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Effect of Persimmon Sap Nutrition on Sugars of Honey in Colony of *Apis mellifera*

Yaser Pourakbari, Ali K. Rezapour and Ahmad Ghorbani

Department of Animal section, animal science, Faculty of Agriculture,
Tabriz branch, Islamic Azad University, Tabriz, Iran, P.C. 5157944533

Abstract: The object of this study was evaluation of Effect of persimmon sap nutrition as a stimulatory nutrition on Sugars of honey in *Apis Mellifera* colony. The experiment conducted based on randomized complete block design. The treatments were as follow: 1. sugar and water syrup (1:1 ratio), 2. persimmon sap and water (1:3 ratio), 3. persimmon sap and sugar (2:1 ratio), 4. persimmon sap and sugar (1:1 ratio), 5. persimmon sap and sugar (1:2 ratio). The overall duration of experiment was 60 days. To colonies at the end of experiment honeys transferred to lab and measured Sugars contain. Data relating to the effect of experimental dietary between control and experimental treatments showed, there are significant differences ($P < 0.05$). The highest reducing sugars related to treatment 2 with 64.72 gr % and the lowest related to treatment 1 with 62.66 gr %. The highest Sucrose related to treatment 1 with 7 .9 % gr % and the lowest related to treatment 2 with 23.2 gr %.

Key words: Honey · Persimmon Sap · Nutrition · Sugars · Honey bees

INTRODUCTION

Honey is a natural gathered energetic food modified and secreted by honey bee apis mellifera. Honey is among many of the natural products that have been used to treat various aliments such as burns and ulcers since ancient times [1,2]. Honey is one of the best sucrose of sugar that provides the body with energy quickly without side effects and for prolonged periods of times [3]. According to Iran's national standard definition, the honey is the natural sweetness which honey bees produce, then from the nectar of the flowers or blossom, or leakage from the living parts of plants or secretion which the sucking insects caused them on the living part of plants, they collected honey and added various enzymes and processing, evaporate the moisture then store in the hive [4]. Compound found in honey included: water, sugar, acids, enzymes, vitamins, minerals, protein, amino acids and fats [5]. Stimulatory factors such as nutrition, young queen, the lack of adequate food and nectar in nature, laying queen in the healthy hive, growing population are immense important in honey production [6]. Productive efficiency of the apicultural industry depends upon improvements in bee breed, bee management and bee forage. Honey bees are the prime pollinators; they are involved in pollination of most field and orchard crops [7]. National and international organizations including the International Commission of Honey (IHC) and the Commission of Food Codex (CAC) have determined criteria for the definition of natural honey [8]. In Iran this task is duty of the Standards and Industrial Research Institute. Honey productions should obey of Iran honey standards are presented in Table 1. A study the inhibition action of of natural honey was investigated with two concentrations by using weight loss method, potentiodynamic polarization technique and electrochemical impedance spectroscopy technique. natural honey was used as the inhibitor because it contains a mixture of organic and inorganic compounds [9]. the mean rate of moisture, pH, reducing sugars, Sucrose in natural honey samples from different places in Azarbijan province %5.17, 6.96, 07.73 and 3.4% [10]. A study conducted on 490 honey samples in Iran showed that pH rate were 3.5- 4.8 [11]. conducted a study on 12 different samples in Brazil, moisture was 20%, Sucrose 8% and pH rate of all samples reported 3.10 to 4.05 [12]. In a study carried on 29 honey samples in the south of Spain, moisture was 59.16%, Sucrose 67.3% and pH average was 4.07 [13]. A study on 7 different honey samples in Poland and Turkey showed the moisture 9.17-3.16%, ash 519.0-112.0% and pH 3.67 to 4.57 [14, 15]. A study on 60 honey samples in Garmsar county (Samnan province), they

Corresponding Author: Yaser Pourakbari,Animal section, Department of animal science,
Faculty of Agriculture, Tabriz branch, Islamic Azad University, Tabriz, Iran.
Tel: +5157944533.

\Table 1: Iran honey standard

Faktors	Acceptable results
Moisture	20 gr % (The maximum)
DM	80 gr % (The Minimum)
pH	5.3 (The Minimum)
reducing sugar	65 gr % (The Minimum)
Fructose to glucose ratio	9.0 (The Minimum)
Sucrose	5 gr % (The maximum)

reported that moisture, pH and ash average were 20%, 4.54 and 28.0% [16]. A study which took three years on 60 honey samples in Portugal, they reported moisture, pH, HMF, reducing sugars, Sucrose and ash average were 83.17%, 4.01, 15.9 mg/kg, 22.72%, 12.1% and 36.0% respectively [17]. In a study conducted on the 11 Indian honey samples, moisture, pH, reducing sugars and Sucrose average were variable from 17 to 6.22%, 3.62 to 4, 3.61-6.72% and 2.1-7.5% [18]. In a study on the 98 honey samples in Morocco, moisture, pH and HMF quantity were 21.3% to 14%, 2.25 to 4.71 and 3.2 to 5.26 mg/kg [19]. In a study conducted in Yaucontan peninsula in Mexico in 2000, moisture and pH average showed 20% to 18.48% and 3.55 to 3.70 [20]. In another study conducted in Argentina which took from 1997 to 2000 on 262 samples throughout country, moisture and pH average were reported 16.9% and 3.7 [21]. A study on pH in west of Nepal and reported pH limitation was 4.61 - 5.03 [22].

The aim of this study was to produce honey with curative properties, sugar material of forest persimmon Sap are glucose and lovoloz,they are not harmful to people with diabetes disease, since forest persimmon sap is a natural material and rich of vitamin, so can be used in production of honey with therapeutic properties.

MATERIALS AND METHODS

In order to evaluate the effect of different feeding level of forest Persimmon Sap as an stimulation factor on Sugars in honey bees colonies in spring 2011 experiment conducted base on different diet level with completely randomized block design with 5 treatments and 5 replications on honey bee (*Apis Mellifera*) in Guilan province. Experimental diet consist of treatment 1:(sugar syrup and water in ratio of 1:1), treatment 2(Persimmon Sap and water in a ratio of 1:3), treatment 3(Persimmon sap and sugar in a ratio of 2:1), treatment 4 (Persimmon sap and white sugar in a ratio of 1:1) and treatment 5 (Persimmon sap and sugar in a ratio of 1:2) respectively, above treatments for 60 days were fed as artificial nutrition. Experimental treatments were 4 times fed weekly at 5 o'clock (to prevent looting) the colonies were set by the syrup containers. Analysis results of a typical forest persimmon Sap presented in Table 2. After finishing the nectar in nature, honey extraction began separately in each hive. Honey production were collected in compliance with the recommended sampling conditions of Institute of Standards and Industrial Research of Iran. 15 samples (3 samples per treatment) in ideal conditions was transferred to the laboratory analysis of the Honey in Research Institute of Animal Sciences (Iran) to check the moisture, pH, reducing sugars, Sucrose and Fructose to glucose ratio. Measured them, as follows: 1) moisture: 2.5 gr of each honey sample placed for 3 hours at 105 ° C temperature inside the oven. After reduction the weight of the sample it considered as the moisture weight and converted to percentage. 2) pH: 10 gr of honey from per sample dissolved in 75 mL of distilled water, then pH of honey samples was measured by using of a digital pH meter with an accuracy of 0.1. 3) Determination of honey sugars (reducing and non reducing sugars) was done by Fhlying method. In this method first reducing sugars (fructose and glucose), then total amount of sugar measured. By reducing sugar from total sugars, non-reducing sugar (mainly sucrose) is acquired. 4) Fructose to glucose ratio: 25 cc of honey mixed with 20 cc of iodine solution and added 2.5 cc of normal Caustic soda and placed in the dark for 15 minutes and 5 cc of sulfuric acid 2 normal and added 3 to 5 drops of 1% starch, continuing Titration until it completely became colorless. 5) Protein: 0.33 g of honey mixed with 7 ml of concentrated sulfuric acid and at a temperature of 420 °C for 3 to 4 hours placed in Microcoldal device.Then by titration, the amount of measured nitrogen and obtained number multiply in 6.25 and measured protein in the honey. Statistical analysis was conducted using SAS 9.1 software. Duncan's multiple range test was used for mean comparison [23].

Table 2: Analysis results of a typical forest persimmon Sap presented

Moisture	Protein	Carbohydrates	Acidity	Ash	Fat	Energy	pH
22	1.14	74.69	14.02	5.35	0.17	35586	5.7

RESULTS

Data related to the effect of nutrition of experimental treatments on the average on Sugars of honey in honey bee colonies are presented in Table 3. Based on data obtained between treatments there are significant difference ($P < 0.05$). The highest honey moisture content belongs to treatment 3 with 19.13% and the lowest content to treatment 5 with 17.4 percent. The highest pH related to treatment 5, with 5.01 and the lowest related to

Table 3: Average chemical characteristics of Honey (±SEM) in different treatments and comparing them through Duncan Method in probability level of 5%

Faktors	Treatment1	Treatment2	Treatment3	Treatment4	Treatment 5
Moisture (gr%)	05.0±6.18 [b]	05.0±6.18 [b]	05.0±13.19 [a]	05.0±2.18 [c]	05.0±4.17 [d]
DM (gr%)	05.0±4.81	[c] 05.0±4.81 [c]	05.0±86.80 [d]	05.0±8.81 [b]	05.0±6.82 [a]
pH	01.0±58.3 [d]	01.0±71.4 [c]	01.0±81.4 [b]	01.0±76.4 [c]	01.0±05.5 [a]
Reducing sugars (gr%)	46.0±6.66 [c]	46.0±6.72 [a]	46.0±1.71 [b]	46.0±2.71 [ab]	46.0±8.70 [b]
Fructose to glucose	03.0±01.1 [a]	03.0±87.0 [b]	03.0±96.0 [ab]	03.0±95.0 [ab]	03.0±93.0 [ab]
Sucrose (gr%)	26.0±7.9 [a]	26.0±23.2 [c]	26.0±46.3 [b]	26.0±46.3 [b]	26.0±33.2 [c]
Protein (gr%)	01.0±183.0 [e]	01.0±55.0 [a]	01.0±27.0 [d]	01.0±4.0 [b]	01.0±32.0 [c]

The means that are in a column with different letters are significantly different (P< 0.05)

treatment 1 with 3.85. The highest Fructose to glucose related to treatment 1 with 01.1 and the lowest related to treatment 2 with 87.0. The highest Sucrose related to treatment 1 with 7.9 % gr % and the lowest related to treatment 2 with 23.2 gr%. The highest reducing sugars related to treatment 2 with 64.72 gr % and the lowest related to treatment 1 with 62.66 gr %. The highest protein related to treatment 2 with 55.0% and the lowest related to treatment 1 with 18.0%.

DISCUSSION

Many International bee breeder organizations, such as (Germany, Belgium, Australia, Italy and Spain), they considered the maximum moisture content of honey 17.5-18.5 % which is reasonable for honey quality. But according to the instructions of Commission of Food Codex valid for the honey Trade in the world, the maximum acceptable moisture content is 21% for honey. With respect to importance of moisture in the honey lasting, honey producers should keep in mind and by using appropriate methods, try to reduce the moisture content of honey. According to Iran honey standard, honey moisture should not be more than 20 percent which present study result adherence it. pH due to its impact on the texture and consistency of honey, it is of utmost importance during the extraction and storage. pH of all honey production in the present study was in the acceptable range. Early honey harvest from the hive causes of high humidity, honey fermented acidy and the rate of acidity will increase and finally the pH will decline. Today, due to bad management some of bee keepers such as undesirable honey processing, little information and increase in honey price caused to profiteering some of people Thus by reducing the nutritional value and poor quality this food will eventually miss its value in the society Sometimes fake honey completely comes to market. Iran honey standard, pH of honey should be at least 3.5 which the present results of this study follow it. Reducing sugars in all samples were higher than to minimum standard of Iran (65%). The rate of reducing sugars in diagnosing honeydew from honey is very useful. According to Iran honey standard, maximum of sucrose should be 5% in the treated samples, except treatment 1, placed in the range. It is interesting that despite the presence of sugar in treatments 3, 4 and 5, using of Persimmon Sap caused to reduced sucrose in honey sample. Ash average of all treatments which had forest persimmon Sap significantly was higher than sugar syrup with respect to the analysis of persimmon Sap and its high levels of ash that is justifiable. Using of Forest persimmon Sap in honey bee nutrition, honey protein is significantly increased ($p < 0.05$).

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