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Some physicochemical properties of Egyptian Sidr bee honey in Upper Egypt

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Abstract

Forty-five samples of Egyptian Sidr bee honey were collected from three regions representing the governorates of Luxor, Qena and Sohag in Upper Egypt, during November 2021. Fifteen samples from every Governorate. (five honey samples/ apiary). Honey samples were collected at the rate of 1000 g for this study. All honey samples were provided by professional beekeepers. Evaluation of nineteen physicochemical properties: color, electrical conductivity, density, viscosity, moisture, pH, free acid, lactone, total acid, glucose, fructose, sucrose, maltose, total sugar, glucose/fructose ratio, glucose/water ratio, Hydroxymethylfurfural (HMF), Diastase and Invertase Index. The results showed significant differences in moisture, acidity (PH, free acid, lactic acid and total acidity), fructose and glucose, percentage content in this study between Luxor, Qena and Sohag Governorates. The mean hydroxymethylfurfural content was very low in all Sidr honey samples under study. Invertase activity ranged from 202.69 to 249.85 U/kg. with an overall mean of 225.44± 50.238 unit/kg. honey, diastase activity ranged from 26.59 to 34.19 in both units. With an overall average of 30.41± 10.655 units in both scales.

Keywords: Egyptian Sidr honey, physicochemical analysis, HMF, Invertase activity.

INTRODUCTION

Bee honey is a popular product all over the world and it is naturally made by bees from nectars extracted from the nectarines of flowers. The product varies in taste, aroma and color depending on its source (National Honey Board, 2002). Also, the composition of bee honey varies depending on the nectar source from which it originated and to a lesser extent on some external factors such as climatic conditions and beekeeping practices.

The main objective of this research is to study the physicochemical properties of three sample local Egyptian sidr bee honeys obtained from three different regions and to compare them with standard specification of the Egyptian Standards and Metrology Organization.

The quality, composition and properties of bee honey depend on its geographical origin, season, environmental factors and treatment by beekeepers (EL Mwally, 2015). Important factors related to honey quality are the sum of fructose, glucose, glucose/water ratio and fructose/glucose, which indicate the honey's ability to crystallize (Buba et al., 2013). The physico-chemical properties of honey depend on some elements, such as: B. Moisture (El-Mwally, 2015; El Sohaimy et al., 2015), Melissopalynology (Ponnuchamy et al., 2014). Studying the physical and chemical properties of honey provides important information about the quality of honey (Soria et al., 2004). The basic sugars of honey are the monosaccharides fructose and glucose, when ingested, the main carbohydrates, fructose and glucose, are quickly transported in the blood and can be used for the needs of the human body. A daily dose of twenty grams of honey covers about 3% of the daily energy requirement. (Bogdanova, 2016). The pH and water content, as well as the glucose/water ratio (w/w) are the most important honey parameters that can control the fermentation and granulation processes. Low pH and moisture protect honey from microbiological activity, thus prolonging its shelf life (Buba et al., 2013; Akhtar et al., 2014; El-Mwally, 2015). For this purpose, the characterization of honey is necessary in order to best meet consumer needs .

The main objective of this research is to study the chemical properties of three sample local Egyptian sidr bee honeys obtained from three different regions and to compare them with standard specification of the Egyptian Standards and Metrology Organization.

MATERIALS AND METHODS

The present investigation was conducted out at plant protection department faculty of agricultural sohag university and Apiculture Research Department, Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza. During the year, 2021 to study physicochemical some properties of the sidr honey.

Honey Samples

Samples of sidr honey were collected during the sidr trees (Ziziphus spp.) blooming season (October and November, 2021), from (Luxor, Qena and Sohag Governorate) Upper Egypt. Forty-five fresh Sidr honey samples were collected; fifteen samples from every Governorate. (five honey samples/ apiary). Each of the honey samples were acquired at 1000 g for the present investigation.

Physicochemical Analysis:

1- Colour intensity value:

The colour of examined sidr honey samples was measured as optical density at 400 nm using spectrophotometer according to White, (1967). One gram of honey samples was dissolved in 10 ml of distilled water in 10 ml beaker, and then the optical density of this solution was measured at 400 nm using spectrophotometer. The colour was determined by the relation between optical density value and USDA standard.

2- Electrical conductivity (EC):

Electrical conductivity (EC) of tested sidr honey samples was evaluated using Electro-conductivity model EN50081-1 at room temperature by using, 2gm of honey dissolved in 10 ml of distilled water. EC value expressed in mS/Cm, according to Vorwohl (1964).

3- Specific gravity and honey grades:

The specific gravity of examined honey samples was measured accoding to Wedmore (1955), and therefore water content % was calculated. To qualify for the top two grades (A & B) honey must contain ≤18.6 % moisture, grade(C)may contain 18.7 – 20 %, and grade (D) may contain >20%, and considered to be with low quality. The viscosity of sider honey samples was measured using viscometer at 29 0C, according to Munro (1943).

4- Viscosity:

The viscosity of fennel honey samples was measured using viscometer at 29 0C,
according to Munro (1943).

5- Moisture content (%):

The refractometer was used, the readings of refractive index, after correction for temperature, were converted to moisture (%), using the table of White et al., (1962).

6- PH value: pH was measured by " HANNA" pH- meter, model H19321, according to (A. O. A. C., 1995).

7- Free acidity, lacton and total acidity:

Free acidity, lacton content and total acidity were measured according to White et al., 1962.

The examined parameters were calculated as follows:

Free acidity= (ml NaoH to bring solution to pH 8.5- blank) × 0.05× 1000/10;

Lacton= (10- titre of Hcl) ×0.05× 1000/ 10; and total acidity= free acidity+ lacton.

Honey acidity is a parameter which comprise pH value, free acids, lacton content and total acidity.

8- Determination of sugars:

Collected sidr honey samples were analyzed to evaluate their sugars content. Fructose, glucose, sucrose and maltose content (%) was identificated and determined using High-Performance Liquid Chromatography (HPLC), according to A.O.A.C. (1995). Reducing sugars and glucose/ fructose ratio (G/F) were also calculated.

9- Hydroxy methyl furfural (HMF):

Hydroxy methyl furfural (HMF) was determined after clarifying tested honey samples with carrez reagents (I and II) and addition of sodium bisulfate according to A. O. C. A. (1995). Absorbance was determined at 284 and 336 nm in 1cm quartz cuvette using a Labomed, inc. Spectro UV-Vis R.S. Spectrophotometer.

HMF is formed in honey by the breakdown of sugars, especially fructose, when honey is stored in hot places for a long time or heated for liquidification of granulation. False honey produced from sucrose treated with weak acids contains high HMF content.

10- Enzyme activity:

10.1. Diastase:

Calculation and expression of results, the transmittance is plotted against time (min) on a rectilinear paper. A straight, line is drawn through at least the three points on the graph to determine the time when the reaction mixture reaches a transmittance of 50%. Divide 300 by the time in minutes to obtain the diastase number (DN). This number expresses the diastase activity as ml 1% starch solution hydrolyzed by the enzyme in gram of honey in 1 hour at 400C.

10.2. Invertase activity:

Invertase activity was spectrophotometrically measured with 4-nitrophenyl-a-D-glucopyanosode and the results are expressed in international units (IU). (Boussaid et al. ,2014).

RESULTS AND DISCUSSION

physicochemical properties of Egyptian Sidr honey samples from Upper Egypt.

Table (1). presents the Physical characteristics of Egyptian Sidr honey samples from Upper Egypt. From the results obtained in this study, the highest colour intensity value was registered with Luxor sidr bee honey samples (0.68±0.113). Followed by Sohag Governorte (0.64 ± 0.154). On the other hand, the lowest colour intensity value was recorded with Qena ones (0.59±0.087). Generally, colour intensity of tested sidr honey samples ranged from 0.422 to 0.828 O.D., with a general mean of 0.64±0.012. The colour changes are due to the intervention of the beekeeper's

interference and different habits of handling the combs such as the use of old wax combs for producing honey, minerals content, contamination of heavy metals, and exposure to either high temperatures or light (Moniruzzaman et al., 2013; El-Metwally, 2015).

While the highest Electrical conductivity (EC) value was registered with (Luxor & Sohag) sidr bee honey samples (0.047±0.009%). On the contrary the lowest EC value was noticed with Qena (0.042±0.006%). Generally, EC of studied sidr bee honey samples ranged from 0.042 to 0.047 %, with general mean value of 0.045±0.008 %, Table (1). This property was used as an indicator of the quality of honey, assisting in the distinction and identification of floral honey. Similar values are reported by Alqarni et al. (2014) and El Sohaimy et al. (2015). Generally. Specific gravity of tested sidr honey samples ranged between 1.42 and 1.43 g/ml, with general mean value of 1.42 ±0.074 g/ml. The highest specific gravity value (1.43±0.075 g/ml) was found in Luxor sidr honey samples. Followed by Qena honey with an average (1.42±0.090 g/ml) On the other hand, the lowest mean value of specific gravity (1.42±0.059 g/ml) was noticed in Sohag sidr honey samples.

In addition to that, the viscosity values were ranged from 186.84 to184.96 poise, with a mean value of 185.67±3.155 poise. Maximum viscosity value (186.84±2.757 poise) was noticed in honey sample from Luxor Governorate, while minimum value of honey viscosity (184.96±3.360 poise) was found in sidr honey sample from Sohag Governorate.

Bradbear (2009) declare that, the consistency of bee honey, colour, odor and flavour are mainly depend upon the plant species that visted by the bees.

The moisture, acidity, PH, Free acidity, Lacton and Total acidity levels in Sidr honey samples from (Luxor, Qena & Sohag), Upper Egypt shown in Table 2. The results obtained in this study indicated that the Qena and Sohag bees honey had the higher moisture levels (17.6%) and PH value (6.11 meq/kg and 5.61 meq/kg) in comparison with Luxor bees honey which were found to be 16.7 % and 6.38 meq/kg, respectively.

In contrast, the Sohag bees honey had the higher levels of Free acidity (12.0 meq/kg): Lacton (7.75 meq/kg) and Total acidity (19.75 meq/kg) when compared with Qena and Sohag bees honey which were found to be 9.57 meq/kg and 12.0 meq/kg; 7.30 meq/kg and 7.75 meq/kg; 16.87 meq/kg and 19.75 meq/kg respectively. Table (2). In general, water content (%) of all analyzed sidr honey samples ranged from 16.5 to 18.4%, with a general mean value of 17.3±1.572%., and accepted by Egyptian standards (2003) or Codex Alimentarius Commission (2001). Chirife et al. (2006) stated that moisture content was affected by climate, season, and moisture content of original plant nectar and was considered unripened at the moisture content higher than 20%. Moisture content is an important quality parameter, important above all for honey shelf-life Bogdanov et al., (2008).

The most important physicochemical parameter for honey is the water content. Low water content increases the shelf life of honey while higher levels promote fermentation during storage. The water content of the honey samples examined was within the acceptable range which should generally not exceed 20% Devi, A. and J. Jangir (2018) and Wei Se (2019). During honey production by bees, the water content is affected by the relative humidity and temperature. Water content results for honey samples of different geographical origins have been documented previously for their water content Hegazi et al. (2021); Hegazi et al. (2022) and Roby et al. (2020). The acidity in honey is due to the presence of organic acids, in particular, gluconic acid, which has been found to affect the flavor, texture, shelf life and stability of honey Warui, et al. (2019). Honey has the power to kill microorganisms, and this power is attributed to the high osmolarity and hydrogen peroxide, pH, as well as the phytochemical nature of honey (Molan, 2015). The moisture content is one of the most important characteristics influencing physical properties of bee honey such as crystallization and viscosity as well as other parameters: flavor, taste, specific gravity, solubility and conservation (Escuredo et al., 2013, El–Metwally, (2015). concluded that, the pH values ranged 3.28 – 5.33, with a mean value of 3.91. The total acidity ranged from 16.5 to

70.75 meq/kg, with an average value of 33.56 meq/kg, of some Egyptian honey types. El Sohaimy et al., (2015) found that, the PH values of Egyptian, Yemen, Saudi and Kashmir were 4.415± 0.09, 4.114± 0.02, 4.46± 0.02 and 4.637± 0.03, respectively. Tesfaye et al., (2016) reported that the pH values ranged 3.54 – 3.92, with an average value of 3.75, while free acidity ranged 29.55 – 36.09 meq/kg. of some honey types obtained from Ethiopia. Valdes-Silverio et al., (2018) reported that, the pH values ranged 3.61 – 4.2 and free acidity ranged 27.74 – 229.63 meq/kg. Of some honey samples collected from the Andean region of Ecuador.

Table 1: Physical properties of Egyptian Sidr honey samples from Upper Egypt**.**

Locality	Colour (O. D.)		Electrical conductivity(mS/cm)		Specific gravity (g/ml)		Viscosity (poise)	
	Range	Average Value ±SD	Range	Average Value ±SD	Range	Average Value ±SD	Range	Average Value ±SD
Luxor	0.512-0.826	0.680 ± 0.113 a	0.036-0.051	0.047 ± 0.008 a	1.417-1.432	1.43 ± 0.075 a	184.8-189.0	186.84± 2.757 a
Qena	0.502-0.704	0.59 ± 0.087 c	0.034-0.045	0.042 ± 0.006 b	1.410-1.428	1.42 ± 0.090 a	182.4-187.0	185.22± 3.189 b
Sohag	0.427-0.781	0.64 ± 0.154 b	0.034-0.034	0.047 ± 0.009 a	1.412-1.424	1.42 ± 0.059 a	183.0-186.8	184.96± 3.360 b
Total (n=15)	-	1.91	-	0.136	-	4.27	-	557.02
General Mean±SD	-	0.64± 0.124	-	0.045± 0.008	-	1.42± 0.074	-	185.67 ±3.155
Range	-	0.68 – 0.59	-	0.047 – 0.042	-	1.42 – 1.43	-	186.84-184.96

All values are represented as the mean of five replicates± SD

Table 2: Moisture, acidity, PH, Free acidity, Lacton and Total acidity levels in different Egyptian sidr honey samples from Upper Egypt.

Location	Moisture (g/100 g)	pH (meq/kg)	Free acidity (meq/kg)	Lacton (meq/kg)	Total acidity (meq/kg)
Luxor	16.7 ± 1.667 a	6.38 ± 0.878 a	9.23±6.587 c	7.45±0.886 b	16.68±7.357 b
Qane	17.6 ± 1.561 b	6.11±0.937 b	9.57±3.103 b	7.30±0.742 c	16.87±3.776 b
Sohag	17.6 ± 1.406 b	5.61±0.463 c	12.00±6.090 a	7.75±0.448 a	19.75±5.975 a
General Mean ± SE	17.3±1.572	6.03±0.835	10.27±5.498	7.50±0.724	17.76±5.928
Maximum	17.60	6.38	12.00	7.75	19.75
Minimum	16.70	5.61	9.23	7.30	16.68

All values are represented as the mean of five replicates± SD

The fructose, glucose, Fructose+ Glucose, Glucose/ Fructose, glucose/ moisture ratio sucrose and maltose levels in different Egyptian sidr honey samples from Upper Egypt shown in Table 3. The highest levels for the all parameters were found in Luxor Sidr honey 35.84± 3.366, 26.14± 1.707, 61.98± 1.64, 0.73± 0.056, 1.57± 0.092, 2.57± 2.515, 1.28± 0.410, respectively, except Fructose/Glucose ratio 1.37± 0.076 the lowest value. Whereas the highest level for fructose / glucose ratio was detected in Sohag Sidr honey 1.49± 0.068.

The sugar content of honey is widely usedto assess the authenticity and overall quality of honey (Geana et al., 2020). Adulteration of honey by mixing honey with other cheaper sugar syrup is a frequent problem in the world market (Salvador et al., 2019). For this reason, the sugar analysis of honey is an indicator of whether honey bees were naturally fed flower nectar or were fed a sugar solution. The use of artificial feeding is evident when the glucose content of honey is much higher than the fructose content (El Sohaimy et al., 2015). The results obtained in this study for sum of glucose and fructose (content of reducing sugars in honey) was within the accepted range and is consistent with the standardization and authenticity of honey as observed by Haya I. Aljohara., (2018) It has been shown that the most common sugar in honey is fructose (El Sohaimy et al., 2015), in their study of winter feeding of honey bees, noted that the ratio of fructose to glucose (F/G) was higher than 1.00 indicates normal feeding of honey bees (Szczesna et al., 2021). In all honey samples in this study, the sucrose content did not exceed 5%, which is the accepted level to consider the honey as authentic as noted by Kazeminia et al., (2021). High sucrose may indicate artificial feeding of bees with some type of sugar syrup or adulteration of honey (Salvador et al., 2019). Two important parameters used to establish the freshness of honey are hydroxymethylfurfural content and diastase activity (Bentabol Manzanares et al., 2014 and Pasias et al., 2017). Several factors influence diastase activity, including the physiological period of the colony, the age of the bees, the amount and sugar content of nectar as well as the period of nectar collection (Belay et al., 2017). Fructose/Glucose (F/G) ratio indicates the ability of honey to crystallize. The honey remains liquid when its F/G ratio is high, and vice versa. Moreover, honey crystallization is slower when F/G ratio exceeds 1.3 and it is faster when the ratio is below 1. However, F/G ratio-based crystallization remained not clearly demonstrated, because honey contains other sugars (sucrose, maltose, etc.) and insoluble substances (dextrin, colloids, etc.) able to influence the crystallization process (Amir et al., 2010). According to our results, all honey samples showed F/G ratios higher than 1. Hence, the chance of crystallization less. The Glucose / Water (G/W) ratio is more appropriate than the F/G for honey crystallization prediction. Honey crystallization is slow or null when G/W ratio is less than 1.3, and it is complete and rapid when the ratio is greater than 2 (Manikis & Thrasivoulou, 2001; Amir et al., 2010).

The Hydroxymethyl furfural (HMF) and Enzymes activity in different Egyptian sidr honey samples from Upper Egypt shown in Table 4. The lowest HMF (mg/kg) was observed in Sohag Sidr honey (2.01±1 .44), whereas the highest level was detected in Luxor Sidr honey (3.23±0.223).

The highest level of diastase activity (unit/kg) was observed in Sohag Sidr honey (34.19±16.25), whereas the lowest level was detected in Luxor Sidr honey (26.59±6.53). In contrast, the highest level of Invertase activity (unit/kg) was observed in Luxor Sidr honey (249.85± 30.93), whereas the lowest level was detected in Sohag Sidr honey (202.69± 52.97).

Two important parameters used to establish the freshness of honey are hydroxymethylfurfural content and enzymes activity (Bentabol Manzanares, 2014 and Pasias, 2017). The WHO Codex Alimentarius, the European Union and the Gulf Technical Regulation on honey (GSO 147:2008-Standards Store-GCC Standardization Organization) (2022) recommend that the maximum HMF content in honey should not exceed 40 mg/kg but in countries with higher degrees of tropical heat, the HMF content in honey should not exceed 80 mg/kg (Hegazi et al.2022; Bentabol Manzanares, 2014 and Pasias et al 2017). In this study, all samples were indoors permissible range of HMF content and diastase number These parameters indicate the

freshness of samples that were preserved by preventing exposure to heat and shortening the storage time prior to the experiment. Hydroxy methyl furfural (HMF) is indisputably, an excellent index of honey freshness and purity. High concentrations of HMF in honey signal overheating or poor storage conditions. According to the International Trade Guidelines (European Economic Committee, 2001). It is well known that honey heating results in the formation of HMF, which is produced during acid-catalyzed dehydration of héxoses, such as fructose and glucose (Belitz and Grosch., 1999). Many factors influence enzymes activity, including the physiological period of the colony, the age of the bees, the amount and sugar content of nectar as well as the period of nectar collection I (Belay, 2017). The results suggest that the proteolytic enzymes of honey can significantly change honey protein profile and there by strongly influence quality and nutritional value of honey (Rossano et al., 2012). The reduction of diastase number can take a marker of honey adulteration by addition of inverted sucrose or hydrolysed starch namely high fructose corn syrup (HFCS). Enzymes are the most important and also the most interesting honey components. They are accountable for the conversion of nectar and honeydew to honey, and serve as a sensitive indicator of the honey treatment (Codex Alimentarius, 1993).

Table 3: Sugar analysis of Egyptian Sidr honey samples from Upper Egypt.

Sample	Fructose	Glucose	Fructos+ Glucose (F+G)	Fructos/ Glucose	Glucose/ Fructose	Glucose/ Moisture Ratio	Sucrose	Maltose
			(g/100g)					
Luxor	35.84± 3.366 a	26.14± 1.707 a	61.98± 1.64 a	1.37± 0.076 c	0.73± 0.056 c	1.57± 0.092 c	2.57± 2.515 a	1.28± 0.410a
Qena	35.68± 1.058 b	25.52± 0.903 b	61.20± 2.o4 a	1.40± 0.046 b	0.72± 0.045 b	1.45± 0.105 b	1.79± 0.829 c	0.91± 0.203b
Sohag	31.62± 2.438 c	21.24± 0.995 c	52.86± 2.33 b	1.49± 0.068 a	0.67± 0.047 a	1.21± 0.079 a	2.25± 0.263 b	0.97± 0.302b
Total (N=15)	103.14	72.9	176.04	4.26	2.12	2.23	8.42	3.16
General Mean ±SD	34.38± 3.123	24.3± 2.604	58.68± 2.01	1.42± 0.081	0.71± 0.055	1.41± 0.176	2.81± 1.535	1.05± 0.350
Maximum	35.84	26.14	52.86	1.49	0.73	1.57	4.37	1.28
Minimum	31.62	21.24	61.98	1.37	0.67	1.21	1.796	0.91

All values are represented as the mean of five replicates ± SD

Table 4: Hydroxy methyl furfural (HMF) and Enzymes activity of Egyptian Sider honey samples from Upper Egypt.

Location	HMF (mg/kg)	Diastase (unit/g)	Invertase (unit/kg)
Luxor	3.23± 0.223 c	26.58± 6.53 c	202.69± 52.97 c 223.79±
Qena	2.69± 0.986 b	30.44± 3.75 b	54.49 b
Sohag	2.01± 1 .440 a	34.19± 16.25 a	249.85± 30.93 a
General Mean ± SE	2.64 ± 1.658	30.41± 10.655	225.44± 50.238
Maximum	3.23	34.19	249.85
Minimum	2.01	26.59	202.69

All values are represented as the mean of five replicates± SD.

CONCLUSION:

The physical and chemical properties of honey determine its biological activity and at the same time act as authentication tools. Forty-five fresh Sidr honey samples were collected from three different regions (Luxor, Qena and Sohag Governorate) Upper Egypt. Fifteen samples from every Governorate (five honey samples/ apiary). The physicochemical parameters were assessed according to the criteria from the different honey quality standards. Our results identify Sidr honey as a promising natural product.

REFERENCES

A.O. A. C. (1995). Association of Official Analytical Chemists, 16th Ed., Washington, DC, USA.

Akhtar, S., Ali, J., Javed, B., Hassan, S., Abbas, S., & Siddique, M. (2014). Comparative physiochemical analysis of imported and locally produced Khyber Pakhtunkhwa honey. Global Journal of Biotechnology & Biochemistry, 9 (3), 55–59. http://dx.doi.org/10.5829/idosi.gjbb.2014.9.3. 8533.

Alqarni, A.S., Owayss, A.A., MAS Hmoud, A.A. & Hannan, M.A. (2014). Mineral content and physical properties of local and imported honeys in Saudi Arabia. Journal

Amir, Y., Yesli, A., Bengana, M., Sadoudi & T. Amrouche.T. (2010). Physico-chemical and microbiological assessment of honey from Algeria. Electronic Journal of Environmental, agricultural and food chemistry, 9(9), 1485-1494.

Belay, A.; Haki, G.D.; Birringer, M.; Borck, H.; Lee, Y.C.; Kim, K.T.; Baye, K.; Melaku, S. (2017). Enzyme activity, amino acid profiles and hydroxymethylfurfural content in Ethiopian monofloral honey. J. Food Sci. Technol. 54, 2769.

Belitz, H.D. and Grosch, W. (1999). Food Chemistry. Springer-Verlag, Berlin, 184-189. http://dx.doi.org/10.1007/978-3-662-07281-3.

Bentabol Manzanares, A.; Hernández García, Z.; Rodríguez Galdón, B.; Rodríguez, E.; Díaz Romero, C. (2014). Physicochemical characteristics of minor monofloral honeys from Tenerife, Spain. LWT—Food Sci. Technol. 55, 572–578.

Bogdanov, S.; Jurendic, T.; Sieber, R. and Gallmann, P. (2008): Honey for nutrition and health: A review. J. Am. Coll. Nutr., 27: 677–689.

Bogdanova, S. (2016). Book of honey, Chaapter 8. Bee Product Science. www.bee-hexagon net

Boussaid, A., Chouaibi, M., Rezig, L., Hellal, R., Donsi, F., Ferrari, G. & Hamdi, S. (2014). Physicochemical and bioactive properties of six honey samples from various origins from Tunisia. Arabian Journal of chemistry, 11(2): 265-274.

Bradbear, N (2009). Bees and their role inforest livelihoods. A guide to the services Provided by bees and the sustainable harvesting, processing and marketing of their products. In Food and Agriculture Organization of the United Nations (FAO) Rome.

Buba, F., Gidado, A. & Shugaba. A. (2013). Analysis of biochemical composition of honey samples from North-East Nigeria. Biochemistry and Analytical Biochemistry, 2 (3), 139. https://doi.org/org/ 10.4172/ 161-1009.1000139.

Chirife, J., Zamora, M.C., & Motto, A. (2006). The correlation between water activity and % moisture in honey: fundamental aspects and application to Argentine honeys. Journal of Food Engineering, 72, 287–292.

Codex Alimentarius Commission (2001): Codex Alimentarius Commission Standard 12, Revised Codex Alimentarius Commission Standard for Honey, Standards and Standard Methods 11.

Codex Alimentarius Standard for honey, 1993. Standard for Honey, Ref. no. CL 1993/14, SH, CAC, FAO/WHO, Rome, Italy.

Devi, A. and J. Jangir (2018). Chemical characterization complemented with chemometrics for the botanical origin identification of unifloral and multifloral honeys from India. Food Res. Int., 107, 216–226.

Egyptian standard (2003) honey and methods of test and experiment chapter 1: honey, Egyptian organization for standardization unification and production quality.

El Sohaimy, S.A., Masry, S.H.D., & Shehata, M.G. (2015). Physicochemical characteristics of honey from different origins. Annals of Agricultural Science, 60(2), 279–287. http://dx.doi.org/10.1016/j.aoas.2015.10.015.

EL-Metwally, A.A.E. (2015). Factors Affecting the Physical and Chemical Characteristics of Egyptian Beehoney. Ph. D. Thesis, Faculty of Agriculture, Cairo University, Egypt.

Escuredo, O., Miguez, M., Fernandez- Gonzalez, M. & Seijo, M. (2013). Nutritional value and antioxidant activity of honeys produced in a European Atlantic area. Food Chemistry, 138:851-856.

European Economic Comminity (2001). Council Directive of 20 December 2001 relating to honey. Official Journal of the European Communities, 110: 47 – 50.

Geana, E.I.; Ciucure, C.T.; Costinel, D.; Ionete, R.E. (2020). Evaluation of honey in terms of quality and authenticity based on the general physicochemical pattern, major sugar composition and 13C signature. Food Control 109, 106919.

GSO 147:2008-Standards Store-GCC Standardization Organization. Gulf Technical Regulation. Available online: https://www. gso.org.sa/store/standards/GSO:518550? lang=en (accessed on 17 February 2022).

Haya I. Aljohara, Hadir M. Mahera, b, Jawza Albaqamia, Maha Al-Mehaiziea, Rawan Orfalia, Razan Orfalia, Sarah Alrubi. (2018). Physical and chemical screening of honey samples available in the Saudi market: An important aspect in the authentication process and quality assessment. Saudi Pharmaceutical Journal 26(7). DOI: 10.1016/j.jsps.2018.04.013.

Hegazi, A.G.; Guthami, F.M.; Al Gethami, A.F.M.; Fouad, E.A.; Abdou, A.M.; Hegazi, S.; Al Guthami, F.M.; A.M. Abdou (2021). Antibacterial activity and characterisation of some Egyptian honey of different floral origin. Bulg. J. Vet. Med., 24, 278–290.

Hegazi, A.G.; Guthami, F.M.; Ramadan M. F. A.; Al Gethami, A.F.M.; Craig A. M. and S. Serrano (2022). Characterization of Sidr (Ziziphus spp.) Honey from Different Geographical Origins. Appl. Sci. 2022, 12, 9295.

Kazeminia, M.; Mahmoudi, R.; Aali, E.; Ghajarbygi, P. (2021) Evaluation of Authenticity in Honey Samples from Qazvin, Iran. J. Chem. Health Risks.

Manikis, I., & Thrasivoulou, A. (2001). Relation of physicochemical characteristics of honey and the crystallization sensitive parameters. Apiacta, 36, 106–112.

Moniruzzaman, M., Khalil, M.I., Sulaiman, S.A. & Gan, S.H. (2013). Physicochemical and antioxidant properties of Malaysian honeys produced by Apis cerana, Apis dorsata and Apis mellifera. BMC Complementary and Alternative Medicine, 13, 1–12. https://doi: 10.1186/1472-6882-13-43.

Munro, J. A. (1943). The viscosity and thixotrophy of honey. J. Econ. Ent. 36 (5):769-777.

National Honey Board (2002). Honey Health and Therapeutic qualities, Retrieved of Saudi Chemical Society, 18, 618–625. http://dx.doi.org/10.1016/j.jscs.2012.11.009.

Pasias, I.N.; Kiriakou, I.K.; Proestos, C. (2017). HMF and diastase activity in honeys: A fully validated approach and a chemometric analysis for identification of honey freshness and adulteration. Food Chem. 229, 425–431.

Ponnuchamy, R., Bonhomme, V., Prasad, S., Das, L., & P. Patel. (2014). Honey pollen: using melissopalynology to understand foraging preferences of bees in tropical South India. PLOSONE, 9 (7), 1–11. https://doi.org/10.1371/journal.pone.0101618 .

Roby, M.H.H.; Abdelaliem, Y.F.; Esmail, A.H.M.; Mohdaly, A.A.A.; M.F. Ramadan (2020). Evaluation of Egyptian honeys and their floral origins: Phenolic compounds, antioxidant activities, and antimicrobial characteristics. Environ. Sci. Pollut. Res., 27, 20748–20756.

Rossano, R., Larocca, M., Polito, T., Perna, AM., Padula, M C., Martelli, G., 23- Riccio, P., 2012. What Are the Proteolytic Enzymes of Honey and What They Do Tell Us? A Fingerprint Analysis by 2-D Zymography of

Unifloral Honeys. PLoS One, 7(11), e49164. doi: 10. 1371 /journal. pone.0049164.

Salvador, L.; Guijarro, M.; Rubio, D.; Aucatoma, B.; Guillén, T.; Jentzsch, P.V.; Ciobota, V.; Stolker, L.; Ulic, S.; Vásquez, L.; et al. (2019). Exploratory Monitoring of the Quality and Authenticity of Commercial Honey in Ecuador. Foods 8, 105.

Soria, A.C., Gonzalez, M., Lorenzo, C., Martinez, C.I. & Sanz, J. (2004). Characterization of artisanal honeys from Madrid (Central Spain) on the basis of their melissopalynological, physicochemical and volatile composition data. Food Chemistry, 85, 121–130.

Szczesna, T.; Wa´s, E.; Semkiw, P.; Skubida, P.; Ja´skiewicz, K.; Witek, M. (2021) Changes in the Physicochemical Properties of Starch Syrups after Processing by Honeybees. Agriculture 11, 335.

Tesfaye, B., Benga, D. & Eshetu, M. (2016). Evaluation of physic-chemical properties of honey produced in Bale natural forest, Southeastern Ethiopia. International Journal of Agricultural Science and Food Technology, 2(1): 21-27.

Valdes-Silverio, L. A., Iturralde, G., Garcia-Tenesaca, M., Paredes- Moreta, J., Narvaez-Narvaez, D. A., Rojas-Carrillo, M. R., Tejera, E., Beltran- Ayala, P., Giampieri, F. & 42-42-Alvarez- Suarez, J. M. (2018). Physicochemical parameters, chemical composition, antioxidant capacity, microbial contamination and antimicrobial activity of Eucalyptus honey from the Andean region of Ecuador. Journal of Apicultural Research, 57(3):382-394.

Vorwohl, G. (1964). Relationships between the electrical conductivity of honwys and their floral arigin. Ann. Abeille, 7: 301-309.

Warui, M.W.; Hansted, L.; Gikungu, M.; Mburu, J.; Kironchi, G.; Bosselmann, A.S. Characterization of Kenyan Honeys Based on Their Physicochemical Properties, Botanical and Geographical Origin. Int. J. Food Sci. 2019.

Wedmore, E.B. (1955). The accurate determination of the water content of honeys. 1- Introduction and results. Bee Wld. 36 (11):197-202.

Wei Se, K.; Abdul Wahab, R.; Nuratiqah Syed Yaacob, S.; Krishna Ghoshal, S. StudyI (2019). review Detection techniques for adulterants in honey: Challenges and recent trends. J. Food Compos. Anal., 80, 16–32.

White, J. W. (1967). Measuring in honey quality a rational approach. Amr. Bee J., 107 (10): 374-375.

White, J. W., Riethof, M. N. I., Subers, M. H. & Kushnir, I. (1962). Composition of American honeys. U. S. Dept. Agr. Tech. Bull., 1261:124pp.

بعض الخواص الفيزيائية والكيميائية لعسل نحل ناجح السدر المصري في مصرالعليا

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الملخص العربى

اجريت هذه الدارسة في قسم وقاية النبات - كلية الزراعة جامعة سوهاج , قسم بحوث النحل - معهد بحوث وقاية النبات - مركز البحوث الزراعية - الدقي مصر خلال عام ٢٠٢١ .

وكان الهدف من هذه الدراسة معرفة الخواص الفيزيائية والكيميائية لعسل نحل السدر المصري في ثلاث محافظات هي الأقصر وقنا وسوهاج تمثل مصر العليا. حيث جمعت خمسة وأربعون عينة من عسل نحل السدر المصري من ثلاث مناطق تمثل محافظات الأقصر وقنا وسوهاج في صعيد مصر خلال شهر نوفمبر 2021 خمسة عشر عينة من كل محافظة (خمس عينات عسل / منحل) وتم جمع عينات عسل. بمعدل 1000 جرام لهذه الدراسة ، تم توفير جميع عينات العسل بواسطة النحالين المحترفين.تقييم تسعة عشر خاصية فيزيائية كيميائية: اللون ، التوصيل الكهربائي ، الكثافة ، اللزوجة ، الرطوبة ، الأس الهيدروجيني ، الأحماض الحرة ، اللاكتون ، الحمض الكلي ، الجلوكوز ، الفركتوز ، السكروز ، المالتوز ، السكر الكلي ، نسبة الجلوكوز / الفركتوز ، نسبة الجلوكوز / الماء ، Hydroxymethylfurfural (HMF) ، نشاط Diastase , Invertaseأظهرت النتائج اختلافات معنوية في الرطوبة ، الحموضة (PH ، الأحماض الحرة ، حمض اللاكتيك والحموضة الكلية) ، الفركتوز ونسبة الجلوكوز في هذه الدراسة بين محافظات الأقصر وقنا وسوهاج ، حيث كان متوسط محتوى الهيدروكسي ميثيل فورفورال منخفضًا جدًا في جميع عينات عسل السدر قيد الدراسة ، وتراوح نشاط إنفرتيز من 202.69 إلى 249.85 وحدة / كجم. بمتوسط إجمالي 225.44 ± 50.238 وحدة / كجم. العسل وتراوحت فعالية دياستاز من 26.59 إلى 34.19 في كلتا الوحدتين. بمتوسط إجمالي 30.41 ± 10.655 وحدة في كلا المقياسين.