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Physicochemical Characterization and Adulteration Assessment of Commercial Honey from Latur Region, Maharashtra

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ABSTRACT

Honey is a natural sweet substance produced by *Apis mellifera* from plant nectar or secretions. It contains a complex matrix of carbohydrates, enzymes, minerals, vitamins, amino acids, and phenolic compounds, which contribute to its nutritional and medicinal properties. In this study, the physicochemical properties of a commercial honey sample from Latur, Maharashtra were analyzed using standard AOAC methods. Parameters including moisture, sugar content, acidity, ash, fructose-glucose ratio, and adulteration (via Fiehe's test) were evaluated. Results confirmed that the tested honey conformed to Codex Alimentarius and FSSAI standards, affirming its authenticity and high quality. This study demonstrates the value of simple analytical tests in honey quality assessment.

1. Introduction

Honey is a natural, viscous and sweet product derived by *Apis mellifera* from plant nectar or secretions. Honey is primarily composed of invert sugars—majorly glucose and fructose—as well as water, amino acids, proteins, organic acids, minerals, vitamins, enzymes, and other bioactive compounds (White et al., 1962; Bogdanov et al., 1999). Due to its medicinal and nutritional values, honey is among the most prized natural products worldwide (Efem, 1988; Alvarez-Suarez et al., 2009). Due to an increasing consumer demand for natural and functional foods, honey has attracted interest not just as a sweetener but also as a possible dietary supplement because of its oligosaccharides, antioxidants, and other useful constituents (Abdellah & Abderrahim, 2014; Farooqui & Farooqui, 2014). It is especially appropriate for infants and the elderly, being more acceptable and readily digestible compared to sucrose (Codex Alimentarius, 2001).

Figure : Apis mellifera Foraging on Moringa oleifera Flowers to Produce Honey from Nectar

The physicochemical properties of honey, including moisture level, electrical conductivity, reducing sugar level, free acidity, mineral level, and hydroxymethylfurfural (HMF), are important determinants of honey quality and freshness (Bogdanov et al., 1999; Qiu et al., 1999). They are controlled by the International Honey Commission (IHC), which suggests these indicators for quality control (Bogdanov et al., 1999; Codex Alimentarius, 2001). Enzymes like invertase, diastase, and glucose oxidase from both bees and plants are also utilized to evaluate the freshness and processing status of honey, as their levels decrease considerably upon heating (Persano Oddo et al., 1990; Persano Oddo et al., 1999; Subramanian et al., 2007).

The majority of commercial honeys available on the market are processed, including heat treatment to prevent fermentation and enhance shelf life, but this has the potential to affect the breakdown of enzymes and bioactive compounds, reducing nutritional value (Subramanian et al., 2007; Gokmen & Morales, 2014). The difference in floral origin, geographical location, and processing techniques results in important differences between branded and unbranded honey quality (Sanz et al., 2004; Nozal et al., 2005; Manzoor et al., 2013). Moreover, adulteration is still a concern in the honey market, with consumers being normally unaware of the quality of products they are consuming (Cuevas-Glory et al., 2007; Lambert et al., 2012).

Due to these issues, routine quality evaluation of commercial honeys is critical. Near-infrared spectroscopy, chromatography, and enzyme activity assays are some of the methods applied to assess the authenticity and quality of honey (Qiu et al., 1999; Crews et al., 1997; Alvarez-Suarez et al., 2009). The present research focuses on assessing the physicochemical and enzymatic quality of some selected commercial honeys from the market and comparing them with international standards in order to derive useful data for consumers as well as to provide protection of public health.

2. Materials and Methods

2.1 Sample Collection

Fresh honey samples were collected from *Gauri Natural Foods*, Chakur (Latur District), Maharashtra. Samples were stored at ambient temperature and filtered through cheesecloth to remove debris.

2.2 Analytical Methods

Standard AOAC (1999) methods were employed for analysis:

- **Moisture**: Measured with refractometer at 20°C using standard tables (Qiu et al., 1999).
- **Acidity**: Titrated with 0.1N NaOH to pH 8.3, expressed as formic acid (%) (Sanz et al., 2004).
- **Sugars**:
    - a) **Reducing sugars** by Fehling's method.
    - b) **Total sugars** by inversion and titration.
    - c) **Non-reducing sugars** calculated by difference.
- **Sucrose**: Layne-Enyon method with HCl inversion (Doner, 2003).
- **Fructose**: Resorcinol method; absorbance measured at 520 nm (Gokmen & Morales, 2014).
- **Ash content**: Dry ashing at 550°C (AOAC, 1999).
- **Fiehe's Test**: Colorimetric method to detect hydroxymethylfurfural (HMF), indicating adulteration (Balayiannis & Balayiannis, 2008).

3. Results and Discussion

Parameters	**Result**	**Standard Limit *(Codex, FSSAI)***
Moisture (%)	19.0	≤20.0
Acidity (%)	0.0926	≤0.20
Reducing Sugar (%)	75.06	≥70.0
Sucrose (%)	0.779	≤5.0
Fructose: Glucose Ratio	1.058	≥1.0
Ash Content (%)	0.161	≤0.5
Fiehe's Test	Negative	Negative

Table 1. Physicochemical Parameters of Honey Sample

3.1 Moisture and Acidity

The moisture content (19%) was within acceptable range. Moisture affects storage, fermentation risk, and viscosity (Mendes et al., 1998). The acidity (0.0926%) was also within limits, indicating freshness and stability (Bogdanov et al., 1999).

3.2 Sugar Profile

The reducing sugars (75.06%) reflect proper maturity and enzymatic activity (Persano Oddo et al., 1999). The sucrose content (0.779%) is well below the 5% threshold, ruling out overfeeding or early harvesting (Subramanian et al., 2007).

3.3 Fructose–Glucose Ratio

The fructose-glucose ratio (1.058) indicates high floral purity and quality (Alvarez-Suarez et al., 2009).

3.4 Ash Content and Mineral Presence

Ash content (0.161%) reflects low mineral load, common in nectar-based honeys (Cuevas-Glory et al., 2007). Minerals like K, Ca, Mg are present but not at nutritionally significant levels (Crews et al., 1997).

3.5 Fiehe's Test for Adulteration

Negative results confirm no added invert sugar or heat degradation, as HMF levels are low (Balayiannis & Balayiannis, 2008).

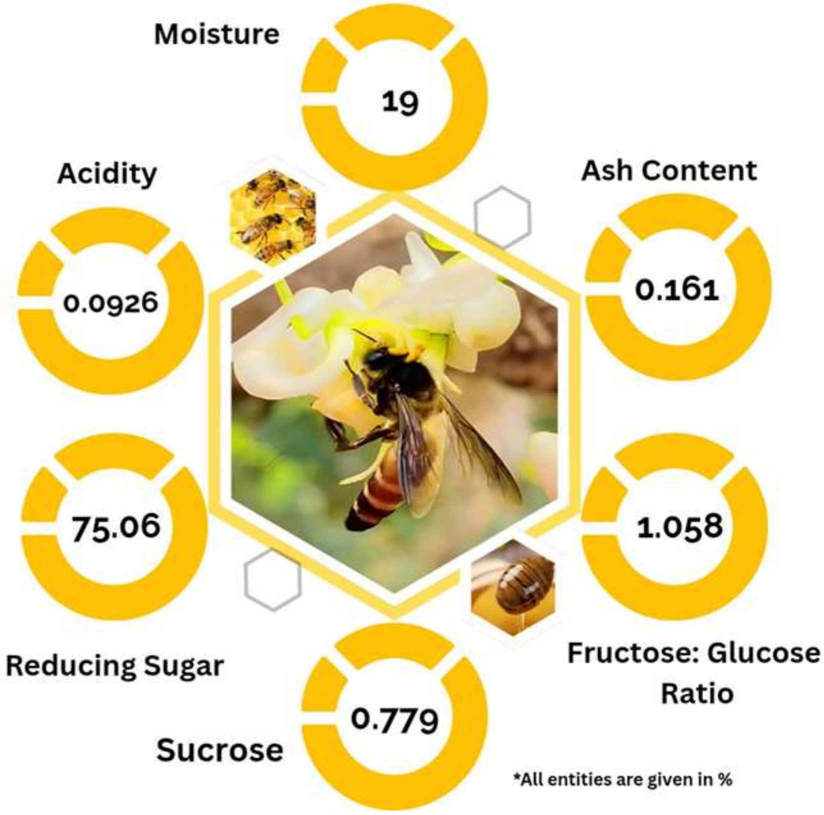

Figure : Graphical Overview of Honey Physicochemical Characteristics

4. Recommendations for Future Studies

As a suggestion for further development of the present study, seasonal variation in honey quality that can impact physicochemical parameters would be included. Branded vs. local unbranded honey comparative profiling would also yield market-wide quality consistency data. Additionally, spectroscopic fingerprinting methods such as FTIR or NIR can be incorporated for quick quality control.

5. Conclusion

The honey sample that was analyzed was consistent with all of the international standards for quality and purity. The honey exhibited low levels of moisture and acidity, high reducing sugar content, low sucrose content, and no indicators of adulteration. The data supports the conclusion that the honey commercially available in the study area is unadulterated and suitable for human consumption. The methods used to assess quality are well established and can be used to routinely monitor the quality of honey. Future work could include the profiling of the antioxidant capacity, as well as heavy metal analysis.

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