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SENZORIAL AND PHYSICO-CHEMICAL CHARACTERISATION OF HONEY FROM MUNTENIA ZONE, ROMANIA

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Abstract
With a high nutritive value and healing properties, honey is a well known natural food product. Factors like floral source and climate condition influence the properties of honey.
The study investigated sensorial and physicochemical characteristics of some honey samples collected directly from the beekeepers from Muntenia Zone, Romania.
The colour, pH, moisture content, electrical conductivity, ash content, acidity and total sugar were evaluated. Moreover, these characteristics were compared with the International Standard of Codex Alimentarius.
The results showed that all the honey samples had similar physico-chemical properties and respect the limits imposed by EU standards; in this way was proved that the honey from Muntenia Zone is a good quality honey. This standard could be sustained by regular training of local bee farmers in honey harvesting and storage.

Keywords: honey, sensorial indicators, physic-chemical characteristics, quality.

1. INTRODUCTION

Honey is defined as "the natural sweet substance produced by *Apis mellifera L*. from the nectar of blossoms or from secretion of living part of plants"(Codex Alimentarius, 2001). Honey bees transform it through enzymatic activity and store it in wax structure called honeycombs (Mulugueta et al., 2017). Honey is a viscous liquid that contain at least 181 constituents (Bogdanov, 2002), sugar, vitamins, minerals and other bioactive substances (amino-acids, phenolic constituents, flavonoids, etc).

The composition and quality of honey are strongly influenced by factors such as bee species, types of flowers utilized by bees, geographical and climatic factors and treatment of honey duringextraction and storage (Tesfaye et al., 2016; Shobham and Nayar, 2017).

Based on their nutritional, medicinal and antioxidant properties, honey is one of the most studied food products. Honey is generally appreciated by physico-chemical parameters such as: moisture, ash content, acidity, electrical conductivity, total solids, hydroxylmetylfurfural (HMF) content. These parameters are indicators for the honey's quality and also provided useful information about the location and the botanical origin of honey (Piazza and Persanno Oddo, 2004).

The objective of this paper was to compare the honey samples from Muntenia zone based on their sensorial, physical and chemical parameters. These characteristics were reported to International Standard for honey quality recommended by European Commission.

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2. MATERIALS AND METHODS

The experiment was conducted in the Chemistry Laboratory from University of Pitesti. The honey samples were collected in different zones of Muntenia (Dabuleni, Rociu, Uda, Vladesti, Visina, Cosesti, Fetesti), during 2017 season, directly from the local beekeepers. The samples were stored at 4˚C until further analysis. All honey samples were prepared and analyzed according to International Standard of Codex Alimentarius, 2001.

Physical composition (colour, moisture content, electrical conductivity) and chemical characteristics (moisture, ash, pH, total soluble solid, free acidity and HMF) were analysed.

Moisture

For the appreciation of moisture content, 5g of each honey sample was dried to constant mass, at 105 ˚C. Then, the ratio of the mass of fresh honey sample and the mass of the dried sample was expressed in percent.

Electrical conductivity

A multimeterC-561 was used to determine electrical conductivity of 20g honey mixed with 100ml distilled water, after calibration of the apparatus using KCl 0.01M.

pH

The pH was measured using a multimeterC-561which was calibrated with standard buffer solution. The pH for 10g honey mixed with 75ml distilled water was recorded for each sample.

Free acidity

Free acidity was determined by mixing 10g honey with 75 ml distilled water and then the mixture was titrated with 0.1M NaOH solution until pH became 8.3. Free acidity was expressed in miliequivalens of acids/kg honey.

Total solids

The percentage total solids was calculated using equation:

$$\text{Total solids (\%)} = 100 - \text{Moisture} \quad (1)$$

Hydroxylmetylfurfural (HMF)

The solution obtained by the dissolution of 5 g of honey in 25 ml distilled water was treated with a clarifying reagent and then was diluted to 50 ml with distilled water. The absorbance of the filtrated is measured at 284 nm and 336 nm against an aliquot of the filtrate treated with 5 ml 0.20% bisulphite solution. The HMF content (A.O.A.C., 1990) is calculate with equation:

$$HMF = ((A_{284} - A_{336})/(\text{sample weight}))*74.87 \quad (2)$$

Ash

5g of each honey sample was heated at 600˚C. After complete ignition to constant mass, the sample was cooled in a desiccator and weighed immediately.

3. RESULTS AND DISCUSSIONS

The organoleptic characteristics of honey samples from Muntenia region are reported in table 1.

The taste of the honey samples ranged from bitter to fair, good to very good or excellent and the odour ranged from fair to excellent**.**

The honey colour is influenced by floral source, geographical region, exposure to high temperature, storage time and beekeeper's intervention (Jones et al., 2011). Thus, the consumer's preferences are determined by honey colour. In our experiment, the honey colour ranged from white to dark brown

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colour. Dark coloured honey (as honey from Uda) contained more minerals (iron and manganese) and more phenolic acid derivates which makes it good for medicinal uses (Gonzales et al., 2000).

Table1. The organoleptic characteristics of honey samples from Muntenia zone

Location	Taste	Odour	Colour
Dabuleni	Bitter	Very good	Whitish
Rociu	Very good	Good	Golden yellow
Uda	Fair	Good	Dark brown
Vladesti	Excellent	Very good	Golden
Visina	Very good	Excellent	Golden
Cosesti	Good	Fair	Golden
Fetesti	Fair	Very good	Golden brown

The investigated physico-chemical parameters are presented in table 2.

Table 2. The physico-chemical characteristics of honey samples from Muntenia zone

Location	pH	Moisture content %	Electric conductivity mS/cm	Ash %	Free Acidity meq/kg	Total solid %	HMF mg/kg
Dabuleni	3.99	15.6	0.21	0.7	22	84.4	11.21
Rociu	3.98	16	0.31	0.7	26	84	20.57
Uda	4.56	19	0.78	0.9	40	81	39.83
Vladesti	4.52	16.2	0.34	0.7	28	83.8	17.53
Visina	3.98	18	0.41	0.8	38	82	25.69
Cosesti	3.98	17.4	0.32	0.5	35	82.6	27.79
Fetesti	4.24	16.2	0.61	0.3	38	83.8	16.34

The moisture content is one of the important parameter for quality of honey; it is directly influenced by atmospheric moisture and depends on location, species and methods of harvesting and extraction of honey. (Iftikhar et al., 2014) In our samples, the moisture content was in the range 15.6% - 19%, which are within the limit (maxim 21% for UE and maxim 20% for USA) recommended by the Codex Alimentarius Standard for honey.Higher moisture content is correlated with a higher probability of honey fermentation during storage (Bogdanov, 2002).

The total solids values in studied samples were very high. They ranged between 81% and 84.4%, indicating that they were within the acceptable total solids range. There was no significant difference in the amount of total solids among honey samples studied from all the seven location.

pH values of the seven honey samples studied ranged between 3.98 and 4.56. So, all the honey samples were acidic and in conformity with the international quality standards. We remark the same pH values for samples honey from Rociu, Visina and Cosesti (3.98) and appropriate values for samples from Vladesti and Uda (4.52 and 4.56). All these pH values are low enough to inhibit the growth of microbial organisms.

The acidity of honey recommended by Codex Alimentarius is less than 40 meq acid/kg. In our study, only the honey from Uda is characterized by this high free acidity(40 meq/kg); for others honey samples the free acidity ranged between 22 meq/kg and 38 meq/kg.

The electrical conductivity of honey samples from Muntenia zone ranged between 0.21 mS/cm and 0.78 mS/cm. These values are within the limits sets by European Legislation (under 0.8 mS/cm),

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which indicated that all honey samples are from nectar honey (Gomez et al., 2010). We remark a variability between the EC values for honey samples investigated because the electrical conductivity depending on the floral source of honey, which was different in our experiment (honey sample from Rociu was from sunflower, honey sample from Dabuleni was from colza, etc)

Ash content is an indicator of the cleanliness of honey and depends on nectar composition (Gairola et al., 2013). In the same time, the ash content is a measure of mineral content of honey and determines the colour and nutritional value of honey (Mulugueta et al., 2017). The ash content in investigated honey samples varied from 0.3% to 0.9 % which is within the acceptable range. These lower values indicate good physical property for the honey (Kayode and Oyeyemi, 2014). The variation in the ash content of the honey samples might be due to differences in the floral origin of the honeys.

HMF (hydroxymethylfufural) is produced when fructose is decomposed and depends upon the pH, heating temperature and storage period (Subramanian et al., 2007). HMF values for honey increase due to the excessive heat treatment during processing of honey or prolonged storage about 27˚C. The HMF is used as standard for testing honey's freshness and overheating of the honey (Iftikhar et al., 2014). The maxim value for HMF recommend by the Codex Alimentarius is 40 mg/kg and we remark from table 2, that HMF is ranged between 11.21 mg/kg and 39.83 mg/kg.

4. CONCLUSIONS

Pysico-chemical properties data have shown that all the investigated honey samples from Muntenia Zone respect the standard recommended by European Commission regarding the honey quality.

It remarks some differences between the values of moisture, ash, acidity, electrical conductivity, HMF content due to different location and botanical source.

It is recommended a continuous monitoring of the honey quality.

It is advisable that beekeepers know and respect the EU standards for production, processing, storage and distribution for honey.

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