AJLS

Asean Journal of Life Sciences, Vol 1(2), 2021 (Special Issue), pp 42-45
Symposium on Final Year Project 2021
18 & 19 August 2021@Faculty of Engineering and Life Sciences, UNISEL

Accepted date: 30 October 2021
Publish date: 31 December 2021

Heterotrigona Itama (Kelulut) Honey and Its Potential Value: A Review

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Abstract

Malaysia local stingless bee, *Heterotrigona itama* or renowned as Kelulut bee creates a path in scientific research due to its honey production. Its honey composed of active therapeutics properties like antioxidant, antimicrobial as well as tonnes of valuable physicochemical properties. These small size stingless bees are not only stress-free to handle but expedient as future commodity to Malaysia. The quality of Kelulut honey is comparable to Manuka honey as therapeutic agents. Undeniably, it worth to have an intensive research upon the honey. A sweet sour of Kelulut honey with acidic pH (3.24-3.71) with low moisture content offers low risk of microbes' contamination. In addition, this foraging bees are active in gaining its food resources from floral rich area resources. The capacity of *Heterotrigona itama* to bring more honey from flower nectar is much higher compare to their other families' member like *Tetrigona apicalis* and *Tetragonula laeviceps*. Thus, this review will analyze on the physicochemical characteristics of this honey such as moisture content, ash content, pH, color intensity, electrical conductivity, phenolic content, flavonoid content and chemical composition. Furthermore, finding uncovered that this honey had antibacterial and antioxidant properties that affect the human health.

Keywords: stingless bee, *Heterotrigona itama*, Kelulut honey, *Tetrigona apicalis*, *Tetragonula laeviceps*

INTRODUCTION

Honey is the natural and valuable source for nourishment and medicine since the ancient times. The numerous benefit of honey like nutritional value, healing possession as well as preventative properties contributed by its several chemical constituents. Honey must be free from any impurities in order to enhance the remedial properties. Due the fact that honey is a natural, effective, and pleasant sweetener, there is an increasing interest in the study of Tropical rainforest honeys that mostly originated from

Malaysia are Kelulut honey, Tualang honey and Gelam honey. The focal interest of this study is about Kelulut honey from *Heterotrigona itama*, a stingless bee that gathers nectar from various floral sources.

Even though *H. itama* is tiny stingless bees but hold a major player in the Malaysian honey market. The Kelulut honey gets its beneficiary properties from the nectar of the Malaysia native flower. It is rich in alkaloids and flavonoids, giving it a distinct sour and acidic taste. It also contains more liquid nature while supplying a very high medicinal property. Kelulut Honey is twice as nutritious compared ordinary natural honey. The higher level of antioxidants was said to be able to delay the aging process. It possesses antibacterial, anti-cancer, and anti-osteoporotic properties due to its high antioxidant properties. Extensively reviewed of Kelulut honey is required as to avoid future cross-studies research due to missed reviews of the existing research as well as attaining the update knowledge. Furthermore, the growing production of Kelulut honey and overpowering demands of the market for natural remedies demand exploration on the composition of Kelulut honey. Although stingless honey is gaining popularity due to enormous therapeutic benefit but the distribution of this honey is less compared to that of the common honeybee. This is due to the limited knowledge about this honey, which has resulted in it being less popular in terms of its industrial production, shelf life, and quality standard

RESULT AND DISCUSSION

The physicochemical test is to determine the quality and purity of honey based on few parameter such as moisture content, ash content, and pH value. Table 3.1 shows the physicochemical of *Heterotrigona itama* honey. Color intensity of honey also can be associated to the antioxidant level. The darker the honey, the higher the antioxidant level of the honey. Furthermore, a great quality of stingless bee honey is demonstrated by the presence of plant phenolic within the honey and its capability to have scavenging properties. However, the antioxidant substance and its anti-oxidative exercises will be greatly changed with the geographic root of the honey.

Parameter	Result
Moisture content	21.40-31.59%
Ash content	0.22-0.41 %
pH	3.24-3.71
Color intensity	1029.00 - 2103.17 mAU
Electrical conductivity	0.74 - 1.51 mS/cm
Color	yellow – dark brown

Table 1 Pysicochemical of *Heterotrigona itama* honey [2].

A previous study by [3] stated that in high concentration of honey shows the highest antiradical activity with 77.29% 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) scavenging effect. Moreover, [4] observed the total antioxidant capacity using three assays namely 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH), 2,2-azinobis-(3-ethylbenzothiazoline-6-sulfonate (ABTS), and Oxygen Radical Antioxidant Capacity (ORAC) for Kelulut and Tualang honeys. It was observed that Kelulut honey demonstrated higher range of total phenolic content (228.09 – 235.28 mg GAE/kg) and flavonoid content (97.88 – 101.5 mg CE/kg) compared to Tualang honey. Furthermore, [5] had proven that the value of superoxide radical scavenging assay for *H. itama* is around 54.1 ± 6.9 to 61.4 ± 7.4 (%) and does not have significant different between other stingless bee honey. Besides that, the TPC value in stingless bee honey where in ranged from 98.284 µg RE/g to 443.25 µg RE/g. However, a study by [5] revealed that the total flavonoid content in stingless bee honey was ranged of 12.41 ± 0.62 to 17.67 ± 0.75 (mg/ml) with $p \leq 0.05$ between species which *H.itama* shows higher flavonoid content.

As of late, the potent inhibitory activity of stingless bee honey has advance expanded the intrigued within the application of honey to annihilate antibiotic-resistant microbes. Moreover, According to [2] said that stingless bee *H. itama* had more prominent antibacterial impacts than two nectar bee honeys with broader antibacterial range and bigger zone of inhibition on *S. aureus* (1.8 ± cm), *E. coli* (1.6 ± cm), *Proteus vulgaris* (2.4 ± cm), *Shigella sonnei* (1.2 ± cm), *and Klebsiella sp*. (8.2 ± 0.5 cm). Furthermore, when compared to Manuka, Kelulut honey revealed lower minimum inhibitory concentration (MIC) than Manuka honey which resulted against *E. coli, P. aeruginosa*, and *P. vulgaris* with the MIC of <5%, <5% and 7.5% (w/v) respectively as compared to Manuka with 10%, 15%, and 10% (w/v). Besides that, the minimum bactericidal concentration (MBC) value for Kelulut honey was at range from 2.5% to 40% (w/v) and from 30% to 90% (w/v) which bears a resemblance to Tualang honey. Moreover, Kelulut honey had similar MBC value to Manuka honey which was 20% (w/v) for bacteria *S. pyogenes* and *S. agalactiae* and 25% (w/v) for *E. aerogenes.* Interestingly, the Kelulut honey had the lowest MBC value of <5% (w/v) on *P. aeruginosa* showed that it has potential as bacterial agent against *P. aeruginosa* due to the lowest MIC and MBC. Besides that, According to [1], the analysis gene of *P.aeruginosa* showed different expression when the Kelulut honey was applied and impacted on the numerous aspects of the flagella regulon which the repression of flagella-associated genes allows Kelulut honey to mediate the de-flagellation of *P. aeruginosa* that leads to decrease motility, adherence and virulence.

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Table 2 Amino Acid inside *Heterotrigona itama* honey (g/100g)

H. itama honey contained 8 essential amino acids, 4 conditionally essential amino acid and 5 non-essential amino acids. Moreover, the amino acid content in bee pollen was increased as a result of protein degradation which driven to arrangement of more peptides and amino acids. Although amino acids are synthesized and accumulated in pollen but they can be reduced through microbial activity where the amino acid were utilized as carbon and energy sources.

CONCLUSION

Kelulut honey originate from *Heterotrigona itama* bees is considered to be a vital medicinal product and can be recognized by their physical and chemical constituents. Moreover, *H. itama* honey is good for human health especially for cancer patient due to its high phenolic content and beneficial physicochemical characteristics in the honey that linked to the antioxidants activity by reducing free radical or oxidative reaction within the food system. Furthermore, due to their physicochemical, antioxidant and antibacterial, many people especially small medium businesses use *Heterotrigona itama* honey to produce cosmetic product such as soap. Besides that, the biological complex properties of the stingless bee's honey which includes sugar, phytochemical compound namely phenolic acid and flavonoid and other bioactive form such as amino acid and phenolic acid, protein and vitamin might play important role in influencing the signalling pathway of disease development.

ACKNOWLEDGEMENT

This study was funded by industry Geran Semesta MBI (I/SEM-MBI/ST/2020/11)

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