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TRADE QUALITY OF HONEYS SOLD IN STORES OF RETAIL CHAINS

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Abstract: The aim of this work was to analyze physicochemical quality parameters of commercial honeys. Twenty six honey samples were bought in stores of retail chains. The samples included 15 multifloral honeys, 7 lime honeys and 4 acacia honeys. The following parameters were determined: water content, insoluble solids content, specific conductivity, free acidity, glucose, fructose and sucrose contents, diastase number and 5-hydroxymethylfurfural content. It was found that the analyzed honeys were characterized by increased insoluble solids content and decreased diastase number, whereas values of the other parameters complied with the relevant legal requirements.
Keywords: honey, physicochemical parameters, trade quality

INTRODUCTION

According to the Regulation of the Minister of Agriculture and Rural Development on the detailed requirements for trade quality of honeys (**Legal Act: Dz.U. 2003 nr 181 poz. 1773**) honey is a natural sweet product that is produced by bees *Apis mellifera* when the nectar or sweet deposits from plants and trees or excretion of insects sucking juices of the living parts of plants are gathered, modified, evaporated and stored in the honeycomb. Honey is a natural sweetening substance with specific physicochemical and sensory properties. Due to its wide chemical composition it is a source of many valuable nutritive compounds and it has medicinal and therapeutic properties (**Hołderna–Kędzia and Kędzia 2008**). Moreover, honey contains many antioxidative compounds, including flavonoids and phenolic acids (**Socha et al., 2011**). The commercial honey has to comply with the relevant quality requirements specified in the laws. In Poland the trade quality of honey is regulated by the Regulation of the Minister of Agriculture and Rural Development on the detailed requirements for trade quality of honeys (**Legal Act: Dz.U. 2003 nr 181 poz. 1773**) as amended.

The aim of this work was to analyze physicochemical quality parameters of commercial honeys sold in stores of retail chains.

MATERIALS AND METHODS

Twenty six honey samples were bought in stores of retail chains in the province of Malopolska. The samples included 15 multifloral honeys, 7 lime honeys and 4 acacia honeys.

According to the Regulations of the Minister of Agriculture and Rural Development on the detailed requirements for trade quality of honeys (Legal Act: Dz.U. 2003 nr 181 poz. 1773) and on methods of analysis related to the assessment of honey (Dz.U. 2009 nr 17 poz. 94) the honeys were analyzed in respect of physicochemical parameters that are required for assessing the quality of commercial honey. Water content was determined by refractometric method using Abbe refractometr (RL3, PZO Warsaw, Poland). Insoluble solids content was determined by gravimetric method. Specific conductivity was determined using conductometer CPC 501 (Elmetron, Warsaw, Poland). Free acidity was determined by titration method. Glucose, fructose and sucrose contents were determined using high

performance liquid chromatograph (HPLC) LaChrome (Merck-Hitachi, Japan) with refractometric detection. Diastase number, according to Schade scale was determined by spectrophotometric method using UV-Vis spectrophotometer (V-530, Jasco, Japan). A 5-hydroxymethylfurfural (HMF) content was determined using HPLC system with detection by UV at 285 nm.

Principal Component Analysis (PCA) was used to provide a ready means of visualizing the differences and similarities among the honey samples. The calculations were performed using Statistica v. 9.0 software.

RESULTS AND DISCUSSION

In Table 1 values of the determined physicochemical parameters for the analyzed groups of honeys are presented. Water content in honey is one of the parameters that determine trade quality of honey. Too high water content may be responsible for fermentation of honey, as well as favors the crystallization process. According to the relevant legal acts (**Legal Act: Dz.U. 2003 nr 181, poz. 1773**), water content in honey should not exceed 20 %. In this study only in one sample of the multifloral honey the water content was slightly exceeded.

Table 1. Values of physicochemical parameters that characterize trade quality of the honeys.

Parameter		Type of honey		
		Multifloral n = 15	Lime n = 7	Acacia n = 4
Water content (g/100g)	range	17.47 – 20.10	17.50 – 19.00	17.13 – 18.60
	mean ± SD	18.41 ± 0.41	18.32 ± 0.17	17.88 ± 0.12
Insoluble solids content (g/100g)	range	0.15 – 0.90	0.20 – 0.44	0.19 – 0.24
	mean ± SD	0.42 ± 0.02	0.31 ± 0.01	0.22 ± 0.01
Specific conductivity (mS/cm)	range	0.14 – 0.37	0.21 – 0.39	0.04 – 0.10
	mean ± SD	0.24 ± 0.06	0.28 ± 0.06	0.08 ± 0.03
Free acidity (mval/kg)	range	11.75 – 21.75	7.75 – 13,00	6.75 – 9.00
	mean ± SD	14.63 ± 0.28	10.39 ± 0.25	8.06 ± 0.26
Glucose + Fructose content (g/100g)	range	65.78 – 76.38	67.14 – 73.30	66.33 – 69.99
	mean ± SD	73.15 ± 0.38	69.68 ± 0.46	68.28 ± 0.26
Sucrose content (g/100g)	range	0.00 – 2.54	0.00 – 1.69	0,00 – 1.07
	mean ± SD	0.58 ± 0.01	0.48 ± 0.01	0.60 ± 0.01
Diastase number (Schade scale)	range	3.61 – 8.57	3.58 – 19.81	5.23 – 9.77
	mean ± SD	4.99 ± 0.15	11.33 ± 0.24	6.59 ± 0.07
HMF content (mg/kg)	range	15.38 – 26.89	6.70 – 15.53	7.65 – 13.63
	mean ± SD	19.07 ± 0.30	9.04 ± 0.20	10.03 ± 0.15

The insoluble solids may consist of grains of pollen, fungi spores, yeast, bacteria, bacterial spores, fragments of bees, cells of algae, the wax and many others (**Hołderna–Kędzia and Kędzia 2008**). According to the Regulation of Ministry of Agriculture and Rural Development (**Legal Act: Dz.U. 2003 nr 181, poz. 1773**) insoluble solids content should not exceed 0.1 g/100 g or 0.5 g/100 g in honey and pressed honey, respectively. As results from the data presented in Table 1 the lime and acacia honeys met the requirements for pressed honey, whereas in the case of the multifloral honeys in many samples an increased insoluble solids content, even up to 0.9 g/100 g, was found. Value of the specific conductivity of honey depends on honey raw materials. Presence of a honeydew that is a rich source of mineral compounds increases value of conductivity of honey (**Majewska et al. 2010**). According to current regulations (**Legal Act: Dz.U. 2003 nr 181, poz. 1773**) specific conductivity of honey should not exceed 0.8 mS/cm for nectar honey. All the analyzed honeys met the above

mentioned requirement (Table 1), however the acacia honeys were characterized by much lower values of the specific conductivity than the lime and multiflower honeys. These differences can result from the fact that spring honeys, including acacia honey, show lower conductivity than summer honeys such as lime and multifloral honeys. Free acidity of honey is an essential parameter that determine trade quality of honey. Increased value of this parameter can reflect fermentation process and can accelerate the formation of HMF (**Majewska in. 2010**). In our study value of free acidity for all the honey samples was in accordance with current regulations (**Legal Act: Dz.U. 2003 nr 181, poz. 1773**) and was lower than 50 mval/kg. The highest mean value of free acidity was determined for the multifloral honeys, while the lowest ones for the acacia honeys. Reducing sugars are the largest group of compounds in honey. According to the Regulation of Ministry of Agriculture and Rural Development (**Legal Act: Dz.U. 2003 nr 181, poz. 1773**) the sum of reducing sugars in honey should not be lower than 60 g/100 g. All the analyzed honey samples met the above mentioned criterion. The highest mean value of sum of fructose and glucose was found for the multifloral honeys, while much lower values were determined for lime and acacia honeys (Table 1). Sucrose, a non-reducing sugar, is an important parameter for quality assessment of honey. Too high sucrose content may reflect that the honey is immature or adulterated by invert sugar. During storage sucrose content in honey decreases due to invertase activity that results in sucrose decomposition (**Hołderna–Kędzia i Kędzia 2008**). Sucrose content in the analyzed honeys did not exceed 5 g/100 g that was in accordance with the requirements on the trade quality of honey (**Legal Act: Dz.U. 2003 nr 181, poz. 1773**). Diastase number is a measure of enzymatic activity in honey and it refers to α-amylase and β-amylase. According to the Regulation of Ministry of Agriculture and Rural Development (**Legal Act: Dz.U. 2003 nr 181, poz. 1773**) diastase number should not be lower than 8 of Schade scale. The lime honeys were characterized by the highest mean value of that parameter, while the multifloral honeys were characterized by the lowest one (Table 1). Only five of all the honey samples showed diastase number meeting the requirement of the current regulations (**Legal Act: Dz.U. 2003 nr 181 poz. 1773**). Such low diastase number of honeys could result, among others, from prolonged storage or too high temperature during filtration and decrystallization processes. A HMF is an aldehyde that is formed at high temperature as a result of dehydration of fructose. In a fresh honey there is little HMF, but its content increases during storage of honey. Increased HMF content may indicate an overheating of honey during filtration or recrystallization, as well as an adulteration of honey by invert sugar. According to the Regulation of Ministry of Agriculture and Rural Development (**Legal Act: Dz.U. 2003 nr 181, poz. 1773**) HMF content can not exceed 40 mg/kg. The highest HMF value was determined in the multifloral honeys, while the lowest one in the lime honeys (Table 1). In all the analyzed honey samples the allowed HMF content was not exceeded.

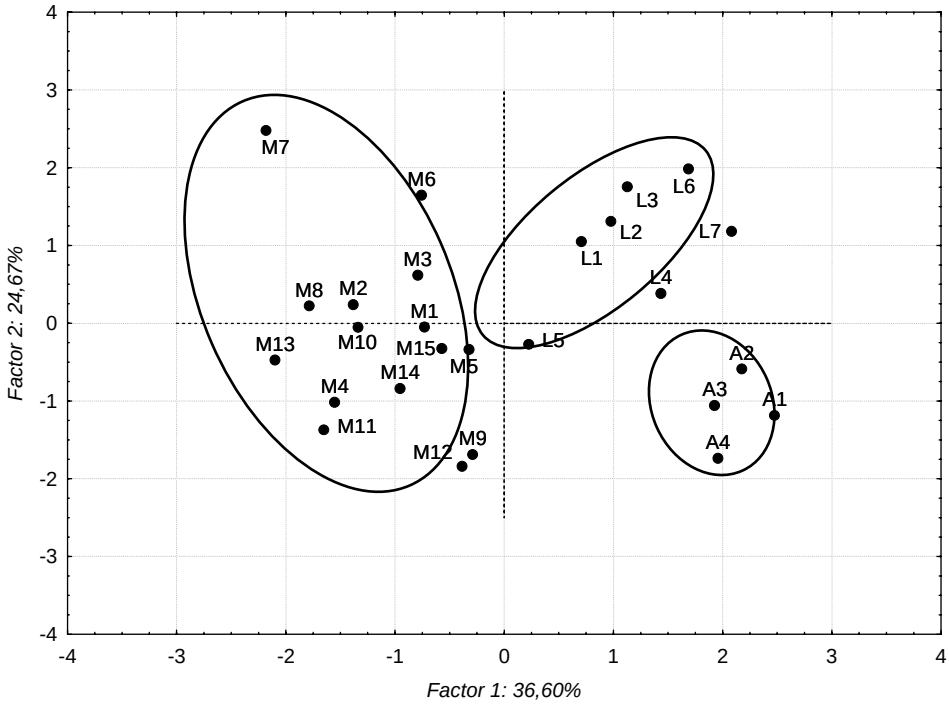

Figure 1. Principal component analysis – distribution of honey samples: M – multifloral honey, L – lime honey, A – acacia honey.

In Fig. 1 results of the principal component analysis are presented. The parameters explaining the variablility were: insoluble solids content, specific conductivity, free acidity, sum of glucose and fructose contents, diastase number and HMF content. Reduced variables explained more than 60% of the variation and clearly show the differences between particular honey varieties.

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