Composition of Hazelnuts (*Corylus Avellana* L.) Grown in Albania

Agriculture

Keywords: Hazelnut, Corylus Avellana L., Tonda romana, Visoka, Triglycerides

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Abstract

Albania belongs to the Western part of the Balkan Peninsula, shores the Mediterranean Sea. Its climate mainly belongs to the Mediterranean subtropical category, but in some regions is present the continental regime. The possibility to cultivate the nuts is evident. Scientific study of the hazelnuts is important due to the possibilities of incorporating the results to the national scheme, currently under implementation, for the enlargement of the cultivated nuts' plantations. Beyond the economic interest their study shows high scientific interest to the nutritional benefits, as an important source of polyunsaturated Fatty Acids, mineironmentral etc.

Preliminary studies on the main constituents from the samples of two nut cultivars, Visoka and Tonda romana, were conducted in two selected sites. These results are part of a study in for the harvesting year 2011. The chemical analysis was carried out according to the AOAC (2000) methods. The results indicate, that the main constituent in the dried hazelnuts result the triglycerides of 59.9- 61.02 g/100 g dry weight. The protein content varies 14.25-15.14 g/100g, and carbohydrates vary on 18.21-20.55 g/100 g dry weight hazelnut.

Introduction

Hazelnut (*Corylus avellana L*) has been consumed as fruit for a long time throughout the world, since prehistoric civilization. It is endemic bush on the many Mediterranean countries. Until 1990, the annual domestic production was calculated to reach 100 ton hazelnut and concentrated to the Visoka locality, Mallakastra region. Recent statistics show that the production have reached 184 ton, in 2011. Mainly it is consumed as unprocessed fruit and in minor part to the confection industry (Rama *et al*. 2011). The imports are calculated to be 18 ton (DSA, 2007).

In the modern times it is used as processed ingredient in the chocolates and other sweets. Main constituents of hazelnuts are fatty acids (FA). The profile is mainly constituted of unsaturated FA, 50 – 73% (Garcia *et al*. 1994). Chemical analyses show that other secondary constituents are phytosterole (Amaral *et al*. 2006a), phenolic compounds and other antioxidants. This compound is supposed to intervene in the controlling other cardiovascular diseases, such as blood hypertension (Alasalvar *et al*. 2006), or in the control of cholesterol level in the blood (Plat and Mensink 2001). Other secondary constituents are vitamins, α-tochopherols (Amaral *et al*. 2006), organic acids and fibers (Botta *et al*. 1994; Alasalvar *et al*. 2006). Recently is reported that hazelnut extracts show antimicrobial activity to the gram-positive bacteria (Oliviera *et al*. 2008).

A number of scientific studies have presented results on the mineral content and vitamins may have indicated by geographical factors (Dunar and Altundag 2004a; Amaral *et al*. 2006 b, c). Studies have confirmed that mineral content in hazelnut is influenced by geography, climate, irrigation and fertilization practices, and the harvesting period in accordance with ripening stage.

A very limited data on the chemical composition do exist in the *Corylus avellana L* cultivated in Albania (Osmani-Lataj, Vorpsi and Topi, 2011). Biochemical composition, nutritive values has been the aim of this study. Two different regions, Mallakastra and Fushekruja have been selected for that study.

Consumption of nuts group is >1kg/person, this value is very low compared to the EU countries. In that aspect is a good possibility to ensure a sustainable development to the agriculture by adding the cultivation of the *Corylus avellana* L. in the hilly regions of the country.

Material and Methods

Plant Material

Seeds of two hazelnut cultivars were harvested during their ripening period 2010-2011, from Visoka plantations, Mallakastra District. The plantation in study was 0.5 ha area, altitude 150m above sea level and Geographic Latitude 40' 36". The samples were stored with husk until conduction of the chemical analysis.

Analytical Methods

Total fat were extracted by Soxhlet at 60^0C per 6 hours and n-hexane was employed as solvent. The hazelnut oil produced was kept in 4^0C in dark place, until GC analysis. The fatty acids were analyzed as Fatty Acid Methyl Esters (FAME) and the equipment employed was GC-FID (Thermo Quest, 2000) with capillary column (23.3m x 0.25mm x 25 μm) according to the AOCS methods (AOCS, 1990). The total ash was calculated according to Koksal *et al*. (2006).
Minerals were analyzed by Spectrophotometer of Atomic Absorption (Varian Spectr AA – 400 Plus). The phosphor was analyzed as phosphomolibdat vanadium according to James (1995) by Spectrophotometer. The chemical analyses were conducted in a four week period after harvesting of the samples.

Statistical analysis

The studied samples was taken during the harvesting period (2010- 2011). Chemical analyses were conducted in three parallel samples from both cultivars. Each sample was of 100 seeds. Data were presented as mean value ±STDEV. Statistical analysis was conducted by Minitab Statistical software (MINITAB INC. 814-238-3280).

Results and Discussions

Proximate composition

The proximate composition of the studied cultivars was analyzed in the harvested nuts. As may be evident, the main constituent, the fat, resulted with values in the interval 59.9 to 61.02 g/100 g. the statistical analyses revealed similarity to the cultivars regarding the fat content. The same conclusions from statistical analysis are drawn regarding to the carbohydrates and proteins.

Table 1: The proximate composition of the *Corylus avellana* and Tonda romana after harvesting.

Composition	Tonda romana	Visoka
Protein	14.25±1.75	15.14±0.94
Fat	59.89±3.23	61.02±4.65
Carbohydrates	20.55±1.40	18.21±2.13
Ash	2.15±0.18	2.45±0.28

Data of one year harvested nuts (n=3) on dry weight basis. The carbohidrates were calculated by substracting the values of proteins , fats and ash by 100 g.

Fatty acid composition

The total fat content was analyzed in both cultivars resulted around 60%. The Visoka cultivar resulted by 61.02% not to different from *Tonda romana* 59.89%. Were identified a number of fatty acids were most important were six of them. Oleic acid was the most abundant by 80.01 %, and others respectively presented in the Table 2. The results on the both cultivars present signiphicative differences for five of FA, except the palmitoleic acid ($P \leq 0.05$) (Tabela 2). The palmitic acid vary from 4.36% (*Tonda romana*) to 5.95% (*Visoka*), while palmitoleic acid varied from 0.37% (*Tonto romana*) to 0.43% (*Visoka*). The Linoleic acid content resulted higher to "*Tonda romana*" by 14.71%.

Table 2: Fatty acid content of hazelnut varieties

Fatty acid	Hazelnut cultivars		Mean	SD
	Visoka	Tonda Romana		
Total fat	61.02	59.89	60.46	0.80
Palmitic	5.95	4.36	5.16	1.12
Palmitoleic	0.43	0.37	0.40	0.04
Stearic	1.62	2.17	1.90	0.39
Oleic	80.01	78.31	79.16	1.20
Linoleic	11.93	14.71	13.32	1.97
Linolenic	0.06	0.075	0.07	0.01
SFA	7.57	6.53	7.05	0.74
PUFA	11.99	14.79	13.39	1.98
UFA	92.43	93.47	92.95	0.73
UFA/SFA	12.21	14.31	13.26	1.49
PUFA/SFA	1.20	0.97	1.08	0.16

SFA, Saturated Fatty Acid (C16:0+C18:0); PUFA, Polyunsaturated Fatty Acid (C18:2+C18:3);

UFA, Unsaturated Fatty Acid (C16:1+C18:1+C18:2+C18:3).

The palmitoleic and Stearic acids were in similar values to that of eastern regions of Mediterranean Sea (Köksal et al. 2006). In our study the stearic acid content (1.90%) resulted similar compared to data of region (2.01%). Oliviera et al. (2008) has reported the mean values of Stearic acid, 1.80% for these cultivars. Oleic acid content 80.01% higher compared to results published to Köksal *et al*., (2006) for cultivars of Black Sea (79.58%). Our results on oleic acid for cultivars *Visoka* and *Tonda romana* differ slightly to these of (Köksal et al. 2006). Mean value of Linoleic acid (13.32%) were higher than those reported by Köksal et al. (2006) value 13.0% LA. Based on the data, the results of FA are attribute mainly to the geography, but the differences on the FA profiles are not so different, significantly.

Analysis of minerals

Ash content was significantly high respectively 2.45±0.28% (*Visoka*) and 2.15±0.18% (*Tonda romana*) a mean value of 1.94% ($P \leq 0.02$) (Table 1). The minerals, presented in Table 3, resulted with high values for potassium by 931 mg $100g^{-1}$ and calcium 237 mg $100g^{-1}$. The potassium levels varied from 883 mg $100g^{-1}$ (Visoka) to 931 mg $100g^{-1}$ (*Tonda romana*). Higher content to the magnesium resulted to *Tonda romana by* 184 mg $100g^{-1}$. The Visoka cultivar resulted with higher content of cupper by 2.02 mg $100g^{-1}$, while the *Tonda romana* by 1.74 mg $100g^{-1}$. The iron measured to *Visoka* resulted *to* 3.21 mg $100g^{-1}$ and *Tonda romana* by 4.06 mg $100g^{-1}$. Zinc resulted to 2.09 mg $100g^{-1}$ (*Tonda romana*), and the max value 2.35 mg $100g^{-1}$ (*Visoka*).

Comparison of the results with data from the literature indicates similarity in the mineral content with cultivars of Eastern Mediterranean Sea (Alasalvar. et al, 2003; Koksal et al, 2006; USDA, 2007). A recent publication, in the Balkan region, has published that palmitic acid values were higher levels compared to the cultivars of eastern region of Black Sea 4.72 – 5.87% (Köksal et al. 2006).

Table 3: Ash content (%), Minerals (mg/100g) expressed as Mean value ± STDEV

Mineral	Hazelnut cultivars		Mean	SD	Mineral content (%)
	Visoka	Tonda Romana			
Potassium	883	931	907	33.94	70.62
Calcium	144	237	190.5	65.76	14.83
Magnesium	157	184	170.5	19.09	13.28
Natrium	2.89	2.15	2.52	0.52	0.20
Manganese	3.4	8.68	6.04	3.73	0.47
Cupper	2.02	1.74	1.88	0.20	0.15
Iron	3.21	4.06	3.635	0.60	0.28
Zink	2.35	2.09	2.22	0.18	0.17

Conclusions

This study analyses the chemical composition of two hazelnut cultivars in the Mallakastra region. The fat content of the cultivars (Table 2) resulted ~ 60%, in accordance with results from other publications (Garcia et al. 1994; Özdemir et al. 2006). Mineral in higher values resulted potassium by 907 mg$100g^{-1}$ and calcium 190.5 mg $100g^{-1}$. The maximum iron content resulted in *Visoka* cultivar by 4.06 mg $100g^{-1}$. The maximum zinc content resulted to "*Tonda Romana*" cultivar by 2.35 mg $100g^{-1}$. Both cultivars in the study are a good source of bioactive fatty lipids and essential minerals. The essential minerals for both cultivars resulted cupper (0.15%), zinc (0.17%), iron (0.28%), manganese (0.47%), magnesium (13.28%), Calcium (14.83%) and Potassium (70.62%). These data are comparable to the publications on the literature review. That bring to the result that cultivation of these cultivars in Visoka plantations has significant interest. Further studies are important to the comparison of the results and to have a database that will give a broad panorama related to the other climatic and human factors in the hazelnut cultivation.

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