

Some physico-chemical properties of different honey (pine honey, sunflower and cotton) types

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Abstract

In current study, hydroxy methyl furfural (HMF), diastas, moisture, acidity, ash, pH and electric conductivity (EC) of collected honey samples were determined. The highest ash content was found in pine honey (0.73 %). pH values of honey samples ranged from 3.76 (cotton) to 4.78 (pine honey). Also, acidity values of honeys were found between 22.79 meq/ kg (sunflower) and 44.25 meq/ kg (cotton). In all samples, hydroxy methyl furfural values were found between 2.32 mg/ kg (cotton) and 4.03 mg/ kg (sunflower). In addition, diastatic activities of honey samples were found between 27.80 (sunflower) and 35.46 (pine honey). EC values of floral honey types changed between 0.42 mS/ cm (floral honey) and 0.85 mS/ cm (cotton honey). While fructos contents of honey change between 24.64 % (pine honey) and 48.13% (cotton), glucose contents of samples varied from 22.03% (pine honey) to 36.74% (sunflower).

Keywords: honey, floral honey, pine honey, acidity, ash, hydroxy-methyl-furfural, diastas, electric conductivity

1. Introduction

Honey is a sweet product formed after collection of flower nectars or sweet substances excreted by *Basra* (*Marchelina hellenica*, iso-winged insects) (by using living parts of plants) by honey bees (*Apis mellifera*) and then change of these substances in bodies of the bees and finally storage and maturation in cells [1,2]. Different honeys are produced in different parts of Turkey according to their flora. The known honeys are pine honey (in Muğla), citrus honey (in Mediterranean) and chestnut honey (in Black Sea region). Various flower honeys are produced in all regions [2]. Composition of honey changes according to source of nectar and seasonal conditions. The most important factor affecting composition of honey is the variety of plant from which nectars are collected.

Zappala et al., [2] reported that the HMF measured by white method, were 27.7 and 31.3 mg/Kg of honey for eucalyptus 1, 6.9 and 7.3 mg/Kg of honey for eucalyptus 2, using the suggested formula and the external calibration, respectively. Küçük et al., [3] measured 17.0%, 19.7 and 19.0% moisture; 0.20, 0.50 and 0.24% ash; 29.4, 36.7 and 33.6 meq/Kg total acidity; 19.2, 28.6 and 24.1 mg/Kg HMF and 17.9, 17.7 and 23.0 diastase activity in Hetrofloral, Chestnut and Rhododendron honeys, respectively. Honey is composed of carbohydrates, enzymes, water, organic acids, minerals, vitamins, proteins, aromatic and antioxidant substances [4]. The aim of this study was to establish physico-chemical properties (hydroxy methyl furfural (HMF), diastas, moisture, acidity, ash, pH and electric conductivity (EC)) of floral and pine honey samples collected different locations.

2. Material and methods

2.1. Material

In this study, four different honeys were used. In this concept, polyfloral honey (Hadim-Konya), sunflower honey (Karapınar-Konya), cotton honey (Kırıkhan-Hatay) and pine honey (Köyceğiz-Muğla) from beekeeper in 2013. Honey samples were kept in hermetic glass jars at the room temperature (22-25°C) in suitable storage conditions.

2.2. Methods

Physico-chemical properties (Hydroxy methyl furfural (HMF), diastase, moisture, acidity, ash, pH and electricity conductivity (EC)) of collected honey samples were analysed according to AOAC [5]. For electricity conductivity analysis, 40mL of 0.1M potassium chloride solution was added to a beaker and the cell immersed in the solution together with a thermometer. The electrical conductance (G) of this solution has been detected in mS after the temperature has been equilibrated to 20 °C. Sugar contents were analysed with HPLC (Shimadzu, Tokio-Japan) according to Bogdanov. Ten grams of honey were weighed into a small beaker and dissolved in 50 ml water and transferred 100 ml volumetric flask and completed to volume with acetonitrile [6].

2.3. Statistical analysis

Statistical analysis of the data obtained in this study was made according to "Duncan Multiple Comparison Test" [7].

3. Results and Discussion

Physico - chemical properties of some pine and floral honeys are given in Table 1. The moisture contents of honey samples changed between 17.50 % (pine honey) and 19.97 % (sunflower), with a mean of 19.74 %. These results are under of values of Turkish Standard Institute (TSI), European Commission and Codex. The highest ash content was found in pine honey (0.73 %). pH values of honey samples ranged from 3.76 (cotton) to 4.78 (pine honey). Also, acidity values of honeys were found between 22.79 meq/ kg (sunflower) and 44.25 meq/ kg (cotton). Acidity value of cotton showed parallel with its pH value. Others showed differences with pH value. These differences can

be probably due to components of nectars and structure of plants. In all samples, hydroxy methyl furfural values were found between 2.32 mg/ kg (cotton) and 4.03 mg/ kg (sunflower). These values show that heating had not been tried to honey samples. In addition, diastase activities of honey samples were found between 27.80 (sunflower) and 35.46 (pine honey). When diastase values compared with TSE, AB and Codex values, they were found in pine honey sample (1.41 mS/ cm). EC values of floral honey types changed between 0.42 mS/ cm (floral honey) and 0.85 mS/ cm (cotton honey). These differences among EC values can be probably due to differences of element contents of honey samples. While fructose contents of honey change between 24.64 % (pine honey) and 48.13% (cotton), glucose contents of samples varied from 22.03% (pine honey) to 36.74% (sunflower). Also, saccharose contents of samples were found under the TSI, AB and Codex values, and changed between 0.47% (cotton) and 1.98% (pine honey). Generally, sugar contents of honey samples are related to structure of plants nectars.

HMF values in study were found different with HMF results of Estevinho et al. [8], Pérez-Arquillué et al. [9] and Özcan and Ölmez [10]. Generally, diastase can be used at the classifications of monofloral honeys [11]. Diastase activity values of our current study were found low according to diastase results of Perez-Arquille et al. [9], and were found partly high according to results of Gül, [12], Özcan and Ölmez, [10], Şahinler and Gül, [13], Gomes et al. [14]. Özcan et al.[28] that diastase activity of acid treated saccharose syrup honey was below the standard limit and HMF content of this honey was high, but not exceeding the limit. In previous study, moisture contents of sunflower and pine honeys were determined as 17.98% and 18.2% to % 14.73% and 16.2%, respectively [10, 15-17].

According to literature values, our moisture contents were found high. It can be said that ash contents of floral honeys are low than secretion honeys [18-21]. In previous study, pH values of honey samples had changed between 4.29 and 4.93 [10,17, 22,23]. Özcan and Ölmez [10] reported that pH value of cotton honey was 3.76. Our findings were found similar compared with literature values. Acidity value of secretion honeys were determined between 10.71 and 34.42 meq/kg [17,23]. Haroun [24]

determined 38.77% and 30.61% fructose, 34.73% and 23.51% glucose, 0.67% and 3.02% saccharose in cotton and secretion honey samples, respectively. In other study, Özkök [22] determined 36.04% fructose, 26.35% glucose and

6.95% saccharose in secretion honey. EC values of sunflower honeys ranged from 0.26 to 1.10 mS/cm [10,25,26,27]. Our EC values were found similar with literature values.

Table 1. Physico- chemical properties of some honeys

Honey samples	Pine Honey	Cotton	Sunflower	Flower honey	Lowest value	Highest value	Mean	TSE	AB	Codex
Moisture (%)	17.63±0.08*	18.50±0.36	19.97±0.08	18.77±0.27	17.50	21.98	19.74±0.09	≤ 20 %	≤ 20 %	≤ 20 %
Ash (%)	0.73±0.04	0.41±0.01	0.23±0.00	0.16±0.01	0.14	0.80	0.47±0.25	≤ 0.6 (ÇB) ≤ 1.0 (SB)	≤ 0.6 (ÇB) ≤ 1.2 (SB)	≤ 0.6 (ÇB) ≤ 1.0 (SB)
pH	4.78±0.09	3.76±0.03	3.88±0.01	4.06±0.03	3.70	4.88	4.29±0.05			
Acidity (meq/kg)	29.17±0.50	44.25±0.81	22.79±0.37	30.25±0.51	22.04	45.45	33.74±0.57	≤ 50 (ÇB)1 ≤ 50 (SB)2	≤ 50 (ÇB)1 ≤ 50 (SB)2	≤ 50 (ÇB)1 ≤ 50 (SB)2
HMF (mg/kg)	3.73±0.13	2.32±0.05	4.03±0.22	2.50±0.66	1.31	4.40	2.85±0.63	≤ 40 (ÇB) ≤ 40 (SB)	≤ 40 (ÇB) ≤ 40 (SB)	≤ 40 (ÇB) ≤ 40 (SB)
Diastas	35.46±0.75	31.84±1.17	27.80±0.92	31.68±1.31	26.20	36.22	31.21±0.00	≥ 8 (ÇB) ≥ 8 (SB)	≥ 8 (ÇB) 1 ≥ 8 (SB) 2	≥ 8 (ÇB) 1 ≥ 8 (SB) 2
EC (mS/cm)	1.41±0.07	0.85±0.03	0.54±0.58	0.42±0.02	0.38	1.53	0.80±0.03	≤0.8(ÇB) ≥0.8(SB)	≤0.8(ÇB) ≥0.8(SB)	≤0.8(ÇB) ≥0.8(SB)
Fructose (%)	24.64±0.31	48.13±0.03	37.56±0.02	37.60±0.10	24.12	37.00	30.56	-	-	-
Glucose (%)	22.03±0.03	29.97±0.21	36.74±0.12	31.63±0.14	21.98	48.20	35.09	-	-	-
Invert sugar (%)	46.67±0.31	78.10±0.25	74.30±0.15	69.23±0.12	46.10	78.60	62.35	≥60(ÇB) ≥45(SB)	≥ 60 (ÇB) ≥ 45 (SB)	> 60 (ÇB) > 45 (SB)
Saccharose (%)	1.98±0.06	0.47±0.12	1.41±0.02	0.92±0.03	0.30	2.10	1.20	≤ 5 (ÇB) ≤ 10 (SB)	≤ 5 (ÇB) ≤ 10 (SB)	≤ 5 (ÇB) ≤ 10 (SB)

*mean±standard deviation; ÇB: flower honey, SB: honeydew

Conclusion

As a result, the properties of honey samples studied were found similar to values of TSI, AB and Codex values. Also, acidity values of honeys were found between 22.79 meq/ kg (sunflower) and 44.25 meq/ kg (cotton). In all samples, HMF (hydroxy methyl furfural) values were found low, and found between 2.32 mg/ kg (cotton) and 4.03 mg/ kg (sunflower). In addition, diastase activities of honey samples were found high, and were found 27.80 (sunflower) and 35.46 (pine honey). Partly differences were observed in honey characteristics. These differences can be due to plant varieties, locations, moisture contents, locations and analytic conditions.

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Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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