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# Measuring consumers' preferences of stingless bee honey (meliponine honey) based on sensory characteristics

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**Abstract**

Nowadays, stingless bee honey (meliponine honey) or locally known as '*madu lebah kelulut*' is becoming popular among Malaysian consumers due to its acclaimed health benefits and advantages such as antioxidant and anti-inflammatory activities. Usually, stingless bee honey is used as a supplement to modern medicine, and the increase in health awareness among consumers has also increased the demand for stingless bee honey. However, due to the low production of stingless bee honey in the local market, Malaysia continues to import honey from other countries. As there is an abundant of imported honey products, local beekeepers are facing stiff competition, and consumers also need to make a difficult purchasing decision on the most preferable honey products in the market. Therefore, the main objective of the present work was to determine the consumers' quality preferences towards stingless bee honey based on sensory characteristics. A total of 406 respondents of honey consumers were selected to test stingless bee honey sample based on its appearance, aroma, texture and flavour. The respondents responded based on a structured questionnaire using a 5-point Likert scale statements about their responses towards stingless bee honey sensory characteristics. The responses of the respondents were analysed based on descriptive analysis, factor analysis and logistic regression analysis. The results revealed nine factors that influenced consumers' preferences towards stingless bee honey such as granularity, colour, bitterness, sweetness, viscosity, spice aroma, sourness, herbal aroma and fruity aroma, with viscosity being the most influential factor. The present work concluded that sensory characteristics were important to determine the consumers' quality preferences towards stingless bee honey on purchasing decision.



## Introduction

Honey is a sweet substance produced by bees which undergoes a complex process before being stored in honey combs or honey-pots until it ripens (Bradbear, 2009). The Codex Alimentarius Commission (2001) defined honey as "the natural sweet substance produced by honey bees from the nectar of plants or from secretions of living parts of plants or excretions of plant sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in the honey comb to ripen and mature". Honey is beneficial not only to the bees, but also to its human consumers. It is popular among consumers as it has unlimited uses throughout history; as food, beauty care product and recently as health supplements. According to Bradbear (2009), honey is used as a sweetener in breakfast cereals, bakery goods as well as in modern medicine.

Malaysia has approximately 100 species of bees (Ismail, 2014), and most of the Malaysian honey is produced in Sarawak, Sabah, Johor and Melaka. Some of these bees are *Apis cerana* (local bee), *A. mellifera* (imported bee; from Australia), *A. dorsata* (forest bee/giant bee) and the meliponines (stingless bee; various species). According to Hosnan (2017),

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the Ministry of Science Technology and Innovation (MOSTI) stated that in Malaysia there are about 750 to 1,000 beekeepers, producing an estimated 30 metric tonnes honey per annum. The giant *A. dorsata* usually nest on the branches of the *tualang* tree (*Koompassia excels*), which can grow up to 85 m tall, and collect nectar and pollen from the surroundings of the rainforest (Ahmed and Othman, 2013; Kek *et al*., 2017). The honey will be harvested during the harvesting season, usually at night, in February and March to ensure that the honey is ripened and suitable to be consumed. On the other hand, *A. mellifera* is usually bred by beekeepers within a controlled environment, and produce more honey than the stingless bees. The colonies of *A. cerana* are typically smaller (≈34,000 bees) than that of *A. mellifera*, thus having smaller nests, and they do not use propolis to cover their hives like *A. mellifera* (Koetz, 2013).

Stingless bee is another type of bees that produce honey for human consumption. According to the Malaysian Agricultural Research and Development Institute (MARDI), in 2013, there are 30 species of stingless bee identified in Malaysia. These species of bees are not dangerous to humans and are very active as compared to other bees. The rearing of this type of bee is known as meliponiculture. At present, there are nine stingless bee species suitable for meliponiculture. Of these, two (*Heterotrigona itama*, *Geniotrigona thoracica*) are widely used because they produce higher volume of honey as compared to the others. Stingless bee honey is usually produced in the honey pot and has higher water content than *A. mellifera* honey (Vit *et al*., 2012). Usually, stingless bee honey has sour taste, less viscous, dark in colour, and has a fermented and herbal aroma (Vit *et al*., 2012). Stingless bee honey has many benefits such as antimicrobial, antioxidant and anti-inflammatory activities, treatment of eye diseases and as a supplement for consumers' health (Rao *et al*., 2016).

The production of honey in Malaysia is lower than the market demand, which leads to it being imported from other countries such as Australia and China. The growing demand for honey occurs due to the increasing population in the country as well as the consumers' health awareness. Nowadays, consumption of honey, especially stingless bee honey, is becoming a trend among the consumers due to their awareness about the benefits and advantages of the honey. Nevertheless, the stingless bee honey industry is still under stagnation due to unsustainable development, which means that the knowledge about honey is still confined to traditional knowledge, leading to reduced honey production and an increase in price. The lag in the local supply has made Malaysia a huge market for imported honey products. The increase need for honey has pushed local consumers towards imported products, irrespective of the quality. Therefore, there is an urgent need for stingless bee honey producers to revamp the Malaysian honey industry to support its growing markets as health supplements. This requires the local producers to rely on the preferences of Malaysian consumers for stingless bee honey. There is also a need to update and understand the current preferences among the consumers on the stingless bee honey, their expectations on honey quality and the sensory characteristics that influence them to buy stingless bee honey products. Besides, there is also a need to update and understand the standards for quality of honey so that a good quality honey can be produced.

In the light of the above, the objectives of the present work were to determine the consumers' quality preferences towards stingless bee honey based on sensory characteristics, and to investigate the factors that influence the consumers' preferences towards stingless bee honey quality. The present work also investigated the consumers' preferences on stingless bee honey, which is perceived to possess better health benefits.

## Materials and methods

Based on Darby and Karni (1973), the scope and quality of honey are diverse depending on how consumers define it. The word quality can be defined as "the composite of the characteristics that can differentiate individual units of products and have significance in determining the degree of acceptability of the products to users" (Groom, 1990). Usually, quality is more influenced by the thinking and culture of the individual. In this context, quality relates to the perception of consumers towards the characteristics of the products as it satisfies their expectations (Ghobadian *et al*., 1993). The product's qualitative characteristics are usually distinguished into quality cues and quality attributes (Steenkamp, 1990). A quality cue is defined as "the informational stimuli that are, according to the consumer, related to the quality of the product, and can be ascertained by the consumer through the sense prior to consumption" (Steenkamp, 1990). Further, quality cues can be categorised into intrinsic which is the part of physical product that cannot be changed without changing the physical product itself, and extrinsic which is related to the products but are not physically part of it (Olson, 1972; Olson and Jacoby, 1972). The examples of intrinsic cues are colour, smell and texture, whereas prices, brand name, country of origin and store name

are the examples of extrinsic cues. For the quality attributes, it can be categorised as experience or credence attributes (Nelson, 1970; Darby and Karni, 1973; Nelson, 1974). According to Nelson (1970), the experience attributes are observed by following the previous experience, for example, the experience attributes in food quality are taste, flavour and colour. The other attributes are the credence attributes. These attributes are difficult to evaluate as they have a wide range of intangible elements such as origin and environmental conservation which need a thorough judgement or certification from authorities.

Sensory evaluation is a scientific discipline that analyses and measures the response of human to the composition of a food and drink such as appearance, touch, odour, texture, temperature and taste (Vit *et al*., 2012). For honey, sensory evaluation enables us to distinguish the botanical origin of honey and to identify and quantify certain defects (fermentation, impurities, off-odours and flavours). Besides, it also plays important role in defining product standards and in the related controls, regarding botanical denominations or other specific levels (Piana *et al*., 2004).

Sensory characteristics are the combination of several sensory attributes which complete the total quality of foods. Usually, appearance, odour or aroma, texture and flavour are the attributes that consumers used to perceive the foods (Garber *et al*., 2003). Measurement of the sensory quality of honey such as appearance can be evaluated before the purchasing and consumption, whereas the attributes such as aroma and taste can be evaluated after the purchasing and consumption. Every people have different views or perception based on individual senses (Deliza and MacFie, 1996). According to Garber *et al*. (2003), sensory characteristics are the most important quality attributes of the food for consumers. Attributes such as sweet aroma, sweet flavour, yellow colour and viscosity are important for the honey quality (Ferreira *et al*., 2009).

Stingless bee honey has a higher moisture (hygroscopicity) or higher water content which makes it less viscous and more dilute (Vit *et al*., 2012: Nascimento *et al*., 2015). Colour is also one of the sensory characteristics of stingless bee honey. The colour of honey usually depends on the floral origin, and dark-coloured honey usually has more minerals which are four to six times higher as compared to light-coloured honey (Nascimento *et al*., 2015). According to Nascimento *et al*. (2015), stingless bee honey has lower sugar content which influences its less-sweet and more-sour taste (Ferreira *et al*., 2009). According to Vit *et al*. (2012), there are several types of stingless bee honey aroma which include floral-fruity, fermented and bee-hive aroma.

Nowadays, consumers' lifestyle is changing. Income becomes one of the indicators that influence the willingness towards higher payment of quality honey. Becker *et al*. (2000) indicated that the price is no longer the main indicator of food quality, especially in food markets. For instance, Ghorbani and Khajehroshanaee (2009) described that price of honey is positively influenced by the type of honey, as well as its packaging, colour, aroma and protraction. Further, Murphy *et al*. (2000) found that the price and texture are the most important product attributes followed by packaging, production and finally the colour of honey. Safi *et al*. (2014) also stated that colour is one of the important factors for consumers to choose honey. There are also several studies which stated that the honey's origin is the most important factor considered when purchasing the honey. Duke *et al*. (2014) found that the consumers prefered locally-produced honey when they were served with local and international honey. According to Gyau *et al*. (2014), consumer who was married and had at least secondary level of education had a strong preference for local forest and savannah honey.

## Methods

Data collection was carried out using face-to-face interviews based on structured questionnaires administered to 406 respondents who were honey consumers from Klang Valley, Malaysia. Purposive random sampling was used as the sampling method for selecting target respondents who regularly consume honey in their daily life and willing to participate in this study. The questionnaire was structured in two sections. The first section consisted of questions and statements on the socio-demographic profiles of the respondents and their purchasing decisions. The second section was established to obtain respondents' perception on stingless bee honey quality based on a 5-point Likert scale statements on sensory characteristics as follows: 1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, 5 = strongly agree.

The honey sample used in the present work was stingless bee honey directly obtained from beekeeper in Selangor to ensure the originality and quality of the honey. The sample was left at room temperature for one day before the sensory testing was performed. The sample was packed in a 250 g glass bottle. The sample was given to the respondents to be tasted and they were then asked to respond based on established statements by filling up the questionnaire.

The sensory testing involved several steps namely (1) the questionnaire was prepared based on 3-digit random codes obtained from the Table of Random Numbers. According to Larmond (1977), these codes were assigned to ensure that there are no hints being given to the respondents about the identity of the sample; (2) the 3-digit random codes were then labelled on the sampling cup. The codes that were labelled on the cup should match with the codes on the questionnaire; (3) the respondents' numbers were labelled at the right top of the front page of the questionnaire; (4) after coding procedures, the sample was prepared for each respondent and placed on a tray according to the sequence of sensory testing number as stated in the questionnaire. For the sensory testing purposes, 20 g stingless bee honey sample was prepared in a 40 mL clear plastic cup labelled with 3-digit random codes and tasted with white plastics spoons (Swanson and Lewis, 1991; Feriera *et al*., 2009); (5) the tray containing the sample was then served to the respondents for analysis; (6) before the sensory testing began, each enumerator was briefed about the sensory testing procedures to prevent bias against sample which could influence the results (Larmond, 1977). During the sensory testing, the enumerators were allowed to assist the respondents if they needed any assistance; (7) after the briefing, the respondents were placed at the numbered tables dedicated to each respondent to test the sample; and (8) after testing the sample, the respondents were asked to rinse their mouth with a slice of apple and mineral water (Swanson and Lewis, 1991; Piana *et al*., 2004; Ferriera *et al*., 2009; Vit *et al*., 2011).

The Statistical Package for the Social Science (SPSS) Version 20.0 software was used to analyse the data. Descriptive analysis was used to analyse the socio-demographic profiles of the respondents and their purchasing decisions. Factor analysis was used to determine the factors that influenced the respondents' perception towards stingless bee honey. Logistic regression analysis was used to estimate the logit model for respondents' preferences towards stingless bee honey quality by predicting the outcome of the dependent variable from the independent variables.

Table 1 shows the coding system that was used for the logistic regression analysis to analyse the respondents' preferences towards stingless bee honey quality.

In the present work, the dependent variable was the preference towards stingless bee honey quality, whereas the independent variables were five socio-demographic variables which included age, gender, income, education level and occupation, and nine sensory attribute variables which included colour, granularity, fruity aroma, herbal aroma, spices aroma, viscosity, sweetness, sourness and bitterness. The dependent variable was categorical values whereas the independent variables were of categorical and continuous nature. The sensory attributes were derived from the score of the factor analysis results.

Table 1: Coding system for logistic regression analysis

| Variables | | Coding System |
|---|---|---|
| Dependent Variable | Preference | 0 = No, 1 = Yes |
| Independent Variables | Age | Age in Years |
| | Gender | 0 = Male, 1= Female |
| | Income | Income in Ringgit Malaysia |
| | Education Level | 0 = Low Education, 1 = High Education |
| | Occupation | 0 = Not Employed, 1 = Employed |
| | Colour | 0 = Not Influenced, 1 = Influenced |
| | Granularity | 0 = Not Influenced, 1 = Influenced |
| | Fruity Aroma | 0 = Not Influenced, 1 = Influenced |
| | Herbal Aroma | 0 = Not Influenced, 1 = Influenced |
| | Spices Aroma | 0 = Not Influenced, 1 = Influenced |
| | Viscosity | 0 = Not Influenced, 1 = Influenced |
| | Sweetness | 0 = Not Influenced, 1 = Influenced |
| | Sourness | 0 = Not Influenced, 1 = Influenced |
| | Bitterness | 0 = Not Influenced, 1 = Influenced |

## Results and discussion

*Socio-Demographic Profiles of Respondents*

Table 2 shows the socio-demographic profiles of the respondents. The 406 respondents were comprised of 37% male ($n$ = 149) and 63% female ($n$ = 257). Majority of the respondents were Malay, which accounted for 77% ($n$ = 313), followed by 10% Chinese ($n$ = 42), 7% Indian ($n$ = 29) and 6% others ($n$ = 22). Majority of the respondents were single, which accounted for 73% ($n$ = 296) and about 27% ($n$ = 110) were married. Majority of the respondents belonged to age group of 21 - 30 years old, which accounted for 56% ($n$ = 230), followed by 22.5% 31 - 40 years old ($n$ = 90),10.8% ≥ 41 years

old ($n$ = 44) and only 10.3% ≤ 20 years old ($n$ = 42). In terms of education, 52.0% were bachelor's degree holders ($n$ = 211), 20.2% were diploma holders ($n$ = 82), 15.5% attended secondary school ($n$ = 63), 9.4% were master holders ($n$ = 38), 2.5% were PhD holders ($n$ = 10) and 0.5% only attended primary school ($n$ = 2). Majority of the respondents worked in the government sectors, which accounted for 43.1% ($n$ = 175), 19.0% students ($n$ = 77), 18.5% worked in the private sectors ($n$ = 75), 10.8% were self-employed ($n$ = 44), 7.4% were unemployed ($n$ = 30) and only 1.2% belonged to other group ($n$ = 5). Finally, the result also indicated the income brackets of the respondents where 46.8% ($n$ =190) earned ≤ RM1,000, 30.5% ($n$ = 124) earned RM1,001 - RM2,000, 15.3% ($n$ = 62) earned RM2,001 - RM3,000, 2.0% ($n$ = 8) earned RM3,001 - RM4,000, and 5.4% ($n$ = 22) earned ≥ RM4,001.

Table 2: Respondents' socio-demographic profiles

| Profile | Frequency (n) | Percentage (%) |
|---|---|---|
| Gender | | |
| Male | 149 | 37 |
| Female | 257 | 63 |
| Race | | |
| Malay | 313 | 77 |
| Chinese | 42 | 10 |
| Indian | 29 | 7 |
| Others | 22 | 6 |
| Marital Status | | |
| Single | 296 | 73 |
| Married | 110 | 27 |
| Age (year) | | |
| ≤ 20 | 42 | 10 |
| 21 - 30 | 230 | 57 |
| 31 - 40 | 90 | 22 |
| ≥ 41 | 44 | 11 |
| Education Level | | |
| Primary School | 2 | 0.5 |
| Secondary School | 63 | 15.5 |
| Diploma | 82 | 20.2 |
| Bachelor Degree | 211 | 52.0 |
| Master | 38 | 9.4 |
| PhD | 10 | 2.5 |
| Occupation | | |
| Government Sector | 175 | 43.1 |
| Private Sector | 75 | 18.5 |
| Self-Employed | 44 | 10.8 |
| Students | 77 | 19.0 |
| Unemployed | 30 | 7.4 |
| Others | 5 | 1.2 |
| Income | | |
| ≤ RM1,000 | 190 | 46.8 |
| RM1,001 - RM2,000 | 124 | 30.5 |
| RM2,001 - RM3,000 | 62 | 15.3 |
| RM3,001 - RM4,000 | 8 | 2.0 |
| ≥ RM4,001 | 22 | 5.4 |

*Consumers' Choice of Stingless Bee Honey*

In the present work, the respondents had to choose between the preferences for stingless bee honey sensory characteristics and non-preferences for stingless bee honey sensory characteristics during the purchasing decision. Majority of the respondents 80.8% ($n$ = 328) showed that sensory characteristics were important quality criteria when purchasing stingless bee honey, with the remaining 19.2% ($n$ = 78) showed that they were influenced by the other criteria while purchasing the stingless bee honey. Brucks *et al*. (2000) and Brennan and Kuri (2002) indicated that based on consumers insight, the food quality is more important than price and a major force driving purchasing decision.

*Factors Influencing Consumers' Preferences towards Quality of Stingless Bee Honey*

In the present work, the reliability analysis was performed to measure the reliability of the items that were used (Weiner, 2007). The reliability analysis showed the Cronbach's alpha (α) of 0.89 which indicates that the variables were valid and reliable for further analysis. Based on Nunnally and Bernstein (1994), the Cronbach's α of 0.7 has good reliability. Raykov and Marcoulides (2012) indicated that the Cronbach's α of ≤ 0.5 are acceptable in social science studies and marketing research.

Table3. KMO and Bartlett's Test Kaiser-Mayer-Olkin

| | | |
|---|---|---|
| Measure of Sampling Adequacy | | 0.824 |
| Bartlett's Test of Sphericity | Approx. Chi-square | 5.156E3 |
| | df | 435 |
| | Sig. | 0.000 |

Table 3 shows the results of the Kaiser-Mayer-Olkin (KMO) and Bartlett's Test of sphericity. The KMO test was used to measure the sampling adequacy and to determine the occurrence of the correlation among the variables, whereas Bartlett's test was used to determine the correlation matrix in the factor model (Raykov and Marcoulides, 2012). The KMO result obtained in the present work was 0.824, and based on Kaiser (1974), this indicates that the variances among the variables are estimable. The Bartlett's test of sphericity showed significance at 1% level, indicating that the factor analysis with a given

variables was appropriate (Raykov and Marcoulides, 2012).

Table 4 shows the nine factors that influenced the consumers' preferences towards the quality of stingless bee honey based on sensory characteristics. The results indicated that the cumulative percentage of variance for the nine factors was 67.922%. The factors were labelled as granularity, colour, bitterness, sweetness, viscosity, spices aroma, sourness, herbal aroma and fruity aroma.

The first factor that influenced the consumers' preferences towards the quality of stingless bee honey based on sensory characteristics was labelled as *granularity* of stingless bee honey with eigenvalue of 6.965 and Cronbach's α of 0.840. This factor consisted of six sub-variables which explained a total variance of 11.584%. The second factor was labelled as colour of stingless bee honey with eigenvalue of 3.086 and Cronbach's α of 0.884. The factor explained a total variance of 10.638% and consisted of four sub-variables. These results are supported by the studies of Roose *et al*. (2017) and Swanson and Lewis (1991) describing that granularity and colour influenced the preferences on honey among the consumers.

The third factor was labelled as *bitterness taste* of stingless bee honey with eigenvalue of 2.320 and Cronbach's α of 0.802. The factor explained a total variance of 7.846% and consisted of three sub-variables. The fourth factor was labelled as *sweetness taste* of stingless bee honey with eigenvalue of 1.703 and Cronbach's α of 0.788. The factor explained a total variance of 7.419% and consisted of three sub-variables. Similar findings were found in Pocol (2012) describing that the taste of honey influenced the consumers' preferences towards honey.

*Viscosity* of stingless bee honey was recognized as the fifth factor with eigenvalue of 1.576 and Cronbach's α of 0.673. The factor explained a total variance of 6.977% and consisted of four sub-variables. The sixth factor was labelled as *spices aroma* of stingless bee honey with eigenvalue of 1.413 and Cronbach's α of 0.856. The factor explained a total variance of 6.271% and consisted of two sub-variables. *Sourness taste* of stingless bee honey was labelled as the seventh factor, with eigenvalue

Table 4: Factors influencing consumers' preference towards quality of stingless bee honey

| Items | Factor Loading |
|---|---|
| Factor 1: Granular | |
| • I believe granular honey is a fresh honey | 0.824 |
| • I believe honey with granular provides many benefits to our body | 0.788 |
| • I believe honey with granular has higher nutritional value and good for health | 0.788 |
| • I prefer honey with more granular | 0.692 |
| • I believe granular honey are safe to be consume | 0.596 |
| • I believe granular honey occurs due to sugar content and storage period of honey | 0.536 |
| Eigenvalue | 6.965 |
| % of variance | 11.584 |
| Cumulative % of variance | 11.584 |
| Cronbach's Alpha | 0.840 |
| Factor 2: Colour | |
| • I believe yellowish colour of honey is a fresh honey | 0.870 |
| • I prefer honey with yellowish colour | 0.853 |
| • I believe a yellowish colour of honey has higher nutritional value and good for health | 0.833 |
| • I believe yellowish colour of honey influenced me to consume honey | 0.752 |
| Eigenvalue | 3.086 |
| % of variance | 10.638 |
| Cumulative % of variance | 22.222 |
| Cronbach's Alpha | 0.884 |
| Factor 3: Bitterness | |
| • I prefer bitter taste of honey | 0.802 |
| • I believe a bitter taste of honey has high nutritional value and medicinal value | 0.797 |
| • I believe bitter taste of honey influence me to consume honey | 0.777 |
| Eigenvalue | 2.320 |
| % of variance | 7.846 |
| Cumulative % of variance | 30.068 |
| Cronbach's Alpha | 0.802 |

Table 4. (Cont.)

| | |
|---|---|
| Factor 4: Sweetness | |
| • I prefer honey with a sweet taste because it is delicious | 0.836 |
| • I prefer honey with sweet taste | 0.836 |
| • I believe honey with sweet taste is a fresh honey | 0.665 |
| Eigenvalue | 1.703 |
| % of variance | 7.419 |
| Cumulative % of variance | 37.487 |
| Cronbach's Alpha | 0.788 |
| Factor 5: Viscosity | |
| • I prefer honey with more viscosity | 0.776 |
| • I believe honey with more viscosity is a fresh honey | 0.750 |
| • I believe viscosity honey is influenced by temperature and amount of water of the honey | 0.625 |
| • I believe the viscosity of honey is maintained even though it is stored for a long period | 0.548 |
| Eigenvalue | 1.576 |
| % of variance | 6.977 |
| Cumulative % of variance | 44.464 |
| Cronbach's Alpha | 0.673 |
| Factor 6: Spices Aroma | |
| • I prefer honey with spices aroma | 0.890 |
| • Spice aroma of honey influence me to consume honey | 0.863 |
| Eigenvalue | 1.413 |
| % of variance | 6.271 |
| Cumulative % of variance | 50.735 |
| Cronbach's Alpha | 0.856 |
| Factor 7: Sourness | |
| • I believe the sourness of honey is influenced by the types of bees and pollen | 0.758 |
| • I believe a sour taste of honey has high nutritional value and medicinal value | 0.735 |
| • I prefer a sour taste of honey | 0.582 |
| Eigenvalue | 1.233 |
| % of Variance | 6.019 |
| Cumulative % of Variance | 56.754 |
| Cronbach's Alpha | 0.706 |
| Factor 8: Herbal Aroma | |
| • I believe honey that stored in a long period have a strong aroma | 0.715 |
| • I prefer honey with herbal smell | 0.619 |
| • I believe fresh honey has a strong aroma | 0.608 |
| Eigenvalue | 1.077 |
| % of Variance | 5.619 |
| Cumulative % of Variance | 62.373 |
| Cronbach's Alpha | 0.571 |
| Factor 9: Fruity Aroma | |
| • I believe fruity aroma of honey influenced by types of fruits chose by bees | 0.810 |
| • I prefer fruity aroma of honey | 0.744 |
| Eigenvalue | 1.002 |
| % of Variance | 5.549 |
| Cumulative % of Variance | 67.922 |
| Cronbach's Alpha | 0.660 |

of 1.233 and Cronbach's α of 0.706. The factor explained a total variance of 6.019% and consisted of three sub-variables. According to Ferreira *et al*. (2009), viscosity is one of the attributes that influenced consumers' preferences towards stingless bee honey. Furthermore, as revealed by Ghorbani and Khajehroshanaee (2009), the scent or aroma of honey influenced consumers' preferences towards stingless bee honey.

Factor number eight, which is also consistent with findings of Ghorbani and Khajehroshanaee (2009), was labelled as *herbal aroma* of stingless bee honey with eigenvalue of 1.077 and Cronbach's α of 0.571. The factor explained a total variance of 5.619% and consisted of three sub-variables. The last factor was labelled as *fruity aroma* of stingless bee honey with eigenvalue of 1.002 and Cronbach's α of 0.660. This factor consisted of two sub-variables and explained a total variance of 5.549%. The results from the factor analysis proved that the combination of several attributes such as granularity, colour, bitterness, sweetness, viscosity, spices aroma, sourness, herbal aroma and fruity aroma had influenced the perception of the consumers towards the quality of stingless bee honey for purchasing decision-making.

*Consumers' Preferences towards Stingless Bee Honey Quality*

The logistic regression analysis was used in the present work to determine the most influential factors that influenced consumers' decision when purchasing the stingless bee honey. The estimate equation model obtained is as follows: -

$$\text{Preference} = 2.030 + 0.300 \times (\text{Granularity}) + 0.496 \times (\text{Colour}) + 0.858 \times (\text{Viscosity}) + 0.347 \times (\text{Sourness}) + 0.665 \times (\text{Herbal aroma}) + 0.373 \times (\text{Fruity aroma})$$

In the present work, there were three variables that have been identified significant at 1% level of significance namely viscosity, herbal aroma and colour, while fruity aroma and sourness, were significant at 5% level of significance. The last variable, granularity was significant at 10% level of significance. The exponential (B) values in the last column are used to calculate the probability of a case falling into a specific category (Raykov and Marcoulides, 2012). The second column shows the positive or negative direction of the relationship between factors that increase or decrease the likelihood of the answer yes. In the present work, the estimated coefficient for viscosity showed a positive relationship. The preference for purchasing quality honey was 2.359 times higher for consumers who were influenced by viscosity when compared to those who were not influenced by it. Herbal aroma also showed positive relationship, with the preference for purchasing quality honey was 1.945 times higher for consumers who were influenced by herbal aroma when compared to those who were not influenced by it.

Table 5: Consumers' preference towards stingless bee honey quality

| Variables | Estimated Coefficient (B) | Standard Error (S.E.) | Wald | Sig. | Exp (B) |
|---|---|---|---|---|---|
| Gender | -.083 | .331 | .063 | .802 | .920 |
| Age | .011 | .021 | .278 | .598 | 1.011 |
| Income | .000 | .000 | .056 | .812 | 1.000 |
| Education | -.053 | .455 | .014 | .907 | .948 |
| Occupation | -.206 | .399 | .266 | .606 | .814 |
| Granularity | .300 | .171 | 3.084 | .079* | 1.350 |
| Colour | .496 | .151 | 10.746 | .001*** | 1.642 |
| Bitterness | -.052 | .168 | .096 | .756 | .949 |
| Sweetness | .247 | .162 | 2.320 | .128 | 1.280 |
| Viscosity | .858 | .182 | 22.306 | .000*** | 2.359 |
| Spices Aroma | -.173 | .158 | 1.198 | .274 | .842 |
| Sourness | .347 | .157 | 4.898 | .027** | 1.415 |
| Herbal Aroma | .665 | .168 | 15.686 | .000*** | 1.945 |
| Fruity Aroma | .373 | .156 | 5.680 | .017** | 1.452 |
| Constant | 2.030 | .843 | 5.807 | .016 | 7.617 |
| - 2 Log Likelihood | | 288.056 | Nagelkerke R Square | | 0.267 |
| Cox & Snell R Square | | 0.156 | Hosmer and Lemeshow Test | | 0.864 |

Note: * Significant at 10% level of significance
** Significant at 5% level of significance
*** Significant at 1% level of significance

Furthermore, the estimated coefficient for colour showed positive relationship, and it explained that the preference for purchasing quality honey was 1.642 times higher for consumers who were influenced by colour when compared to those who were not influenced by it. Meanwhile, fruity aroma estimated coefficient had a positive relationship. The preference for purchasing quality honey was 1.452 times higher for consumers who were influenced by fruity aroma when compared to those who were not influenced by it. Sour taste of honey was one of the factors that influenced consumers' preference for decision-making on purchasing. The positive sign of estimated coefficient of sourness taste indicates that the preference for purchasing quality honey was 1.415 times higher for the consumers who were influenced by sourness taste when compared to those who were not influenced by it. The estimated coefficient for granularity showed the positive sign. This indicates that the preference for purchasing quality honey was 1.350 times higher for consumers who were influenced by granularity when compared to those who were not influenced by it. The overall results showed that viscosity was the most influential sensory attribute that influenced consumers during the purchasing decision for quality honey. Based on Claybon and Barringer (2002), viscosity is one of the attributes that influenced the consumer's preferences towards products.

## Conclusion

Honey is one of the important foods for Malaysians nowadays. Honey has become one of the components of consumers' diet because it has several medicinal values. The demand for good quality stingless bee honey in Malaysia is expected to increase in coming years. In addition, the increase in consumers' awareness towards healthy lifestyle has also made them very sensitive towards food intake and consumption. Based on the results of the present work, majority of consumers agreed that quality is an important criterion to fulfil satisfaction on purchasing decision. Consumers perceived viscosity, colour, bitterness, sweetness, granularity, spices aroma, sourness, herbal aroma and fruity aroma as factors that influenced their preferences towards stingless bee honey quality. Viscosity of the stingless bee honey was the major factor influencing the consumers' purchasing decision towards stingless bee honey. As the results positively showed that there were several quality preferences among the consumers for their purchasing decision of stingless bee honey, these results however should not be generalised as only small number of respondents were involved which in turn might not be sufficient to represent the entire population. Therefore, the results of the present work could be improved further if the number of respondents is increased and to cover most of socio-demographic profiles. In conclusion, the present work provides important information for the marketers and the producers to improve their performance on stingless bee honey production for more competitive honey industry. Understanding the consumers' needs and wants will enable the producers to act quickly on the market changes from fluctuating consumers' demands. The results also provide valuable guidance for the marketers and industry players regarding the stingless bee honey. The Ministry of Agriculture and Agro-based Industry (MoA) has established a policy known as superfoods which aims to enhance the quality of the stingless bee honey so as to gain trust from the consumers. This policy will also fulfil the consumers' needs for the stingless bee honey. Overall, all related parties should be concerned with consumers' preferences and expectation towards the quality of the stingless bee honey to ensure smooth movements of the products along the supply chain as well as increasing the industry's competitiveness.

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