

COMPARATIVE ANALYSIS OF THE PHYSICO-CHEMICAL AND ANTIOXIDANT PROPERTIES OF HONEY AVAILABLE IN TANGAIL, BANGLADESH

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Abstract

The aim of the current study was the comparative analysis of the physical, biochemical and antioxidant properties of Mustard, Litchi, and Nigella honey. The physical parameters include the mean moisture content of Mustard, Litchi and Nigella honey were found 14.32%, 15.27%, and 14.12% respectively; P^H content were 6.97, 5.8, 4.78; the TSS content were 71%, 70%, and 73% respectively. The biochemical parameters including protein content were 1.103%, 0.57% and 0.985%; mean ash content were 0.2%, 0.19%, and 0.188%, total carbohydrate content were 84.377%, 83.97% and 84.496% and the minerals contents Na were 539.238 ppm, 424.3565 ppm and 588 ppm; K were 239.216 ppm, 219.017 ppm and 1063.774 ppm; Ca were 1710.499 ppm, 611.4852 ppm and 75.4 ppm for the Mustard, Litchi and Nigella honey respectively. The Antioxidant properties such as polyphenol content were found 42.572 ± 0.00529 mg gallic acid/50 ml, 30.625 ± 0.00529 mg gallic acid/50 ml and 95.5 ± 0.00529 mg gallic acid/50 ml; flavonoid content were found 1.052 ± 0.000577 mg catechin/50 ml, 0.6 ± 0.000577 mg catechin/50 ml and 2.66 ± 0.000577 mg catechin/50 ml and vitamin C content were 0.41 mg/100ml, 0.63 mg/100ml and 0.7 mg/100ml for Mustard, Litchi and Nigella honey respectively.

Keywords: Honey, Physico-chemical, Antioxidant, Polyphenol, Flavonoid

1. INTRODUCTION

Honey is a remarkable complex natural liquid reported to contain at least 181 substances. The composition of honey is rather variable and primarily depends on the floral sources; however, certain external factors also play the important role, such as seasonal and environmental factors and processing [1, 2]. Honey is the bees' produced royal nutritious sugary jelly, the world's healthiest food, available in all flavors and colors, processed applying natural regurgitation and evaporation techniques, processing the picked up nectar from the pollen of various flowers on nature [3]. It's is in use since long time both in medical and domestic needs, but recently its antioxidant property has come to limelight. It is rich in phenolic acids, flavonoids, ascorbic acid, carotenoid derivatives, organic acids, amino acids and proteins [4]. The dietary habit is changing day by day and the advice to take honey a day is a great saying to aid the nutritional well-being along with other food items with meal distribution patterns a day wisely [5]. Honey is the bees made sweet, thick, golden liquid food applying

natural regurgitation and evaporation process within bees Gastrointestinal Tract (GIT) and stomach treating their consumed nectar collected from different types of flower available on the God gifted nature. Mustard honey is the bees made sweet, thick, yellowish liquid monofloral honey applying natural regurgitation and evaporation process within bees GIT and stomach treating their consumed nectar collected from the pollen of respective flower on the nature having a distinctive color, flavor and taste because of the principal nectar sources. Litchi honey is the widely used honey originated from natural nectar collected from Litchi flower at the orchards. It's variable use due to its distinctive aroma, texture and flavor. Nigella honey is the bees made sweet, thick, black-diamond semiliquid monofloral honey applying natural regurgitation and evaporation process within bees GIT and stomach treating their consumed nectar collected from the pollen of nigella flower on the nature having a distinctive color, flavor, taste because of the principal nectar sources [6]. Honey contains a number of compounds and the antioxidant properties of honey are well

known [7-9]. The amount and type of these antioxidants are largely dependent on the floral source or honey variety, and a correlation between antioxidant activity with total phenolic content has been established [7, 9]. Honey represents a natural product devoid of harmful side effects. Among the compounds found in honey; vitamin C, phenolic substances showed antioxidant properties. In Islam, there is an entire Surah in the Qur'an called al-Nahl (the Bee). According to hadith, Prophet Muhammad (Sm.) strongly recommended honey for healing purposes [10]. The Qur'an promotes honey as a nutritious and healthy food. Below is the English translation of those specific verses. "And thy Lord taught the Bee to build its cells in hills, on trees, and in (men's) habitations; Then to eat of all the produce (of the earth), and find with skill the spacious paths of its Lord: there issues from within their bodies a drink of varying colors, wherein is healing for men: verily in this is a Sign for those who give thought" [11]. The objectives of the study are to comparative evaluation of the physical, chemical and antioxidant properties of Mustard, Litchi and Nigella honey.

2. METHODOLOGY

2.1. Place of Experiment and Sample Collection

The study was carried out at Food Technology and Nutritional Science (FTNS) laboratory of Mawlana Bhashani Science and Technology University (MBSTU), Santosh, Tangail, Biochemistry and Molecular Biology laboratory of Jahangirnagar University (JU) and Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhanmondi, Dhaka. The topic sample, Mustard (*Brassica alba*), Litchi (*Nephelium litchi* Cambess) and Nigella (*Nigella sativa*) honey (number of samples analyzed= 10 for each) by name was collected from different honey producing farm in Tangail, Bangladesh. The study was continued from the 2nd week of July 2013 to the 1st week of February 2014 based on the selected honey sample.

2.2. Physicochemical Quality Analysis

Estimation of moisture, protein, ash content, Carbohydrate, Energy, TEF and vitamin C were determined by AOAC method-2005 [12], The TSS of the samples was determined by a hand refractometer, Minerals and heavy metal content of sample were determined by Atomic Absorption Spectrophotometer (AAS) and Flame Emission Spectrophotometer, Na and K were determined by Flame Emission Spectrophotometer, The total polyphenol was determined applying the Folin-Ciocalteu's method, The total flavonoid was determined applying Aluminum chloride colorimetric assay method and Absorption Spectrophotometer was used to measure Calcium (Ca), Magnesium (Mg), Iron (Fe) and Lead (Pb) [12].

2.3. Data Analysis

Statistical mean, median, mode, standard deviation (SD) and range were determined using SPSS 16 programme. For linear, tabular, chart and graphical representation, Microsoft Word and Microsoft Excel were used in the respective arena.

3. RESULTS AND DISCUSSION

3.1. Nutrient Contents of Mustard, Litchi and Nigella Honey

Table 1 shows the nutrient contents of Mustard, Litchi and Nigella honeys. The mean moisture content in the investigated Mustard, Litchi and Nigella honey sample was 14.32%, 15.27% and 14.12% respectively contributing within the limit $\leq 20\%$ recommended by the international regulations [13]. The protein content of the Mustard honey was highest among the three samples. The ash content of the Mustard, Litchi and Nigella honey sample was almost same. Therefore, Nigella honey was in the best quality due to its low moisture, highest total carbohydrate, the Mustard honey was better and Litchi honey was in good quality.

3.2 Antioxidant Contents of Mustard, Litchi and Nigella Honey

Table 2 shows the Antioxidant contents of Mustard, Litchi and Nigella honeys. Among three samples Nigella honey contained highest amount of polyphenol and Litchi honey contained the lowest amount of polyphenol. Result showed that Nigella honey also contained highest amount of flavonoid among three samples. The result was similar to a previous study in which honey samples also contained high polyphenol and flavonoid content [14]. The vitamin C content were 0.41 mg/100ml, 0.63 mg/100ml and 0.7 mg/100ml for Mustard, Litchi and nigella honey respectively were detected, indicating that the observed honeys contribute a high antioxidant potential. Thus, the study revealed that Mustard, Litchi and Nigella honey were good sources of antioxidants and other nutrients. Therefore, Nigella honey was in the best quality due to its high polyphenol, flavonoid and vitamin C content.

3.3. Biochemical Analysis

Table 3 represents the biochemical analysis of Mustard, Litchi and Nigella honeys. The mean P^H content was 6.97, 5.8 and 4.78 for the Mustard, Litchi and Nigella honey respectively. The average pH of honey is 3.9, but can range from 3.4 to 6.1. Honey contains many kinds of acids, both organic and amino. However, the different types and their amounts vary considerably, depending on the type of honey [15, 16]. Among the three specimens Nigella and Litchi honey was expected pH. Mustard honey was contained slightly high P^H value. The P^H value was similar to those previously reported for other honey samples from India, Spain, Brazil, Malaysia and Turkey [17, 18].

3.4. Minerals and Heavy Metal Analysis

Table 4 shows the Minerals and heavy metal analysis of Mustard, Litchi and Nigella honeys. The Na and K content of investigated Mustard honey were measured 539.238 ppm and 239.216 ppm respectively as well as the Ca, Mg, Fe and Pb content were measured. 1710.499 ppm, 267.799 ppm, 63.70 ppm and BDL (Bellow Detection Limit) respectively. The Na and K content of investigated Litchi honey were

measured 424.3565 ppm and 219.017 ppm respectively. The Na and K content of investigated Nigella honey were measured 558 ppm and 1063.774 ppm respectively. Among three honey samples Nigella honey contained highest amount of lead (Pb) and Mustard honey contained lowest amount of lead (Pb) and the acceptable blood Pb level for adults is 10 µg/dl [19].

4. CONCLUSION

The present study concluded that three honey sample showed the good physicochemical potentials, pointing the low moisture content, pH, high TSS, the lowest protein, ash, mineral contents as well as the outstanding antioxidant potentials, pointing the high polyphenols, flavonoids and vitamin C contents. On the basis of employed analytical methods, among three specimens of honey samples Nigella honey contains lowest moisture, p^H content than that of Mustard and Litchi honey. Investigated honey samples rich in antioxidant compounds promising pharmacological agent for preventing cancer. The antioxidant potential, such as polyphenol, flavonoid and vitamin C were highest in Nigella honey than the others two specimens. The ash and mineral were highest in Mustard honey than the others two specimens. Under the circumstances stated above, there was no confusion of Nigella honey being the best, Mustard the better as well as Litchi honey the good according to CAC given honey quality parameters.

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Table 1 Nutrient contents of Mustard, Litchi and Nigella honeys

Nutrient contents	Mustard honey	Litchi	Nigella
	(%)	honey (%)	honey (%)
Moisture	14.32	15.27	14.12
Protein	1.103	0.57	0.985
Ash	0.2	0.19	0.188
TSS	71	70	73
Total carbohydrate	84.377	83.97	84.496

Table 2 Antioxidant contents of Mustard, Litchi and Nigella honeys

Types of honey	Polyphenol (mg gallic acid/50 ml)	Flavonoid (mg catechin acid/50 ml)	Vitamin C (mg/100 ml)
Mustard	42.572 ± 0.00529	1.052 ± 0.000577	0.41
Litchi	30.625 ± 0.00529	0.6 ± 0.000577	0.63
Nigella	95.5 ± 0.00529	2.66 ± 0.000577	0.7

Table 3 Biochemical analysis of Mustard, Litchi and Nigella honeys

Types of honey	P ^H value
Mustard	6.97
Litchi	5.8
Nigella	4.78

Table 4 Minerals and heavy metal analysis of Mustard, Litchi and Nigella honeys

Types of honey	Major minerals (ppm)				Essential	Others
					minerals (ppm)	(ppm)
	Na	K	Ca	Mg	Fe	Pb
Mustard	539.238	239.216	1710.499	267.799	63.70	0.1
Litchi	424.3565	219.017	611.4852	143.066	251.1102	1.8
Nigella	588	1063.774	75.4	58.8471	344.2112	5.6