

## **COMPARATIVE STUDIES BETWEEN SOME PHYSICAL AND CHEMICAL PROPERTIES OF CITRUS, CLOVER AND COTTON HONEY IN KAFR EL-SHEIKH AND BEHEIRA GOVERNORATE**

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### **ABSTRACT**

Eighteen bee honey samples were collected from two different locations in Egypt, representing the following plant sources: citrus honey (six samples), clover honeys (six samples), cotton honey (six samples) Samples were collected from two different provinces represent each of them at the first geographic area Kafr El-Sheikh governorate and second are Beheira. No significant differences between treatment in all Physical, chemical properties and Suger analysis. The mineral analysis showed no significant differences among all treatments except in potassium that was significant, with lowest value (11.050) at Motobes, Kafr- El-Sheikh citrus honey and the highest value 56.1 at Abou-Elmtamir, Beheira cotton honey.

### **INTRODUCTION**

Honey standardization is an important object to study even country in all over the world has its special honey standard, depending on the different environmental factors existing in each country. Survey of floral honey composition have established that the three major components are fructose, glucose, and water (Doner,1977) .The flora plays an important role in beehoney components and properties. Honey therapeutic varies depending on its origin. The floral source has been shown to affect largely on composition of honey. It is also possible that the components of honeys affect their antibacterial activity since honeys with lower antibacterial activities may mask the higher antibacterial activity of other honeys (Basualdo *et al.*, 2007)

The quality of honey is mainly determined by its sensorial, chemical, physical and microbiological characteristics (Finola *et al.*, 2007). In fact, numerous studies have been reported on the physicochemical parameters of honeys from all over the world (Azeredo *et al.*, 2003; Finola *et al.*, 2007; Kucuk *et al.*, 2007; Al *et al.*, 2009). More recently, a correlation has been established between the level of H<sub>2</sub>O<sub>2</sub> and the degree of antimicrobial activity of honey. It was also suggested that H<sub>2</sub>O<sub>2</sub> alone may not be sufficient to account for the antimicrobial activity (Chen *et al.*, 2012). Phenolic compounds are among the most important groups of compounds occurring in plants, and are found to exhibit anticarcinogenic, anti-inflammatory, antiatherogenic, antithrombotic, immune-modulating and analgesic activities, as then function as antioxidants (Giorgi *et al.*, 2011).

Thus, with different compositions of active compounds in honey collected from different locations, differences in honey properties are to be expected. Diastase numbers, hydroxymethylfurfural, proline and sucrose are

usually used as indicators of the ripeness and quality of honeys (Arreaz *et al.*, 2006).

As not all honeys are created equal in molecules terms of antimicrobial and antioxidant activity because of differences in levels of peroxide production and non-peroxide factors, which vary by floral source and processing, a comparative study has been conducted to establish the antibacterial and antioxidant potency of four varieties of honey from different botanical and geographical origins. Given the huge number of reports on the antioxidant properties of honey, the latter might be a novel antioxidant in the management of chronic diseases commonly associated with oxidative stress (Erejuwa *et al.*, 2012).

The present study aims to investigate if the honey samples collected from different location and variable flora have an effect in physical and chemical properties of honey. and also the minerals and bacteria-inhibiting effect were studies.

## **MATERIALS AND METHODS**

This investigation was conducted at the Sakha Agricultural Research Station and helth monestar laboratory during the period of 2011 to Identify differences in the physical and chemical properties and concentration of minerals in honey collected from different location.

### **Collecting honey Samples :**

Eighteen honey samples were collected from two different locations in Egypt(Kafr El-Sheikh governorate and EL-Beheira governrat), representing the following plant sources: citrus honey, clover honey, cotton honey (six samples each). The samples were collected from two different provinces; Kafr El-Sheikh and second are Beheira governorate. All samples were stored in plastic containers, and kept in cool conditions (-10 c°). The samples were analyzed at The Ministry of Health Labs for the following properties:

#### **1. Physical properties**

##### **1.1. water content (%)**

Water content of tested honey samples was carried out according to the methods of Wedmore (1955), Whit *et al* (1962) and A.O.A.C (1995)

##### **1.2. Total soluble solids % ( T. S. S. %):.**

T.S.S.% of honey samples was measured by using Abbe refractometer standardized at 20c according to A.O.A.C (1995). This measurement may reflect the sugar content in honey

##### **1.3. Specific gravity:**

The specific gravity of testing samples was measured according to Wedmor (1955), and therefore, tabulated water content % was calculated and honey grades were determined, according to White (1967). Top grade honeys (A&B) contain not more than 18.6% water; grade C contains water % to 20%, and grade D contains more than 20% water

##### **1.4. Viscosity:**

The viscosity of honey samples was measured by using a Viscometer at 29C, according to Munro (1943).

### **1.5 Colors (as optical density)**

The optical density of all samples was determined, and the color was measured by using the relation between optical density and USDA color standards as indicated by the White (1978)

### **1.6. Electrical conductivity.**

Based on the method of Vorwohl (1964)

### **1.7 Granulation:**

The granulation of different types of examined honey was measured according to White *et al.* (1962) as the percentage between glucose and fructose (D/L).

## **2. Chemical properties:**

### **2.1. Sugars**

The concentrations of fructose%, glucose%, sucrose% and maltose% of honey samples were determined by High-Performance Liquid Chromatography (HPLC) according to the method of **Bogdanov and Baumann** (1988).

### **2.2. Minerals**

The following minerals were determined in the tested samples; K (potassium), Na (sodium), Mn (manganese), Cu (copper), Fe (ferric), Zn (Zink) and Pb (lead) .

Determination was carried out according to **Chapman and Pratt** (1978).

One gram of the dried honey sample was accurately weighed and digested in a Kjeldahle flask with 10 ml. Of 3:2:1 nitric – Perchloric – sulfuric acid mixture. The contents of the flask were heated slowly to encourage smooth digestion without stirring. After complete digestion, the flask was strongly heated to remove excess nitric and perchloric acids and to reduce the volume of the solution. The solution was cooled and transferred quantitatively into a 100 ml .Volume with diagnosed water. A blank experiment was carried out by using 10 ml. of the acid mixture. The contents of K, Na, Mn, Cu, Fe, Zn and Pb were determined by using an atomic absorption method, FMD3 Zeiss, according to Chapman and Pratt (1978).

### **2.3. PH and total acidity**

pH and total acidity were determined according to White *et al* (1962)

### **2.4. Hydroxy methyl furfural (HMF)**

The method of determination was carried out according to Winkler (1955)

All data were organized and programmed using a computer for statistical analysis according to "t" test.

## **RESULTS AND DISCUSSION**

Date in the table (1) showed that no significant difference among location , as well as among crops, at all treatements

**Table (1): Physical properties of clover, citrus and cotton honey**

Location	Honey type	Properties				
		Moisture	Specific Gravity	Electric conductivity (EC)	Total soluble solids (T.S.S)	Color
Sakha (Kafr- El-Sheikh)	Clover	19.000 <sup>a</sup>	1.410 <sup>a</sup>	0.017 <sup>a</sup>	81.000 <sup>a</sup>	0.312 <sup>a</sup>
Abou-ELmatamir, (Beheira)		21.000 <sup>a</sup>	1.395 <sup>a</sup>	0.011 <sup>a</sup>	79.000 <sup>a</sup>	0.358 <sup>a</sup>
Motobes, (Kafr El-Sheikh)	Citrus	20.000 <sup>a</sup>	1.407 <sup>a</sup>	0.013 <sup>a</sup>	80.500 <sup>a</sup>	0.162 <sup>a</sup>
Abou-ELmatamir, (Beheira)		19.500 <sup>a</sup>	1.403 <sup>a</sup>	0.010 <sup>a</sup>	80.000 <sup>a</sup>	0.212 <sup>a</sup>
Sakha (Kafr El-Sheikh)	Cotton	22.000 <sup>a</sup>	1.395 <sup>a</sup>	0.051 <sup>a</sup>	78.000 <sup>a</sup>	0.525 <sup>a</sup>
Abou-ELmatamir, (Beheira)		22.000 <sup>a</sup>	1.395 <sup>a</sup>	0.046 <sup>a</sup>	78.000 <sup>a</sup>	0.459 <sup>a</sup>

For each column, means followed by the same letter did not differ significantly at the 5% level

Date in the table (2) showed that no significant difference among location , as well as among crops, at all treatment

**Table (2): Chemical properties of clover, citrus and cotton honey**

Location	Honey type	Properties				
		PH	Free acidity	Lacton	Total acidity	Hydroxy Methylfurfural (H.M.F)
Sakha (Kafr- El-Sheikh)	Clover	3.65	48.00 <sup>a</sup>	5.00 <sup>a</sup>	53.00 <sup>a</sup>	3.84 <sup>a</sup>
Abou-ELmatamir, (Beheira)		3.40	38.00 <sup>a</sup>	12.50 <sup>a</sup>	50.50 <sup>a</sup>	0.00 <sup>a</sup>
Motobes, (Kafr El-Sheikh)	Citrus	3.73	28 <sup>a</sup>	1.0 <sup>a</sup>	29 <sup>a</sup>	9.6 <sup>a</sup>
Abou-ELmatamir, (Beheira)		3.62	43 <sup>a</sup>	7.5 <sup>a</sup>	50.5 <sup>a</sup>	3.84 <sup>a</sup>
Sakha (Kafr El-Sheikh)	Cotton	3.780	68.000 <sup>a</sup>	7.500 <sup>a</sup>	75.500 <sup>a</sup>	13.440 <sup>a</sup>
Abou-ELmatamir, (Beheira)		3.700	55.500 <sup>a</sup>	1.000 <sup>a</sup>	56.500 <sup>a</sup>	1.920 <sup>a</sup>

For each column, means followed by the same letter did not differ significantly at the 5% level

Date in the table (3) showed that no significant difference among location , as well as among crops, at all treatments.

**Table (3): Suger analysis of clover, citrus and cotton honey**

Location	Honey type	Fructose (%)	Glucose (%)	Sucrose (%)	Maltose (%)
Sakha, Kafr- El-Sheikh	Clover	39.0 <sup>a</sup>	31.5 <sup>a</sup>	1.2 <sup>a</sup>	3.25 <sup>a</sup>
Abou-Elmtamir, (Beheira)		39.0 <sup>a</sup>	29.9 <sup>a</sup>	3.1 <sup>a</sup>	4.9 <sup>a</sup>
Motopes , (Kafr El-Sheikh)	Citrus	40.0 <sup>a</sup>	31.0 <sup>a</sup>	1.6 <sup>a</sup>	3.5 <sup>a</sup>
Abou-Elmtamir, Beheira		39.9 <sup>a</sup>	30.2 <sup>a</sup>	1.5 <sup>a</sup>	4.2 <sup>a</sup>
Sakha, (Kafr- El-Sheikh)	Cotton	28.0 <sup>a</sup>	42.0 <sup>a</sup>	0.57 <sup>a</sup>	1.95 <sup>a</sup>
Abou-ELmtamir, (Beheira)		32.0 <sup>a</sup>	33.8 <sup>a</sup>	0.46 <sup>a</sup>	4.7 <sup>a</sup>

For each column, means followed by the same letter did not differ significantly at the 5% level

Date in the table (4) revealed no significant differences between meaning in manganese with lowest value (1.9) at Abou-Elmtamir, Beheira citrus honey, highest value (2.03) at the Sakha research station, Kafr- El-Sheikh cotton honey, ferric with lowest value 1.9 in Abou-Elmtamir, Beheira cotton honey, highest value (1.68) at the Sakha research station, Kafr- El-Sheikh cotton honey. Zink exhibited the lowest value (0.129) at Sakha research station, Kafr- El-Sheikh cotton honey, highest value 1.68 in in Abou-Elmtamir, Beheira clover honey. Sodium with lowest value (15.48) at Motobes, Kafr- El-Sheikh citrus honey, highest value (59.34) at Sakha research station, Kafr- El-Sheikh cotton honey and Copper displayed the lowest value (0.590) at Motobes, Kafr- El-Sheikh citrus honey, highest value (2.68) at Abou-Elmtamir, Beheira citrus honey. However The potassium values were significant higher at Abou-Elmtamir (Beheira) cotton and citrus honey than at in Sakha research station (Kafr- El-Sheikh) cotton and (Kafr El-Sheikh) Motobes citrus honey.

**Table (4): Minerals content of honey**

Location	Honey type	MN Ppm	FE Ppm	ZN Ppm	K Ppm	NA Ppm	CU Ppm
Sakha (Kafr- El-Sheikh)	Clover	2.100 <sup>a</sup>	1.450 <sup>a</sup>	0.105 <sup>a</sup>	22.100 <sup>a</sup>	21.500 <sup>a</sup>	0.920 <sup>a</sup>
Abou-ELmatamir, (Beheira)		2.020 <sup>a</sup>	1.420 <sup>a</sup>	0.329 <sup>a</sup>	21.250 <sup>a</sup>	20.64 <sup>a</sup>	1.070 <sup>a</sup>
Motobes, (Kafr El-Sheikh)	Citrus	1.970 <sup>a</sup>	0.93 <sup>a</sup>	0.043 <sup>a</sup>	11.050 <sup>a</sup>	15.48 <sup>a</sup>	0.590 <sup>a</sup>
Abou-ELmatamir, (Beheira)		1.900 <sup>a</sup>	1.21 <sup>a</sup>	0.168 <sup>a</sup>	31.450 <sup>b</sup>	21.50 <sup>a</sup>	2.680 <sup>a</sup>
Sakha (Kafr El-Sheikh)	Cotton	2.030 <sup>a</sup>	1.680 <sup>a</sup>	0.129 <sup>a</sup>	26.350 <sup>a</sup>	59.34 <sup>a</sup>	2.000 <sup>a</sup>
Abou-ELmatamir, (Beheira)		1.970 <sup>a</sup>	0.930 <sup>a</sup>	0.297 <sup>a</sup>	56.100 <sup>b</sup>	40.42 <sup>a</sup>	1.240 <sup>a</sup>

For each column, means followed by the same letter did not differ significantly at the 5% level

From the obtained results, it could be suggested that in the physical properties of clover, citrus and cotton honey did not differ significantly in the two areas in all treatments. In chemical properties of clover, citrus and cotton honey no significant difference between all treatments in the two areas. However, no significant difference between mains in Sugars and minerals except in potassium in the two geographic areas. These differences may be due to the change in climatic factors, differentiation of farmer fertilization practices and the difference between the two geographic areas. Many authors discussed the physical, chemical, sugar analysis and Mineral content properties of the honey and found that, The quality of honey is mainly determined by its sensorial, chemical, physical and microbiological characteristics. The criteria for ensuring quality honey have been specified by the EC Directive 2001/110 (Kirk, *et al* 1992). EC is one of the most important factors for determining the physical characteristics of honey (Serrano *et al* 2004). The major criteria are moisture content, electrical conductivity, ash content, reducing and non-reducing sugars, free acidity, diastase activity and Hydroxy Methylfurfural (H.M.F) content (AL, *et al* 2009). The pH of honey samples is important during the extraction process because it affects the texture of honey as well as its stability and shelf life (Terrab, *et al* 2002).

Ajlouni and Sujirapinyokul (2010) reported low Hydroxy Methylfurfural (H.M.F) concentrations of two unprocessed Australian honey samples, gray box and Banksia (1.35 and 1.12 mg/kg, respectively). The highest limit set for total sugar content by the European community directive (Council Directive of the European Union, 2002)

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مقارنة بين بعض الخصائص الطبيعية والكيميائية لعسل الموالح والبرسيم والقطن  
من محافظة كفر الشيخ والبحيرة  
أشرف شريف فتحي  
مركز البحوث الزراعية، معهد بحوث وقاية النبات

جمعت ثماني عشر عينة من العسل من موقعين مختلفين والتي تمثل المصادر النباتية التالية: عسل الموالح، عسل البرسيم، عسل القطن (ست عينات من كل مصدر نباتي) من منطقتين مختلفتين تمثل كل منها منطقة جغرافية الأولى محافظة كفر الشيخ والثانية هي محافظة البحيرة. وقد بينت النتائج مايلي: لا يوجد فرق معنوي بين جميع المعاملات في الخصائص الطبيعية والكيميائية ومستوى السكر. لا يوجد فرق معنوي بين جميع المعاملات في المعادن باستثناء البوتاسيوم وكانت أقل قيمة 11,050 في عسل الموالح من مطوبس محافظة كفر الشيخ وأعلى قيمة 56,1 في عسل القطن من أبوالمطامير محافظة البحيرة.

قام بتحكيم البحث

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