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ASSESSMENT OF MICRONUTRIENTS IN *APIS* HONEY FROM KARNATAKA

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ABSTRACT

Honey is an easily digestible food stuff that contains a range of nutritionally important compounds. It is a rich source of minerals that includes both micro and macronutrients. The mineral content is highly variable with the species of honeybee, the geographical area and botanical origin. The majority of medicinal properties of honey along with its flavour depend on its mineral content. The major components of honey include various saccharides, water, amino acids, minerals, proteins, vitamins and unstable compounds such as enzymes. In the present study, honey samples of Apis florea, Apis mellifera, Apis dorsata and Apis cerana were collected from Bengaluru and Coorg districts of Karnataka. The total ash content ranged between 0.11 to 0.35 percent. The F-test and analysis of variance values of total ash content parameter of honey samples were significant at 5% levels. The micronutrients with high frequency were; Copper 0.05±0.004, Iron 0.09 ±0.03, Manganese 0.16±0.03, Sodium 4.3±0.01 and Zinc 0.09±0.001 ppm. All the micronutrient contents were within range and varied significantly at p< 0.05 levels. The investigations confirmed the good quality of Indian honey.

***KEYWORDS**: Honey Quality, Apis Honey, Total Ash Content, Micronutrients*

Article History

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INTRODUCTION

Honey is derived from nectar gathered and modified by the honeybee. It is carbohydrate-rich syrup derived from floral and other plants nectars and secretions. Honey is one of the oldest and best loved sweetening agents for foods and over the centuries, it has still retained a “natural” image (Aparna and Rajalakshmi, 1999). The raw material for the production of “Floral” honey is nectar, a dilute solution of sugars found in the nectaries of flowering plants. Honey is an easily digestible food stuff that contains a range of nutritionally important compounds (Celechovoska and Vorlova, 2001). The major components of honey include various saccharides, water, amino acids, minerals, proteins, vitamins and unstable compounds such as enzymes (Qiu *et. al.,* 1999). Thus, honey is generally considered as a natural and healthy product (Reybroeck, 2003).

Karnataka produces 800 to 900 tons of honey annually. The characteristics of honey from different floral sources influence the commercial value and the consumer preferences (Shripad and Rangaswamy, 2001). The major minerals are mainly derived from the soil and nectar-producing plants, but they may also be added from anthropogenic sources, such as environmental pollution. It has been reported that micro- or trace minerals originating from organic or plant sources are important for maintaining human health, while those which originate from inorganic or metallic sources, such as heavy metals, can be toxic (Hernandez *et. al.,* 2005; Pohl 2009). Honey has also been used as an indicator for a variety of environmental contaminants, including heavy metals, low level radioactivity, and pesticides (Nalda *et. al*., 2005).

Several different surveys have been compiled on the nutritional and health aspects of honey (Molan and Rhodes, 2015). The records of honey as functional health food and uses of other honey-bee products are still incipient. Thus, the need to review some relevant materials on natural honey becomes imperative. The present study reveals that the natural honey values as a nutrient food and encourage the economic importance of natural honey production and other apicultural practices. Thus, the present investigation aims at determining the essential micronutrients such as Cu, Fe, Mn, Na and Zn in *Apis* honey samples collected from various regions of Karnataka, India.

MATERIALS AND METHODS

Procurement of *Apis* Honey Samples

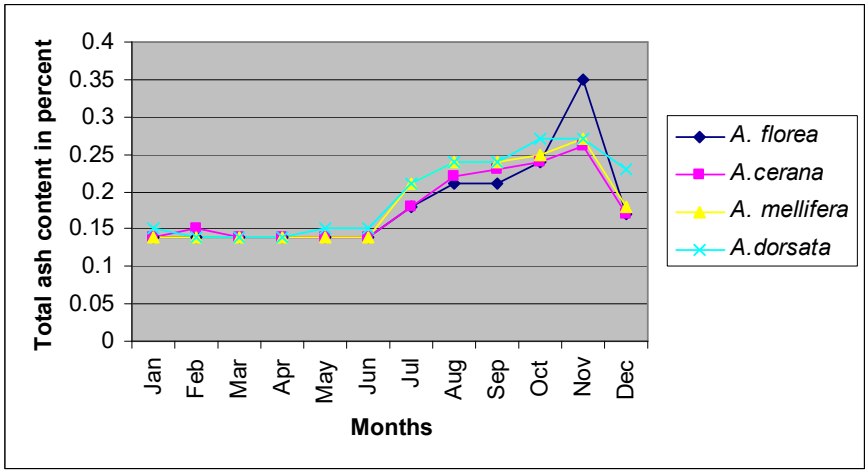
Thirty five *honey* samples from *Apis florea, Apis mellifera, Apis cerana Apis dorsata,* were collected from various geographical areas of Coorg and Bengaluru districts of Karnataka during spring season of 2019. The collected samples were stored at 4^0C in quality air tight plastic containers with authentic labels.

The total ash content of honey was determined by Ivanov and Chevanakova (1984) method. The results were expressed as mg/Kg.

The mineral content was estimated by atomic absorption spectroscopy method (Rodriguez-otero *et. al., 1*994). The data of all mineral contents of honey samples were analyzed by Analysis of Variance (ANOVA) along with F test, highly significant values were determined by using F table ($p \leq .005$).

RESULTS

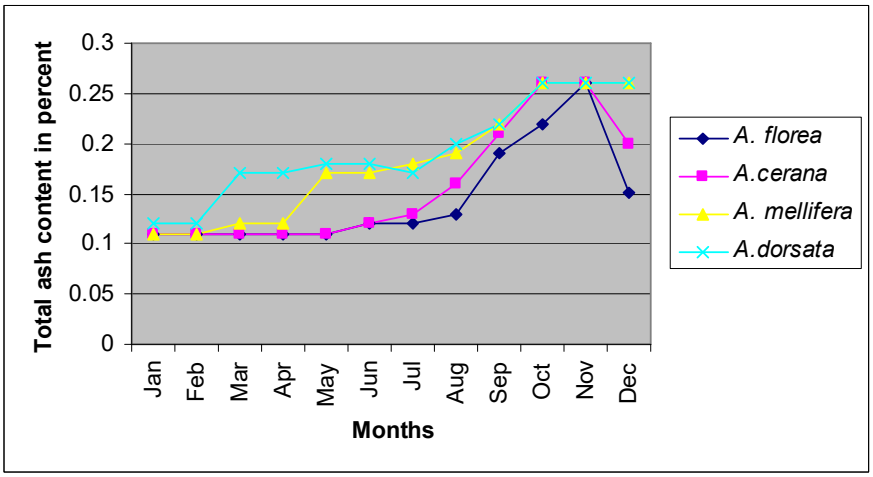
The micronutrient mineral composition of *Apis* honey showed significant variations. The total ash content of honey of Coorg varied between 0.15 and 0.35 percent. The honey samples of *Apis florea* ranged from 0.15 to 0.35 percent, *Apis cerana* between 0.14 and 0.26 percent, *Apis mellifera* from 0.14 to 0.26 percent and *Apis dorsata* from 0.15 to 0.26 percent.



Significant at $p < 0.05$

Figure 1: Total Ash Content of Apis Honey Samples From Coorg During 2019.

The honey samples of Bangaluru district ranged from 0.11 to 0.26 per cent (Fig.2). The honey samples of *Apis florea, Apis cerana,* and *Apis mellifera* ranged from 0.11 to 0.26 per cent. *Apis dorsata* ranged from 0.12 to 0.26 per cent.



Significant at $p < 0.05$

Figure 2: Total Ash Content of Apis Honey Samples from Bengaluru During 2019.

The F-test and analysis of variance values of total ash content of honey samples from Coorg, as well as Bengaluru were significant at 5% levels.

Table 1: Micronutrients of Apis Honey of Coorg During Spring Season in 2019

Micronutrient	Honey Samples			
	Apis florea (ppm±S.E)	*Apis cerana* (ppm±S.E)	*Apis mellifera* (ppm±S.E)	*Apis dorsata* (ppm±S.E)
Copper	0.01±0.008	0.02±0.004	0.03±0.004	0.05±0.004
Iron	0.7±0.01	0.7±0.03	0.8±0.04	0.09±0.03
Manganese	0.13±0.001	0.13±0.002	0.14±0.003	0.16±0.003
Sodium	2.65±0.06	3.91±0.01	4.2±0.01	4.3±0.01
Zinc	0.07±0.008	0.09±0.002	0.09±0.001	0.09±0.002

Significant at $p < 0.05$

Micronutrients of various *Apis* honey samples of Coorg during investigation period showed highest ppm values for Sodium of *Apis* honey and the least recorded value was of Copper. However, the values were significant at 5 percent levels (Table. 1).

Table 2: Micronutrients of Apis honey of Bengaluru during spring season in 2019

Micronutrient	Honey Samples			
	***Apis florea* (ppm±S.E)**	***Apis cerana* (ppm±S.E)**	***Apis mellifera* (ppm±S.E)**	***Apis dorsata* (ppm±S.E)**
Copper	0.01±0.003	0.01±0.004	0.02±0.006	0.02±0.007
Iron	0.6±0.02	0.7±0.01	0.6±0.08	0.6±0.04
Manganese	0.13±0.001	0.13±0.005	0.11±0.008	0.13±0.003
Sodium	3.65±0.07	3.98±0.04	4.1±0.03	3.81±0.09
Zinc	0.09±0.005	0.09±0.008	0.09±0.008	0.09±0.003
Significant at $p < 0.05$				

Micronutrients of various *Apis* honey samples of Bengaluru during investigation period showed highest ppm values for Sodium of *Apis* honey and the least recorded value was of Copper. However, the values were significant at 5 percent levels (Table 2).

DISCUSSION

In the present analysis of total ash content in *Apis* honey ranged from 0.11 and 0.35 percent. Similar findings were reported by Bonvehi and Coll (1993) reported 0.06 to 0.39 percent of average ash content in French lavender honey of Spain. Anass *et. al.* (2003) analysed average ash content with 0.16 to 0.44 percent in Eucalyptus honey. Joseph *et. al.* (2007) reported 0.66 percent of ash content in Sudano Guinean honey.

The major micronutrients of *Apis* honey recorded were Iron, Manganese, Sodium, Zinc and Copper. The highest content being Sodium with 4.3±0.01 and 4.1±0.03 ppm for honey samples of Coorg and Bengaluru respectively. Least range was recorded for Copper 0.01±0.008 and 0.01±0.003 ppm for honey samples of Coorg and Bengaluru respectively.

The mineral iron content is highest in *Apis dorsata* honey of Coorg with 0.09±0.03 ppm and 0.6±0.02 ppm was recorded least in *Apis florea* honey samples from Bengaluru. In the present study, the values of iron recorded were lower than those values of 13.5 and 3.37 ppm reported earlier in Zulia and Tenerife (Frias *et. al.,* 2008), Mudasar Manzoor *et. al.,* 2013 and closer to values reported earlier by A. Mbiri,*et. al* 2011, ranging between 0.08 and 0.59 ppm.

The mineral manganese content is highest in *Apis dorsata* honey of Coorg with 0.16±0.003 ppm and 0.13±0.001 ppm was recorded least in *Apis florea* honey samples from Bengaluru. Mahmood Ahmed *et. al.,* (2016) reported 0.73 to 0.97 ppm Mn in the Pakistan honey samples. The highest concentration of Mn was found in *Apis dorsata* from Western Ghats of Tamil Nadu with a value of 1.126 ppm reported by Mudasar Manzoor *et. al.,* 2013.

The mineral sodium content is highest in *Apis dorsata* honey of Coorg with 4.3±0.01 ppm and 4.1±0.03 ppm was recorded least in *Apis mellifera* honey samples from Bengaluru. 122.8 to 181.7 ppm was reported by Mahmood Ahmed *et. al.,* (2016) in the Pakistan honey samples. Mudasar Manzoor *et. al.,* (2013) reported 25.17 ppm of Na in *Apis cerana* honey samples from Tamilnadu and Kashmir.

The mineral copper content is highest in *Apis dorsata* honey of Coorg with 0.05±0.004 ppm and 0.02±0.006 ppm was recorded least in *Apis mellifera honey* samples from Bengaluru. The concentration of Cu in present samples were lower, compared to the values recorded in Swiss and Tenerife honey which were 0.88 and 1.28 ppm (Stefan *et. al.,* 2007)

and has a closer values reported by A. Mbiri,*et. al. (*2011) ranging between 0.02 and 0.03. The highest concentration of Cu was recorded in honey sample *Apis dorsata* from Western Ghats of Tamil Nadu with a value of 0.624 ppm while the lowest concentration of Cu was recorded from honey sample *Apis mellifera* from Jammu and Kashmir with value of 0.275 ppm (Mudasar Manzoor *et. al.,* 2013).

The mineral zinc content is highest in *Apis mellifera honey* of Coorg with 0.09±0.001 ppm and 0.09±0.003 ppm in *Apis mellifera* honey samples from Bengaluru. In *Apis* honey samples, Ciobanu Radukscu (2016) reported 0.987 mg/kg of Zn. Bhushanam and Madhusudan (2017) analyzed honey from Coorg and Kolar reported that dark colored honey have more minerals than light colored honey of *Apis.* Though, the quantity of minerals was less, they play a vital role in determining the color, medicinal and nutritional value of honey. From present study, it is observed that the Indian honey is good in quality.

CONCLUSIONS

The present study concludes that the micronutrients of *Apis* honey are essential for nutritional quality and safety of honey. Of all the micronutrients tested in the honey samples, *Apis dorsata* honey from Coorg have high contents of Fe, Mn, Cu, Na and Zn as compared to the honey samples of Bengaluru. The results of the present study reveal that honey quality with respect to the concentration of these micronutrients is good for human consumption and medicinal applications.

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