



ORIGINAL RESEARCH PAPER

Biotechnology

EVALUATION OF BIOACTIVE VITAMIN PROFILE OF MULTIFLORAL *APIS* HONEY FROM COORG, KARNATAKA

KEY WORDS: vitamin profile, multifloral honey, *Apis* honey, honey quality.

Abhinandini Innocentia David

Department of Zoology, GFGC, Channapatna, Karnataka, India.

M. Bhushanam*

Department of Zoology, Maharani's Science College for Women, Bengaluru, India – 560 001. *Corresponding Author

Madhusudan S

Department of Biotechnology, Maharani's Science College for Women, Bengaluru, India – 560 001.

ABSTRACT

Honey has specific organoleptic characteristics, with nutritional and health benefits. It is highly appreciated by consumers, not only as food but also as the pharmaceutical and cosmetic agent. The major composition of honey is carbohydrates that contribute 95–97% of its dry weight. Furthermore, honey includes main compounds, such as proteins, vitamins, amino acids, minerals, and organic acids. Besides, the pure, raw and unprocessed honey consists of flavonoids, polyphenols, vitamins, reducing compounds, alkaloids, glycosides, cardiac glycosides, anthraquinone, and volatile compounds. Honey composition varies between regions according to the surrounding flora, enabling its characterization by source or type. Monofloral honey may reach higher market values than multifloral ones. Honey's aroma is very specific, resulting from the combination of volatile compounds present in low concentrations. In this investigation, thirty five multifloral honey from Coorg were selected for vitamin profiling using HPLC method. Seven vitamins of *Apis* honey namely, thiamine (B1), riboflavin (B2), niacin (B3), panthothenic acid (B5), pyridoxine (B6), cobalamin (B12) and ascorbic acid (C) were analysed.

The overall amount of the analytes in the samples showed highest concentration of Vitamin B6 and Vitamin C with 23.87 and 24.98 mg/100 gm for *Apis florea* honey respectively. Vitamin B1 ranged from 5.23 to 7.45, B2 from 8.25 to 10.42, B3 from 9.96 to 12.33, B5 from 6.41 to 8.56 mg per 100 gm of *Apis* honey samples. However, Vitamin B12 showed insignificant concentration of 0.001 gm/100 gm of *Apis* honey. All the vitamin constituents except vitamin B12 were within range and varied significantly at $p < 0.05$ levels. This wide variation in the vitamin profile is dependent on the floral origin of the honey. The present investigations ensure that the *Apis* honey samples from Coorg, Karnataka is of good quality.

INTRODUCTION

The foraging bees of honeybee colony collect the nectar, honeydew, resinous substances (to produce propolis), pollen and water from the environment for their own developmental needs. Honey contains proteins, amino acids, carbohydrates, lipids (fatty acids, sterols), vitamins, minerals (salts) and water. It has occupied a prominent place in traditional medicines throughout world history. The ancient Egyptians, Assyrians, Chinese, Greeks and Romans employed honey for wounds and diseases of the gut. Honey is reviewed as a balanced diet for all ages (Ali A Al-Jabri 2005). Honey needs no refrigeration, it never spoils, and it can also be stored unopened at room temperature in a dry place too. Even to date, honey happens to be a major ingredient of most of the ayurvedic medicines.

Antioxidants present in honey such as flavonoids, polyphenolics, Vitamin C, and monophenolics are associated with a reduced risk of cardiovascular failures and many other medical complications. Vitamin C (ascorbic acid) is associated with health and vital force, and therefore food products are well accepted by the consumer when a high content of vitamin C is indicated. The ascorbic acid is quite unstable, reacting very easily with oxygen, especially in the presence of heavy metal ions and light, forming dehydro-ascorbic acid and further degradation products (Christy et al., 2011). Vitamin C plays an important role as a component of enzymes involved in the synthesis of collagen and carnitine. Vitamin C intake markedly reduces the severity of cold; it also effectively prevents secondary viral and bacterial complications (Bender David A. 2003). Vitamin C works by stimulating the immune system and offers protection against damage caused by the free radicals released by the body in its fight against infection (MV Balasubramanyam. 2020). The official Recommended Daily Allowance (RDA) is 60 mg/day. Several B vitamins are key components of certain co-enzymes that help release energy from food. Thiamin, riboflavin, niacin, panthothenic acid, and biotin engage in energy production (Shripad N Agashe and Rangaswamy B.E. 2001). Vitamins B6,

B12, and folic acid metabolize amino acids and help in multiplication of cells. Vitamin B1 is essential for producing various enzymes that help break down blood sugar. Vitamin B2 is essential for the growth and development of body cells and helps to metabolize food. Vitamin B3 helps cells to grow and work correctly. Vitamin B 5 is essential for producing energy and hormones (Krishnasree, V and Mary Ukkuru, P., 2018). Hitherto not much of work has gone on estimation of vitamin profile of *Apis* honey from different regions of Karnataka. To bridge this lacuna, partially variations in vitamin characteristics of multifloral honey of *Apis* species from different regions of Coorg, Karnataka were analyzed. The studies indicate variations in vitamin content in different honey samples from different *Apis* species. Seven different vitamins viz., thiamine (B1), riboflavin (B2), niacin (B3), panthothenic acid (B5), pyridoxine (B6), cobalamin (B12) and ascorbic acid (C) were analyzed in *Apis* honey.

MATERIALS AND METHODS

Selected study area

The study area selected for current investigations is Coorg district of Karnataka.

Procurement of filtered raw *Apis* honey samples

The honey samples (n=40) of *Apis florea*, *Apis mellifera*, *Apis cerana Apis dorsata*, were harvested from various geographical areas of Coorg, Karnataka during 2021. Each honey sample was first filtered with a sterile mesh to remove debris. All the samples were collected and transported in sterile sealed bottles or screwed cups with authentic labels. Four replications of bottles for each sample were kept under storage at 2-8 °C until tested as per the method standardised by Nzeako and Hamdi (2000).

Determination of Vitamin profile

The collected filtered raw *Apis* honey samples for vitamin estimation were analyzed by High-performance liquid chromatography (HPLC) method demonstrated by Rizzolo A and Polesello S. (1992). Data of all vitamins 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 vitamins of *Apis* honey were broadly categorized as major vitamins viz., C and B6. While minor vitamins include B1, B2, B3 and B5 based on quantity and concentration. Whereas Vitamin B12 was showing insignificant values. Vitamin B6 and Vitamin C with 23.87 and 24.98 mg/100 gm for *Apis florea* honey respectively. Vitamin B1 ranged from 5.23 to 7.45, B2 from 8.25 to 10.42, B3 from 9.96 to 12.33, B5 from 6.41 to 8.56 mg per 100 gm of *Apis* honey samples (Fig.1). However, Vitamin B12 showed insignificant concentration of 0.00 1 gm/100 gm of *Apis* honey. All the vitamin constituents except vitamin B12 were within range and varied significantly at $p < 0.05$ levels.

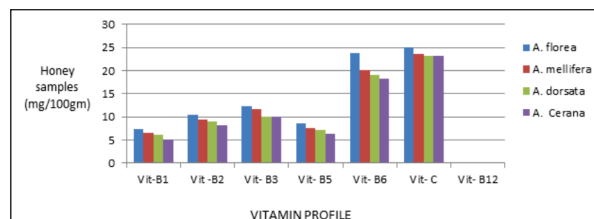


Fig.1. Vitamin profile of different *Apis* honey from Coorg, Karnataka.

The vitamin C content ranged from 23.11 to 24.98 mg/ 100g. Highest range was recorded for *A. florea* honey (24.98 mg), followed by *A. mellifera* (23.65 mg) and *A. dorsata* (23.23 mg); the least content was analysed in *A. cerana* honey (23.11mg). The vitamin B6 content ranged from 18.35 to 23.87 mg/ 100g. *A. florea* honey showed highest recorded value (23.87 mg), followed by *A. mellifera* (20.16 mg) and *A. dorsata* (19.01 mg); the least content was noticed in *A. cerana* honey (18.35 mg). The vitamin B1 content ranged from 5.23 to 7.45 mg/ 100g. Highest range was recorded for *A. florea* honey (7.45 mg), followed by *A. mellifera* (6.66 mg) and *A. dorsata* (6.12 mg); the least content was recorded in *A. cerana* honey (5.23 mg). The vitamin B2 content ranged from 8.25 to 10.42 mg/ 100g. *A. florea* honey showed highest recorded value (10.42 mg), followed by *A. mellifera* (9.47 mg) and *A. dorsata* (9.11 mg); the least content was determined in *A. cerana* honey (8.25 mg). The vitamin B3 content ranged from 9.96 to 12.33 mg/ 100g. *A. florea* honey showed highest recorded value (12.33 mg), followed by *A. mellifera* (11.63 mg) and *A. dorsata* (10.12 mg); the least content was recorded in *A. cerana* honey (9.96 mg). The vitamin B5 content ranged from 6.41 to 8.56 mg/ 100g. Highest range was recorded for *A. florea* honey (8.56 mg), followed by *A. mellifera* (7.68 mg) and *A. dorsata* (7.11 mg); the least content was analysed in *A. cerana* honey (6.41 mg). The vitamin B12 content ranged from 0.000 to 0.001 mg/ 100g. *A. florea* honey showed highest recorded value (0.001 mg), whereas *A. mellifera*, *A. dorsata* and *A. cerana* honey showed no content (0.000mg).

DISCUSSION

The *Apis florea* honey samples showed good range of vitamins such as thiamine (B1), riboflavin (B2), niacin (B3), panthothenic acid (B5), pyridoxine (B6), cobalamin (B12) and ascorbic acid (C). The vitamin C content recorded was highest with 24.98 mg/ 100g. Similarly the Vitamin B6 with 23.87mg/100gm of honey. Vitamin B1 was 7.45mg/100gm, vitamin B2 with 10.42mg/100 gm, Vitamin B3 with 12.33 mg/100 gm, Vitamin B5 with 8.56 mg/100gm, and Vitamin B12 with 0.001 mg/100gm of honey. The *Apis cerana* honey samples showed least values for all the tested analytes of vitamins.

The present scientific research findings share the similarities reported by other investigators. The ascorbic acid concentration

was observed to be high in Bangladeshi honey (129.8 to 154.3 mg/kg) (Islam *et al.*, 2012 & 2014), Portuguese honey (140- 145 mg/ kg) (Ferreira *et al.*, 2009), Indian forest honey (260.90 mg/kg) (Kishore *et al.*, 2011), Algerian honey (236.80 to 315.90 mg/kg) and Malaysian pineapple honey (146.40 mg/kg) (Khalil *et al.*, 2012). Among the raw *Apis* honey analyzed, *A. cerana* had the least Vitamin C value of 3.84 mg/kg. The raw *T. iridipennis* honey had 4.8 mg/kg. On processing there was reduction to 2.4 and 5.28 mg/kg. Among the processed honey the highest vitamin C content was in the *A. dorsata* honey (5.28 mg) followed by that of *Trigona* (4.32 mg) and *A. cerana* (3.6 mg) (Bolander F.F. 2006; Rahamanian *et al.*, 1970). MV Balasubramanyam (2020) reported that Vitamin B 6 was highest of 1.80 µ gm and lowest of 1.40 µ gm in *A. florea* and *A. cerana* honey from Western Ghats and hills respectively. B1 was minimum of 0.07 µ gm and 0.10 µ gm in *A. florea* and *A. cerana* honey from hills and Western Ghats. Vitamin B2 was lowest 0.12 µ gm in honey of *A. cerana* from plains and highest of 0.20 µ gm from Western Ghats. Vitamin B5 was highest of 0.25 µ gm and lowest of 0.11 µ gm in *A. florea* and *A. cerana* honey from Western Ghats and plains respectively. Vitamin B3 was maximum of 0.55 µ gms and minimum of 0.43 µ gm in *A. cerana* honey from Western Ghats and hills respectively. Vitamin C was highest of 1.55 µ gm and lowest of 1.28 µ gm in *A. florea* and *A. cerana* honey from Western Ghats and hills respectively.

CONCLUSIONS

It is the time to place in records the conclusions drawn from the present investigation. The vitamin profiling of *Apis* honey is essential for the assessment nutritional quality. Of all the vitamins tested in the honey samples, *Apis florea* honey from Coorg of Karnataka, has high contents of thiamine (B1), riboflavin (B2), niacin (B3), panthothenic acid (B5), pyridoxine (B6), cobalamin (B12) and ascorbic acid (C) as compared to the other honey samples. The findings of the present study reveal that Indian honey quality with respect to the concentration of these vital bioactive vitamins is well within the safety baseline levels for human consumption.

REFERENCES

1. Ali A Al-Jabri. 2005. Honey, Milk and Antibiotics. *African J. Biotechnol.* 4(13): 1580-1587.
2. Bender David A. 2003. Nutritional biochemistry of the vitamins, Cambridge, U.K. Cambridge University Press, pp:48-78.
3. Bolander F.F. 2006. Vitamins: Not Just Enzymes. *Current Opinion on Investigating Drugs.*;7(10):912-915.
4. Christy E Manyi-Loh, Roland N N dip and Anna M Clarke. 2011. Volatile compounds in honey: a review on their involvement in aroma, botanical origin determination and potential biomedical activities. *Int. J. Mol. Sci.* ;12(12):9514-32.
5. Ferreira, I.C.F.R., Aires, E., Barreira, J.C.M. and Estevinho, L.M. 2009. Antioxidant activity of Portuguese honey samples: Different contributions of the entire honey and phenolic extract. *Food Chemistry*, 114: 1438-1443.
6. Islam, M., Moniruzzaman, M., Mottalib, M., Sulaiman, S. A., Gan, S.H. and Khalil, M. 2012. Physicochemical and antioxidant properties of Bangladeshi honeys stored for more than one year. *BMC Complement Alternative Medicine*, 12(1):177.
7. Islam, S. M., Jothi, J.S., Islam, M. and Zubair, A. M. 2014. Antioxidant and Physico-chemical properties of litchi honey procured from Gazipur and Tangail District, Bangladesh. *Journal of Entomology and Zoology Studies*, 2(5): 207-211.
8. Khalil, M.I., Moniruzzaman, M., Boukraa, L., Benhanifia, M., Islam, M. A., Islam, M. N., Sulaiman, S. A. and Gan, S. H. 2012. Physico-chemical and antioxidant properties of Algerian honey. *Molecules*, 17(9): 11199-11215.
9. Kishore, R.K., Halim, A.S., Syazana, M.S.N. and Sirajudeen, K.N.S. 2011. Tualang honey has higher phenolic content and greater radical scavenging activity compared with other honey sources. *Nutrient Research*, 31:322-325.
10. Krishnasree, V and Mary Ukkuru, P. 2018. Nutrient And Antioxidant Profile Of Bee Honey From Kerala. *Indian Journal of Entomology*, 80(3): 1-6.
11. MV Balasubramanyam. 2020. Minor constituents of multifloral honey of indigenous bee *Apis florea* and *Apis cerana* indica from different regions of Karnataka. *Journal of Entomology and Zoology Research*; 8(5): 1956-1959.
12. Nzeako, B. C. And Hamdi, J. 2000. Antimicrobial potential of honey on some microbial isolates. *Med. Sci.* 2: 75-79.
13. Rahamanian M, Kouhestani A, Ghaviteker H, Tersarkissian N, Olszynanarzyns A, Donoso G 1970. High ascorbic acid content in some Iranian honey: Chemical and Biological assays. *Nutrition and Metabolism*; 12(3):133-135.
14. Rizzolo A and Polesello S. 1993. Chromatographic determination of vitamins in foods. *J. Chromatogr.* 624(1-2):103-52.
15. Shripad N Agashe and Rangaswamy B.E. 2001. Chemical characterization of *Apis cerana* F and *Apis florea* F honey from Dakshina Kannada, Karnataka (India). *Indian Bee Journal*; 63(3-4):15-20.