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NUTRIENT COMPOSITION OF OAK ACORN FLOUR

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Abstract
The nutrients in plant seeds play an important role during germination. At the same time, these nutrient values are also useful sources in human nutrition. The mineral element content of pedunculate oak (Quercus robur) acorn flour was investigated (collected from the Great Hungarian Plain) and compared with literature data. The potassium content was outstanding in the examined sample, which plays a significant role in the optimal functioning of the muscle and nerve tissues and the regulation of the blood glucose level. In addition, we found high values for calcium and iron compared to cereals. This results may justify the use of naturally occurring oak species in the functional foods market.

1 Introduction

Minerals are that inorganic substances which remain in the ashes after cremation of plant or animal origin food [2].

Minerals are essential for the human body. They play a significant role in the metabolic processes and responsible for the optimal functioning of life processes. They are also determinant factors in regulating of osmosis, acid-base balance and electrochemical system. Some of them are components of connective tissues and control enzymatic reactions [2]. They make up 4.3-4.4 % of our body. Minerals can be divided into two groups, depending on daily intake is above or less than 100 mg. The former group are called macronutrients, while the latter are called micronutrients or trace elements [1].

Oilseeds are one of the important sources of nutrients: they contain in larger quantities calcium from the macronutrients and zinc from the micronutrient group [2]. An aqueous extract of *Quercus robur* acorns also contain magnesium, potassium, phosphorous, iron, copper and manganese [6]. The nitrogen and potassium macronutrient content, as well as the iron and zinc content of the oak acorn must be highlighted [5].

2 Method

The fruits were collected under the *Quercus robur* trees in the northern and central parts of the Great Hungarian Plain (Kecskemét, Nagykőrös, Cegléd) in October, 2018. The fruits were dried at room temperature and ground into flour in the grain mill in the laboratory of the Faculty.

The macro- and micronutrient content was determined by the Soil and Plant Laboratory of John von Neumann University. Nitrogen content was determined by the FOSS Kjeltec 2300 steam distillation and automatic titration machine, according to MSZ-08-1783-6:1983 method. For detection of other macronutrients and micronutrients the JY ULTIMA 2 ICP-OES spectrometer was used, according to MSZ-08-1783-29:1985. The results were compared data in professional literature.

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3 Results

Examining the data, it can be concluded that the highest amount of macronutrients was potassium (1.09 % by weight) and nitrogen (0.884 % by weight). The value of potassium content is outstanding in comparison with other *Quercus* data as well as cereal species (corn, wheat, rice) and shelled fruits (macadamia nuts, nuts, hazelnuts) (Table 1). However, the phosphorus content of oaks is lower than value of nuts or grains. The magnesium content of our results was 25-50 % of the magnesium content according to [7] and [4]. There was no significant difference between the cereals and the *Quercus robur* and *Quercus brantii* species (Table 1).

Table 1. Macronutrient content of Quercus robur, Quercus brantii and three significant nuts and cereal species (in % by dry weight)

Species name	***N***	***P***	***K***	***Ca***	***Mg***	***Na***	***Source***
Quercus robur	0.884	0.095	1.09	0.077	0.051	0.010	own data, 2019
Quercus robur	2.118	0.090	0.784	0.109	0.074	0.013	[5]
Quercus brantii	-	0.071	0.637	0.073	0.035	0.016	[7]
Zea mays	-	0.28	0.30	0.02	0.12	0.02	
Triticum aestivum	-	0.31	0.42	0.05	0.10	0.06	
Oryza sativa	-	0.32	0.46	0.06	0.12	0.02	
Macadamia integrifolia	-	0.22	0.53	0.06	0.12	-	[4]
Juglans regia	-	0.41	0.45	0.08	0.17	-	
Corylus avellana	-	0.40	0.73	0.10	0.19	-	

The iron content of our sample is outstanding in Table 2. This value (197 mg/kg) is more than three times higher than rice which contain the second most iron. In addition, the amount of the other metallic microelement (copper) should be mentioned. The copper content of our sample was double than in wheat or rice. And the same time, the content of manganese and zinc was lower than the cereal grains (Table 2).

Table 2. Microelement content of Quercus robur, Quercus brantii and three important cereal species (in mg/kg dry matter)

Species name	***Fe***	***Mn***	***Zn***	***Cu***	***B***	***Mo***	***Se***	***Source***
Quercus robur	197	3.92	10.4	15.2	16.9	<0.5	-	own data, 2019
Quercus robur	32	7.9	-	6.2	-	-	-	[5]
Quercus brantii	23.67	3.2	9.17	4.63	-	-	0.05	[7]
Zea mays	45.0	7.0	18.0	3.0	-	-	0.03	
Triticum aestivum	40.0	24.0	28.0	7.0	-	-	0.06	
Oryza sativa	60.0	58.0	31.0	7.0	-	-	0.38	

4 Discussion

Our sample had higher nutrient values than the literature data in the case of nitrogen, potassium, iron and copper. The human body needs large amounts of potassium (2000 mg/day), the metallic microelements are found mainly in seeds [3]. Potassium plays an important role in fluid balance and iron and copper are known to be important in hematopoiesis and oxygen transport [1]. In addition, due to the role of copper in reducing oxidative stress (a component of oxidoreductase enzymes) [2], the fruit of *Quercus robur* can be perspective in human nutrition as species which can help to expand diversity.

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