THE EFFECT OF GEOGRAPHICAL ORIGIN ON THE COMPOSITION OF HONEY

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Abstract: Beside some quality parameters, forty four elements were determined by ICP-OES in 19 honey samples from different places of Hungary, in this study. These samples have different botanical origin. Acacia (*Robinia pseudo-acacia*), linden (*Tilia sp.*), rape (*Brassica sp.*), coriander (*Coriandrum sativum*), cherry (*Prunus cerasus*), lavender (*Lavendula angustifoia*) and multifloral honey. Ca, K, S, P, Mg and Na were the most abundant elements (896; 556; 60,5, 48,2; 31,5; 31,1 mg/kg, respectively). The B, Fe and Se content generally ranged from 2 to 8 mg/kg. In addition, we determined the electrical conductivity, - which is closely connected with element-, sugar- and moisture content.

Keywords: Honey, Sugar and moisture content, Element composition, Mineral content, EC

Introduction

Honey is definied by the EU (EC Council Directive 2001/110/EC) as „The natural, sweet product produced by Apis Mellifera bees from the nectar of plants or from secretions of living plants, which bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in honeycombs to ripen and mature." Quality of honey depends on several parameters, such as sugar- moisture-, sucrose-, hydroxymethylfurfural (HMF)-, Potassium-, vitamins-, prolin- and mineral content, rate of fructose/glucose, organic acids, diastase activity, electrical conductivity, enzymes, solid corpuscles,etc. (Table 1.). Some quality parameters of honey are effected by geological and botanical origin.

Table 1. Quality requirement of honey by right of Codex Alimentarius Hungaricus (2002)

1. Sugar content	
1.1. Fructose and glucose contents	
a) Flower honey	min. 60 g/100g
b) Honeydew honey and mixture of floral and honeydew honey	min. 45 g/100g
1.2. Sucrose content	
a) Generally	max. 5 g/100g
b) Acacia honey	max. 10 g/100g
c) Lavender honey	max. 15 g/100g
2. Moisture content	
a) Generally	max. 20%
3. Electrical conductivity	
a) Generally	max. 0,8 mS/cm
b) Honeydew and sweet chesnut honey	min. 0,8 mS/cm
4. pH value	
a) Flower honey	3,6-4,5
b) Honeydew honey	4-5,4

Naturally, the honey have many important properties but in this study we deal with mineral content present in honeys and also with electrical conductivity.

Honey contains many important elements that get into the product with the vegetable sap. Each honey has different element composition. One kg flower honey contains about 100 mg mineral substance, but can be 1000 mg in the honeydaw honey. The main elements in honey: Potassium, followed by Chlorine, Sulphur, Sodium, Phosphours, Magnesium, Silicon, Iron and Cooper (Frank, 2006; La Serna Ramos et al., 1999). Composition and amount of ash are largely depending on the soil of the collecting area (Örösi, 1989). Iron and Cooper are the most important among the micro elements (Frank, 2006). Mineral content of honey depends on botanical origin, pedoclimatic condition (Birkás et al., 2006), or extraction techniques (La Serna Ramos et al., 1999).

Honey is an environmental indicator, because it may contain contaminating elements and various pesticides (Varró et al., 2007). Honey can provide environmental data from the area where bees are feed. This area is about 7 km^2 (Pisani et al., 2007). There is a risk of the presence of toxic heavy elements (As, Cd, Pb). High heavy metal content have been found in honey coming from areas with heavy industrial activity or highway (Gajek et al., 1987). These contaminants may also derive from the incorrect treatment of honey (Pisani et al., 2007).

Electrical conductivity (EC) is associated with the element content of honey but its value is affected by organic acids, proteins and sugar alcohols. The value of electrical conductivity must be maximum 0,8 mS/cm in case of pure honey, while this value must be minimum 0,8 mS/cm of honeydew honey and sweet chestnut honey. Close correlation was found between the electrical conductivity and potassium content (r=0,754). The electrical conductivity increases with the increasing Potassium content (Guler et al., 2007).

Element composition of honey can also be used to detect adulteration, such as addition of sugars and syrups, mixing of honey of different botanical and geological origins, or feeding bees with artificial syrups (Rashed and Soltan, 2004).

Materials and methods

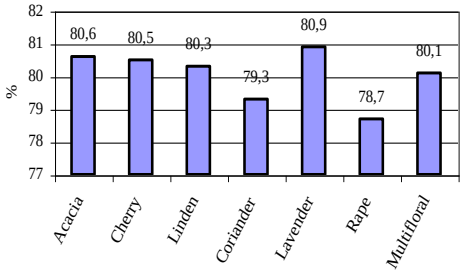
We examined 18 honey samples from different areas of Hungary: Heves county (rape, cherry and multifloral honey), Pest county (acacia, linden, rape, lavender and multifloral honey), Zala county (acacia, linden, rape and multifloral honey), Hajdú-Bihar county (acacia, rape, coriander and multifloral honey), Baranya county (linden honey) and Bács-Kiskun county (acacia honey). These counties have different environmental and geological properties (Prokisch, 2007). All samples come from beekeepers.

Sugar and water content were determined by DIGIT-5890 Honey pocket refractometer. Electrical conductivity was determined from the 20 g/100ml solution of honey with conductometer (Radelkis).

Samples were digested for element content determination according to Kovacs (1996). The element content was determined Inductively Coupled Plasma with Optical Emission Spectroscopy (ICP-OES). The number of examined elements were 46.

Results and discussion

Moisture content changed between 16,3 and 21,1 %. The lowest value was detected in the cherry honey and the highest in the multifloral honey (from Hajdú-Bihar county).



Sugar and water contents were in the range given by the Codex Alimentarius Hungaricus (2002). Sugar contents were between 77,5 and 82,4 % (Fig. 1.) The highest amount of sugar was measured in the lavender honey, followed by linden, acacia, cherry and the last was the rape honey.

Figure 1. Sugar content of different honey types

The results of the element content determination are shown in Figure2. B, Ca, Fe, K, Mg, Na, P and S were the most abundant elements, with average content exceeding 2 mg/kg.

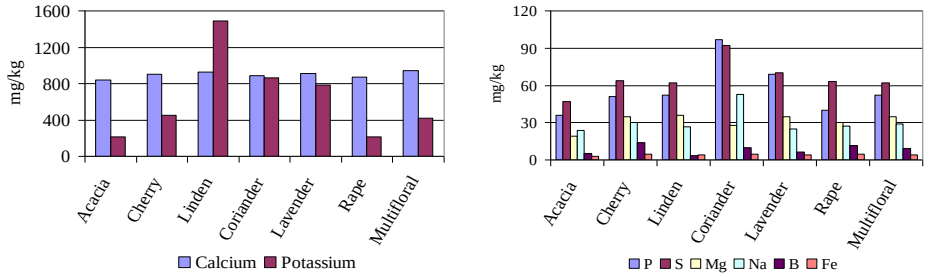


Figure 2. Element content of different honey types

Among the elements Calcium was present at the highest concentration (mean 894 mg/kg), followed by Potassium (554 mg/kg), Sulphur (61,1 mg/kg), Phosphorus (49,3 mg/kg), Magnesium (30,18 mg/kg), Sodium (28,16 mg/kg). The amount of the Boron, Iron and Selenium was in the range of 2-9 mg/kg. The concentration of Al, Sr, As, Si, Mn and Zn was usually between 500-2000 µg/kg. The content of other measured elements was lower than 500 µg/kg. We note, that linden honey was an exception, as Potassium content was higher than the Calcium. This differences can derive from geological and botanical origins. We think, as our samples are from different areas with various soil and base rock, the cause of the high Potassiun concenration of linden honey can not be geographical. To prove this more analisys are needed.

Since, the electrical conductivity is in close relation with potassium content (r^2=0,8963, in this study), the highest electrical conductivity was measured in linden honey and the lowest value in the acacia honey. This study shows that the electrical conductivity is low in the Hungarian honey because the potassium content was low also in these honey samples.

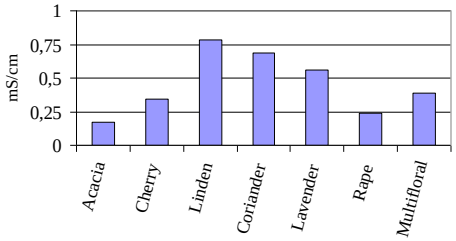


Figure 3. Electrical conducitivity of various honey types

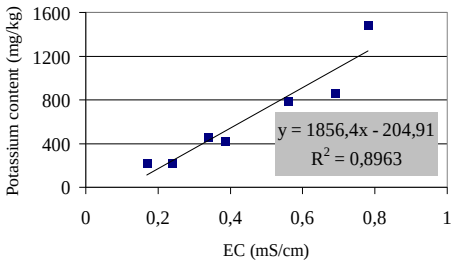


Figure 4. Relation of EC and Potassium content

Conclusions

In this study we determined the elements composition of honey produced in different counties of Hungary. Contrary to data from literature, the amount of Potassium in Hungarian honey is lower than the Calcium. Potassium content in the linden honey is lower than in the others samples. In the cherry honey the Manganese content is very high.It is worth mentioning that the Zinc content of the coriander honey is two times more then in the others. As this type of honey is rather rare, we could not compare its element content with similar honey with different geographical origin.

Several honey samples came from zone of Gyöngyös where there is quite big industrial activity (mines, power station). All the same, these samples were not contain contaminants or heavy metals.

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