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# Study on the Physicochemical and Antioxidant Properties of Nigella Honey

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**Abstract:** Honey is a remarkable complex natural liquid and rich in phenolic compounds, which act as natural antioxidants and are becoming increasingly popular because of their potential role in contributing to human health. The intent of the current study was to characterize the physical, chemical, biochemical and antioxidant properties of the Nigella honey sample. The physicochemical glimpse, such as moisture, pH, Total Soluble Solid (TSS), protein, ash, total carbohydrate, energy, Thermal Effect of Food (TEF), minerals and heavy metal content were measured applying various laboratory and mathematical techniques. Several biochemical and antioxidant tests were done to determine the antioxidant properties of Nigella honey sample. The mean moisture content was  $14.331 \pm 0.377$  %, pH content was 4.78, Total Soluble Solid (TSS) content was 73 %, protein content was 0.985 %, mean ash content was  $0.188 \pm 0.071$  %, total carbohydrate content was 84.496 %, energy content was 350.4721 Kcal/100 g, Thermal Effect of Food (TEF) content was 35.05 Kcal/100 g and the minerals and heavy metal content named Na, K, Ca, Mg, Fe and Pb were 558 ppm, 1063.774 ppm, 75.4 ppm, 58.8471 ppm, 344.2112 ppm and 5.6 ppm respectively. The antioxidant glimpse, such as polyphenol content was  $95.5 \pm 0.0052$  mg Gallic acid/ 50 ml, flavonoid content was  $2.66 \pm 0.000577$  mg catechin/ 50 ml and vitamin C content was 0.69mg/100ml, were detected, indicating that Nigella honey contributes a high antioxidant potential. Thus, the study revealed that Nigella honey is a good source of antioxidants.

**Keywords:** Nigella Honey, Antioxidant, Heavy Metal, Phenolic Compounds

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## 1. Introduction

Honey is a sweet and flavorful product that has been consumed over the years for its high nutritional values and beneficial effects on human health. The chemical composition of honey is complex, containing approximately 181 substances including sugars, proteins, moisture, vitamins, minerals, 5-hydroxymethylfurfural (HMF), enzymes, flavonoids, phenolic acids and volatile compounds [1]. The main constituents of honey are moisture, glucose, fructose, sucrose, minerals and proteins [2–5]. Composition of honey is rather variable and primarily depends on the floral source; however, certain external factors also play a role, such as seasonal and environmental factors and processing steps and conditions [6]. It is in use since long time both in medical and domestic needs, but recently its antioxidant property has come to limelight. With raising demand for antioxidant in the

food, honey is becoming the trendy source of antioxidant since it is rich in phenolic acids, flavonoids and other antioxidants including glucose oxidase, catalase, ascorbic acid, carotenoid derivatives, organic acids, amino acids and proteins [7]. Honey contains a number of compounds and the antioxidant properties of honey are well known. The antioxidant properties of honey are derived from both enzymatic (e.g., catalase, glucose oxidase and peroxidase) and nonenzymatic substances (e.g., ascorbic acid,  $\alpha$ -tocopherol, carotenoids, amino acids, proteins, Maillard reaction products, flavonoids and phenolic acids) [8–10]. 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 [8, 10]. 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 [11]. 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 [6]. It has been shown in several studies that the antioxidant potential of honey is strongly correlated with the concentration of total phenolics present [12-15]. Furthermore, it has been reported that the antioxidant activity is also strongly correlated with the color of the honey, where dark colored honey has been reported to have a higher total phenolic content and consequently higher antioxidant capacities [13, 14]. There are more than 150 polyphenolic compounds that have been reported, including phenolic acids, flavonoids, flavonols, catechins and cinnamic acid derivatives [16]. 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. 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" [17]. As the honey has a potentiality to act as an antioxidant the objectives of the study were to evaluate the physicochemical and antioxidant properties of 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, Nigella honey (*Nigella sativa*) by name was collected from Afsar Ali, Tangail district unit Bangladesh Apiculturist Welfare Association (BAWA) president and also a renowned honey cultivator at Sagardighi of Ghatail upazila in Tangail. The study was continued from the 2<sup>nd</sup> week of July 2013 to the 1<sup>st</sup> 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 [18], 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, Absorption Spectrophotometer was used to measure Calcium (Ca), Magnesium (Mg), Iron (Fe) and Lead (Pb) [18].

### 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

The analysis of the physicochemical and antioxidant properties of nigella honey was done according to the framework discussed earlier and from the results gained the following discussion can be sketched.

### 3.1. Nutrient Contents of Nigella Honey

Table 1 shows the nutrient contents of Nigella honey and fresh Nigella honey was analyzed for moisture, protein, ash, total carbohydrate and the TSS contents. The results were represented Nigella honey contained 14.331±0.377 percentage moisture, 0.985±0.051 percentage protein, 0.188±0.071 percentage ash, 84.49 percentage total carbohydrate and 73 percentage TSS. The mean total moisture content of Nigella honey sample was 14.331 % contributing within the limit ≤20% recommended by the international quality regulations [19]. The investigated Nigella honey sample was of good quality, as indicated by the low moisture content. The Nigella honey showed to have high TSS content. The honey contributes an ample of sugar concentration suspended on the natural honey solution and represents the strength of the solution. Low protein content is desired for crisp, tender products eg. snacks whereas the high protein content desired to get product with chewy texture. The ash is the measure of the total mineral content of selected honey sample was in ample amount. It's the essential component of food in care of catalyst over various body functioning reactions to sustain sound health. There was high amount of available carbohydrate (84.75 %) in the respective honey sample. Available carbohydrate is the premier fuel to fuel alcohol formation in fermentation process [20].

*Table 1. Nutrient contents of Nigella honey*

Nutrient contents	Amounts ( Percentage )
Moisture	14.331±0.377
protein	0.985±0.051
Ash	0.188±0.071
Total Carbohydrate	84.496
TSS	73

### 3.2. Minerals and Heavy Metal Analysis

From the analysis of the selected specimen, the measured minerals and heavy metal contents were presented in Table 2.

The analysis showed the composition of major minerals Na 558 ppm, K 1063.774 ppm, Ca 75.4 ppm, Mg 58.8471 ppm, essential mineral Fe 344.2112 ppm and heavy metal Pb 5.6 ppm. The lower amount Na and K content measured in Nigella honey and they help in the smooth continuation of ETS system in the body. The Ca, Mg, Fe and Pb content of Nigella sample were measured low in concentration and they are growth enhancer of the body and heavy metal Pb is detrimental for health if exceeds acceptable range in the sample taken.

**Table 2.** Minerals and heavy metal contents of Nigella honey.

Major minerals	Amounts (ppm)	Essential mineral	Amount (ppm)	Heavy metal	Amount (ppm)
Na	558	Fe	344.2112	Pb	5.6
K	1063.774				
Ca	75.4				
Mg	58.8471				

### 3.3. Biochemical Analysis

From the analysis of the selected specimen the pH content of Nigella honey was obtained 4.78 at 27°C room temperature.

### 3.4. Energy Boosting Analysis

The energy content and the TEF content were analyzed applying laboratory plus mathematical techniques. From the investigation, the dietary energy content was found 350.4721 Kcal/100 g and the TEF content was 35.05 Kcal/100 g, indicating the Nigella honey was the prime energy booster for health consumption.

### 3.5. Antioxidant Analysis

The antioxidant contents were analyzed applying laboratory plus statistical techniques. The results were presented in Table 3. From the analysis, the phenolic content was in Nigella honey sample 95.5 mg gallic acid/ 50 ml, flavonoid content was 2.66 mg catechin/ 50 ml and the vitamin C content was 0.69mg/100ml. There was high phenolic acid content found only 4.5 mg gallic acid/ 50 ml lesser than that of 100 mg gallic acid/ 50 ml found in Nigella honey. The concentration and the type of polyphenolic substances in honey are variable and are reported to be dependent on the floral origin of honey samples. The high mean total phenolic content in Nigella honey indicates the Bangladeshi honeys are in good antioxidant properties. The darker colored honey is the phenolic compounds booster than that of light colored honey [21]. The antioxidant activity of natural honeys depends largely on their chemical composition, such as phenolics, enzymes, organic acids, amino acids and Millard reaction products [22]. The flavonoids are low molecular weight phenolic compounds to lead the vital factor for aroma and antioxidant properties of honey. The antioxidant activities of natural honeys mostly rely on their chemical composition, i.e., flavonoids, organic acids, carotenoids as well as their source of origin [23]

**Table 3.** Antioxidant contents of Nigella honey.

Parameter	Amount
Polyphenol	95.5 ± 0.00529 mg gallic acid/ 50 ml
Flavonoid	2.66 ± 0.000577 mg catechin/ 50 ml
Vitamin C	0.69mg/100ml

## 4. Conclusion

The study investigates the positive presence of Nigella honey showing the first-class physicochemical potentials, pointing the low moisture content, pH, high TSS, the lowest protein, ash, minerals and heavy metal content as well as the first-class antioxidant potentials, pointing the high polyphenols, flavonoids and vitamin C content.

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