

Elemental metabolomics nutritional value of Polish and Greek honeys - Mn, Cu and Mg



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Introduction

Honey is a supersaturated solution of sugars containing small amounts of proteins, enzymes, amino acids, trace elements, vitamins, aroma compounds and polyphenols. Trace elements such as Mn and Cu are essential for human health, while other elements such as Mg are required in relatively large amounts in a diet [1]. To prevent nutrient deficiencies and reduce the risk of chronic diseases such as osteoporosis, cancer and cardiovascular diseases, specific limits for the intake of each element at values adjusted to different population groups (children, adolescents, pregnant or elderly) have been established. The European Commission has set Nutritive Reference Values (NRV) for adults [2]. The World Health Organization (WHO)/ Food and Agriculture Organization (FAO) and the United States Department of Agriculture (USDA) have also established Recommended Dietary Allowances (RDAs) indicating the amount of an individual nutrient that people need for good health depending on their age and gender.

Material & methods

Fifty seven honey samples were collected from Poland and 30 were purchased from Greek markets. Samples from Poland were characterized based on the information from the producers. Samples from Greece were characterized according to their botanical type and geographical origin, based on their labeling.

Honey (0.50 g) was weighed into the vessels and 7 mL HNO₃ were added and the mixture was left for 1 h at room temperature. Then, 2mL H₂O₂ were added and once the vessels were capped, they were placed in the microwave oven (MARS, CEM, USA). The time and temperature program used was as follows: 0–200°C for 20 min (1200 W), hold for 2 min, then 15 min ramp to 40°C (100 W). Chromafil PET filters (0.20 µm/15 mm) from Macherey-Nagel (Germany) were used for filtrating samples. ICP-MS analysis was performed using the ELAN 9000 ICP-MS Perkin Elmer SCIEX, Canada.

Results & discussion

According to FAO, 4.24 grams of honey are consumed daily per capita in Greece [3]. This value is one of the highest in the world. Based on the median of samples from Greece and Poland the contribution of honey on Mn, Cu and Mg NRV, adequate intake (AI) and RDAs of various population groups is small, ranging from 1.4% (AI Lactation 31–50 years of age for honeys from Greece) to 5.6% (NRV and AI Pregnancy 31–50 years of age for honeys from Poland) for Mn (table 1), from 1.0% (RDA Lactation 31–50 years of age for honeys from Poland and Greece) to 1.5% (RDA Males 31–50 years of age for honeys from Poland and Greece) for Cu (table 2) and from 0.09% (RDA Males 31–50 years of age for honeys from Poland) to 0.31% (RDA Lactation 31–50 years of age for honeys from Greece) for Mg (table 2). Beyond nutritive elements Pb, as an example of toxic elements, has been also studied. The FAO / WHO Joint Expert Committee on Food Additives (JECFA) has established a Provisional Tolerable Weekly Intake (PTWI) for several toxic elements and especially heavy metals. Results for the typical 75 kg adult show 0.03% Pb intake from honeys of both countries (table 3).

Table 2. Magnesium and copper

	Magnesium			Copper		
	Value	Greece	Poland	Value	Greece	Poland
NRV	375 mg	0.26 %	0.10 %	1 mg	1.3 %	1.4 %
RDA Males 31–50 years of age	420 mg	0.23 %	0.09 %	0.9 mg	1.5 %	1.5 %
RDA Pregnancy 31–50 years of age	360 mg	0.27 %	0.10 %	1 mg	1.3 %	1.4 %
RDA Lactation 31–50 years of age	320 mg	0.31 %	0.11 %	1.3 mg	1.0 %	1.0 %

References

- [1] P. Zhang, C.A. Georgiou and V. Brusica. Briefings in bioinformatics, 19.3 (2018) 524-536.
- [2] Regulation (EU) No. 1169/2011.
- [3] <http://www.fao.org/3/ca4657en/ca4657en.pdf> (Last accessed 17/9/2021).

Table 1. Manganese

	Value	Greece	Poland
NRV	2 mg	1.9 %	5.6 %
AI Males 31–50 years of age	2.3 mg	1.6 %	4.9 %
AI Pregnancy 31–50 years of age	2 mg	1.9 %	5.6 %
AI Lactation 31–50 years of age	2.6 mg	1.4 %	4.3 %

Table 3. Lead

	Value	Greece	Poland
PTWI	25 µg/kg bw	0.03 %	0.03 %

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