

CHEMICAL AND BIOCHEMICAL CHARACTERIZATION OF THREE DIFFERENT TYPES OF HONEY FROM BIHOR COUNTY

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Abstract:

Honey has been used as a food since the earliest times. In recent years has evidenced its antioxidant capacity. It plays an important part in our nutrition and it is well-known for its positive effects on health. Polyphenols and ascorbic acid are compounds wich act as a natural antioxidants. The antioxidant capacity of honey is varies greatly depending on the floral source and some external factors such its processing. Diastase activity is a honey quality parameter used to determine if honey has been extensively heated during processing. The aime of this study was to determin some chemical and biochemical parameters of three different types of honey from Bihor county: Acacia honey, Linden honey and Polifloral honey, to determine the quality of the analyzed samples. The following parameters were analyzed: moister, ash, diastase activity (DN), invertase activity (IN), total polyphenols, ascorbic acid.

Keywords: honey, moisture, ash, diastase activity, invertase activity, poliphenols, ascorbic acid.

INTRODUCTION

Honey is a sweet and viscous fluid produced by honey bees and derived from the nectar of flowers. It plays an important part in our nutrition and it is well-known for its positive effects on health. Honey gets its sweetness from the monosaccharide fructose and glucose and has approximately the same relative sweetness as granulated sugar (97% of the sweetness of sucrose, a disaccharide). Honey has attractive chemical properties for baking, and a distinctive flavor which leads some people to prefer it over sugar and other sweeteners (Belitz, and Grosch, 1999).

In the recent years there has been growing interest in functional foods that can provide not only basic nutritional and energetic requirements but also additional physiological benefits. Nowadays a functional food can be defined as a food that produces a beneficial effect in one or more physiological functions, increases well-being and/or decreases the risk of suffering from a particular medical condition. The functionality of a food is unsually related to some of the ingredients that it contains and at present consumers prefer these ingredients to have a natural rather than synthetic origin (Goldberg, 1996). Honey is reported to contain at least 181 substances and is considered as part of traditional medicine (White, 1975). Among the functional ingredients the group most widely studied is the family of antioxidants. Traditionally, these kinds of compounds have played an important role in food science and technology because of their usefulness

in preserving foodstuffs against oxidative degradation (Madhavi et al, 1996).

Mineral content (ash) - the ash content is a quality criteria for honey botanical origin.

Honey can contain a number of different enzymes. Enzymes are the most important and also the most interesting honey components. They are accountable for the conversion of nectar and honeydew to honey, and serve as sensitive indicator of the honey treatment. Some of these are introduced by bees, and some are found in the nectar. As with most aspects of honey, different nectar/honey sources have widely varying enzyme activity. Typically enzymes are proteins of complex structure that catalyse a specific chemical reaction. They are sensitive to heat, visible in UV light and other forms of energy such as microwaves.

Of all the enzymes in honey, *diastase* and *invertase* have received the most attention. They are introduced to honey by bees but their presence in honey is variable. Factors that affect their presence are thought to be nectar composition and concentration, the age of the bees, and the intensity of the nectar flow. An intense flow of nectar with a high concentration usually yields low values for diastase and invertase activity.

Diastase (β -amilase) is responsible for converting starch to dextrins and sugars is introduced into honey by the bees. Its main point of interest is as an indicator of heating.

Invertase (α - glucosidase) is one of the most important enzymes. Its sensitivity towards temperature is very high. In some European countries invertase activity determination is used as a parameter related to the freshness of honey, to its warming or storing conditions (Vorlova and Pridal, 2002). Invertase is primarily responsible for converting the sucrose in nectar to glucose and fructose.

The antioxidant compounds have an important role in human health. These include flavonoids and phenolic acids, enzymes, ascorbic acid, Maillard reaction products, carotenoid-like substances, organic acids, aminoacids and proteins (Antony et al, 2000; White, 1978). In fact several preventative effects against different diseases such as cancer, coronary diseases, inflammatory disorders, neurological degeneration, aging, etc., have been related to the consumption.

Polyphenols are also products of the secondary metabolism of plants. These compounds are reported to exhibit anticarcinogenic, anti-inflammatory, anti-atherogenic, antithrombotic, immune modulating and analgesic activities, among others and exert these functions as antioxidants (Gomez-Caravaca, 2006).

Ascorbic acid (vitamine C) - Ascorbic acid is largely used in therapy as an anti-infections factor. It is essential to the normal functioning of cells.

The objective of this study was to determine moisture and ash content, diastase activity (DN), invertase activity (IN), total polyphenols and ascorbic acid content to study the quality of analyzed honey samples.

MATERIAL AND METHODS

This study was realised in the agrifood-biochemistry laboratory of the Faculty of Environmental Protection of the University of Oradea in 2010 - 2011.

A number of 15 honey samples were analysed. All samples were obtained directly from beekeepers of Bihor county in 2010. The honey samples were sorted by their botanical origin into three groups: 5 samples of Polifloral honey, 5 samples of Accacia honey and 5 samples of Linden honey. In each sample, we determined the moisture and ash content, the activity of invertase and diastase, the total polyphenols and ascorbic acid content.

Moisture content was determined using refractometric method - the water content is that value determined from the refractive index of the honey by reference to a standard table. The moisture content is the only composition criteria, which as a part of the Honey Standard has to be fulfilled in world honey trade. Honey having a high water content is more likely to ferment. The maximum value is 21%.

Mineral content (ash) - the ash content is a quality criteria for honey botanical origin. The honey is ashed at a temperature no higher than 600°C and the residue weighed.

Invertase activity – was determined according to the method of Siegenthaler (1977) which is based on the spectrophotometric measurement of decomposition of p-nitrophenyl- α -D-glucopyranoside (p-NPG) in p-nitrophenol and is determined spectrophotometrically at 400 nm. The honey invertase activity was calculated from the measured absorbency multiplying by the factor of 158.94 and calculated to a kilogram of honey. Then the value was expressed as invertase number (IN). The IN indicates the amount of sucrose per gram hydrolysed in 1h by the enzymes contained in 100g of honey under test conditions. Each sample was analysed two times. The results are expressed in units of the enzyme per kilogram (U/Kg).

Diastase activity – was determined according to the spectrophotometric method of Bogdanov, (1997). The absorbance of the solutions was determined using an UV-Visible mini – 1240 Shimadzu spectrophotometer at 660 nm. The diastase activity is calculated as diastase number (DN-Gothe unit). One unit is defined as the amount of enzyme that will convert 0.01 g of starch to the prescribed end-point in 1h at 40°C under the conditions of test.

Total poliphenol contents in honey – was determined with colorimetric assay based on the reaction of Folin-Ciocalteu reagent. The method consists of calibration with a pure phenolic compound, extraction of phenols from the sample and the measurement of absorbance of the reaction mixture at 765 nm against a methanol blank. Gallic acid is used as a standard to produce the calibration curve. The mean of three readings is used and the total phenolic content is expressed in mg of gallic acid equivalents/100 g of honey (Singleton et al 1999).

Vitamin C - or ascorbic acid - is an important antioxidant. In the cells it is easily oxidized to dehydroascorbic acid, removing oxidizing agents before they can do damage to other substances. This reaction is the basis of the iodometric titration of ascorbic acid - it is quantitatively oxidized by iodine.

RESULTS AND DISCUSSION

Analyses of honey samples from polifloral, acaccia and linden flower indicate that levels of moisture was under 21%, the maximum value was 20.1% in polifloral honey, 19.7% in acacia honey and 19.3% in linden honey.

Table 1.
Estimative mean values for moisture and ash content, diastase activity and invertase activity of analysed honey samples

Type of Honey	Sample nr.	Moisture %	Ash %	Diastase activity expressed in DN Gothe unit	Invertase activity expressed in IN
Polifloral	1	19,1	0,35	16.5	26.5
	2	20,1	0,3	24.6	32.4
	3	16,9	0,37	19.8	30.1
	4	18,1	0,4	15.9	24.8
	5	17,8	0,31	12.3	22.4
	Mean \pm sd	18.4 \pm 1.23	0.34 \pm 0.04	17.82 \pm 4.63	27.24 \pm 4.02
Acaccia	6	17,6	0,17	9.8	10.2
	7	18,2	0,23	8.3	9.8
	8	16,4	0,21	9.6	10.1
	9	18,7	0,18	10.8	11.2
	10	19,7	0,19	8.9	9.9
	Mean \pm sd	18.12 \pm 1.23	0.19 \pm 0.02	9.48 \pm 0.94	10.24 \pm 0.56
Linden	11	18,2	0,25	7.2	15.4
	12	17,6	0,33	20.2	21.8
	13	18,7	0,22	6.4	13.2
	14	18,1	0,19	18.5	19.8
	15	19,3	0,29	19.6	20.3
	Mean \pm sd	18.58 \pm 0.88	0.25 \pm 0.05	14.38 \pm 6.95	18.1 \pm 3.63

The variability in ash contents has been associated in a qualitative way with different botanical and geographical origins of honeys which is interesting when considering the production of a wide range of honey types.

The lowest level of ash content was registered in Acaccia honey (0.19%) in according with a light yellow colours and highest level (0.34%) was obtained in case of polifloral honey. In this case the colour of samples was dark brown (Table 1).

Table 1 show the values for invertase and diastase activity. In case of the polifloral honey the mean value for invertase activity was higher (27.24 ± 4.02) than in case of Linden (18.1 ± 3.63) and Acacia honey (10.24 ± 0.56).

Registered values for diastase number (DN) was higher than 8 unit for every samples.

The total polyphenol and ascorbic acid content was insert in table 2. The polifloral honey was richer in total polyphenols than Linden and Acaccia honey samples. For ascorbic acid the Acaccia honey has the highest values (12.04 mg\%), followed by polifloral honey (8.02 mg\%) and Linden honey (4.42 mg\%).

Table 2.
Estimative mean values for total polyphenol and vitamin C content of analysed honey samples

Type of Honey	Sample nr.	Total polyphenol content (mg of gallic acid equivalents/100g of honey)	Vitamin C mg ascorbic acid/ 100g honey
Polifloral	1	87.8	8.1
	2	95.6	7.5
	3	89.4	9.3
	4	98.2	8.5
	5	97.6	6.7
	Mean \pm sd	93.72\pm4.8	8.02\pm0.98
Acaccia	6	44.9	14.2
	7	46.7	10.5
	8	46.3	12.3
	9	44.9	13.4
	10	47.2	9.8
	Mean \pm sd	46\pm1.05	12.04
Linden	11	52.7	4.2
	12	48.6	3.4
	13	55.9	4.8
	14	59.8	5.1
	15	60.6	4.6
	Mean \pm sd	55.5\pm5.0	4.42

CONCLUSION

The analysis of the results obtained in this study shows that:

- ✓ Samples analyzed for all types of honey correspond to chemical and biochemical parameters, like moisture, ash, diastase activity and invertase activity according to standards for fresh honey without falsification and without heat treatment.
- ✓ Due to the nature of antioxidant compounds honey has an important role in maintaining the health of human body. The content of these compounds depends on the floral origin of honey.
- ✓ The polyphenolic compounds had the highest value for polyfloral honey followed by Linden and Acacia honey. Following the results obtained was observed that Acacia honey, polyfloral and Linden flower honey, contain an important amount of Vitamin C, which is necessary for human body.

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