

Content of some trace metals in honey from south-eastern Anatolia

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Abstract

Contents of Na, K, Ca, Mg, Cu, Fe, Mn, Zn and Co in honey (30 samples) from different parts of south-eastern Anatolia (Turkey) were determined by atomic absorption spectrometer AAS. The mean values for Na, K, Ca, Mg, Cu, Fe, Mn, Zn and Co were 118, 296, 51, 33, 1.8, 6.6, 1.0, 2.7 and 1.0 mg/kg, respectively. Also determined in the honey samples were invert sugar, sucrose, hydroxymethylfurfural, diastase activity, free acid, lactone, pH, ash, proline and moisture. In south-eastern Anatolia the honeys were found to have low ash contents, and some high mineral contents. © 1999 Published by Elsevier Science Ltd. All rights reserved.

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1. Introduction

Turkey has an important place among the honey producer countries, since it is suitable for apiculture in terms of the flowers. Turkey produces about 80,000 tons of honey per year (DIE, 1997). The greatest part of the honey is from blossom (floral source). This honey has lower contents of ash, mineral and sucrose and a higher content of invert sugar (Bozkurt and Aydoğan, 1986; Orak, 1986). The Turkish Standards Institute (Anonymous, 1990) has set maximum values for ash of blossom honey and honeydew: 0.6% and 1.0%, respectively.

In south-eastern Anatolia the honey is all blossom, and honey production in this region is quite low compared with total honey production in Turkey. Honey in south-eastern Anatolia has been studied previously (Bozkurt and Aydoğan, 1986; Yılmaz, 1994). Mineral content in honey, however, has not been investigated until now; hence it seemed of interest to determine this parameter. Also chemical composition of this honey was determined.

2. Materials and methods

2.1. Samples

The samples were 30 raw, strained, liquid honeys collected from different beekeepers in south-eastern Anatolia, Turkey.

2.2. Ash determination

Ash content was determined by heating 20 g of honey at 550°C to constant weight, after desiccating with an infra-red lamp to prevent foaming (AOAC, 1984).

2.3. Mineral analysis

Solutions containing sodium, potassium, calcium, magnesium, copper, iron, manganese, cobalt, zinc and nickel ions were obtained by dissolution of ash in 10 ml of hydrochloric acid (0.1 N) and subsequent dilution to 100 ml with distilled water.

Mg, Cu, Fe, Mn, Co, Zn and Ni were determined directly in the ash solution by atomic absorption spectrometer (AAS) (ATI UNICAM 929). Na, K and Ca were determined by flame photometer (JENWAY PFP 7 Flame Photometer).

2.4. Physicochemical analysis

Invert sugar, sucrose, hydroxymethylfurfural, diastase activity, free acid, lactone, pH, ash, proline and moisture were determined by standard methods of the Association of Official Analytical Chemists (AOAC, 1984).

3. Results and discussion

Mean mineral contents (mg/kg of honey) together with the corresponding standard deviations and coefficients

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Table 1
Statistical analysis and mineral content (ppm) in south-east Anatolia honey samples

Metals	Number of samples	Mean	Standard deviation	Coefficient of variation
Na	30	118	54.4	0.46
K	30	296	153	0.52
Ca	30	51	42.6	0.82
Mg	30	33	14.3	0.443
Cu	30	1.8	1.7	0.82
Fe	30	6.6	312	0.48
Mn	30	1.0	0.7	0.70
Zn	30	2.7	2.5	0.82
Co	30	1.0	0.6	0.60
Ni	30	ND ^a	–	–

^a Not determined.

Table 2
Chemical composition of the honey samples

Analytical value	Mean	Range
Moisture (%)	15.7	14.4–18.6
Invert sugar	72.6	64.1–76.7
Sucrose	3.0	0.8–5.0
Ash (%)	0.23	0.06–0.41
Proline (mg/kg)	47.0	21.0–75.0
Diastase number	14.8	10.2–30.2
HMF (mg/kg)	3.6	0.0–20.4
Free acid (meq/kg)	17.2	10.0–28.0
Lactone (meq/kg)	5.7	3.4–8.6
pH	4.2	3.8–4.5

of variation are shown in Table 1. It can be seen that south-eastern Anatolia honeys generally have lower ash contents, for example, than those reported from the Aegean region of Turkey by Öztürk, Dalgiç, and Gemici (1989), north-west Spain by Rodriguez-Otero, Pasrio, Simal, and Cepeda (1994), and from Italy by Lower (1987).

The mineral contents of south-eastern Anatolia honeys were generally lower than those reported in the literature, but some mineral contents were exceeded. Potassium, which accounts on average for 58% of ash weight, was the most abundant of the elements determined; the mean content of 296 mg/kg is much lower than that reported by Rodriguez-Otero et al. (1994) and by Sevimli, Bayülgen, and Varinlioğlu (1992).

Cobalt constitutes an average 0.2% of ash weight, and was lowest of the elements determined; the mean

content of 1.0 mg/kg is much higher than that reported by Sevimli et al. (1992) and Ivanov and Chervenokova (1984). Also, copper content exceeded that reported previously (Rodriguez-Otero, Pasrio, Simal, Terradillos, & Cepeda, 1992; Ivanov & Chervenokova, 1984).

Sodium, magnesium and manganese contents were also lower than those reported previously (Rodriguez-Otero, Pasrio, Simal, Terradillos, & Cepeda, 1992) and iron content was lower than in previous reports (Ivanov & Chervenokova, 1984; Sevimli et al., 1992). Calcium and zinc contents, on the other hand, were intermediate.

Mineral contents determined in honeys of south-eastern Anatolia showed very high coefficients of variation (Table 1).

The chemical compositions of honey samples whose mineral contents were also determined are shown Table 2, The chemical compositions fit the standards (Anonymous, 1990).

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