected at weekly intervals between August and October. As the harvesting time increased, all nut varieties contained less water and more fat at the same time [16].

Conclusions

In conclusion, there is a large variation in the nutritional value of various nuts. In terms of fat content, the nuts can be divided into two groups. One which contain more than 55% fat (brazil nuts and pine nuts, hazelnuts and walnuts) and those that contain less than 50% fat (macadamia nuts, cashews and pistachios).

In order to ensure that the correct nutrition information is indicated on the label, analytical determinations of nutrient content of each batch should be performed so that

the declared content of these nutrients is not significantly lower than what is determined analytically.

Virtually all the tested nuts can be considered a good source of vitamin E, thiamine (vitamin B1) and magnesium. Pine nuts, pistachios and Brazil nuts proved to be the best sources of iron. The quite high content of phosphorus in all types of nuts should be noted as its presence in a diet is quite controversial.

Literature

[1] Casas-Agustench P., Bulló M., Salas-Salvadó J. Nuts, inflammation and insulin resistance. *Asia Pac. J. Clin. Nutr.*, 19(1):124–130, 2010.

[2] Chisholm A. Nuts! their health benefits. *Diabetes Voice*, 48(1):16–18, 2003.

[3] Fischer S., Glei M. Potential health benefits of nuts. *Ernaehrungs Umschau International*, 60(12):206–215, 2013.

[4] Ciemniewska-Żytkiewicz H., Krygier K., Bryś J. Nutritional value of nuts and their importance in the diet. *Postępy Techniki Przetwórstwa Spożywczego*, 1:90–96, 2014.

[5] Niewczas K. Criteria for food selection. *ŻYWNOŚĆ. Nauka. Technologia. Jakość*, 6(91):204–219, 2013.

[6] PN-EN ISO 20483:2014-02. Cereals and pulses – Determination of the nitrogen content and calculation of the crude protein content – Kjeldahl method (ISO 20483:2013, EN ISO 20483:2013).

[7] Association of Official Analytical Chemists. Official Methods of Analysis, Washington 1984, 1990.

[8] PN-ISO 6496:2001. Animal feeding stuffs – Determination of moisture and other volatile matter content.

[9] PN-A-79011:1998. Dry food mixes – Test methods – Determination of total ash and ash insoluble in 10 percent (m/m) hydrochloric acid.

[10] Amaral J.S, Casal S., Pereira J.A., Seabra R.M., Oliveira B.P.P. Determination of Sterol and Fatty Acid Compositions, Oxidative Stability, and Nutritional Value of Six Walnut (*juglans regia L.*) Cultivars Grown in Portugal. *J. Agric. Food Chem.*, 51(26):7698–7702, 2003.

[11] Brufau G., Boatella J., Rafecas M. Nuts, source of energy and macronutrients. *Br. J. Nutr.*, 96(2S):24–28, 2006.

[12] Neto V.Q., Bakke O.A., Ramos C.M.P., Bora P.S., Letelier J.C., Conceição M.M. Brazil nut (Bertholletia excelsa HBK) seed kernel oil: characterization and thermal stability. *BioFar, 3(10):33-42, 2009*, 3(10):33–42, 2009.

[13] Dogan M., Akgul A. Fatty acid composition of some walnut (*juglans regia L.*) cultivars fromeast Anatolia. *Grasas e Aceites*, 56(5):328–331, 2005.

[14] Evaristo I., Batista D., Correia I., Correia P., Costa R. Chemical profiling of portuguese *pinus pinea L.* nuts and comparative analysis with *pinus koraiensis. Sieb. & Zucc. Commercial kernels Options Méditerranéennes*, A(105):99–104, 2013.

[15] Taha N.A., Al-wadaan M.A. Utility and importance of walnut, *juglans regia L.*: A review. *Afr. J. Microbiol. Res.*, 5(32):5796–5805, 2011.

[16] Panahi B., Khezri M. Effect of harvesting time on nut quality of pistachio (*pistacia vera L.*) cultivars. *Scientia Horticulturae*, 129(4):730–734, 2011.

Received: 2018
Accepted: 2018