

# Exploration of nutritional information in some honeys of commercial brands- and *Apis dorsata* in Vidarbha region of Maharashtra State in India

Paliwal Gopal<sup>1\*</sup>, Paliwal Sunita<sup>2</sup>, Khandelwal Puja<sup>2</sup> and Zade Varsha<sup>3</sup>

<sup>1</sup> and <sup>2</sup>Centre for Bee Development, Nalwadi, Wardha, MS, India, 442 001

<sup>3</sup>Govt. Vidharbha Institute of Science & Humanities, Amravati, MS, India, 442 001

<sup>4</sup>Associate Professor, Govt. Vidharbha Institute of Science & Humanities, Amravati, MS, India, 442 001

\*Corresponding Author: Dr. Gopal Paliwal Email: [gopalpaliwal23@gmail.com](mailto:gopalpaliwal23@gmail.com)

## Manuscript Details

Received :21.03.2020

Revised : 01.04.2020

Accepted : 26.04.2020

Published :28.04.2020

Available online on <https://www.irjse.in>  
ISSN: 2322-0015

Editor: Dr. Arvind Chavhan

## Cite this article as:

Paliwal Gopal, Paliwal Sunita, Khandelwal Puja and Zade Varsha. Exploration of nutritional information in some honeys of commercial brands- and *Apis dorsata* in Vidarbha region of Maharashtra State in India, *Int. Res. Journal of Science & Engineering*, 2020, Volume 8 (2): 71-84.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>

## Abstract

The nutritional information related with the parameters like moisture, protein, fat, fiber, carbohydrate, caloric value, sodium, potassium, calcium, iron and magnesium contents in some honey samples has been critically explored in the present study. The honeys commercially available in local market (probably resourced from *Apis mellifera* bee-species) have been compared with the honeys of *A. dorsata* bee-species that gathered from different floral origin for the said purpose. The comparative analytical outcome (nutritional information) suggests that the levels of 'moisture', 'sodium' and 'iron' found to be significantly less in *A. dorsata* honeys than that of commercial brands. The values in the case of 'protein' and 'fiber' have been measured to be at moderate level with insignificant variations on comparison while that in the case of parameters like 'fat', 'carbohydrate', 'caloric value', 'potassium', 'calcium' and 'magnesium' were drastically at the very high level in *A. dorsata* honeys than commercial honeys. It also means that the honeys generated from *A. dorsata* bee-species and commercially available brands shows their unique nutritional characteristics and seems to be influenced and attributed with bee-species-, floral- and geo-specific conditions.

**Keywords:** Honey, *Apis dorsata*, *Apis mellifera*, Nutritional Information, Vidarbha

## 1. Introduction

Indian regulations are not mandatory to disclose the amount of salt/sodium, added sugar, dietary fibre, vitamin and minerals unless the product makes a health claim. However, commonly the packaging with nutritional information on major packaged food products of leading Indian and multinational brands are being marketed in India [1,2,3]. The disclosed nutritional information on their food labels is to facilitate the consumers in making informed choices as per the strategy of respective packer. Because almost all food products have embedded credence attributes, it is difficult for consumers to evaluate the quality of food products themselves by looking at the food labels.

In general, consumers do not understand the complex and technical information regarding health and nutrition that is given on such labels. However, this information definitely increases consumer confidence about food quality and safety [4]. The way nutrition labels are formatted influence how effectively they can be used, interpreted and compared by consumers. Regulations are important because they dictate which nutrients are listed and the way that they are expressed quantitatively, along with other aspects of label design [5].

The Codex has encouraged consistency between trading partners, but different countries have developed a diverse array of approaches to these requirements. Codex Alimentarius Commission [6] and FSSAI India guidelines [7] recommended the information on the energy, fat, protein and carbohydrate, common minerals be listed on nutrition labels. Dietary fibre should be added where a claim for dietary fibre is made, and sugars where a claim is made for carbohydrates.

In Vidarbha region of Maharashtra state in India the honey is mostly gathered from the wild nests of forest bee, *A. dorsata* (F.) during the summer season (March to June) exclusively from the wild plants like *Mangifera indica* (mango), *Butea monosperma* (palas), *Azadiracuta indica* (neem), *Ceiba pentandra* (white katsawar), *Bombax*

*ceiba* (red katsawar), *Pongamia pinnata* (karanj), *Calycopteris floribunda* (kukurangi), *Madhuca indica* (mahua), *Hardwickia binata* (anjan), *Terminalia arjuna* (arjun), *T. bellirica* (bahera), *T. chebula* (harda), *Terminalia alata* (ain); *Wrightia tinctoria* (dudhapuda), *Adina corifolia* (haldu), *Syzygium cumini* (Jamun); etc. Such honeys are multi-floral and available for formal sale at Centre for Bee Development, Wardha, MS besides some Khadian Outlets.

However, there are also some branded honeys in the market which seem cultivated in apiaries through the modern science of beekeeping. Such honeys mostly are mono-floral in origin and generated from *Litchi chinensis* (Litchi), *Brassica campestris* (mustard), *Trifolium alexandrinum* (Barshim) or *Eucalyptus* flowers.

Therefore, in the present study, the nutritional information has been explored and compared in total 9 samples of all these honeys for the general awareness of the consumers.

## 2. Materials and Methods

### Materials:

Total 9 different honey samples were collected for analysis. Out of these '9' samples, sample A, sample B, sample C, sample D were the honeys of popular commercial brands available in the local market at Wardha (MS, India) while sample E, sample F, sample G, sample H, sample I were gathered from Centre for Bee Development, Wardha (MS, India) of different floral origins as detailed in table. 1.

### 2.2 Methods:

For the detection of Moisture, Protein, Fat, Fiber, Carbohydrate, Caloric Value and Minerals like Sodium, Potassium, Calcium, Iron, and Magnesium, we used the standard quality control manuals and protocols viz. India Standards (IS)- 4941 B-2, IS-7219, IS-1797, IS-10226, difference method, Flame Photometry, Atomic Absorption Spectrophotometer as approved by the competent authorities.

The methods adopted are detailed as in below.

Table.1. Honey samples from different botanical origin exclusively from *A. dorsata* species.

Samples of honeys	Botanical names of dominant flora resourced by bees in making honey	Local names of the flora
Sample E	<i>Gossypium spp.</i> and <i>Cajanus cajan</i>	Cotton and Tur
Sample F	<i>Butea monosperma</i> , <i>Azadiracuta indica</i> and <i>Bombax ceiba</i>	Palas, Kadua Neem and Katesawar
Sample G	<i>Calycopteris floribunda</i> and <i>Madhuka indica</i>	Kukurangi and Mahua
Sample H	<i>Calycopteris floribunda</i> , <i>Madhuka indica</i> and <i>Terminalia tomentosa</i>	Kukurangi, Mahua and Ain
Sample I	<i>Syzygium cumini</i> and <i>Terminalia tomentosa</i>	Jamun and Ain

### 2.2.1 Moisture by IS 4941 B-2

Moisture was determined using the indirect refractometric method. All measurements were taken using an Abbe refractometer, and the percentage of moisture obtained from the refractive index of the honey sample by consulting a standard table for the purpose [88].

The table is derived from a formula developed by [9].

$$W = 1.73190 - \frac{\log[R_I - 1]}{0.002243}$$

W is the water content in g per 100 g honey and R.I. is the refractive index

### 2.2.2. Protein by IS 7219

#### a. Principle:

The sample is digested with concentrated sulphuric acid in the presence of catalyst to convert the organic nitrogen into ammonium sulphate from which the ammonia is liberated by distillation with concentrated alkali solution. The ammonia so evolved is absorbed in standard sulphuric acid and the excess acid is back titrated with standard alkali solution.

#### b. Instruments:

Electronic Balance (Least count 0.1 mg).

#### c. Apparatus and Reagents:

- Kjeldahl digestion flask
- Kjeldahl distillation unit 20 mesh sieve.
- Conc. Sulphuric acid Nitrogen Catalyst for Kjeldahl
- Sodium Hydroxide 0.2 Sulphuric acid 0.2 N
- Concentrated Sodium hydroxide solution
- Methyl red indicator
- Magnesium oxide

**d. Sample Preparation:** Grind the sample to pass through 20 mesh sieve.

#### e. Procedure: For total Nitrogen

##### Digestion

- Weigh accurately about 1 gm of sample (if the expected protein is between 15 to 60% , if less than 5 to 15% weigh about 2 gm of sample, if less than 5% then weigh 5 gm of sample, if more than 60% weigh about 0.5 gm of sample). Transfer the sample to a Kjeldahl flask.
- Add few pieces of pumice stone, 11 gm of Nitrogen Catalyst and 20 ml of Conc. sulphuric acid cautiously in inclined position.
- Heat the flask first on low flame and vigorously till the solution become clear and banana green and no black particles observed.
- Cool the flask and add 150 ml of distilled water cautiously.

##### Distillation

- Connect the kjeldahl flask to a distillation assembly and check it for air leakage (with the help of dropping funnel).
- Take 50 ml of 0.2 N sulphuric acid into a conical flask and add 2 to 3 drops of methyl red indicator. The tip of the receiving tube should deep in the conical flask.
- Add from the stopper funnel 100 ml of 40%  $\frac{W}{W}$  of

sodium hydroxide solution slowly till the solution is distinctly alkaline (copper sulphate solution will change its colour to Brown black).

- Start heating the distillation flask till 100 ml of distillate is collected into conical flask containing 0.2 N sulphuric acid (take generally about 45 minutes).

- Lowered the acid flask and continue the distillation for further 15 minutes. (The colour of the solution should be pink only, if the colour changes to yellow repeat the experiment by taking smaller quantity of the sample).
- Wash the condenser with distilled water and collect the washing in the same conical flask.
- Titrate the excess of acid with standard 0.2 N NaOH using methyl red as an indicator.
- Carry out the blank by taking 2 gm of sucrose in place of sample and repeat all the steps mentioned above.

#### f. Calculation: For total Nitrogen

- Wt. of sample:
- Normality of 0.2 N NaOH:
- Vol. of 0.2 N NaOH required for Blank:
- Vol. of 0.2 N NaOH required for sample for total N.:
- Vol. of 0.2 N H<sub>2</sub>SO<sub>4</sub> consume for total N (iii - iv):
- 1 ml of 1 N H<sub>2</sub>SO<sub>4</sub> eq. to 0.014 gm of N :

$$\% \text{ of total Nitrogen} = \frac{v \times ii \times 0.014 \times 100}{i} =$$

$$\% \text{ of protein} = \% \text{ of Nitrogen} \times 6.25$$

#### 2.2.3 Fat by IS 1797 (extraction method)

##### a. Procedure :

- Weigh accurately about 10 g of sample in 100 ml beaker.
- Add 25 ml 10 % dil HCl and dissolve it.
- Extract with Petroleum Ether (60-80)
- Evaporate in tared beaker.

##### b. Calculation:

- Wt. of sample :
- Wt of beaker :
- Wt of beaker + extracted fat :
- Wt of extracted fat: :

$$\% \text{ of Fat as such Basis } \left( \% \frac{w}{w} \right) = \frac{iv \times 100}{i} =$$

#### 2.2.4 Crude Fiber by IS 10226

**a. Principle:** During the acid and subsequent alkali treatment, oxidative hydrolytic degradation of the native cellulose and considerable degradation of lignin occur. The residue obtained after final filtration is weighed, incinerated, cooled and weighed again. The loss in weight gives the crude fibre content.

##### b. Instruments:

- Electronic Balance. (Least count 0.1 mg).

- Water bath.
- Electrical Drying oven. (Least count 1.0°C).
- Electrical Muffle Furnace. (Least count 5.0°C).

##### c. Apparatus and Reagents :

- Crucible
- Soxhlet's Extraction Apparatus
- 500 ml round bottom flask with water cooled reflux condenser. Desiccators.
- Extraction Thimble/Paper.
- Muslin Cloth
- Petroleum Ether 60-80 Dil. Sulphuric Acid 1.25 % w/v  $\equiv$  0.255 N Sulphuric acid
- NaOH solution 1.25 % w/v  $\equiv$  0.313 N NaOH Ethanol (95 % v/v
- Ash less filter paper.

##### d. Procedure :

- Weigh accurately about 2 g of sample in an extraction paper.
- Extract with Petroleum Ether (60-80) in a soxhlet for about 1 hr or till completely extracted.
- Transfer the material in the extraction paper to a 500 ml Round Bottom Flask (RBF), add some pumice stone.
- If Non Volatile Ether Extract (NVEE) is performed then take the residue preserved after extraction and proceed.
- Take 200 ml of Dil. Sulphuric Acid in a beaker and bring to a boil.
- Transfer carefully whole of the acid to the flask containing the fat free material and immediately connect the R.B. flask with a water cooled reflux condenser and heat so that the content of the R.B flask begin to boil.
- Rotate the R.B flask occasionally.
- Continue boiling for 30 minutes.
- Remove the Round Bottom Flask (RBF) and add 50 ml of distilled water, filter the content through fine line.
- Add 50 ml of hot distilled water into the R.B. Flask and filter it again through linen.
- Repeat the washing of the insoluble matter until the washing is neutral to litmus paper.
- Transfer the residue to 500 ml RBF,

- Measure 200 ml of Sodium Hydroxide Solution and bring it to boil, add this solution to the R.B flask with the residue, add few pumice stone.
- Immediately connect the R.B. flask with the reflux condenser and boil for 30 minutes.
- Remove the R.B flask and immediately filter through the linen.
- Thoroughly wash the residue with boiling water and transfer carefully the residue in a 200 ml beaker with the aid of hot water.
- Weigh to the constant wt. the ash less filter paper No. 40 previously heated at  $105 \pm 5^\circ\text{C}$
- Filter the crude fibre through above weighed filter paper, wash the residue thoroughly first with hot water and then with about 5 ml of ethanol and with three successive washings of 5 ml of petroleum ether each.
- Dry the crucible in electric oven at  $105 \pm 5^\circ\text{C}$  for 1 hr., cool in desiccators, weigh and again heat till constant weight (Difference between two consecutive weight NMT 1 mg )
- Weigh the pre heated crucible and transfer the filter paper with residue in it.
- Incinerate the contents of the crucible in the muffle furnace at  $550 \pm 20^\circ\text{C}$  for 2 hrs. (till all the carbonaceous matter is burnt).
- Cool the crucible containing the ash in a desiccators and weigh.
- Again place the crucible in the muffle for 30 min., cool in desiccators and weigh. The difference between the two weights should be less than (0.001 g)
- Record the lowest mass.

**f. Calculation:**

- i. Wt. of sample taken (from NVEE test) :
- ii. Wt. of filter paper :
- iii. Wt. of filter paper + residue(after drying) :
- iv. Wt. of dried residue (iii - ii) :
- v. Wt. of crucible :
- vi. Wt. of crucible + ash (after ignition):----- , -----
- vii. Wt. of ash :
- viii. Wt. of crude fiber (iv - vii) :
- (Wt. of residue - Wt. of ash) :

$$\% \text{ of CF on as such Basis } \left( \% \frac{w}{w} \right) = \frac{(viii) \times 100}{(i)} =$$

**2.2.5 Carbohydrate by Difference method**

- a. Principle :** Carbohydrate is determined in food by subtracting other constituents except carbohydrate.
- b. Calculation:** Carbohydrate =  $100 - (\text{Moisture} + \text{Total Ash} + \text{Fat} + \text{Protein} + \text{Crude Fibre})$

**2.2.6 Calorific Value by calculation**

- a. Principle :** The Calories to the body are mainly supplied by protein, fat and carbohydrates. The calories are calculated from these constituents. Here calorific value is not absolute value.
- b. Calculation:**  
Calorific value per 100 gm in kcal. :
  - i. gm of protein per 100 gm : x 4.0 =
  - ii. gm of carbohydrate per 100 gm : x 4.0 =
  - iii. gm of fat per 100 gm : x 9.0 = **Sum**
 The sum of these will give the calorific value per 100 gm in kcal.

**2.2.7. Sodium, Potassium and Calcium by Flame**

**Photometry**

- a. Principle :** Metallic ion in solution in flame are raised to higher energy level and emit radiations characteristcs of that metal and emitted radiations are propo-rtional to concentration of that metal. Sodium emits specific light of wavelength at about 589 nm and potassium emits specific wavelength at abouts 768 nm.

**b. Instruments:**

- Electronic Balance (Least count 0.1 mg).
- Muffle Furnace (least Count  $5^\circ\text{C}$ )
- Flame photometer.

**c. Apparatus and Reagents:**

- NIST standard 1000 ppm solution - Sodium
- NIST standard 1000 ppm solution - Potassium
- Sulphuric acid
- Nitric acid
- Nitric acid (2 %)
- Hydrochloric acid
- Distilled water
- Whatman filter paper No 41
- Volumetric flask 100 ml

**d. Standard Preparation:**

- Preparation of 100 ppm Standard for Sodium and potassium : Prepare 100 ppm solution by diluting 10 ml of NIST standard of 1000 ppm in 100 ml volumetric flask with 2 % nitric acid.



Preparation of standard solution from 100 ppm Sodium / potassium standards solution

S. No.	Volume in ml of 100 ppm stock	Dilute to 100 ml with 2% HNO <sub>3</sub>	PPM
1.	10	100	10
2.	8	100	8
3.	6	100	6
4.	4	100	4
5.	2	100	2

#### e. Sample Preparation :

##### For Food / Other Products:

- Weigh accurately about 10 gm of sample.
- Moisten with 1ml sulphuric acid.
- Heat on low flame till carbonise.
- Ignite in muffle furnace at 550°C for 2 hours.
- Cool crucible and dissolve ash in 20 ml dilute hydrochloric acid.
- Make up the volume to 50 ml and filter it with whatman filter no. 41.

#### f. Procedure:

Estimation of Sodium/Potassium is carried out by using light petroleum gas and air for flame generation:

- Operate instrument as per SOP of instrument.
- Select element from menu as per SOP of instrument.
- Aspirate standard solution one by one from lower to higher concentration and prepare calibration curve.
- Aspirate sample solution with proper dilution and record the readings.

#### g. Calculation:

- Wt. of sample :
- Vol. of solution :
- Dilution factor :
- Reading of Sodium in ppm :
- Reading of Potassium in ppm :

$$\text{Metal in sample in ppm} = \frac{\text{Reading of metal in ppm} \times \text{dilution factor}}{\text{Vol./wt. of sample taken}}$$

#### h. Precaution:

- All the precautions should be taken as mentioned in SOP of Flame photometer.
- Aspirate known solution after every 10 solution of sample to check the calibration.
- Working standards should be freshly prepared.

## 2.2.8 Iron and Magnesium by Atomic Absorption Spectrophotometer

### a. Procedure : Standard Preparation

*Preparation of 100 ppm Standard :* Dilute 10 ml of 1000 ppm standard solution to 100 ml in 100 ml volumetric flask with 2 % nitric acid.

*Preparation of 10 ppm Standard:* Dilute 10 ml of 100 ppm standard solution to 100 ml in volumetric flask with 2 % nitric acid.

- Preparation of working standard from 100/10 ppm to prepare x ppm standard: Dilute x ml of required standard to 100ml in 100 ml volumetric flask with 2 % nitric acid obtain required ppm solution. Prepare calibration curve from 5 standard of required ppm standards.

$$\text{Volume from stock standard} = \frac{\text{Std. required} \times \text{Volu. Made}}{\text{Stock Standard}}$$

### b. Procedure : Sample Preparation :

*For Food Products :*

- Thoroughly homogenise the product by shaking.
- Weigh accurately about 10-20 gm of sample in porcelain crucible.
- Moisten with 1ml sulphuric acid.
- Heat on low flame till carbonise.
- Ignite in muffle furnace at 550°C for 2 hours.
- Cool crucible and dissolve ash in 20 ml dilute hydrochloric acid.
- Swirl crucible with care so that all ash comes into contact with acid.
- Make up the volume to 100 ml and filter it with whatman filter no. 41.

### c. Procedure:

- Estimation of elements is carried out by using air acetylene gas flame:
  - Operate instrument as per SOP.
  - Aspirate standard solution one by one from lower to higher concentration and prepare calibration curve.
  - Aspirate sample solution with proper dilution and record the readings.

### iv. Calculation

*For Food Products :*

- Weight of sample :
- Volume of solution : 100 ml
- Reading of metal in ppm from AAS Dilution :

$$\text{Metal in sample in ppm} = \frac{\text{Reading of metal in ppm} \times \text{dilution factor} \times 100}{\text{Wt. of sample taken}}$$

### 3. Result and Discussion

The samples of total 9 different honeys were analyzed to explore the comparative variations in nutritional information with respect to the parameters like moisture, protein, fat, fiber, carbohydrate, caloric value and minerals (sodium, potassium, calcium, iron and magnesium). The results were verified (table 2) and compared (Figs. 1 to 11) in the cases of some honey samples of commercial brands (Sample A, Sample B, Sample C, Sample D) which are commonly generated from *A. mellifera* bee-species with that of exclusive *A. dorsata* honey being sold under the 'Sevagram Nisarg' brand in 5 different floral variants (Sample E, Sample F, Sample G, Sample H, Sample I).

#### 3.1 Moisture:

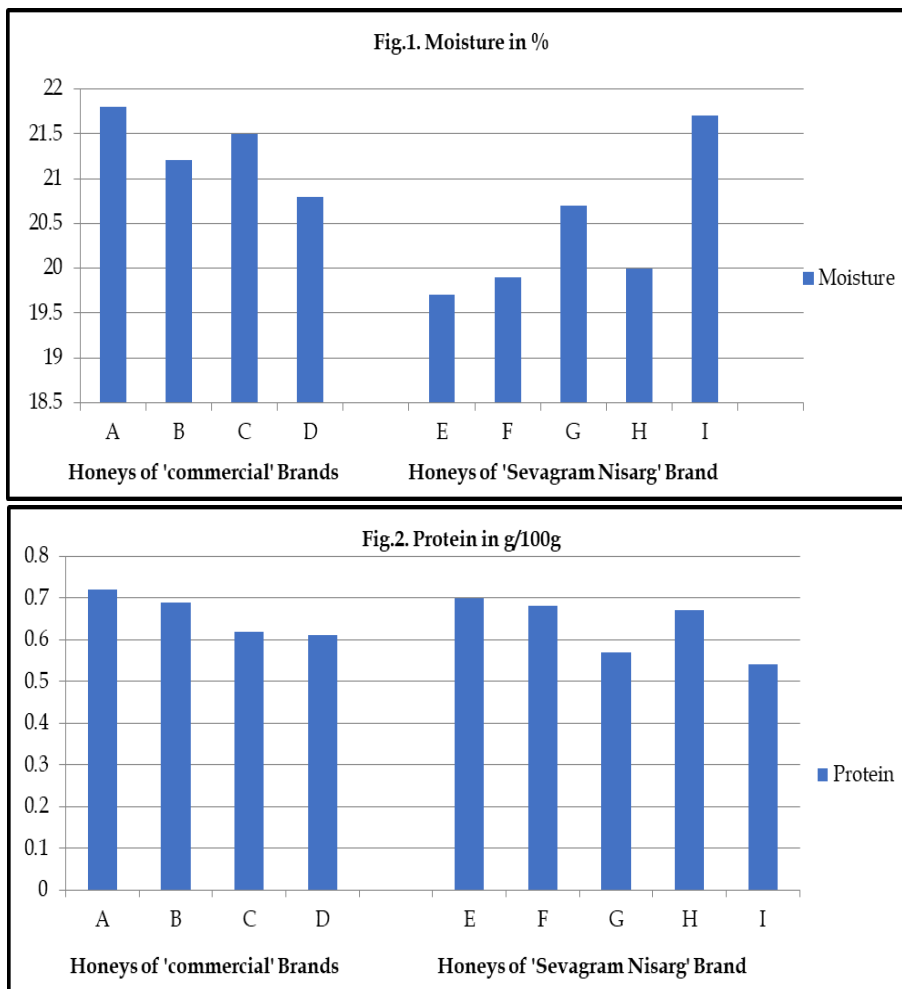
Moisture content is one of the important parameter that decides primarily the shelf life in any honey. Lesser the

moisture betters the quality of honey. Honey naturally contains moisture as its one of the most important component and many methods have been derived for its quantitative analysis [10, 11]. Many micro- and macro ingredients along with minerals are dissolved into it. During processing of raw honey, the practice of moisture reduction is undertaken so as to maintain the moisture level between 19 to 25 % [10,11].

In the present study, the moisture level in all 9 samples was found to be from  $19.7 \pm 0.98$  to  $21.8 \pm 1.09$  % (table 2) which is within the prescribed range as per quality legislations [6, 7, 122, 13]. These results are well in support of the earlier observation [14- 17,19]. Except Sample I, all the honeys (Samples E to H) of *A. dorsata* were found with less moisture [14] as compared to the commercial brands supporting the view of El-Biale and Sorour [18] in which they compared Tunisian honeys with other honeys.

**Table-2. Nutritional Information in various honey samples-**

Nutritional Information		Honey samples of commercial brands				Honey samples of 'Sevagram Nisarg'				
		A	B	C	D	E	F	G	H	I
Moisture	g/100g	21.8 $\pm 1.09$	21.2 $\pm 1.27$	21.5 $\pm 1.75$	20.8 $\pm 1.04$	19.7 $\pm 0.98$	19.9 $\pm 0.99$	20.7 $\pm 1.04$	20.0 $\pm 1.20$	21.7 $\pm 1.09$
Protein	g/100g	0.72 $\pm 0.04$	0.69 $\pm 0.03$	0.62 $\pm 0.04$	0.61 $\pm 0.04$	0.70 $\pm 0.04$	0.68 $\pm 0.04$	0.57 $\pm 0.03$	0.67 $\pm 0.04$	0.54 $\pm 0.03$
Fat	g/100g	0.12 $\pm 0.01$	0.11 $\pm 0.01$	0.10 $\pm 0.01$	0.11 $\pm 0.01$	0.16 $\pm 0.01$	0.14 $\pm 0.01$	0.12 $\pm 0.01$	0.13 $\pm 0.01$	0.14 $\pm 0.01$
Fiber	g/100g	0.23 $\pm 0.01$	0.20 $\pm 0.01$	0.19 $\pm 0.01$	0.26 $\pm 0.01$	0.23 $\pm 0.01$	0.21 $\pm 0.01$	0.26 $\pm 0.01$	0.22 $\pm 0.01$	0.21 $\pm 0.01$
Carbohydrate	g/100g	76.85 $\pm 1.84$	77.57 $\pm 1.87$	77.30 $\pm 1.89$	78.01 $\pm 1.90$	78.99 $\pm 1.95$	78.76 $\pm 1.94$	78.02 $\pm 1.90$	78.73 $\pm 1.94$	77.16 $\pm 1.86$
Caloric Value	Kcal/100g	311.0 $\pm 1.53$	314.0 $\pm 1.70$	313.0 $\pm 1.64$	315.0 $\pm 1.79$	320.0 $\pm 2.17$	319.00 $\pm 2.96$	315.0 $\pm 1.77$	319.0 $\pm 2.94$	312.0 $\pm 1.63$
Sodium	mg/100g	19.58 $\pm 0.97$	14.93 $\pm 0.74$	17.72 $\pm 0.88$	26.71 $\pm 1.33$	5.71 $\pm 0.29$	9.51 $\pm 0.48$	6.45 $\pm 0.32$	5.39 $\pm 0.27$	6.56 $\pm 0.33$
Potassium	mg/100g	58.56 $\pm 2.93$	28.56 $\pm 1.43$	19.40 $\pm 0.97$	3.23 $\pm 0.16$	129.13 $\pm 3.46$	160.79 $\pm 4.03$	133.8 $\pm 3.69$	162.73 $\pm 4.14$	278.09 $\pm 5.91$
Calcium	mg/100g	41.18 $\pm 1.76$	205.29 $\pm 4.26$	142.06 $\pm 3.11$	22.20 $\pm 0.11$	232.34 $\pm 5.62$	225.5 $\pm 4.28$	228.33 $\pm 4.42$	266.11 $\pm 6.31$	274.2 $\pm 6.71$
Iron	mg/100g	0.72 $\pm 0.04$	1.75 $\pm 0.08$	0.30 $\pm 0.02$	0.17 $\pm 0.01$	0.12 $\pm 0.01$	0.27 $\pm 0.01$	0.20 $\pm 0.01$	0.15 $\pm 0.01$	0.18 $\pm 0.01$
Magnesium	mg/100g	2.06 $\pm 0.11$	4.04 $\pm 0.21$	3.76 $\pm 0.19$	0.85 $\pm 0.04$	2.88 $\pm 0.14$	4.85 $\pm 0.24$	3.78 $\pm 0.19$	3.71 $\pm 0.18$	4.91 $\pm 0.24$



### 3.2 Protein:

Pollens are the integral part of any natural honey as bees collect them from the flowers along with the nectar for making honey as the final produce. However, during ultra-filtration through the press filters, most pollen are screened out from honey and thus, the transparent honey is made available for the market [10]. However, as per the Food Safety Standards, [19] Amendment Regulations, 2019, the minimum pollen count per gram shall be 25,000 [7, 122]. The pollens assume to be the probable resource of protein in honeys [20-244].

The present study reports presence of protein in all nine honey samples ranging from  $0.54 \pm 0.03$  to  $0.72 \pm 0.04$  grams per 100gms (table 2). Iurlina and Fritz [25] reported 0.3% protein in honey. The reduction or absence of protein indicates that honey is adulterated, overheated, or

excessively stored. Moreover, the present study also demonstrates that even though there had been different floral origins of all 9 samples of honeys, there were no significant variations in terms of protein contents (fig. 2) supporting the earlier observation by Boussaid *et al.* [17] in case of the Tunisian Honeys.

There is no any regulation or legislation as far as limits for the protein in honey but it is needed for the labeling purpose.

### 3.3 Fat:

Fat is the important ingredient of food. In honey, it is probably derived from the pollen. The present study confirmed the same as fat contents (g/100gm) of commercial honey brands found to be in the range of  $0.10 \pm 0.01$  to  $0.12 \pm 0.01$  while that in *A. dorsata* honeys from



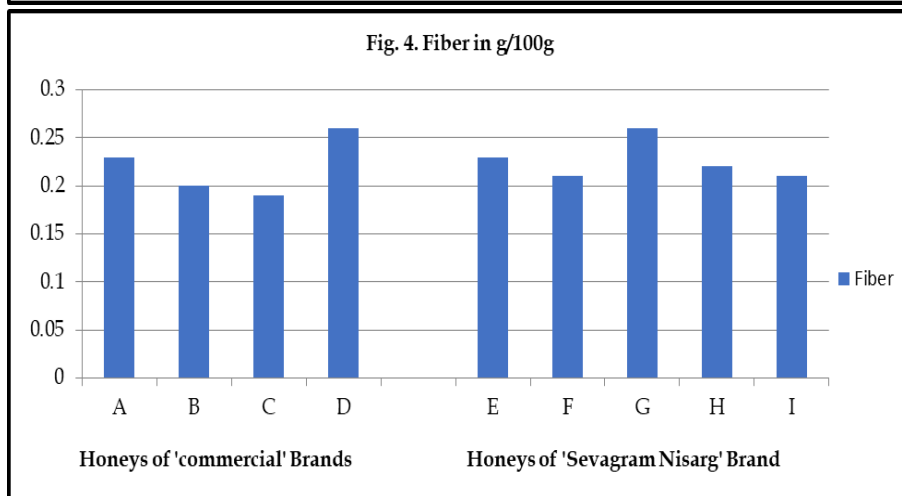
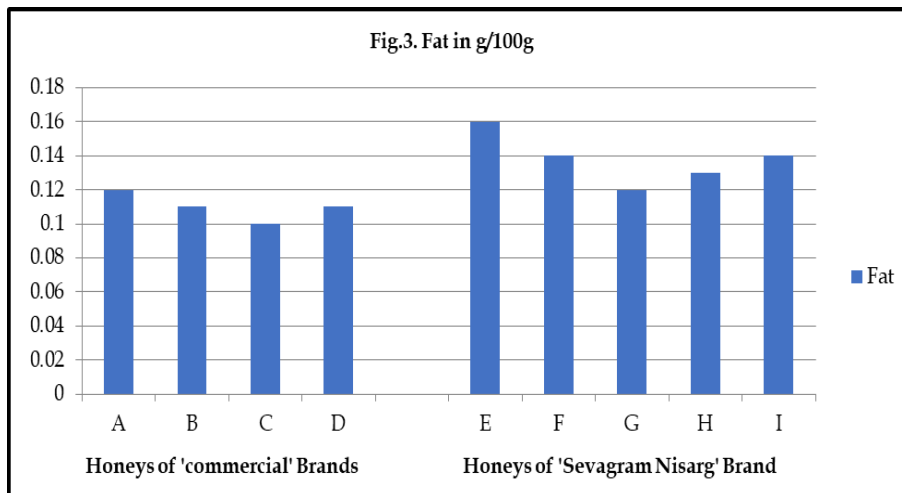
0.12±0.01 to 0.16±0.01 (table 2). It was marginally more in the case of *A. dorsata* honey as compared to that of the honeys of commercial brands (fig.3). The reason behind more fat percentage in *A. dorsata* honey seems to be attributed with availability of more pollen in its honey as compared to the commercial honeys thus, supporting the earlier observations by Almeida-Muradian [26].

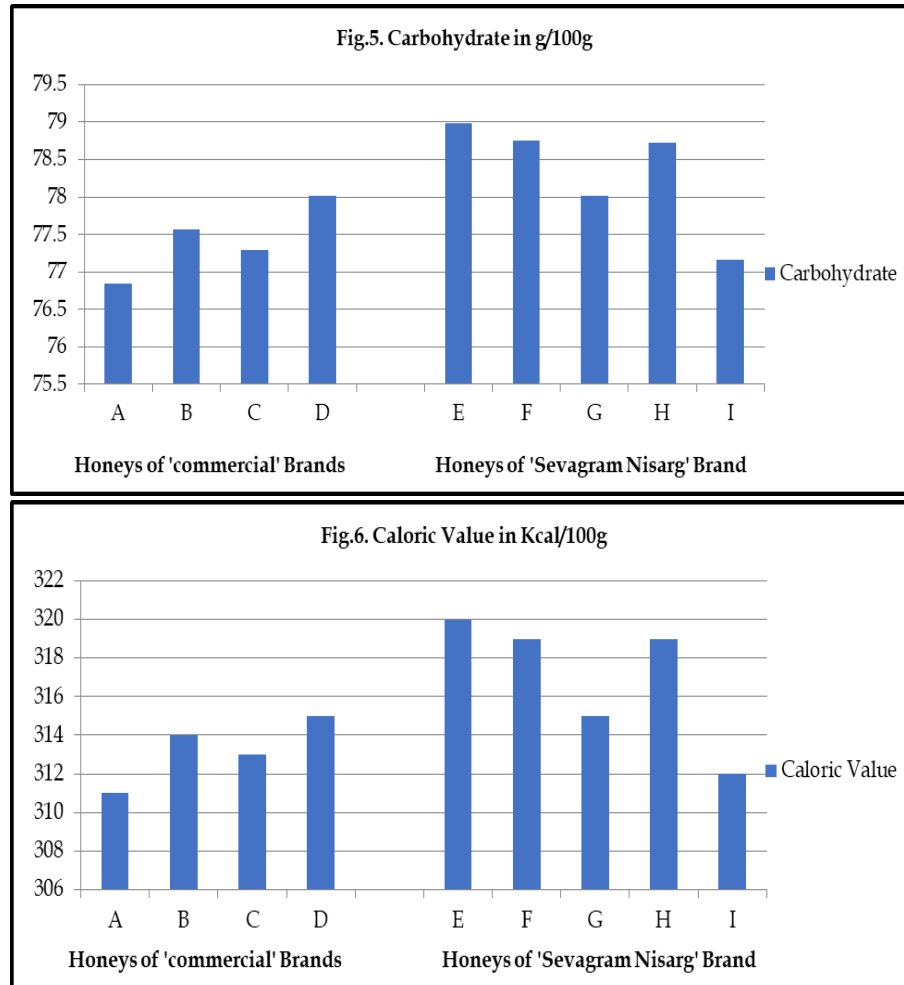
**3.4 Fiber:**

The availability of fiber in the 'commercial honeys' and 'Sevagram Nisarg' honeys derived from the *A. dorsata* was found to be nearly in the same range i.e. 0.19±0.01 to 0.26±0.01 g/100gms (table 2). Although, no significant change or variations in the values of Fiber noticed in present study but found the same was marginally better in the case of *A. dorsata* honeys as compared to that of the commercial brands (fig.4).

**3.5. Carbohydrate:**

The carbohydrate is major constituents in any natural honey [27- 30]. The amount of carbohydrates in all nine samples was noticed to be in between the range of 76.85±1.84 to 78.99±1.95 per 100gms honey (Table 2). The derived range was as per the required standards of FSSAI, [7] and Codex Alimentarius Commission [6]. Our results reported that the carbohydrate was marginally more in 'Sevagram Nisarg' honey of *A. dorsata* bee-species as compared with that of the commercial brands which are mostly derived from the bee-species, *A. mellifera* (fig, 5). It also means that the carbohydrate in honey has been the very important factor mostly relies upon the bee-species-, flora- and geographical origin supporting the similar observations of EI-Sohaimy, et. al. [24].





### 3.6. Caloric Value:

The caloric value in 9 samples of different honeys tested was found to be in the range of  $311 \pm 1.53$  to  $320.0 \pm 2.17$  kcals (table 2). These results are simply harmonizing with the results of Carbohydrate. Here, the Caloric Value was noticed to be marginally more in 'Sevagram Nisarg' honey derived from *A. dorsata* bee-species as compared with that of the commercial brands which are mostly derived from the bee-species, *A. mellifera* (fig. 6). It also means that the Caloric Value in honey mostly depend upon the bee-species-, flora- and geographical origin supporting the earlier observation by Almeida-Muradian [26].

### 3.7. Minerals:

The concentrations of minerals like sodium, potassium, calcium, iron and magnesium have been studied for all nine samples of honey of different floral resources and

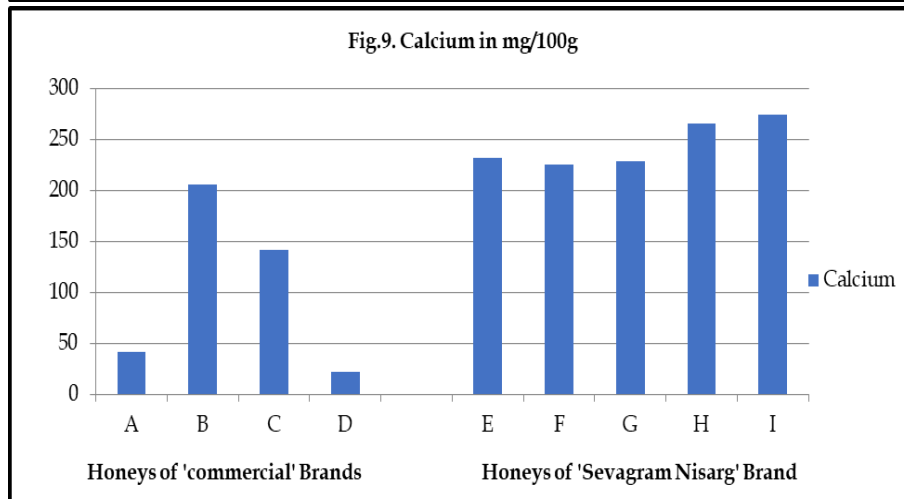
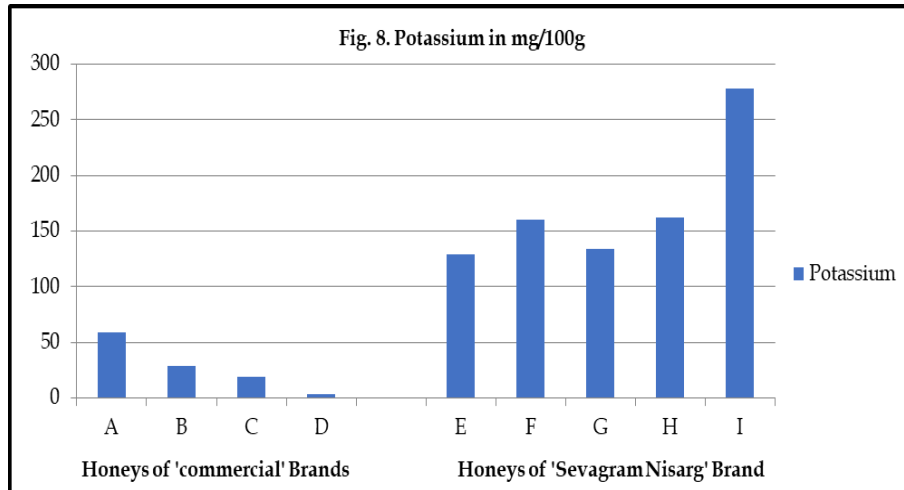
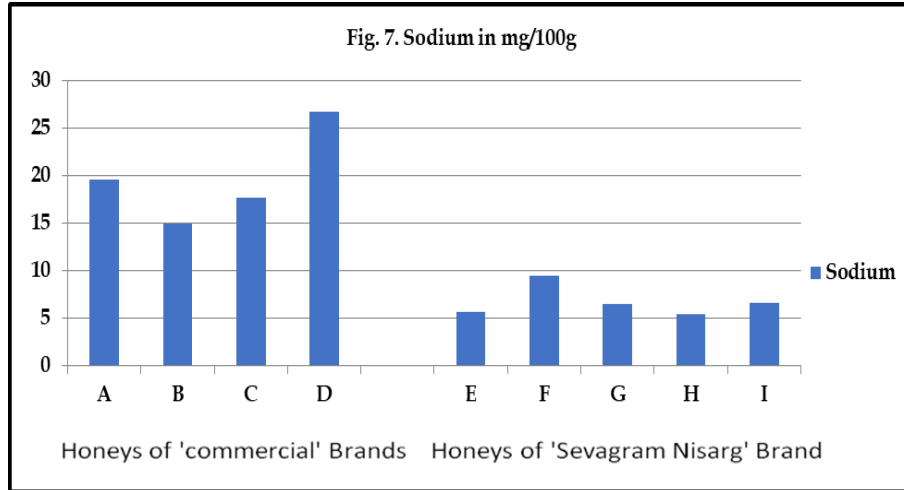
bee-species (table 2). The minerals that found in most abundant were potassium, calcium and magnesium in the honeys of *A. dorsata* while sodium and iron in the honeys of commercial brands (figs. 7-11). The overall results in the present study are in agreement with the earlier observations Vanhanen *et al.* [16] Boussaid *et al.* [17], Rodriguez-Otero *et al.* [31] and Puja [32].

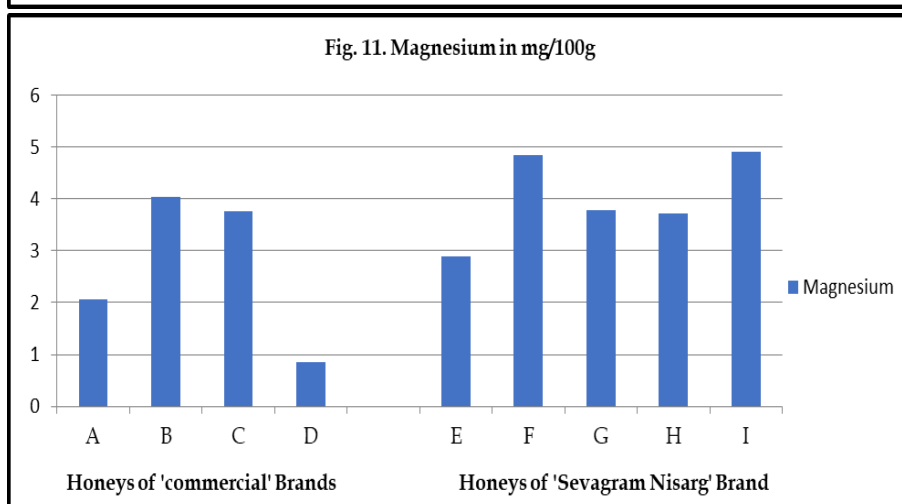
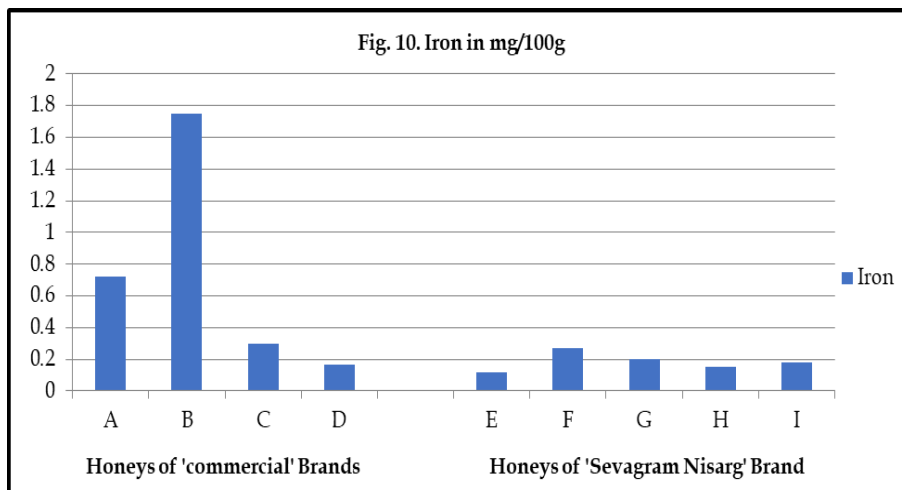
**3.7.1. Sodium-** The level of sodium (table 2) in the commercial honeys was detected very high i.e. from  $14.93 \pm 0.74$  to  $26.71 \pm 1.33$  while that in the case of honeys of 'Sevagram Nisarg' brand which derived from *A. dorsata* bee-species was surprisingly very low i.e. from  $5.39 \pm 0.27$  to  $9.51 \pm 0.48$  (fig.7). This observation seems to be the specific character related with the source of honey i.e. bee-species, flora or geographical distribution.

**3.7.2. Potassium-** The level of Potassium (table 2) in the commercial honeys was detected very low i.e. from 3.23

$\pm 0.16$  to  $58.56 \pm 2.93$  while that in the case of honeys of 'Sevagram Nisarg' brand which derived from *A. dorsata* bee-species was surprisingly very high i.e. from  $129.13 \pm$

$3.46$  to  $278.09 \pm 5.91$  (fig.8). This observation seems to be the specific character related with the source of honey i.e. bee-species, flora or geographical distribution of bees.





**3.7.3. Calcium** The level of Calcium (table 2) in the commercial honeys was detected comparatively low i.e. from  $22.20 \pm 0.11$  to  $205.29 \pm 4.26$  while that in the case of honeys of 'Sevagram Nisarg' brand which derived from *A. dorsata* bee-species was comparatively higher end i.e. from  $225.5 \pm 4.28$  to  $274.2 \pm 6.71$  (fig.9). This observation seems to be the specific character related with the source of honey i.e. bee-species, flora or geographical distribution of bees.

**3.7.4 Iron-** The level of Iron (table 2) in the commercial honeys was detected comparatively at the higher end i.e. from  $0.17 \pm 0.01$  to  $1.75 \pm 0.08$  while that in the case of honeys of 'Sevagram Nisarg' brand which derived from *A. dorsata* bee-species was comparatively higher end i.e.

from  $0.12 \pm 0.01$  to  $0.27 \pm 0.01$  (fig.10). This observation seems to be the specific character related with the source of honey i.e. bee-species, flora or geographical distribution.

**3.7.5 Magnesium-** The level of Magnesium (table 2) in the commercial honeys was detected comparatively at the lower end i.e. from  $0.85 \pm 0.04$  to  $4.04 \pm 0.21$  while that in the case of honeys of 'Sevagram Nisarg' brand which derived from *A. dorsata* bee-species was comparatively higher end i.e. from  $2.88 \pm 0.14$  to  $4.91 \pm 0.24$  (fig.11). This observation seems to be the specific character related with the source of honey i.e. bee-species, flora or geographical distribution.

## Conclusion

The comparative nutritional information in case of honeys of *A. dorsata* bee-species and commercial brands was critically analyzed in the present study. The analytical results clearly suggest that 'each' honey has uniqueness that probably seems influenced and attributed with the bee-species-, floral- and geo-specific specifications. Most honeys passes though the specifications set by quality regulatory laws. Nutritional information has to be depicted on the label to educate the consumers before buying the product.

## Acknowledgements

We are thankful to Mission Samriddhi, Chennai for the financial help. We are also grateful to Centre for Bee Development, Nalwadi, Wardha (MS-India) and Qualichem Laboratories, Nagpur for their immense technical help during the present studies.

**Conflicts of interest:** The authors stated that no conflicts of interest.

## References

- Deininger DU and Sur M. Food safety in a globalizing world: opportunities and challenges for India", South Asia Sustainable Development Department, World Bank, 2007.
- Euromonitor, 2008, Packaged Food - India Report, London: Euromonitor International.
- Kumar S and Jabir Ali et al. Regulatory Arrangements for Disclosure of Nutritional Information on Food Labels in India. In : 21<sup>st</sup> Annual IFAMA World Forum and Symposium on the Road to 2050: Sustainability as a Business Opportunity, Frankfurt, Germany during June, 2011; 20-23.
- Murali D. 2006, Always check nutritional labels. *The Hindu business line* (Internet edition)
- FAO, 2003, Assuring Food Safety and Quality: Guidelines for Strengthening National Food Control Systems", FAO Food and Nutrition Paper 76, Food and Agriculture Organization of the United Nations and World Health Organization, Rome. ISSN 0254-4725.
- Codex Alimentarius Commission. 2001. Revised Codex Standard for honey, Codex STAN 12-1981, Rev. 1 (1987), Rev., 2.
- FSSAI (2011) the Food Safety and Standards Rule, 2011, Gazette of India, Part II, Section 3 (i).
- Chataway HD. Determination of moisture in honey. *Canad J Res.*, 1932, 6: 532-547.
- Wedmore EB. The Accurate Determination of the Water Content of Honeys: Part I. Introduction and Results, 2015, Pages 197-206, Published online
- Wakhale, D.M., Phadke, R.P., Pais, D.V.E. And Nair, S.K. (1996). Design for honey processing unit Part 2, *Indian Bee J.*, 58: 5-9.
- Acquarone, C., Buera, P. and Elizalde, B. (2007). Pattern of pH and electrical conductivity upon honey dilution as a complementary tool for discriminating geographical origin of honeys. *Food Chemistry*, 101, 695-703.
- AGMARK (1984). Honey grading and Marking Rules.
- Bogdanov, S. C. Lüllmann, P. Martin, W. Von Der Ohe, H. Russmann, B.L. Mossel, B. D' Arcy, G.R. Vorwohl, L. Oddo, A.G. Sabatini, G.L. Marcazzan, R. Piro, C. Flamini, M. Morlot, J. Lheretier, R. Borneck, P. Marioleas, A. Tsigouri, J. Kerkvliet, A. Ortiz, T. Ivanov, P. Vit, P. Martin, (1999) Honey quality, methods of analysis and international regulatory standards: review of the work of the international honey commission *Bee World*, 80 (1999), pp. 61-69
- Paliwal SG. Studies on the sustainable apicultural biotechnology of rock honey bee, *A. dorsata* (F.) (Hymenoptera: Apidae), Ph. D. thesis submitted to RTM Nagpur university, 2008.
- Fea' S, X., Pires, J., Iglesias, A., Estevinho, M.L., (2010). Characterization of artisanal honey produced on the Northwest of Portugal by melissopalynological and physico-chemical data. *Food Chem. Toxicol.* 48, 3462-3470.
- Vanhanen LP. Emmertz A, Savage GP. Mineral analysis of mono-floral New Zealand honey. *Food Chem.* 2011, 128, 236-240.
- Boussaid A, Moncef C, Leila Rezig, Raoudha H, Francesco D, Giovanna F, Salem H. Physicochemical and bioactive properties of six honey samples from various floral origins from Tunisia, *Arabian Journal of Chemistry*, 2018, 11, 265-274.
- EI-Biale NM and Sorour MA. Effect of adulteration on honey properties. *Int. J. Appl. Sci. Technol.* 2011, 6. 122-133.
- Food Product Standards and Food Additives, Amendment Regulations (2019).
- Anklam EA. review of the analytical methods to determine the geographical and botanical origin of honey. *Food Chemistry*, 1998, 63, 549-562



21. Azeredo LDC, Azeredo MAA, Souza SR and Dutra VML. Protein contents and physicochemical properties in honey samples of *A. mellifera* of different origins. *Food Chemistry*, 2003, 80, 249-254.
22. Schäfer, MOV, Dietemann, CWW, Pirk P, Neumann RM, Crewe HR, Hepburn J, Tautz K Crailsheim. Individual versus social pathway to honeybee worker reproduction (*Apis mellifera*): pollen or jelly as protein source for oogenesis, *J. Comp. Physiol.* 2006, A, 192, pp. 761-768.
23. Subramanian R, Hebbar HU and Rastogi NK. Processing of honey: a review *Int. J. Food Prop.*, 2007, 10 (1): 127-143
24. El-Sohaimy, SA, Masry SHD, Shehata MG. Physicochemical characteristics of honey from different origins, *Annals of Agricultural Science*, 2015, 60 (2), 279-287.
25. Iurlina MO and Fritz R. Characterization of microorganisms in Argentinean honeys from different sources. *International Journal of Food Microbiology*, 2005, 105, 297-304.
26. Almeida-Muradian, Ligia B. de, Klaus M. Stramm, Andreia Horita, Ortrud M. Barth, Alex da Silva de Freitas and Leticia M. Estevinho. Comparative study of the physicochemical and palynological characteristics of honey from *Melipona subnitida* and *Apis mellifera*, *International Journal of Food Science and Technology*, 2013, 48, 1698-1706.
27. White JW and Doner LW. Honey Composition and Properties: Beekeeping in the United States. *Agriculture Handbook No. 335*, 1980, pp. 82-91.
28. Buba FA, Gidado A Shugaba. Analysis of biochemical composition of honey samples from North-East Nigeria *Biochem. Anal. Biochem.*, 2013, 2 (3), p. 139
29. Manzoor M, Shah GHN, Mathivanan V, Mir GM, Shah Nawaz AD. Chemical analysis of honey of *Apis cerana F.* and *A. mellifera* from Plains of Jammu and Kashmiri and Tamil Nadu, *Int. J. Agri. Sci. Res.*, 2013, 3 (4), pp. 139-146.
30. EL-Metwally AAE. Factors Affecting the Physical and Chemical Characteristics of Egyptian Beehoney. Ph. D. Thesis, Fac. Agric. Cairo Univ., 2015, 320p.
31. Rodriguez-Otero JL, Paseiro P, Simal J, Cepeda A. Mineral content of the honeys produced in Galicia (North-west Spain). *Food Chem.* 1994, 49, 169-171.
32. Puja K., Paliwal G. and Zade V. Physicochemical Composition of *A. dorsata* honey collected from the Vidarbha Region of Maharashtra State in India. *Int J. Recent Sci Res.*, 2020, 11(02), pp. 37431-37437.

**Submit your manuscript to a IRJSE journal and benefit from:**

- ✓ Convenient online submission
- ✓ Rigorous peer review
- ✓ Immediate publication on acceptance
- ✓ Open access: articles freely available online
- ✓ High visibility within the field

Email your next manuscript to IRJSE

: [editor@irjse.in](mailto:editor@irjse.in) | [editorirjse@gmail.com](mailto:editorirjse@gmail.com)