

Evaluation of the Status of Iron in Different Honey Samples

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Summary: The aim of this study was to assess the content of essential element, iron in different honey samples using atomic absorption spectrophotometer. Thirty honey samples, classified as natural, branded, and farming were collected from hives, farms and local market. Mineral acid mixture sulfuric acid and nitric acid in (1: 1 ratio) was used to destroy the organic matter. A significant difference in iron content was found between natural honey (22.994 ± 4.188), Farming honey (14.49 ± 6.23) and branded honey (16.71 ± 7.8) with ($p < 0.001$). Natural honey contained higher amount of iron content as compared to the farming and branded honey.

Introduction

Honey is a sweet, viscous fluid, elaborated by bees from the nectar of the plants and stored in their combs as food. It is used worldwide as a basic foodstuff, either by direct ingestion or as a sweetener in a variety of foodstuffs. Honey is easily digestible foodstuff containing a range of nutritiously important element. Honey contains a high content of range of saccharides; there are also organic acids, mineral matter, colours, aromatic substances and trace amount of fats [1]. Individual group of honey (natural, farming and branded honey) varies in colour, aroma and taste. There are also differences in the chemical composition which are reflected in many physiochemical properties, such as the content of ash, the spectrum of saccharides, the activity of enzymes, electrical conductivity, pH and optical rotation [2].

The mean content of mineral substances in honey has been calculated to be 0.17%, although this can vary with in a wide range. Honey contains many trace minerals that are essential to health: phosphorus, iron, aluminum, magnesium, copper, manganese, silica, chlorine, calcium, potassium and sodium [3-5]. All the above elements are required for the growth of plants. Plants absorb elements and deliver them to the nectar, which is a major resource used by bees to make honey. Therefore honey vary in mineral content not only according to the resources of soil (where its evolution starts), but also according to the kind of plants from which the bees took nectar.

The nutritional elements serve as cofactors in a wide array of enzymatic reactions. Various

circumstances may results in inadequate status of nutritional elements: insufficient intake, poor digestion, poor absorption, and competitive inhibition by toxic elements. Iron is necessary for the formation of some proteins, hemoglobin, myoglobin, and cytochrome. Also it is necessary for oxygen transport, cellular respiration and peroxide deactivation [6, 7]. The objective of this study was to determine the content of iron in different thirty honey samples in three groups (Natural honey, Farming honey and Branded honey), analyzing by Atomic absorption spectrometry. Our work also aimed to find some relationships among individual groups of honey.

Results and Discussion

Iron is essential to life and play irreplaceable role; it is an important constituent of hemoglobin, myoglobin and many iron-containing enzymes critical to cellular metabolism. Iron intake and its absorption very markedly, depending on dietary factors. In honey great range of nutrient are found and provides good amount of iron as supplement [11-13]. In this purpose about thirty honey samples were investigated. i.e. Natural honey, Branded honey and farming honey. Iron content of honey was determined with ASS technique. Results showed the concentration of iron varied in individual group of honey (Fig. 1).

Statistically significant differences ($p < 0.001$) were found in the content of iron between natural and farming honey samples, and between branded and

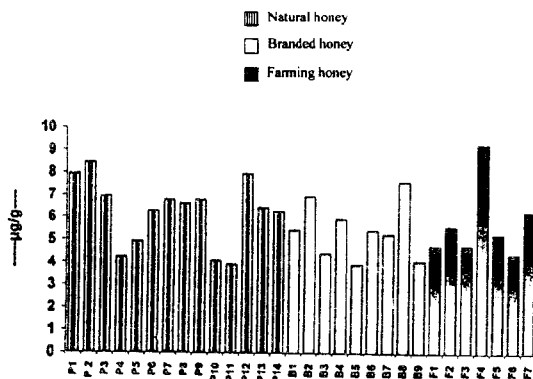


Fig. 1. Content of iron in different honey samples

natural honey samples (Table-1). This shows that the variation in iron content of different honey samples varies less than 1 %.

Table-1: Average concentration of iron and standard deviation in the individual groups of honey.

Honey samples	Range ($\mu\text{g/g}$)	Mean (standard deviation)	P values
Natural honey	16.35 - 31.89	22.99 \pm 4.188	0.001
Branded honey	8.05 - 28.71	16.709 \pm 7.678	0.001
Farming honey	3.81 - 19.70	14.5 \pm 6.236	0.001

The highest concentration of iron was observed in natural honey (22.994 ± 4.19) as compared to the farming honey and branded honey. The lowest amount of iron was found (14.5 ± 4.2) in farming honey samples (Table-2). In natural honey samples the bees collect nectar from different kinds of flower from different region and also depends upon the soil in which plant grow which is the base substance used by bees to make honey. In farming honey samples only limited area and particular environment are available for bees to collect nectar. So natural honey is a good source of essential element iron, and is an excellent medicine for all sorts of cold.

Experimental

Methodology

Sampling

The nine samples of imported and branded honey were purchased from local market of Karachi and Hyderabad. Seven samples of farming honey were collected from, Karachi, Tandojam, Quetta, and Gujranwala and fourteen samples of Natural honey

were collected from different areas of Islamabad and Hyderabad.

Preparation of sample

All honey samples were pretreated to destroy organic matter, because the technique used for metal analysis i.e. atomic Absorption Spectrophotometer required clear organic matter free and transparent solution. For acid digestion of biological material, concentrated acid or mixture of acid was used.

The triplicate samples (2 gm) of each honey samples was weighed into separate digestion flasks and treated with mineral acid mixtures of concentrated nitric acid, sulfuric acid (1: 1) ratio, and side by side 5 ml of mineral acids mixture was also added in empty flasks, which served as blanks for the procedure. For thermal agitation the samples, were placed on a hot plate and covered with watch glasses. The hot plate was set at 100°C , which resulted in a slight boiling of the sample. After heating for 30 minutes, the contents of flasks were treated with additional 5 ml of mineral acid mixture followed by 2 ml of 35 % hydrogen peroxide and then heating at gentle reflux was continued until a clear and transparent solution was obtained. The content of the flasks were cool and diluted with 2N nitric acid and filtered through Whatman # 42 paper into 10 ml volumetric flasks, marked as stock sample solutions. Elemental analysis of unknown samples on Hitachi model 180 - 50 Atomic absorbance / flame spectrophotometer using air acetylene flame. Calibration was made at four points on standard solutions including blank solution. General analytical measurement conditions [8-10] are shown in Table-2.

Elemental analysis

A series of standard of iron, were simultaneously run in the concentration range are given in (Table-2). Concentration values of iron were calculated from the absorbance value by use of linear regression equation. A blank reading was also taken and necessary correction was made during the calculation of percentage concentration of iron. The precision and accuracy of digestion method was verified using the recovery test by standard addition methods. The percentage recovery for iron is ranged from 97-99 %.

The resulting data were processed for statistical calculation using Minitab II. The mean value of iron concentration and standard deviation

was calculated for each separate group of honey samples.

Table-2: Atomic absorption spectrophotometer conditions

	Recommended values	Experimental setting
Lamp current	10.0 mA	7.5 Ma
Wavelength	248.3 nm	248.5 nm
Burner height	7.5 mm	7.5 mm
Slit width	0.2 nm	0.2 nm
Oxidant (Air)	1.60 kg / cm ²	1.60 kg / cm ²
Fuel (Acetylene)	0.3 kg / cm ²	0.3 kg / cm ²
Flow rate (Air)	9.41 / min	9.41 / min
Flow rate (Acetylene)	2.301 / min	2.301 / min
Signal out put	-	100%

Slopes, Intercepts and Errors of linear graph of regression lines for concentration versus Absorption data of Iron using Hitachi Model 180 – 50 Atomic Absorption Spectrophotometer.

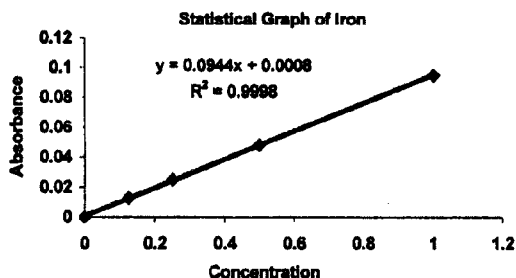
Concentration range = 0.00 – 1.00 ppm

Absorbance range = 0.00 – 0.091

Dilution Factors

2 g honey/10ml (A) _____ 1ml of A /10ml

Statistical data $y = mx + c$



Conclusions

It was concluded that the natural honey are rich essential nutrients such as iron, which is necessary for human health.

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