

## Quality evaluation of four honey types collected from Upper Egypt governorates

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### Abstract:

Keywords:  
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solids (TSS),  
water content (%),  
(RI), PH values  
and HMF content

Thirty four honey samples were collected from four governorates in Upper Egypt region to evaluate their quality standards. The samples represented four honey types, fennel, clover, sesame and multi-floral honey. Total soluble solids (TSS), water content (%), refractive index (RI), PH values and HMF content were assessed for evaluating honey samples. The present results indicated that there are no clear differences among (TSS) and water content (%) means of different honey types. There were relative difference among honey types in PH and HMF content. The PH values ranged between 3.38 and 4.57. The HMF values ranged between 4.48 and 7.68 mg/kg. The highest HMF content was recorded in poly floral honey and the lowest one was recorded in clover honey. The present data confirmed that characteristics of honey samples were related to their floral sources and season of extraction. It could be stated that all honey types collected from Upper Egypt governorates were accepted by quality control of Egyptian honey specification and also by European council directive.

### INTRODUCTION

Honey has been considered as healthy and natural product. Often, it is used as a food and/or a medicine. Several studies indicated that floral sources used

by honey bee colonies in gathering nectar and pollen affected the sensory and physicochemical characteristics of the honey (**Bogdanov, *et al.*, 1999** and **Gheldof *et al.*, 2002**).

The rich floral diversity in Egypt offers the opportunity for producing a wide variety of honey from medicinal plants, fruit trees and endemic plants. Many studies have been conducted for evaluation different honey types in Egypt (El-Sherbiny *et al.*, 1980; Hassan, 1985; Nour, 1988, 1998; Gomaa, 2002; Badawy *et al.*, 2004; Nafea, 2004; Rateb, 2005; Saleh, 2005; Farag, 2007, 2013, El-Metwally, 2015 and Ismail, 2015). The most important parameters were used to evaluate the honey quality. The aim of this study was to investigate properties of some Egyptian honeys produced under Upper Egypt conditions and their compliance with standards set by **Egyptian Organization for Standardization and Quality Control (EOSC) (2005) and Codex Alimentarius (2001).**

## **MATERIALS AND METHODS**

The present investigation was conducted in Plant Protection Department, Faculty of Agriculture, Sohag University. The experiments were carried out during season 2013 to evaluate four honey kinds produced under Upper Egypt region.

### **a- Condition of study and nectar sources**

Honey samples were collected from four governorates in Upper Egypt (Sohag, Qena, Luxor and Aswan). The apiaries were selected where the main crop constituted the majority of flora for nectar collection. The locations of the apiaries were described in Table (1) and the common name of floral sources and scientific names were recorded in Table (2).

### **b- Samples collection:**

Total number of thirty four honey samples (250 gm/apiary) were collected directly during honey extraction from professional apiaries. Each honey sample was mixed and strained

through cheese cloth to remove foreign matter and kept refrigerated in dark glass containers for analysis.

**c- Type of honey:**

The honey samples were classified to four honey types after the main flowering plant. Three type of honey were monofloral honey (fennel, clover and sesame) and one was multifloral honey which collected from different nectar sources in late summer. Numbers of honey samples for every type were recorded in Table (1).

**d- Honey characteristics determination:**

▪ **Total soluble solids (TSS%), water content (%) and refractive index (RI).**

For determining TSS and water content % or RI value in all honey samples, abbey refractometer (NR 101) was used at 30°C. Corresponding moisture contents % were calculated according to method of **AOAC (1995)**.

▪ **PH value:**

A pH meter (Orion model 410A Boston, MA 02129 USA) was used for determining the pH values in all honey samples. A solution containing 10 gm honey dissolved in 75 ml Co<sub>2</sub>-free distilled water. The solution was statired with magnetic stirred. PH values were recorded according to the method of Association Official Agriculture Chemists (**AOAC 1995**).

▪ **Hydroxy methyl furfural (HMF):**

Determination of HMF was carried out in Laboratory of Plant Protection Research Institute, Cairo, according to the method of **White (1979)**. Five samples from each honey type were prepared for determination five gm from every sample honey was diluted with 20 ml. distilled water, 0.5 ml of 15 g potassium ferrocyanide dissolved in 100 ml water and 0.5 ml of 30 g zinc acetate in 100 ml water, using different pipettes and made up to

50 ml in volumetric flask. The solution was mixed and filtered. The first 10 ml were discarded then 5 ml of the filtrate were pipetted into each of two test tubes. 5 ml of deionized water were added to one tube and 5 ml fresh bisulphate solution (0.2 g sodium, metabithiosulphite in 100 ml water) to the other as a reference. The tubes were shaken well and the absorbance (a) at 254 & 336 nm were recorded

against the reference solution using UV spectrophotometer type Shimadzu 120.02. The HMF value was calculated as  $(A_{254}-A_{336}) \times 149.7$  to the nearest mg/kg.

#### Statistical analysis:

Data were analyzed using F-test with non-equal replicates. The ranges, means and standard deviation were calculated and significance was set at  $P < 0.05$  or  $< 0.01$ .

**Table (1): Sites and number of honey samples collected from Upper Egypt governorates during 2013 season.**

Gov.	Sites	Source of honey	Samples number	Collection date
Qena	Qena, 2; Naqada, 2	Fennel	4	April-May 2013
Sohag	Sohag, 4; Akhmim, 1; Dar-El-Salam, 3	Clover	16	May-June 2013
Qena	Qena, 2; Naqada, 1			
Luxor	Esna, 2; Al-Qorna, 1			
Aswan	Edfu, 1; Toshkah, 1			
Sohag	Juhaynah, 2; Akhmim, 2	Sesame	4	Aug-Sept. 2013
Sohag	Sohag, 2; Juhaynah, 1; Sagolta, 1	Multi-floral	10	Aug-Sept. 2013
Qena	Najahamadi, 1			
Luxor	Al Qarna 1; Esna, 2; Qena, 1			
Aswan	Kom Ombo, 1			
<b>Total samples</b>			<b>34</b>	

\* Multi floral sources include Alfalfa, Acacia, Cotton and other flowering plants.

**Table (2): Botanical origins of honey samples in Upper Egypt.**

Common name	Scientific name	Family
Fennel	<i>Foeniculum vulgare</i>	Apiaceae
Egyptian clover	<i>Trifolium alexandrinum</i>	Leguminosae
Sesame	<i>Sesamum indicum</i>	Pedaliaceae
Alfalfa	<i>Medicago sativa</i>	Leguminosae
Sunflower	<i>Helianthus annuus</i>	Asteraceae
Cotton	<i>Gossypium barbadense</i>	Mallaceae
Egyptian acacia	<i>Acacia arabica</i> (Lam.)	Fabaceae

Nebk trees	<i>Fangula alnus</i>	Rhamanaceae
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**RESULTS AND DISCUSSION**

The common names of floral source, regional name and honey collection sites are summarized in Tables (1 and 2). Types of honey were classified as one multi floral honey and three mono floral honeys (fennel, clover, sesame). The results of

total soluble solids % (TSS%) may reflect the total sugar contents of honey. Data presented in Table (3) showed that TSS% was at low percentage (81.25%) in fennel honey. However, it increased in significantly in multi floral honey (83.00%).

**Table (3): Total soluble solids (TSS%) of some Egyptian honeys collected from Upper Egypt governorates during season of 2013.**

Botanical origin of honey	Samples number	Total soluble solids (TSS%)	
		Range	Mean ± Sd
(T <sub>1</sub> ) Fennel	4	81 – 84	81.25 ± 0.85
(T <sub>2</sub> ) Clover	16	80 – 85	82.56 ± 0.39
(T <sub>3</sub> ) Sesame	4	82 – 85	83.25 ± 0.75
(T <sub>4</sub> ) Multi floral	10	81 – 86	83.00 ± 0.68
General mean	34	80 – 86	82.52

Significancy LSD values from unequal replicates

	(T <sub>1</sub> ) Fennel	(T <sub>2</sub> ) Clover	(T <sub>3</sub> ) Sesame	(T <sub>4</sub> ) Multi floral
(T <sub>1</sub> ) Fennel	-	2.0149 <sup>NS</sup>	2.5486 <sup>NS</sup>	2.1323 <sup>NS</sup>
(T <sub>2</sub> ) Clover	-	-	2.0149 <sup>NS</sup>	1.4529 <sup>NS</sup>
(T <sub>3</sub> ) Sesame	-	-	-	2.1323 <sup>NS</sup>
(T <sub>4</sub> ) Multi floral	-	-	-	-

NS= Not significant, \* Significant, \*\* highly significant.

Also, honey moisture levels in different type varied between approximately 14% and 20%. These parentages were compatible with international honey standards (**Codex Alimentarius, 2001**). The highest

moisture level was recorded in fennel honey (18.25%) and the lowest one was determined in sesam honey (16.75%) as shown in Table (4). Data cleared that kinds of honey collected during early summer had a higher

percentage of moisture whereas the multi honeys had a lower one. The present results was in agreement with results of **Hassanein *et al.*, (2010)** who recorded that water content of some mono floral honeys ranged from 16 to 21% and **Finola *et al.*, (2007)** who recorded that water content or moisture content of honey depends on source of nectar, harvest season and degree of maturity. Refractive index (RI)

(Table 5) was determined in all samples among RI means of four different honeys statistically no significant difference was found. The R1 values ranged between 1.4257 and 1.4283. The fennel honey had the highest value of RI. These findings are in agreement with data obtained by **Saleh (2005)** on some Egyptian honeys which were collected from different regions in Egypt.

**Table (4): Water content (%) of some Egyptian honeys collected from Upper Egypt governorates during season of 2013.**

Botanical origin of honey	Samples number	Water content (%)	
		Range	Mean ± Sd
(T1) Fennel	4	16 – 19	18.25 ± 0.85
(T2) Clover	16	15 – 20	17.43 ± 0.39
(T3) Sesame	4	15 – 18	16.75 ± 0.75
(T4) Multi floral	10	14 – 19	17.00 ± 0.68
General mean	34	14 – 20	17-35

Significance

LSD values from unequal replacts

	(T1) Fennel	(T2) Clover	(T3) Sesame	(T4) Multi floral
(T1) Fennel	-	2.0148 <sup>NS</sup>	2.5468 <sup>NS</sup>	2.1323 <sup>NS</sup>
(T2) Clover	-	-	2.01487 <sup>NS</sup>	1.4529 <sup>NS</sup>
(T3) Sesame	-	-	-	2.1323 <sup>NS</sup>
(T4) Multi floral	-	-	-	-

NS= Not significant, \* Significant, \*\* Highly significant.

**Table (5): Refractive index (RI) of some Egyptian honeys collected from Upper Egypt governorates during season of 2013.**

Botanical origin of honey	Samples number	Refractive index (RI)	
		Range	Mean ± Sd
(T1) Fennel	4	1.4258-1.4275	1.4267 ± 0.0007
(T2) Clover	16	1.4258-1.4283	1.4264 ± 0.0008
(T3) Sesame	4	1.4258-1.4266	1.4261 ± 0.0007
(T4) Multi floral	10	1.4257-1.4280	1.4266 ± 0.0003

General mean	34	1.4257-1.4283	1.4264
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Significance LSD values from unequal treatments (All values of LSD are very low)

As shown in Table (6) the mean of PH values of fennel honey was 4.11 and its values ranged between 4.00 and 4.28, whereas, the PH mean of clover honey samples were 3.68 and ranged between 3.45-3.82. The highest PH value was for honey sample collected from Sohag district. The means of PH values of sesame honey which collected in late summer from Juhaynah and Akhmim districts varied between 4.02 and 4.86, respectively. **Crain (1979)** described that the PH value of honey affected somewhat by amount of various acids present in honey and botanical origin. When authors evaluated characterization of main Egyptian honeys characters, **Ibrahim *et al.*, (1977)** mentioned that PH values ranged between 4.00 and 4.30. **Nour (1988)** stated that PH values of Egyptian honeys ranged between 3.84 and

4.49. Also the present data were in agreement with **El-Metwally (2015)** results who found that the PH mean value of clover honey collected from Upper Egypt region was 3.88 where as the PH value of clover honey samples collected from Lower Egypt governorates decreased slightly to 3.78. The present data indicated that the PH values of four honey types were still with a normal level mentioned by quality control of Egyptian Honey Standardization (EOSC) (2005) and Codex Alimentarius (2001).

Data presented in Table (7) revealed that the general HMF mean of all tested honey samples was 6.38 mg/kg. The highest mean value of HMF was recorded in multi-floral honey produced in late summer (7.68 mg/kg) while the lowest one was recorded in clover honey (4.45 mg/kg) followed by value of

sesame honey, whereas the row data of HMF content showed that only one sample of clovers honey was free from HMF. The present data were in agreement with El-Metwally (2015) results who found that the cotton honey samples collected from Upper Egypt region had the highest HMF value the mentioned that the high mean of HMF in cotton honey extracted in late summer season was increasing of

associated with low diastase number. From the present data, it is a good results that HMF values for all fresh honey samples produced during active season under Upper Egypt conditions were under the international limet accepted by Egyptian Organization for Standardization and quality control, EOSC (2005) and international honey standards (Codex, 2001).

**Table (6): PH values of some Egyptian honeys collected from Upper Egypt governorates during season of 2013.**

Botanical origin of honey	Samples number	PH values	
		Range	Mean ± Sd
(T <sub>1</sub> ) Fennel	4	4.00 – 4.28	4.11 ± 0.06
(T <sub>2</sub> ) Clover	16	3.45 – 3.82	3.68 ± 0.03
(T <sub>3</sub> ) Sesame	4	4.02 – 4.86	4.57 ± 0.19
(T <sub>4</sub> ) Multi floral	10	3.60 – 3.98	3.73 ± 0.04
General mean	34	3.45 – 4.86	4.02

Significancy LSD values from unequal replacts.

	(T <sub>1</sub> ) Fennel	(T <sub>2</sub> ) Clover	(T <sub>3</sub> ) Sesame	(T <sub>4</sub> ) Multi floral
(T <sub>1</sub> ) Fennel	-	0.1935**	0.2447**	0.2048**
(T <sub>2</sub> ) Clover	-	-	0.1935**	0.1395 <sup>NS</sup>
(T <sub>3</sub> ) Sesame	-	-	-	0.2048**
(T <sub>4</sub> ) Multi floral	-	-	-	-

NS= Not significant, \* Significant, \*\* Highly significant.

**Table (7): Hydroxy methyl furfural (HMF) of some Egyptian honeys collected from Upper Egypt governorates during season of 2013.**

Botanical origin of honey	Samples number	Hydroxy methyl furfural HMF (mg/kg)	
		Rang	Mean ± Sd
(T <sub>1</sub> ) Fennel	5	5.76 – 9.60	7.16 ± 0.91
(T <sub>2</sub> ) Clover	5	0.00 – 6.74	4.47 ± 1.47
(T <sub>3</sub> ) Sesame	5	3.84 – 7.68	6.21 ± 0.73



(T <sub>4</sub> ) Multi floral	5	3.84 – 17.28	7.68 ± 3.23
General mean	20	0.00 – 17.28	6.38

L.S.D = 5.4684

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