

DETERMINATION OF THE CONTENT OF CHEMICAL ELEMENTS IN SOME CENTRAL ASIAN HONEY SAMPLES

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ABSTRACT

The method of neutron activation analysis determined the elemental composition and quantitative content of 25 macro- and microelements in honey samples from different regions of Uzbekistan and Kyrgyzstan.

Keywords: macro- and microelements, honey, neutron activation analysis.

INTRODUCTION

Honey is a food product that is produced and transformed by honey bees (*Apis mellifera*) from the nectar of flowers. *Apis mellifera* belongs to the Apidae family. Honey bees are bred to obtain various beekeeping products: wax, honey, poison, propolis, and others. Honey, being a healthy and easily digestible natural product, is full of carbohydrates, vitamins, minerals, amino acids, proteins and enzymes [1,2]. Various volatile components, phenolic compounds and flavonoids were also found in honey [1]. Honey has a variety of colors and colors, from almost colorless to dark brown, and its taste ranges from mildly soft to distinctly greasy, as both taste and color are influenced by the type of nectar collected by bees from different flowers. Usually, a lighter color indicates a milder taste, while dark honey has a stronger taste and contains more minerals. Quality honey rarely consists of 100% of one flower nectar, but is a mixture with a predominance of one type of flowers. The mineral composition of honey largely depends on its botanical origin, as well as on the climatic conditions and the geographic region where it was produced. Honey reduces cardiovascular risk factors and is also a potent inhibitor of *Helicobacter pylori*. This is a spiral-shaped gram-negative bacterium that infects various areas of the stomach and duodenum [3]. Moreover, honey exhibits antimutagenic activity against bladder cancer and breast carcinoma [1]. Research also indicates that honey's unique composition, in addition to a natural nutritive sweetener, makes it useful as an antimicrobial agent and antioxidant. Honey also reduces skin inflammation, swelling and exudation, as well as promotes wound healing, reduces scar size and stimulates tissue regeneration [1]. Honey comes from a wide variety of geographic areas and can have different chemical and organoleptic properties. The aim of this work is to study the macro- and microelement composition of various honey samples from different regions of the Republics of Uzbekistan and Kyrgyzstan.

The samples represented the most common types of honey that are readily available to consumers in Uzbekistan. Samples are numbered in the following order: 1-sample - mountain honey (Uzbekistan, Namangan region); 2-sample - forest honey (Kyrgyzstan, Uzgen district of Osh oblast); 3-sample - psoralein honey (Uzbekistan, Jizzakh region); 4-sample - honey with a camel thorn (yantak - Uzbek, Alhagi - Latin - a genus of desert plants of the legume family; Uzbekistan, Syrdarya region); 5-sample - cotton honey (Uzbekistan, Jizzakh region); 6-sample - flower honey (Uzbekistan, Altaryk district of Fergana region). The pH of honey samples was determined: 1-sample - pH = 5.2; 2-sample - pH = 4.8; 3-sample - pH = 5.5; 4-sample - pH = 4.5; 5-sample - pH = 4.7; 6-sample - pH = 4.2.

The quantitative determination of macro- and microelements in honey samples was carried out in the analytical laboratory of the Institute of Nuclear Physics of the Academy of Sciences of the Republic of Uzbekistan. The studies carried out made it possible to determine 25 chemical elements.

Quantitative data on the content of elements in the analyzed honey samples are given in Table 1.

Table 1. Content of macro- and microelements in natural honey samples, $\mu\text{g} / \text{g}$.

Element	Sample №1	Sample №2	Sample №3	Sample №3	Sample №3	Sample №3
Mg	90.2	74.3	93.6	72.4	66.8	82.5
Cl	169.5	185.3	171.4	183.5	172.2	176.4
Mn	3.93	4.21	3.25	3.50	3.41	3.34
Na	96.4	82.9	90.3	84.5	81.8	88.3
K	361	364	325	360	364	333
Cu	4,44	4,36	3,96	3,48	3,92	3,05
Ca	194	205	217	202	188	174
Fe	8.42	8.20	9.05	7.25	8.50	6.64
Zn	8,60	8,80	7,95	7,86	8,24	7,45
F	133	124	114	131	103	122
P	267	249	254	231	275	223
Co	0.23	0.18	0.21	0.34	0.15	0.18
Al	23.2	25.4	21.3	23.8	24.7	28.5
Ba	0.82	0.91	0.88	0.94	0.85	0.79
V	0.05	0.04	0.05	0.06	0.04	0.05
Ni	0.41	0.37	0.39	0.26	0.39	0.42
Cr	0.94	0.91	0.88	0.84	0.90	0.93
Sb	1.33	1.35	1.25	1.31	1.65	1.42
Sr	0.36	0.34	0.51	0.29	0.42	0.33
I	3.04	3.65	3.32	3.39	3.65	3.26
Se	0.25	0.28	0.21	0.16	0.21	0.25
Si	5.03	4.95	5.02	5.01	5.25	4.68
Ga	0.023	0.026	0.016	0.019	0.025	0.028
Ge	0.011	0.009	0.014	0.012	0.015	0.17
Ag	0.31	0.32	0.29	0.33	0.28	0.30

In the composition of honey samples from macronutrients, the content of potassium, calcium, magnesium, sodium, phosphorus and chlorine was determined, only sulfur is absent. Of the essential or vital trace elements, the contents of iron, iodine, copper, zinc, cobalt, chromium, nickel, vanadium, selenium, manganese, fluorine, silicon were determined. They lack molybdenum, arsenic, lithium, boron and bromine. There are no toxic elements such as mercury, cadmium, lead and thallium, and the concentration of aluminum is within the permissible range. In general, the content of elements in the composition of the studied honeys corresponds to the literature data [5-15].

In conclusion, it should be noted that according to the results obtained, Uzbek and Kyrgyz varieties of honey are a valuable food product, not only supplying the body with a significant amount of energy and vitamins, but also with the necessary amount of macro- and microelements such as Mg, K, Ca, Zn, Cu, Fe and Mn. The relatively higher selenium content compared to Turkish samples increases the nutritional value of Uzbek honey, since there is evidence that selenium binds free radicals. Taking into account the iodine deficiency in natural objects of the Republic, honey can be recommended as a means of preventing endocrine diseases, since local varieties contain a relatively higher amount of iodine in comparison with other regions. Toxic elements were not found in honey samples.

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