

ELEMENT CONTENT OF PROPOLIS FROM DIFFERENT REGIONS OF TURKEY

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Levels of Na, K, Ca, Mg, N, Cu and Zn of propolis samples originating from different geographic locations of Turkey were investigated. Sodium was the most abundant element in the samples. The calcium content was found between 0.118–0.0793 mg g⁻¹. The highest magnesium content was found in samples from Yozgat region, whereas the lowest was in those of Adana region. Potassium content changed between 0.121–0.364 mg g⁻¹. There were no statistical differences in nitrogen levels. Interestingly, no sulphur (S) was detected in propolis samples. The copper and zinc content changed between 0.045–0.096 mg g⁻¹, 0.176–0.676 mg g⁻¹, respectively. Finally, mineral content of Turkish propolis was about the same as the commercial propolises from other countries. The content of Cu in propolises was generally within safe limits, and compared well with levels in foods from Turkish Food Codex, though Zn contents were high.

Keywords: propolis, element content, Turkey

Propolis is a complex resinous mixture of plant-derived products, which are collected and used by bees as a general purpose sealer and antibiotic in their hives. Propolis's phenolic constituents and their derivatives have been shown to exhibit several positive pharmacological properties, such as anti-bacterial (UGUR et al., 2000), anti-cancer (LEE et al., 2000). Therefore, propolis has widely been used in traditional medicine in Western countries. Propolis has also some nutritive value, apart from the presence of small amounts of proteins, amino acids, sugars and some elements. Elements are necessary for taking part in many of the reactions occurring in the human organism, for example, trace elements are of interest because of their essential or toxic nature and they are taken by different food and biological samples (RODRIGUEZ et al., 1999). Elemental composition of food and biological samples is important for the health professionals, and recent food legislation has also highlighted this issue (IHLE-MILLER, 1996; ANON., 1997). As is the case in Turkey and other countries, such biological samples could be a part of daily food intake. However, data are not readily available for most of the chemical and elemental composition of the raw propolises in developing countries such as Turkey or less-developed countries.

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A few studies related to propolis in Turkey have been previously published (OZTURK et al., 2000; VELIKOVA et al., 2001; SILICI & KAFTANOGLU, 2003). The present study focuses on elemental composition of propolis from Turkey. The aim of this research was to determine the levels of the element content (Na, K, Ca, Mg, N, Cu, Zn) of propolis samples originating from different geographic locations of Turkey.

1. Materials and methods

1.1. Propolis samples

The propolis samples belonging to *Apis mellifera* colonies were collected from seven different regions in Anatolia in the spring season of 2003. The hives were located in Bursa (Marmara region) Sivas and Yozgat (Central-Anatolian region), Erzurum (East-Anatolian region), Artvin (Black Sea region), Adana (Mediterranean region) and Izmir (Aegean region) provinces. The resin content was determined with extraction (ethanol 70%, twice), and was the following for the samples from different locations: Bursa 34.5%, Erzurum 39.2%, Artvin 56.7%, Sivas 52.8%, Izmir 33.3%, Yozgat 47.7% and Adana 51.4%.

1.2. Analytical method and analysis

Homogenized samples (1 g) were weighed into acid-cleaned porcelain dish and placed into a muffle furnace model MS-120 (Nuve, Turkey). The samples were dried at 105 °C, and were carbonized at 250 °C. The temperature was gradually ramped up to 450 °C, increasing the temperature in 50 °C intervals, and samples were held at 450 °C overnight (IHLI-MILLER, 1996). Analyses were performed directly from the ash solution by atomic absorption spectrophotometer (AAS) (HITACHI-Z/8000, Japan) by the standard calibration technique. Elemental analyzer (Carlo Erba Model EA 1108, Italy) was used to determine nitrogen (N) and sulphur (S) contents. Analysis was carried out according to the reference procedure (KIRSTEN, 1983; IHLI-MILLER, 1996).

1.3. Statistical analysis

Statistical analyses were analyzed using the SAS system (SAS, 1988). The samples were compared based on element contents using multiple comparison and ANOVA. Multiple comparisons were performed using LSD (Least Square Differences) method (KLEINBAUM et al., 1988).

2. Results and discussion

It was determined that propolis samples collected from various regions of Turkey contained different element levels (Table 1). At the present study, the highest Na content in propolis was observed in samples from Artvin, Izmir and Bursa regions,

respectively, while the minimum was in samples from Erzurum region. Sodium contents of the other samples were similar to each other. It was reported previously that sodium levels of dietetic products containing propolis were found between 0.195–1.36 mg g⁻¹ (RODRIGUEZ et al., 1999). The amount of K content changed between 0.121–0.364 mg g⁻¹. However, there was no statistically significant difference observed in K contents of the propolis samples ($P>0.05$). The highest Ca content was found in samples from Yozgat and Sivas regions, which are geographically close vicinities. The Ca content of samples was generally in agreement with the literature (RODRIGUEZ et al., 1999). The highest Mg content was determined in the samples from Yozgat, and the lowest was in the samples of Adana region with 0.502 and 0.237 mg g⁻¹, respectively. Nitrogen content was observed in a very low (insignificant) amount and was similar in quantity in each sample. In the propolis samples, S level was not high enough for detection with the element analyzer. The highest Cu content was found in the samples from Bursa region and the lowest Cu content was in the samples of Sivas region, probably because these cities are clearly located in different geographic regions. The highest level of Zn content was in the regions of Izmir, Erzurum, Artvin Sivas, Adana and Yozgat, whereas the lowest were in regions of Bursa and Yozgat. It has been reported that the propolis from different parts of the hive has different compositions (BANKOVA et al., 1998). Likewise, it has been reported that the wax content of propolis may vary even in the same hive (GARCIA-VIGUERA et al., 1992).

Table 1. Na, K, Ca, Mg, N, Cu, Zn contents of the propolis samples from different locations in Turkey (mg g⁻¹)

Regions	Na	K	Ca	Mg	Cu	Zn	N
Bursa	1.351 ^a	0.153 ^a	0.118 ^e	0.402 ^{bc}	0.0096	0.0176	5.70
Sivas	0.513 ^b	0.232 ^a	0.585 ^b	0.455 ^{ab}	0.0045	0.0488	4.10
Izmir	1.384 ^a	0.364 ^a	0.251 ^d	0.472 ^{ab}	0.0084	0.0676	4.90
Adana	0.512 ^b	0.158 ^a	0.231 ^d	0.237 ^d	0.0069	0.0486	2.50
Yozgat	0.570 ^b	0.272 ^a	0.793 ^a	0.502 ^a	0.0075	0.0259	4.00
Erzurum	0.412 ^c	0.121 ^a	0.336 ^c	0.345 ^c	0.0084	0.0594	3.20
Artvin	1.416 ^a	0.273 ^a	0.133 ^e	0.491 ^a	0.0051	0.0498	5.40

Numbers with the same letter in a column are not significantly (LSD, $P>0.05$) different from each other.

Turkish propolis appears to contain high levels of metals such as copper and zinc but mineral contents of samples are similar to those of commercial propolis from Italy (RODRIGUEZ et al., 1999). Also this could be attributed to the use of different propolis sources in a hive (SORKUN et al., 2001; SILICI & KAFTANOGLU, 2003; KARTAL et al., 2003).

3. Conclusion

The study has demonstrated that the element content of Anatolia propolises changed according to different regions. It is obvious that these propolises are rich in the minerals of K, Na, Mg, Ca and could be more beneficial in human nutrition. When Cu levels of

propolis were compared with levels in similar foods (ANON., 1997), the content of Cu in propolis samples from regions were generally within safe limits, but Zn contents were high. Especially, industrial conditions in the area may affect the heavy metal content of the propolis.

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