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MINERAL COMPOSITION OF DIFFERENT UNI FLORAL HONEYS OF EAST GODAVARI DISTRICT, ANDHRA PRADESH, INDIA

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Honey is an excellent and unique natural product which is synthesized by honey bees by collecting nectar from different kinds of flowers having both food and medicinal values and useful to the mankind and other living organisms. Biological systems of living organisms require minerals. Hence minerals play very crucial role in the vital activities of organisms. Hence we investigated and studied the elemental compositions of some UNI FLORAL honeys of particular areas and seasons of East Godavari District (EGH), Andhra Pradesh and their ash contents also mentioned the importance of essential (micro to macro) and non-essential elements (whose functions are unknown).

Keywords: Meleto palionology, Frequency classes, Pollen morpho types, Chromoproteins, Metal activators, Multifloral

INTRODUCTION

Modern people are more health and beauty conscious. They are searching for a natural product which has no side effects and to satisfy their quench for their requirements. Honey is one which is having all the required qualities (food and medicinal) desired by present generation and an excellent sweetening agent and can be preserved for a long time without adding any preservative. This unique property acquired by the honey is caused by nearly 300 different chemicals. These chemicals are giving colloidal texture and tart taste to honey.

Importance of Metal Elements in Bio Chemical Reactions

Human body requires 13 most important metals. We detected 9 micro elements 9 micro elements in 3 EGH samples of honeys. Fe, Cu, Mn, Zn and Mg play very important role in biochemical reactions. These metals directly links with proteins and known as metalproteins or chromoproteins. These elements present in enzymes and acts as metal activators and helps in group transfer, redox and hydrolysis reactions of the organisms (Messallam and El-Shaarway, 1987). And the rest of the metals have their own significance in biochemical reactions of the organism. The human body requires Na, K, Mg and Ca are at macro levels and Zn, Cu, are in micro levels. Fe is in between micro and macro levels.

Mineral Composition of the Honey

In most of the studies minerals in honey are grouped and expressed as ash content, but analysis of the element has been largely ignored. The present study determined ash content, electrical conductivity and 3 individual elements like K, Na, Mg, Mn, Cu, Fe, Zn and Ni of different honeys. The related data are presented, where the K/Na ratio is also included. The values of ash content are expressed as percent of honey weight, and those of individual elements are in ppm.

POLLEN ANALYSIS

Honey Samples

3 EGH honey samples are procured from different areas of Andhra Pradesh in different seasons. The samples were

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subjected to qualitative and quantitative pollen analysis following the methodology recommended by the International Commission for Bee Botany (ICBB) (Louveaux *et al.*, 1978). The pollen morphotypes were identified with the help of reference slides mentioned in the Central Bee Research Institute (CBRI, Pune) palynarium.

METHODS

The pollen types recovered and identified were placed under four frequency classes as mentioned bellow. The three EGH samples were investigated for their origin by using pollen analysis of honey is known as Meleto palionalysis (Abu-Tarboush *et al.*, 1993).

1. Predominant pollen type: More than 45% of the total pollen grains counted.
2. Secondary pollen type: Between 16 and 45% of the total pollen grains counted.
3. Important minor pollen type: Between 3 and 15% of the total pollen grains counted.
4. Minor pollen type: Less than 3% of the pollen grains counted.

The honey sample was termed as Unifloral if the prepared slide contains a predominant pollen morphotype. If several morphotypes are represented, the honey sample was termed as Multifloral (Agashe, 1997; and Chaturvedi, 1998a and 1998b. Basing on the above information honey samples were identified as Unifloral.

Names of the Unifloral Honey Samples Investigated (EGH)

EGH 1: Psidium Guajava (Guava)

EGH 2: Momordica charantia (Bitter guard)

EGH 3: Cajanus Cajan (Arhar)

Table 1: Frequency Classes and Frequencies of Pollen Morphotypes in UNI FLORAL Honey Samples of the Present Study

Honey Sample	*Frequency Class	Pollen Morphotype	Frequency (%)
EGH-1	P	Psidium Guajava	72
	S	Borassus flabellifer	21
	I	Cocos nucifera	5
	M	Ageratum conyzoides	2
EGH-2	P	Momordica charantia	65
	S	Sorghum vulgare	25
	I	Cyanotis sp.	8
	M	Fabaceae	2
EGH-3	P	Cajanus Cajan	64
	S	Sorghum vulgare	20
	I	Fabaceae	14
	M	Cyanotis sp.	2

Note: *P = Predominant; S = Secondary; I = Important minor; M = Minor.

Determination of Total Ash (AOAC, 1975)

About 25 g of the well homogenated honey sample was placed in an ashing vessel of known weight. The materials in the vessel was carbonized under the hood initially on a low heat to prevent spattering. Then, the silica crucible was transferred to a muffle furnace maintained at 550 °C and incarcerated for about 6 hrs.

The dish was taken out, cooled to room temperature and the ash was wetted with minimum amount of water, followed by the addition of a few drops of concentrated HNO_3. The contents were dried on low heat and again turned into ash at 550 °C, till carbon free ash was obtained. The crucible was cooled down to 100 °C and transferred to a desiccator for further cooling to room temperature and later weighed. (The ash was reserved for the estimation of mineral matter).

$$\% \text{ of Ash} = \frac{\text{Weight of Ash}}{\text{Weight of sample}} \times 100 \quad (1)$$

Preparation of Sample Solution Suitable for Mineral Component (Deter--minati Oon of Ash)

a) The ash obtained was dissolved in 10ml concentrated HCl, boiled and evaporated to near dryness on a hot plate.

Figure 1

Psidium Guajava,

Borassus flabellifer,

Cocos nucifera

Ageratum conyzoides,

Momordica charanti,

Sorghum vulgare

Cyanotis sp,

Fabaceae,

Cajanus Cajan

b) The residue was redissolved in 10 ml HCl of 2 N normality by boiling gently and filtered through the fast ash less filter (Whatman 41) into 50 ml volumetric flask. The residue and paper were washed thoroughly with water collecting all the filtrates in to the same volumetric flask. The solution was made with 50ml with water mixed well.

c) The concentration of metals in ash solutions under consideration was measured directly or diluted with 0.5 N HCl to obtain solutions within the range of standards.

Detailed Procedure for Each Metal as Follows

a) Determination of Calcium : The determination was done by complexometr—ic titration .

Reagents

1) Ethylene diamine tetra acetic acid salt (0.1 ml).

2) Murexid indicator (ammonium purpurate)

3) Sodium hydroxide solution (2 N)

b) Determination of sodium and potassium: Flame photometer was used for this purpose.

Reagents

1) Stock solution - 1000 ppm (1 ml = 1 mg).

2) Stock potassium solution -1000 ppm (1 ml = 1 mg).

Procedure: The sample was aspirated after waiting for a few minutes the readings of sodium and potassium were noted.

$$\text{Sodium(mg/l)} = \frac{\text{Reading} \times \text{ppm of Na std.}}{100}$$

$$\text{Potassium(mg/l)} = \frac{\text{Reading} \times \text{ppm of K std}}{100}$$

The ash samples of Mg, Cu, Zn, Ni, Fe and Mn were aspirated in the calibrated Atomic absorption spectrophotometer (A.A.S) and the concentrations of the elements in ppm were recorded. The parameters used for the elements are as follows.

Procedure: The ash sample was aspirated in the calibrated A.A.S and the concentration of each element was noted in ppm.

$$\text{Content of element (in ppm)} = \frac{C \times D \times 50}{W}$$

where C = Concentration of metal (in µg/ml) read from instrument, D = Dilution factor, if the original ash solution (of 50 ml) was distilled further. W = Weight (in g) of the sample taken for ashing.

RESULTS

Ramanujam *et al.* (1998) in their pollen analysis of apiary honey samples of East Godavari dist. Andhra Pradesh, India made into two honey flow periods.

1. November – February as major honey production period
2. March – June as less production of honey

But Psidium, Momordica, Cajanus did not figure in the study of Ramanujam *et al.* (1998). But these honey varieties are available in both flow periods.

Among the 3 unifloral EGH types of East Godavari dist., Psidium (EGH1) showed the highest percent of ash (%) content and the lowest value was that of Cajanus (EGH3). The increasing order of ash (%) content of the study samples are as follows:

Psidium > Momordica > Cajanus

Regarding individual elements Psidium EGH1 is rich in elemental composition. The predominant elements are Fe, Mn, Na, K, Mg. Along with these elements other elements are also present in this honey. The lowest composition of mineral content appears in Cajanus EGH3. Momordica EGH2 another unifloral honey is also rich in elements, but not like Psydium along with other elements. The increasing order of elemental composition is as follows:

Psidium > Momordica > Cajanus

Of the unifloral honeys EGH3 from East Godavari dist. was rather poor in both ash (%) content and total minerals. The difference may be due to the difference in the mineral content in the soil of the different areas since plants obtain minerals in soil, aeration between the mineral content of honeys and of soil may be expected (White, 1975; and Crane, 1975). The relation was shown by Varju (1970) who investigated the mineral composition of Acia honeys and the soils. The honeys of Acia trees grown in soil rich in Ca and Fe were richer in these elements. Such findings suggest the potential use of honey as an indicator in environmental contamination (Jones, 1987). Morse and Lisk (1980) determined 16 elements in honey and the high concentration of certain elements were related to the sours of these metals

Table 2: Parameters Used for the Elements

S. No.	Element	Lamp Current (mA)	Fuel	Support	Wave Length (nm)	Slit Width (nm)	Reagent (1:1 and 1 ml Stock Solution)
1	Mg	4	Acetylene	Air	285.5	0.1	HNO_3 in Dist. Water
2	Cu	4	Acetylene	Air	324.7	0.5	HNO_3 in Dist. Water
3	Zn	5	Acetylene	Air	213.9	1	HNO_3 in Dist. Water
4	Ni	4	Acetylene	Air	232	0.2	HNO_3 in Dist. Water
5	Fe	5	Acetylene	Air	248.3	0.2	Hcl in Dist. Water
6	Mn	5	Acetylene	Air	279.9	0.2	HNO_3 in Dist. Water

additional reports of the elemental composition of honeys in areas with and without pollution are required to see the possibility of utilizing honeys as indicator of environmental pollution, and also the relationship between the mineral composition of honey samples and their geographical origin. Uren *et al.* (1998) showed that only honeys with low total mineral content may be affected easily by the contamination sources, and may have elevated levels of possible contaminants.

The values of ash content obtained in recent study are comparable with similar data reported earlier for Indian honeys. The values of the East Godavari District honey are either close to or exceed the values of ash content reported for honeys in other countries like USA (Donner, 1977; and White and Doner, 1980) and (Whits *et al.*, 1962), Calcia (Rodriquez-Otero *et al.*, 1994): Molise region (Esti *et al.*, 1997). And several other countries mentioned in (Kirkwood *et al.*, 1960) and White (1975). Rodriquez-Otero *et al.* (1994) mentioned that the Calcian honeys have in general a higher mineral content than the honey from various European countries. The Calcian honeys also appear to exceed the ash content values of Indian honeys.

Majority of honey types content of K greatly exceeded the other elements. Thus the study found K as the most abundant of the element determined (Kirkwood *et al.*, 1960). Potassium accounted for a higher % of ash weight in the Calcium honeys (Rodriquez-Otero *et al.*, 1994) and also in US honey for dominance of K over other elements has also been reported for Calibrian honey and Molise region honeys (Esti *et al.*, 1997) (Giri, 1938; Echigo, 1970; and Herich, 1990). The Molise workers found a positive correlation between pH and ash content of honeys and attributed the same to the high cationic content, particularly K that influences the Stalinized fraction of the acids. A similar positive correlation exists between ash content and pH of the honey types of the present study as seen above.

CONCLUSION

Elemental analysis of some unifloral honeys of East Godavari Dist. of A.P, India. We investigated three unifloral honeys for the elemental composition. All unifloral honeys contain all elements, i.e., Na, K, Ni, Fe, Mg, Zn, Cu, Mn and Ca. However, some unifloral honeys are rich with some elements (Cu, Zn, Mn and trace elements).

If we go through the importance in human biological system Ni functions are not completely established, however it comes to know that Ni has an important key role in the human biology. Na, K present in this honey are very good electrolytes and who maintains body fluid osmotic pressure. Fe is the most important macro element of the life. K activity is most important in biological systems like Na, Zn metal improves mental ability.

Cajanus contains all minerals in small quantities. Ratio of K/Na is more. Each element is having its own importance in human biological system. Hence we can recommend each floral honey as an additional food supplement accordingly instead of taking other food supplements. Because honey is a very fine mixture of different foods (components) which are essential for the human body and having no adverse results if we consume. One of the elements of the honey is present in Insulin, hence increases the Insulin gland secretion. Hence diabetic people can use honey basing on their blood sugar condition.

Recognition of Pure Floral Honeys

Pure honey does not adhere to the paper and it possesses tart taste and gel nature. Most of the honeys contain their flower color and smell. Dark honeys indicate the more elemental composition. Different branded honeys are available in the market. They are pure, but we cannot say its origin. For unifloral honeys one can contact beekeeper and he can guide us in the proper way.

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