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Physicochemical characterization of honey from Kasr Khiar and Garaboli areas-Libya

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ABASTRACT

Honey is a naturally sweet dark golden liquid produced by honeybees. The physicochemical properties of honey samples collected during raining season(November 2014 to March2015) from Kasr Khiararea were compared with honey samples obtained from Garaboliarea (West of Libya)with the aim to determining the differences between these samples and comparing the results with the British Pharmacopoeia 2009 and International standards. The results showed that the average value of moisture, pH value, specific conductivity, total dissolved solids, specific gravity, acid equivalent, sucrose content, and maltose content of samples collected from Kasr Khiar area were found to be 18.722 %, 3.77, 587.8 µS / cm, 674 ppm, 1.368, 23.33 m Eq./ kg, 1.38 %, and 9.02 % respectively, while for Garaboli samples the average values, for the above parameters, were found to be 18.11 %, 4.09, 777 µS / cm, 1255 ppm, 1.38, 16.66 m Eq./ kg, 1.68 %, and 8.95 % respectively. Mineral composition studies using Flame photometer technique for Kasr Khiar samples showed that Potassium has the higher value followed by Calcium, Sodium and traces of Lithium, while for Garaboli samples the major elements are in the order Potassium, Sodium, Calcium, Lithium. The maltose content of honey samples collected from Kasr Khiar and Garaboli areas were ranged respectively from 6.24 to 10.98 % , and 7.98 to 9.87%, This is a slight higher than the international standard (<7.5%). According to the international standards and the British Pharmacopoeia– 2009 of honeybee, all these samples are agree within the specification of purity and they have high quality and they unspotted from mixed.

Key words: Honey, Sucrose, Maltose, Specific Gravity, Acid Equivalent

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INTRODUCTION

Honey is viscous fluid produced by honeybees (*Apis mellifera* L.) from the nectar of flowers or from secretions of living parts of plants which the bees collect, transform by combining with specific substances of their own, dehydrate, deposit, store and leave in the honey comb to ripen and mature. If the bee has been exposed to treatment to prevent or cure diseases or to any substance intended for preventing, destroying or controlling any pest, unwanted species of plants or animals, appropriate steps are taken to ensure that the levels of residues are as low as possible [1].

About 90 % of dry honey composed of monosaccharide mainly fructose and glucose [2],beside traces of trisaccharides. It has small quantities of mean mineral and trace element contents such as Ca, Mg, K, Na, Fe, Cu, Cr, and Pb[3, 4],also contains proteins essentially Enzymes, the amount of acid in dry honey sample normally less than 0.5% of sample weight, but this value contributes to the botanical and geographical origin of the nectar [5].

Honey has been used mainly as food in Kasr Khair and Garaboli areas in the east of Tripoli, the capital of Libya, beside that traditionally used to treatment of several diseases because Lord said to the honeybee in the Quran, a Holy book for Muslims۞Then eat of all the fruits and walk in the ways of your Lord submissively. There comes forth from within it a beverage of many colours, in which there is healing for men; most surely there is a sign in this for a people who reflect۞ (Section 16 Verse 69).The study of the physicochemical properties of honey has

increased in the last years because these parameters are important for the certification process that determines honey quality. The present work is an attempt to, establish a frame of a specification for the honey produced in this area with respect to international standards.

MATERIALS AND METHODS

***Sample location and pre-treatment*:**
Ten honey samples were collected from Kasr Khiar and Garaboli (Tripoli Area) in west of Libya. All samples were stored in glass jars at room temperature(25±1 °C).All other chemicals used wereof analytical reagent grade.

Physicochemical analysis: Standard analytical methods of analysis to determine physicochemical properties such as moisture content, and specific gravity were used [6].

***pH, Specific conductivity, and TDS*:** pH of 20% solution of honey sample was measured directly using a glass electrode pH meter (Jenway- Model 3505)according to the method described by Pearson (**1976**) [7] . Specific conductivity (µS /cm^{-1}), and Total dissolved solids (ppm) were measured using a conductivity meter (Jenway-Model 3545) for a 20 % (w / v) Honey in distilled water after the temperature fixed at 25^{o}C[8].

***Acid equivalent*:** The total acid equivalent of each honey sample was determined by acid-base titration[9], then the acidity of honey samples calculated according to the following equation:

$$\text{Acid equivalent (m eq. / kg)} = \frac{\text{NaOH (0.1)} \times \text{V equ.}}{\text{Kg of honey sample}}$$

***Sucrose and Maltose content*:** Colorimetric Method (Phenol-Sulphuric Acid Reagent) of reducing sugars and polysaccharide determination as described by Michel Dubois was adopted to measuring sucrose and maltose content in honey sample using Spectrophotometer(Jenway-Model 6300)with quartz cuvette cell [10].

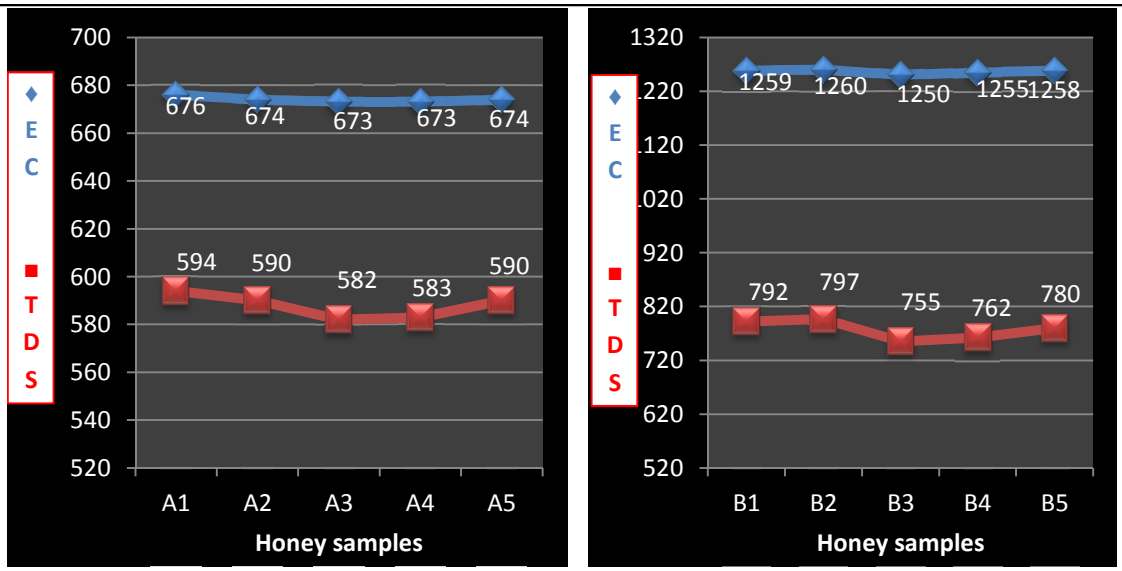
***Mineral Composition*:** Acid digestion (1:1 v/v Nitric :Per chloric acid) was used to prepare honey samples for cationic analysis[11]. Calcium, Potassium, Sodium, and Lithium amount were determined using a flame photometer (BWB Technologies, UK).

RESULTS AND DISCUSSION

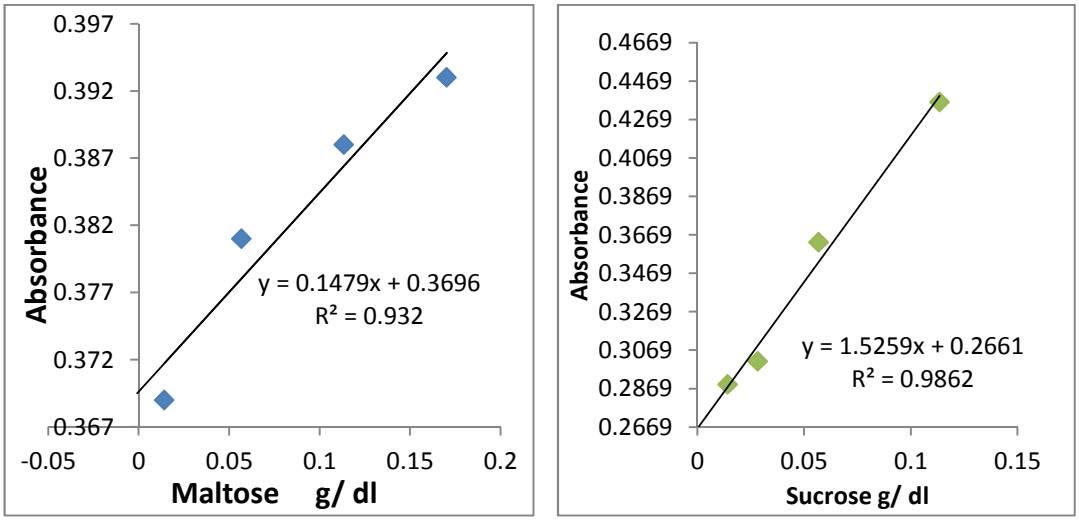
Tables 1 and 2 show the results of the physicochemical characterization of honey samples from Kasr Khiar and Garaboli respectively. The mean moisture content of Kasr Khiar and Garaboli samples were found to be 18.72% and 18.11% respectively. The results are agreed with international standard(≤20%).The pH values of honey samples collected from Kasr Khiar and Garaboli equal 3.77 and 4.09 respectively, while the mean specific gravity of honey samples collected from Kasr Khiar and Garaboli were found to be 1.368, and 1.36 respectively, there is no significantly difference on pH value, and specific gravity between the honey samples of two areas. The results for pH value, and specific gravity are fall within international standard.

The specific conductivity values of Kasr Khiar honey solution at 25 ^{o}C were found in range 582 to 594 µS / cm with mean 587.8 µS / cm, while the specific conductivity values of Garaboli honey solution were found in range from 755 to 792 µS / cm with mean value 777 µS / cm, results exhibited significant differences in specific conductivity values between honey samples of two areas, but all the results agree with British Pharmacopoeia 2009 (lower than 800 µS / cm).The ionic organic and inorganic substance in honey samples were measured as TDS, the results showed that TDS of Kasr Khiar samples lower than Garaboli samples. Fig.1 shows that there is a clear correlation between total dissolved solids and specific conductivity (EC), indicating that both parameters can be used to determine honey purity.

The acidity of honeybee related to about 18 amino acid and other organic acid as oxalic, tartaric, citric, pyruvic, and acetic, The result shows that the mean value of acid equivalent of honey samples collected from Kasr Khair and Garaboli equal 23.33 and 16.66 m eq. /Kg respectively. The results fall within the limit of international standard (lower 50 m eq. / Kg).



Figure(1): Correlation between TDS and EC.of (A)Kasr Khiar, (B) Garaboli samples



Figure(2): Standard curves of absorbance vs. sugar concentration

Fig.2 shows that the two curves obtained by plotting absorbance versus concentration of sucrose (λ_{487}) and maltose (λ_{490}) are very similar. The intensity of color developed at a constant phenol concentration is proportional to the concentration of sugar present. British Pharmacopoeia 2009 has reported a maximum of 5% sucrose content in honey. The mean values obtained from the analysis of Kasr Khiar and Garaboli samples equal (1.38and 1.68 %) fall within this limit. While the maltose contents of Kasr Khiar and Garaboli honey samples falls between 6.24 and 10.98% with an average value of 9.02% and between 7.98 and 9.87 with an average value of 8.95 % respectively, The result obtained of all samples are a slight higher the international standard limit.

Table (1): Analytical data of physicochemical analysis of honey samples collected from Kasr Khiar

Sample No.	Moisture%	pH value	Specific conductivity µS / cm	TDS (ppm)	Specific Gravity	Acid Equivalent m eq./ Kg	Sucrose %	Maltose%
A_1	19.18	3.79	594.0	676	1.38	23.56	1.48	10.98
A_2	19.12	3.80	590.0	674	1.35	22.90	1.49	6.24
A_3	18.56	3.74	582.0	673	1.37	23.60	1.21	7.98
A_4	18.22	3.73	583.0	673	1.38	23.77	1.23	8.93
A_5	18.53	3.81	590.0	674	1.36	22.86	1.49	10.96
X	18.72	3.77	587.8	674	1.368	23.34	1.38	9.02
S	0.413	0.036	5.119	1.22	0.013	0.426	0.146	2.026
Sr	0.022	0.010	0.009	0.002	0.010	0.018	0.106	0.225

X = Mean ;S = Standard average déviation; Sr = Relative standard deviation

The cationic analysis of honey samples from two locations, has the highest value of cationic composition. Table 3 shows that potassium, sodium, and calcium are most abundant elements in the all honey samples. The cationic analysis of samples collected from Kasr Khiar exhibited that the main value of potassium, calcium, and sodium equal 1675, 1005, and 961.0 mg / kg respectively, while for Garaboli samples the mean value for above element equal 2466, 1414, and 2110 mg / kg respectively. Results indicated that the major elements are in the order K >Ca> Na for Kasr Khiar samples and in the order K > Na >Ca for Garaboli samples. These differences may be attributed to environmental condition and soil of samples location. The high standard deviation values of this element indicate that there is a variation between honey samples.

Table (2): Analytical data of physicochemical analysis of honey samples collected from Garaboli

Sample No.	Moisture%	pH value	Specific Conductivity µS/ cm	TDS (ppm)	Specific Gravity	Acid Equivalent m eq./ Kg	Sucrose%	Maltose %
B_1	17.50	3.92	792	1259	1.40	17.25	1.56	9.87
B_2	18.69	4.21	797	1260	1.36	16.06	1.70	7.98
B_3	19.27	3.99	755	1250	1.37	16.79	1.81	8.92
B_4	18.30	4.23	762	1255	1.40	16.11	1.87	8.32
B_5	16.77	3.92	780	1258	1.38	17.11	1.48	9.67
X	18.11	4.09	777.2	1256	1.38	16.66	1.68	8.95
S	0.986	0.13	18.32	4.037	0.018	0.555	0.164	0.822
Sr	0.054	0.03	0.024	0.003	0.013	0.033	0.097	0.092
International limit	≤ 20	3.2 – 4.5	≤ 800	-	1.38 –1.45	≤ 50	≤ 5	≤ 7.2

Table (3): The cationic content, (mg / kg), of Honey samples

Sample code		Ca	Li	K	Na
Kasr Khiar	**A_1**	1029	57.19	1747	1045
	A_2	977.9	52.00	1679	853.1
	A_3	956.8	43.50	1662	1013
	A_4	1014	56.34	1567	957.7
	A_5	1049	55.25	1724	935.6
	X	1005	52.86	1675	961.0
	S	37.58	5.588	69.70	74.26
	Sr	0.037	0.106	0.042	0.077
Garaboli	**B_1**	Nd.	Nd.	Nd.	Nd.
	B_2	1411	36.78	2521	2367
	B_3	1416	33.46	2398	1944
	B_4	1421	32.50	2506	1952
	B_5	1408	35.79	2440	2175
	X	1414	34.63	2466	2110
	S	4.949	1.723	49.81	175.2
	Sr	0.004	0.050	0.020	0.083
Reference		47.7 - 341.0	--	296 - 1935	11.8 - 279

*References values were obtained from Saif (**2008**)[12].*

CONCLUSION

The physicochemical studies of the honey samples obtained from Kasr Khiar and Garaboli, which locatedin the same ecological area in the West of Libya, showed the following characteristics: Moisture content, pH value, specific gravity, specific conductivity, total dissolved solids, acid equivalent and sucrose fall within the international standard limits. The low standard deviation values of this parameters indicate that there is no variation both between homey samples.

The study show that potassium, calcium, and sodium, are most abundant elements in all honey samples. The mean value exhibited that the major elements in Kasr Khiar honey samples are in the order K>Ca> Na, and traces Li, while for the Garaboli samples are in the order, K, Na, Ca, and traces Li. Based on the above results it was found that honey produced in this areas if it is well packaged will be good enough for export.

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REFERENCES

[1]British Pharmacopoeia, Monographs: Medicinal and Pharmaceutical Substances Honey, Published by (MHRA), London , Vol. I & II, **2009,** p. 2969-2973
[2]Lawal, R.A., LawalA.K.andAdekalu J.B, *Pakistan J. Bio. Sci*.,**2009**, 12 (15), p.1080-1084.
[3]Serra, B.J. **,***An. Bromatol*,**1989,** (41) p. 41.
[4]Visser, R F., J.M. Allen, and Shaw,G.J., *J. Apic. Res*.,**1989,** 27: p.175-81.
[5] Joseph, T., Awah-Ndukum, J., Fonteh-Florence, A., Delphine, N. D., Jonnas, P. and Ze Antoine, M., *African Journal of Biotechnology*,**2007,** 6 (7) 2: p. 908-913.
[6] Olugbemi O., Ikemem, C.H., and Dioha, I. J., *Nigeria Research Journal in Engineering and Applied Sciences*,**2013,** 2(3) p. 199-202.
[7] Pearson, D., The chemical analysis of food.(7th Ed.). Churchill Livingston Edinburgh, London.**1976**, P. 128.
[8] Bogdanov, S., Martin, P., Lüllmann, C.,Harmonised methods of the European honey commission. Apidologie, **1997,** P. 1–59.
[9]DesissaYadata, *Food Science and Technology*,**2014,** 2(5): P. 59 - 63.
[10]DuBois,M., Gilles,K. A., Hamilton, J. K.,Rebers, P. A., Smith, F., *Analytical Chemistry*, **1956**, 28, P. 350.
[11]James, M., and Prichard,E., Practical Physical Chemistry. Third ed., Longman Publishers, USA.,**1974,** P.252.
[12]Saif-ur-Rehman, Zia Farooq Khan, and TahirMaqbool, *Cien. Inv. Agr*.,**2008,** 35(2):P. 199-204.