

DETERMINING THE RATIO OF CARBOHYDRATES AND SOME TYPES OF REDUCING AND NON-REDUCING SUGARS IN HONEY FEED HONEY BEES ON CITRUS FLOWERS (*Citrus Singensis*) AND CHRIST THORN JUJUBE'S FLOWERS (*Ziziphus Spina _Christi*)

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Abstract: *The medical importance made the honey one of the most significant subjects in a great deal of Research and studies. Now that the structure of honey differed from a type another due to plant source, time of gathering, the kind of bee worker gathering of blossoms. Testing of honey Samples In this research, the ratio of carbohydrates is indicated there was approximated results, it is also define the ratio of reducing and non-reducing sugars for the Samples of the honey bee feeding Christ thorn jujube (*Ziziphus Spina Christi*) and orange blossoms (*Citrus Singensis*).*

Keywords: *carbohydrates, reducing sugar, non-reducing sugar, honey Citrus Singensis and Ziziphus Spina_Christi .*

Introduction

Honey Linked to most areas of everyday life, curing and nourishing . So make the latter an important subject in many research studies over the years these studies intended to identify properties and synthesis of the latter to determine the criteria for its quality and the special use and development of curative area, especially a single source honey, And since the composition of honey so it kind of different from honey to another because different vegetable exporters pending this research study vegetation footprint on my sample of honey to the Valley (honey *Leptadenia pyrotechnica* , *Zygophyllum _album* (Badadaa,2017).

Principally, natural honey is a viscous and sticky liquid. It is well demonstrated (80-85%) carbohydrate (mainly) glucose and fructose, 15-17% water, 0.2% ash, 0.1-0.4% protein and minor quantities of enzymes, amino acids, and vitamins besides other substances like phenolic antioxidants (James *et al.*, 2009; National Honey Board,2003; Gheldof and Engeseth, 2002; Jeffrey and Echazarreta, 1996; White and Doner, 1980; Mustafa, AL-Samarraie,2020).

Multivariate analysis methods have been used to discover the geographical source of honey based on free amino acid content botanical origin according to physical and chemical descriptors (Krauze and Zalewski, 1991; Mustafa, AL-Samarraie,2020). Other study has been performed on the mathematical classification of honey (Persaon *et al.*, 1995; Stefanini, 1988,1984).

Honey is a natural sweet aggregated from the nectar of flowers making by the honeybees (Urmila & Sanjay, 2010). Honey has consisted of 80-85% carbohydrates,15-17% water, 0.1%-0.4% protein and few

amounts of vitamins, amino acids and proteins are also an integrant of honey (Khalil *et al.*, 2012; Blassa *et al.*, 2006; National Honey Board, 2003). The composition of honey account on its geological, floral and zoological origin, minor external factors such as seasonal and environmental ingredient play a principal role (Moniruzzaman, 2013).

The ratio of carbohydrates estimated between 73% - 83%, which is the biggest proportion of honey Fructose and glucose (the highest percentage of sugars) (www.na71a.com/Prodhon) are responsible for some characteristics of honey bees sweetness and viscosity as well as crystallization and its mixture of water and energy. The high ratio of saccharides has a clear and effective effect in stopping the activity of types of many fungi and a lot of bacteria species (Sanz *et al.*, 2004).

Types of sugar in honey mono and disaccharides, the almost important of which is sugar of glucose between 28-34% in addition to fructose between 35- 41% but other sugars are between 5 -10% (WWW.mansoubeaty.com) as dextrin, barley and other sugars, although these sugars were not presented in monosaccharide in the nectar, but they found in honey during fermentation and ripening (Al-Zoreky, 2016) Honey is accounted for the highest ratio of sugar and this is due to the activity of the enzyme of the invertase produce by the workers. The nectar, they work to convert glucose, which is disaccharides into fructose and glucose, responsible for most of the nutrition and physical properties of honey (Krell, 1996) A test of 23 types of honey has performed in Saudi Arabia as well as in six countries to find out chemical and physical properties, flower's pigment and minor content. The test of Saudi honey of Seder and Asacia plant showed contents of low water, supreme value of solid materials and density (Al Qarni ,Owayss and Mahmoud 2012). The chemical composition and characteristics, flavour, aroma, colour of honey depend basically on time of gathering the kind of bee worker gathering of blossoms, geographical regions ,climate and flowers source of nectar involved its production. (Escuredo *et al.*, 2014; Tornuk *et al.*, 2013)

Honey is compound nutrition sweetness contained basically carbohydrates 60–85% and water 12–23%. It also consists of few amounts of other compounds such as minerals, organic acids, vitamins , amino acids, enzymes, proteins ,Maillard reaction matter, volatile compounds, and many bioactive materials (flavonoids and phenol , among others), besides pollen grains (Almeida-Muradian *et al.*, 2013; Gomes *et al.*, 2010; Cano *et al.*, 2001; White, 1979a) DE-MELL for as sweetener and human energy origin The monosaccharide are consisted fructose (32–44%) and glucose (23–38%) are the main honey sugars. In almost all honey kinds, fructose is the main sugar, but there are exemptions such as rape (Brassica napus), dandelion (Taraxacum officinale) and blue curls (Trichostema lanceolatum) honey is comprised glucose in higher quantities (White 1979a). The concentration of glucose and fructose, In addition to their ratio ,have been developed as advantageous cursors for the classification of unifloral honeys (Person Oddo *et.al* 1995 and Piro 2004)

. In almost kinds of honey, fructose is the carbohydrate in the greatest ratio, but in some kinds of honey such as rape (Brassica napus) and dandelion (Taraxacum officinale), wherein the fraction of glucose may be higher than the fraction of fructose (Escuredo *et al.*, 2014), and then these honey mostly have a quick crystallization. The sugars profile of honey have been researched by scientists over world wide. At these profiles, many sugars were recognized, such as fructose, glucose, sucrose, rhamnase, trehalose, nigerbiose, isomaltose, maltose, erlose maltotetraose, maltotriose, maltose, melezitose, melibiose, nigerose, palatinose, raffinose, and others (Fuente *et al.*, 2011). Sugars of honey are formed by monosaccharide, fructose and glucose pursued by disaccharides, turanose, sucrose, maltose, maltose, nigerose, isomaltose, trehalose, kojibiose and trisaccharides melezitose and maltotriose. Disaccharides and trisaccharides like sucrose and maltotriose hydrolyzed enzymatically to .monosaccharides. Sucrose contains one molecule of fructose connected with glucose through a-1,4 binding. It is hydrolyzed by the enzyme invertase, producing an equimolar blending of hexoses (Kamal & Klein, 2011) .

Materials and a method

Determination of Sugars

Methylene blue, the Fehling solution A (copper sulphate), the Fehling solution B (Sodium potassium tartrate) Hydrochloric acid, Sodium chloride solution. Add distilled water of honey conical flask add distilled water and dissolve it to be of volume 100 ml. Added 2-3 drops of Phenolphthalein then add

Sodium hydroxide solution till the solution till its origins color and then add D.H₂O 200ml of honey solution .5ml of honey solution mix with 5ml Fehling solution A and the Fehling solution B in a conical flask and boiled for two minutes .During boiling add 3- drops of Methylene blue indicator ,titrate with honey solution brick red colored end point .Note volume of honey solution used.

$$\text{Reducing sugar \%} = \frac{\text{fehling solution constant (0.051)} \times \text{total volume of solution} \times 100}{\text{Wt of sample solution} \times \text{volume of titrate}}$$

Take five gram of honey solution in a beaker Add distilled water. Add 2-3 drops of , add Sodium hydroxide solution till the solution till its origins color Phenolphthalein then add D.H₂O to 200ml (v1) total volume. Take 50ml (w2) form above solution , five gram citric acid and boil for 10 minutes and cool it. Then neutralize it as in reducing sugar and add D.H₂O to make total volume up to 200ml (v2). took five gram of honey solution add 5ml the Fehling solution A(copper sulphate), the Fehling solution B(Sodium potassium tartrate) and boil for two minutes . Add 2-3 drops of Methylene blue and titrate with it till become red color. Note the volume of honey solution used.

$$\text{Total sugars\%} = \frac{\text{Fehling solution constant (0.051)} \times \text{total volume of } 200 \times 200 \times 100}{50 \times 50 \times \text{Vol. of honey solution used for titration}}$$

Non-Reducing Sugars=total sugars- Reducing Sugars.

Result and Discussion

The result in table 1 showed for the Samples of the honey bee feeding the orange blossom that the ratio of carbohydrates was between 81.2-82.4%. This proportion is similar to the result of Buba *et al.*, 2003 and he affirmed that the ratio of carbohydrates in the bee's honey in North East Nigeria was 82±2.3% whereas Iftikhl *et al.*, 2014 emphasis that the sugars 'ratio is honey was 75-83%.

The relative difference in the sugars' ratio ascribed to the variety of bee nutrition. It was Expanded that the difference in carbohydrates' ratio attributed to the variform blossoms and he also showed that the sugar ratio in honey was between 77-80%by Adeniyi *et al.*,2014. At reducing-sugar ,the ratio was between 76.98-67.80%.This proportion approached the result of Nit in 2019 for seven-provinces-Venezuelan ,honey patterns. The sugar ratio was showed as 62.30-77.57% by Amabye & Prehiubt ,2016 whereas a reducing sugar's ratio in Ethiopia provinces was 75.85±9.38% for wukro, 75.29±13.72 for Adigrat ,72.85±4.75% for Astbi, 69.56±0.56% for Kiltewawelo,71.5±2.63%for Sinkata and 69.83±3.8% for Gatafeshum Badada 2017 also affirmed that the ratio of sugars in glucose and fructose into the honey made it have a property of reduction when he proved that the ratio of carbohydrates was 73-83%and the higher ratio of sugars gave it the property of viscosity, sweetness ,potential and crystallization.

In non-reducing sugars the ratio was between 2.65-5.22%for the honey bees feeding the orange blossoms. The decrease in the non-reducing sugars' ratio returned to the higher proportion of the reducing-sugar for sugars of glucose and fructose as well as to some kinds of sugars. This proved Ahmed and AL-Hilaly, 2010. We assured that the sugar of fructose and glucose, as reducing-sugar, made the maximum rate of honey plus the maltose sugars ,as proved by Peter *et al.*, in 2007 that the glucose and fructose reached at 85-95% from the total sugar in addition to maltose sugar (they are disaccharides).Al these sugars are reducing sugar ,so the non-reducing sugars' ratio was low.

Table 1 illustrated reducing sugars and non-reducing sugars and the sum of carbohydrates for honey feeding the orange blossoms.

Non-reducing sugars	Reducing sugars	Total carbohydrates
2.65	76.32	81.80
4.68	70.85	81.2
4.94	72.2	81.2
3.4	74.55	81.2
4.4	67.8	81.5
4.9	71.2	82.9
4.6	72.8	81.6
4.89	71.1	81.4
4.74	70.61	81.6

4.68	69.8	82.5
3.90	73.2	81.6
3.98	73.2	81.6

In the honey bees feeding Christ thorn jujube , Ratio of carbohydrates was between 81.1-81.9%. This proportion is approached to the result of James *et al.*, 2009; National Honey Board, 2003; Euazarr, 2002; Jeffery, 2002; Doner, 1993; White, 1980. We proved that the honey is sticky and viscid properties containing a ratio reached at 80-85% of carbohydrates, most of which are sugars of fructose and glucose as indicated by Bidad, 2017 that the ratio of carbohydrates for *Zygophiuon al bum.L*(2015) was 83-85% , and it was 85.5% , but for *Lepaveala pyotchia*, Carbohydrates was 82.5% in 2015, while was 83% in 2016, and he did his tests in centigrade, whereas Abdul Muty, 1991 showed that Christ thorn jujube

contained 84% of carbohydrates and 21% starch. For the honey bees' feeding Christ thorn jujube, the percentage was between 60.9-68.1%. This proportion is similar to the result of Krenn in 1996 when he mentioned that the increasing the ratio of the monosaccharides in honey had returned to the enzyme activity (Invertase) which had converted the sucrose in to fructose and glucose. The bee worker secreted this enzyme responsible for some nutritive and physical properties of honey Abdul Al- Ghany in 2009 proved that the ripeness of honey needs the mechanical and chemical processes doing in the honey sac that contained a group of juices and enzymes working for converting cane sugar, is a disaccharide, into glucose and fructose, that is considered mono saccharides reduced ,as the catalase enzyme breaks down H₂O₂ into oxygen and water , and the enzyme diastase ,which breaks down starch into glucose , and the lipase that breaks down fat in pollen ,in addition to phosphatase enzyme that breaks down glycerophosphate .

As for the non-reducing sugars of the studied honey patterns for the honey bees feeding the blossoms of Christ thorn jujube a ratio was between 7.6-9.8% ,but these ratios were superior to non-reducing sugars for the honey bees feeding the orange blossoms. White affirmed in 1980 that the increase of fructose ratio 38.1-39.8% for two types of honey feeding blossoms in California and Florida as well as the ratio glucose reached at 31.96-32.1%.

It made decreased of sucrose rate 2.60-2.68%. This is from non-reducing sugars, whereas the maltose sugar is also from reducing sugars. So ratio range between 6.26-7.2% .The difference in sugars' ratio for the properties structures natural patterns of honey varied according gathering a pollen and the type of blossoms are gathering, the type of bee-worker gathering pollen. This proved by Al- Najjar (2010).

Table 2 illustrated reducing sugars and non-reducing sugars and the total of carbohydrates for a honey bees feeding Christ thorn _jujube 's blossoms.

Non-reducing sugars	Reducing sugar	Total carbohydrates
6.9	68.1	81.3
5.22	72.98	81.2
7.1	65.2	81.9
7.1	65.98	81.3
7.6	60.6	81.2
6.8	65.8	81.3
6.85	64.9	81.5
6.9	64.9	81.5
5.2	67.4	81.4
6.1	66.4	82.7
7.2	65.2	81.2
6.9	64.9	81.5

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