# DETERMINATION OF PROXIMATE COMPOSITION, ANTIOXIDANT ACTIVITY, VITAMIN C, TOTAL PHENOLIC AND FLAVONOID CONTENT OF BANANA BLOSSOM POWDER FOR OPTIMIZATION OF ITS USE

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***Abstract:***
*Banana blossom is a by-product of banana farming. The banana blossom is huge and grows at the end of the banana bunch. It can be utilized as vegetables and powder or flour which is incorporated in the formulation of bakery products. The goal of this study is to find out the proximate composition, antioxidant activity, vitamin C, total phenolic and flavonoid content of banana blossoms powder for optimization of its use. Banana blossom powder was prepared by drying banana blossom slices at 60°C for 12 hrs in a tray drier. Nutritional composition, antioxidant activity, total flavonoid, and phenolic content of powder were studied according to standard methods. Among the nutritional composition carbohydrate content was highest (95.92%). This powder is a good source of dietary fiber (12.61%) as well as vitamin C content (5.64mg/ 100gm). The results obtained signify the potential of banana blossom powder as a source of natural antioxidants including phenols (7.17mg/100 gm) and flavonoids (4.27 mg/100 gm). DPPH free radical scavenging assay indicated average antioxidant activity was 90.69%.The Banana blossom can be utilized in diets as vegetables and dehydrated powder or flour which is easily included in food formulations due to its excellent nutritional qualities. Optimization of its use is beneficial in terms of nutritional and economical points of view. So, the use of banana blossom in diet and food formulation is recommended.*

**Keywords:** Banana blossom, Flour, Powder, Nutritional composition, Antioxidant activity, Dietary fiber

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## 1. INTRODUCTION

The banana plant (Musa sp.) is a big, perennial monocotyledonous herb belonging to the genus Musa in the Musaceae family. In Bangladesh, the banana (*Musa acuminata*) is the fourth most significant fruit crop based on the consumption pattern (Islam and Hoque, 2005). Bananas are the most popular food after rice, wheat, and maize. Bananas are farmed in over 150 countries; yielding 105 million tons of fruit every year (Krishnan and Sinija, 2016).Bananas planted for domestic consumption are typically grown conventionally. In terms of banana output, Bangladesh is ranked 30th in the world (FAO, 2020). Bogura, Narsingdi, Rangpur, Natore, Pabna, Noakhali, Faridpur, Khulna, Rangamati, Khagrachari, and Bandarban are the districts in Bangladesh with the most banana plantations.

Banana blossom is regarded as a by-product or sometimes a waste material of banana farming. The banana blossom is huge and grows at the end part of the bunch. It blooms in a dark purple red color. Bananas would grow from the little blossoms. It is a vegetable that can be incorporated into one's diet. Outside of the mature blossom, there is a hard husk. It is also used as an ingredient for preparing noodles and soup. It's sometimes served as a salad also. Banana blossoms are consumed in raw form in some parts of the world. The blossom of the banana has exceptional therapeutic capabilities that aid in the prevention of anemia, diabetes, obesity, and a variety of other ailments(Ragab et al., 2016). It has a very beneficial nutrient profile. Banana blossom is high in minerals like phosphorus, calcium, potassium, copper, magnesium, and iron, which are necessary for a variety of bodily functions (Emaga et al.,

2007). Literature indicated that it appears to be extremely successful at treating infections in a natural manner (Kumar et al., 2012). Ethanol is present in banana flower extract, which inhibits the growth of pathogenic microorganisms (Ahmad et al., 2015). The iron content of banana blossoms can help with anemia symptoms like weariness, irregular heartbeat, and a pale complexion (Kumar et al., 2012). Banana blossom has an anti-spoilage effect on food products and fibers extracted from it are used for decorative purposes (Acharya et al., 2019). It has a starchy flavor and is also claimed high in vitamin-C content. The effects of fiber and antioxidants on the human body are significant. Fiber aids in the maintenance of our body structure, the reduction of cholesterol, and the prevention of obesity. Antioxidants aid in the protection of the immune system against a variety of diseases (Sharma et al., 2019).Considering all these factors the goal of this study is to find out the proximate composition, antioxidant activity, vitamin C, total phenolic and, flavonoid content of banana blossoms powder.

## 2. MATERIALS AND METHODS

### 2.1 Banana Blossom Sample

*Musa acuminata* (banana) trees flower used in this study were obtained from the local area at Tangail district, Bangladesh. Banana blossoms were collected from the local gardens of the Santosh area. Common maturity characteristics (size, shape, and color) were observed in matured uniform samples without any bruising or deformities. Firstly, sorted the blossom then removed soil and dirt by cleaningit with distilled water, and stayed sometime on clear tissue paper to reduce extra water. The banana flower is then cut into even, small pieces and thendried at 60°C for 12 hours in a tray drier. The sample pieces were ground in a grinder, and thenpassed through a 200µm size mesh. The powder or flour was stored in an airtight plastic box for the next analysis.

### 2.2 Chemical and Reagents

The necessary chemicals used in the present study include Sodium hydroxide, sulfuric acid, hydrochloric acid, copper sulfate, methyl-red, potassium sulfate, boric acid, petroleum ether, anthrone reagent, dextrose, methanol, ethanol, ascorbic acid, metaphosphoric acid, sodium bicarbonate, glacial acetic acid,2,6-dichlorophenol indophenols, sodium bicarbonate,2,2-diphenyl-1-picrylhydrazyl (DPPH), meta-phosphoric acid, diisopropyl-fluorophosphate, sodium nitrite, aluminum chloride were analytical grade. Chemicals were collected from Moon scientific, Dhaka, Bangladesh, and Sigma Aldrich, Germany. Soxhlet apparatus, Kjeldahl apparatus, UV spectrophotometer, muffle furnace, centrifuge machine, grinder, electric water bath, oven, micropipettes, etc were used as major apparatus.

### 2.3 Proximate Analysis of Banana Blossom Powder

The nutritional composition (moisture, carbohydrate, protein, fat, dietary fiber, and ash) of banana blossom powderwas determined using standard procedures provided by the AOAC (1995).The powder sample was dried at 100°C in an oven until reached a constant weight; moisture content was determined using gravimetric measurements of weight loss. The protein content was measured using the Kjeldahl technique (Kjeldahl, 1883),and the crude protein content was estimated by converting the total nitrogen content and the conversion factor was 6.25.The Soxhlet extraction method was used to examine crude fat. The amount of ash in the sample was determined by using a muffle furnace at 600°C until a consistent weight was attained. The crude fiber was estimated according to the AOAC method (1995).The carbohydrate content was calculated using the difference method.

**2.4 Preparation of Banana Blossom Extracts (BBE)**The extracts of banana blossoms were made with one distinct solvent: ethanol. The following procedure was used to make ethanol extracts of blossom: 50gm of banana blossom was agitated in the solvent medium (ethanol) for 6 hours in a shaker. After shaking filtered the ethanol extracts by Whatman filter paper

No 5. After filtration, the residues were dried overnight and again filtered the extracts using the sametype filter paper. The obtained extract was kept at -4°C in amber-colored airtight containers until its next analysis.

**2.5 Antioxidant Activity of BBE**

The DPPH radical scavenging activity was determined using a modified version of the Yen and Chen (1995) approach. The produced ethanolic extracts of samples were employedin the free radical scavenging test. Extracts were taken at concentrations of 0.1, 0.2, and 0.3 ml, and each test tube received 6 ml of 0.004% DPPH in 80%$CH_3OH$ (methanol). Then the test tubes were placed for incubation in a dark environment for 15 minutes at room temperature (25°C). At 515 nm, the absorbance was taken against a blank. Then the following equation was used -

$$\times 100$$

Where A = absorbance of pure DPPH in oxidized form and B = absorbance of the sample taken after 15 minutes of reaction with DPPH

**2.6 Estimation of Total Phenol Content**

The Folin-Ciocalteau colorimetric technique was applied to measure the total phenol concentration of extracts (Singleton et al., 1999). The Folin-Ciocalteau reagent (1 ml) and 1 ml of 7.5% sodium carbonate were combined with extract solution (3 ml). The absorbance was measured against water at 760 nm (UV-Spectrophotometer) after 1.5 hours of incubation at room temperature. The standard curve was formed with gallic acid, and the results were represented as mg of gallic acid equivalents per 100 gm of extract. Estimation was performed using the following equation -

$$C = x \times vm$$

Where, C = Total phenolic content, x = Concentration of gallic acid obtained from calibration curve in mg/ml, v = Volume of extract in ml, m = Mass of extract in grams

**2.7 Estimation of Vitamin C Content**

The concentration or amount of vitaminC content was analyzed with the help of titration. A standardized solution of 3% meta-phosphoric acid is used in this process. The titration process was held against 2,6-dichlorophenol indophenol solution to get the pink color at the endpoint. The endpoint of the titration process appears when a slightly extra solution of indophenol dye is included in the solution of ascorbic acid or sample. Its stay is about for a few seconds (Majumdar and Majumder, 2003).

**2.8 Estimation of Flavonoid Concentration**

The flavonoid concentration was determined using a colorimetric technique (Kim et al., 2003). At first, 1 ml diisopropyl-fluorophosphate extract was mixed with 4 ml distilled water. Then, add a 0.3 ml solution of 5% sodium nitrite, followed by a 10% aluminum chloride solution (0.3 ml). After 5 minutes of incubation at room temperature, 2 ml of 1 M NaOH were added to the mixture. The volume of the reaction mixture was immediately filled up to 10 ml with distilled water. The mixture was then vortex. The absorbance of the pink color obtained was measured at 510 nm. A calibration curve was created with catechin and the results were represented as mg Catechin Equivalents (CEQ) per 100 gm sample.

**2.9 Statistical Analysis**

For statistical analysis, IBM SPSS version 21.0 was applied. For each analysis triplicate tests were performed. The obtained data were presented as mean ± standard deviations.

## 3. RESULTS AND DISCUSSION

The nutritional composition analysis of banana blossompowder is summarized in Table 1. The proximate composition analysis gives knowledge on the agricultural waste's basic chemical composition. The composition includes fat, protein, ash, carbohydrate, moisture, and crude fiber. These elements are essential in determining the nutritional quality of the food under investigation. The samples had moisture content (87.84%), which was substantially lower than what had been reported 90.1% in the pova an variety and 90.23% in month an variety in the literature by Krishnan and Sinija (2016).High moisture

content food items are subjected to increased microbial decomposition, degradation, and short shelf life (Tressler et al., 1980; Adepoju and Onasanya, 2008).The dry matter content of fresh fruit is proportional to its moisture content (Warner, 1981).A product's free fatty lipids are determined by crude fat. This parameter can be used to calculate processing temperatures and auto-oxidation, which can result in rancidity (affect the flavor of food).The fat content of banana blossom powder samples was very low (0.5%), which will extend the storage life by reducing the chances of rancid flavor development. However, the banana tree waste may not be a good source of fat-soluble vitamins or may not contribute considerably to the calorie value of food that may be made with it. The amount of ash in a product can be used to determine its quality. The ash (1.37%) readings indicated that the banana blossom powder contains minerals (particularly macro-minerals).The ash content of the samples was nearly identical to that of Musa varieties reported by Adebowale and Bayer (2002).The quantity of cellulose, hemicellulose and lignin in food is measured by crude fiber. Hemicellulose is made up of hetero-polymers of polysaccharides, while lignin is made up of polymers of phenolic acids (Zakpaa et al., 2010). The crude fiber content of the banana blossom powder was high (12.61%), comparable to that of some plant products such as apple fruit pulp, African star variety (*Chrysophyllum albidum*) which contain 4.3gm/100gm fiber (Adepoju and Ketiku, 2003). The high fiber content in food and diet has been shown to promote the elimination of carcinogens, possible bile acids, mutagens, xenobiotics and steroids by absorbing or binding to dietary fiber components and being promptly excreted, resulting in health benefits for both non-ruminants as well as ruminants (Ayoola and Adeyeye, 2009).The carbohydrate content of the sample was high (95.92%), suggesting that it could be an excellent source of energy. The protein content was found at 1.42% and it is an essential component of human diets, and their primary role in nutrition is to provide enough amounts of vital amino acids. Growth retardation, muscular atrophy, edema, abnormal belly bloating, and fluid accumulation in the body are all symptoms of protein inadequacy (Mounts, 2000).

**Table 1: Proximate composition of banana blossom powder**

| Parameters | Percentage composition (%) |
|---|---|
| Protein | 1.42 ± 0.02 |
| Fat | 0.5 ± 0.1 |
| Ash | 1.37 ± 0.03 |
| Carbohydrate | 95.92 ± 0.87 |
| Moisture | 87.84 ± 0.68 |
| Crude Fiber | 12.61 ± 0.47 |

*Values are expressed as Mean ± SD.

DPPH is normally used to evaluate antioxidant activity. The reduction capability of the DPPH radical is measured by the reduction in its absorbance at 515nm, induced by antioxidants. The decrease in absorbance of DPPH radical is affected by antioxidants, because the reaction between antioxidant molecules and radicals, progresses, which results in the scavenging of the radical by hydrogen donation. Figure 1 demonstrated the antioxidant activity of banana blossom in comparison with different concentrations of DPPH solutions, which is indicating average antioxidant activity (90.69%).

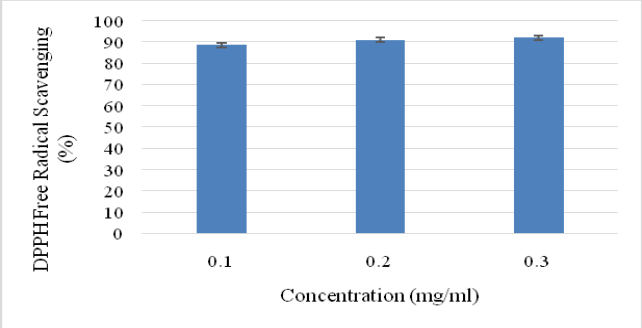


**Figure 1: DPPH radical scavenging activity under different concentrations in banana blossom extracts using ethanol**

The flavonoids content of the banana blossom was high (4.27mg/100gm), which was comparable to the flavonoids content of

plantain root (*Musa paradisiaca*) which was 1.34mg/100gm (Ayoola, 2011). The presence of flavonoids suggests that the banana blossom has some biological activity and functions such as give protection against free radicals, allergies, microbes, viruses, inflammation, platelet aggregation, ulcers, and, hepatotoxins, as well as protection against various stages of carcinogenesis and has anticancer activity (Farquar, 1996; Okwu, 2004; Abigail et al., 2012).

**Table 2: Quantitative estimates of vitamin-C, total phenolic and flavonoid content of banana blossom**

| Constituents | Amount (mg/100gm) |
|---|---|
| Total Phenolic Content (mg/100 gm) | 7.17±0.28 |
| Vitamin-C (mg/ 100gm) | 5.64±0.16 |
| Total Flavonoid Content (mg/ 100gm) | 4.27±0.12 |

*Values are expressed as Mean±SD,

The results showed that phenolic compounds present in the banana blossom indicate it may contain an antibacterial agent that is useful in the treatment of bacterial diseases and typhoid fever (Ofokansi et al., 2005), as well as the treatment of the navel and placenta of newborn babies (Ofokansi et al., 2005). Vitamin C content was determined to be 5.64 mg/100 gm, which was lower than *Brassica oleracea* leaves (23.43 mg/ 100 gm) powder (Emebu and Anyika, 2011). Vitamin C is beneficial to the bronchia, lungs, gums, teeth, blood purification, joints, and bones. It reduces the severity of inflammatory illnesses like rheumatoid arthritis, osteoarthritis, and asthma (Cohen et al., 2000) and can thus be used in herbal therapy to treat the common seasonal cold, flu, prostate cancer, and some other diseases (Okwu, 2004).

## 4. CONCLUSION

The proximate composition, vitamin C, antioxidant, total flavonoid, and phenolic content of banana blossom powder have been examined in this study. Banana blossom is considered a by-product of banana cultivation. This study was based on *Musa acuminata*, one of the most popular and widely available wild species in Bangladesh. Among the nutritional composition carbohydrate content was highest (95.92%). This powderis a good source of crude fiber (12.61%). The results obtained signify the potential of banana blossom as a source of natural antioxidants including vitamin C content (5.64 mg/100 gm), phenols (7.17 mg/100 gm) and flavonoids (4.27 mg/100 gm). Banana blossom can be utilized in diets as vegetable and dehydrated flour or powder which is easily included in food formulations due to its excellent nutritional qualities. Optimization of its use is beneficial in terms of nutritional and economical points of view. So, the use of banana blossom powder is recommended.

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