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EVALUTION OF PHYSIOCHEMICAL, NUTRITIONAL PROFILE AND ANTIOXIDANT POTENTIAL OF FRESH – BANANA PULP EXTRACT

Kokila Sivasangarn. Priyanga,T. and Anuradha, R*
PG and Research Department of Biochemistry,
Sengamala Thayaar Educational Trust Women's College (Autonomous), Sundarakkottai,
Mannargudi-614 016, Thiruvavur Dt.,Tamil Nadu, India.

ABSTRACT

The present study was performed to determine the phytochemical analysis and antioxidant activity of *Musa balbisiana colla*. The antioxidant activity was analysed in fresh-Banana extraction juice methods. The fresh-Banana extraction juice were evaluated for antioxidant assay using 1,1- diphenyl-2-picrl-hydrazyl (DPPH). These tests depicted that the fresh-Banana extraction juice possess highestscavenging activity across all the assays. From all the parts analysed the fresh- Banana extraction juice exhibited highest antioxidant activity. The *Musa balbisiana* fresh-Banana extraction juice were evaluated for qualitative tests and proximate analysis and it was found that *Musa balbisiana* fresh-Banana extraction juice contains high amount of protein, carbohydrate, energy, micronutrients and fiber. Hence, the fresh-Banana extraction juice demonstrated compositional, functional, and nutritional properties, and the fact that these formulas are inexpensive, easily accessible, and nutritious may make them effective in addressing some of the nutrition problems that infants and children face. As a result, they were discovered to be potentially suitable for use as weaning foods, both at home and in the commercial setting.

Keywords: Antioxidant, Nutrient rich, *Musa balbisiana colla*, fresh-Banana pulp extraction.

INTRODUCTION

The human body encounters free radicals every day in daily life through over-exposure to sun, toxins in food, carcinogens present in our environment, polluted air and water, car fumes, and even stress can create free radicals [1]. Our body is always in a constant attack by free radicals or highly reactive atoms or species and as a result the chain reaction starts in the cell which causes damage to proteins, DNA and RNA leading to a number of degenerative conditions [2]. Antioxidants are substances which have the capacity to remove free radicals, inhibit oxidation processes and prevent the development of diseases such as cancer, heart disease, stroke, diabetes, cataracts, rheumatoid arthritis, Alzheimer's disease, and premature aging [3, 4]. Plant materials have potential

antioxidant and antibacterial properties. The natural antioxidants from plants could reduce cellular oxidative damage not only in foods but also in the human body.

Musa balbisiana Colla belonging to the family *Musaceae* is a widespread species and available in South Asia, Southeast Asia, and Southern China. The plant is a fast growing herbaceous habit that grows upto 15–20 feet, and produces flowers and fruits only once a life. *M. balbisiana* is popular among different communities of India and its inflorescence is eaten as vegetable by the folk people of this region. India is the largest producer of banana contributing 20% of world's banana production [5]. In NE India, an aqueous extract called Kolakhar prepared from the ash obtained by burning the different parts of dried banana plant is used as popular food additives. It is used by folk people of Tamilnadu region of India to prevent bacterial attack on freshly cut injuries, normalizing digestive disorder of stomach and also used as soap and detergents for washing cloth and shampooing hair [6]. The ripe fruits are nutritious, used as baby food and are good sources of vitamin C, potassium, riboflavin and pyridoxine [7]. *Musa balbisiana* root extract has antidiabetic and antilipidemic property [8]. *Musa balbisiana* inflorescence extract had been reported to have antibacterial activities [9]. Water extract of banana inflorescence is taken orally as a remedy for diabetes, bloody dysentery, and is also used in case of rheumatism and headache [10, 11]. Recently, Tin *et al.* [12] also isolated and reported triterpenes from *Musa balbisiana* inflorescence and this may be a potential source of high value phytochemicals for nutraceutical, pharmacological and food additive applications. The present study was undertaken to investigate the proximate and mineral compositions, and antioxidant activity of *Musa balbisiana* inflorescence collected from Mannargudi, Tamilnadu, India.

Materials and Methods

Collection of samples

Bulk amount of samples were obtained from local markets of Mannargudi,Tamilnadu. The banana was selected at first and different parts like fruit, collected for the further studies.

Preparation of extract fresh banana juice

The fruit was cut and the seeds were taken out and cleaned. The fruit was cut into small pieces then grounded to fine paste using mixer grinder. Further the paste was mixed with *Cynodon dactylon* and after some time the paste were then filteredusing Whatman No 1 filter paper.

Preliminary Phytochemical Screening

Phytochemcial screening (quantitative and qualitative) method for plant analysis. 150 ml of each solvent was used to extract the banana extract fresh juice separately and the presence of the phytochemicals: alkaloids, saponins, flavonoids, phenol, steroids, glycosides and tannins were tested. The phytochemicals present wereestimated quantitatively.

Quantitative Phytochemical analysis

The phytochemicals which are present in the extracts of *Musa balbisiana* were determined and quantified by standard procedures.

Determination of total flavonoids

The technique is based on the development of a complex between flavonoids and aluminum, which exhibits a maximum absorptivity at 415 nm. A drop of acetic acid and 100 l of the plant extracts in methanol (10 mg/ml) were combined with 100 l of 20% aluminum tri chloride in methanol. Then, methanol was used to dilute the mixture to 5 ml. After 40 minutes, the absorbance at 415 nm was read. 100 ml of plant extracts, one drop of acetic acid, and 5 ml of methanol were used to create the blank samples. Under the same circumstances, the absorption of a standard rutin solution (0.5 mg/ml) in methanol was determined. All determinations were carried out in triplicates [13].

Determination of total alkaloids

Total alkaloids were calculated by weighing 5 g of the sample into a 250 ml beaker, adding 200 ml of 10% acetic acid in ethanol, covering the container, and letting the mixture rest for 4 hours. This was filtered, and the extract was then concentrated to a fourth of its original volume in a water bath. Until the precipitation was finished, concentrated ammonium hydroxide was added dropwise to the extract. After allowing the whole solution to settle, the precipitated 28 was collected, cleaned with diluted ammonium hydroxide, and then filtered. The alkaloid, which was dried and weighed, is the residual [14].

Determination of Tannins

The Folin-Ciocalteu technique was used to determine the tannin content. A volumetric flask (10 ml) containing 7.5 ml of distilled water, 0.5 ml of Folin-Ciocalteu reagent, 1 ml of 35% Na2CO3 solution, and 10 ml of distilled water was filled with the sample extract in an amount of around 0.1 ml. After thoroughly shaking, the mixture was left at room temperature for 30 minutes. In the same way as previously stated, a series of reference standard solutions of gallic acid (20, 40, 60, 80, and 100 g/ml) were created. Using a UV/Visible spectrophotometer, absorbance for test and standard solutions was measured against the blank at 725 nm. The tannin concentration was calculated as 12.1 mg of tannin per milligram of extract [15].

Determination of total Phenols

Total phenol content in the extracts was estimated using the Folin-Ciocalteu assay method. The reaction mixture consisting of 1 ml of extract and 9 ml of distilled water was taken in a volumetric flask (25 ml). One ml of Folin-Ciocalteu phenol reagent was added to the mixture and shaken well. After 5 minutes 10 ml of 7 % Sodium carbonate (Na2CO3) solution was added to the mixture. A 25 ml volume was created. In the same way, as previously described, a series of standard solutions of gallic acid (20, 40, 40, 60, 80, and 100 g/ml) were created. Incubated for 90 minutes at room temperature and the absorbance for test and standard solutions were

determined against the reagent blank at 550 nm with an Ultraviolet (UV) /Visible spectrophotometer. Total phenol content was expressed in mg of 8.8µg/mg of extract [16].

Determination of proximate composition

The Association of Official Analytical Chemists method [17] was used for the evaluation of moisture, ash, crude fat, crude protein and crude fibre. Crude fat was estimated by extracting with petroleum ether using a Soxhlet apparatus. Crude protein was determined by the Kjeldhal method. Total protein was calculated by multiplying the evaluated nitrogen by a protein conversion factor of 6.25. Total carbohydrate was determined by the difference method [18]. The calorific value in kcal/100 g of the sample was calculated [19] on the basis of data of proximate analysis.

Determination of minerals

Minerals were determined using Atomic Absorption Spectrometer (AAS-ICE 3500, Thermo Scientific, UK) at Sophisticated Analytical Instrumentation Centre (SAIC), Tezpur University. The oven dried sample (0.5 g) was heated with a silica crucible to ash in a Muffle furnace at 500oC for 2 h. It was digested repetitively with concentrated HNO3 till it becomes colorless, then dissolved in distilled water, and filtered with Whatman no. 1 filter paper. The volume was made upto 50 mL with distilled water in a volumetric flask and was taken for metal analyses. Results obtained were converted to mg/100 g of dried sample.

Determination of antioxidant properties

Antioxidant property with DPPH assays, TPC with Folin-Ciocalteu's reagent and TFC of MBI methanol extract were determined using an UV–VIS spectrophotometer (Perkin Elmer, Lambda 35) following previously reported procedures [20].

Statistical analysis

All the experiments were carried out in triplicates and the results were expressed as mean ± standard deviation calculated using MS Excel.

Results and Discussion

Qualitative and Quantitative Phytochemical Screening Result

From Table 1 generally, water extract fared better with respect to amount ofphytochemicals found in it except for Cardiac glycoside where it was notablyabsent. The presence of virtually all the phytochemicals in the water extract connotes that water could be used as the main solvent for the extraction of the metabolites for pharmaceutical purposes. Table 2 showed that the banana extract fresh juice contains phytochemicals in relative abundance with percentage comparative measure following the trend Tannin> Alkaloids> Flavonoids> Saponins> Cardiac glycosides while weight by weight comparison shows that Phenol> Haemaglutinin> Phytate> Oxalate. Phytochemicalsare known to occur in banana extract fresh juice of plants with diverse functions which include provision of strength to plants, attraction of insects for pollination and feeding, defence against predators, provision of colour, while some are simply waste products [21].

Table 1: Qualitative analysis of *Musa balbisiana colla*

S.No.	Phytochemical	Extract
1	Alkaloid	+
2	Cardiac glycoside	+
3	Flavonoid	+
4	Phenol	+
5	Protein	+
6	Saponin	+
7	Steroid	+
8	Tannin	+
9	Terpenoid	+

+Pesence; -Absence

Table 2: Qualitative analysis of *Musa balbisiana colla*

S.No.	Phytochemicals	Quantity µg/mg
1.	Alkaloids	8.16
2.	Cardiac glycosides	1.6
3.	Flavonoid	4.02
6.	Phenol	5.57
8.	Saponin	3.5
9.	Tannin	9.13

Proximate composition

Proximate composition was determined from the fresh raw sample following the AOAC method. The results of proximate analysis based on fresh sample of MBI are shown in Table 3. The study showed moisture content of 85.438 ± 0.52 g/100 g of fresh sample and that of dried sample was found to be 11.431 ± 0.321 g/100 g. MBI was found to contain 1.714 ± 0.012 g of ash. The investigation showed low crude fat (0.539 ± 0.005 g/100 g) and crude protein (1.793 ± 0.034 g/100 g). The crude fibre and total carbohydrate contents exhibited were 7.683 ± 0.184 g and 10.183 ± 0.043 g per 100 g of fresh weight respectively. The calorific value of MBI was found to be 53.048 ± 0.490 kcal/100 g of fresh weight. In our previous report, the total carbohydrate content of selected wild edible plants varied from 4.97 ± 0.02 g to 12.48 ± 0.45 g and the calorific value ranged from 29.48 ± 0.12 kcal to 67.42 ± 1.82 kcal per 100 g of fresh weight [22]. The proximate composition of plants depends on

the species, locations, climatic conditions and age of the plants. Carbohydrates, fats and proteins are the indispensable nutrients of life. Diet rich in carbohydrate provides more energy. The main function of carbohydrate in the body is to provide energy and it is responsible for doing various activities in human life [23].

Table 3: Proximate analysis of *Musa balbisiana colla*

S. No.	Parameter	Result (g/100g)
1	moisture content	85.43
2	Protein	17.26
3	Fat	0.76
4	Fiber	2.06
5	Total carbohydrates	64.42
6	Total sugars	8.14
7	Energy (Kcal)	333

Determination of minerals

Table 4 shows the mineral contents in mg per 100 g of dried MBI. The study showed sodium content of 7.066 ± 0.340 mg/100 g. MBI was found rich in minerals like potassium (1546.128 ± 31.445 mg/100 g), calcium (503.027 ± 0.910 mg/100 g) and magnesium (108.328 ± 1.159 mg/100 g). The iron and zinc content detected were 15.689 ± 0.468 mg/100 g and 0.969 ± 0.066 mg/100 g respectively. In comparison to present study, Saha *et al*. [24] reported higher iron content in some underutilized green leafy vegetables of Sonitpur district of Assam, India that ranged from 29.40 mg/100 g to 241.20 mg/100 g and the zinc content reported was also higher ranging from 1.50 mg/100 g to 7.50 mg/100 g. The amount of copper, manganese and cobalt detected in MBI were 0.643 ± 0.035 mg, 2.459 ± 0.052 mg and 0.378 ±0.062 mg per 100 g respectively. Minerals play very important roles in maintaining and functioning of good health in the human body. Inadequate consumption of minerals is associated with increased susceptibility to infectious diseases due to the weakening of the immune system [25]. The trace elements like iron, zinc, copper, manganese, cobalt and nickel are needed in very trace quantities as they are essential for the physiological and biological functions of human body [26] and deficiency and excess of these metals leads to metabolic disorders [27–29].

Table 4: Mineral composition of banana extract fresh juice

S.No.	Parameter	(mg/100g)
1	Iron	2.26
2	Zinc	0.22
3	Calcium	42.17
4	Magnesium	23.47
5	Phosphorus	42.3

Antioxidant property

In this study, antioxidant activities of MBI methanol extract were investigated following DPPH assays. The DPPH free radical scavenging activities of the extract and standard ascorbic acid are presented in Table 5. The study revealed that the DPPH free radical scavenging activity increased with increasing concentrations of sample extract showing the maximum inhibition (784.77±1.2 µg/ml) while that of standard ascorbic acid was found to be 94.473 ± 0.445% at 300 µg/mL. tion of antioxidant activity of plant extracts. DPPH (1, 1-diphenyl-2- picrylhydrazyl) is a stable free radical having a characteristic absorption at 517 nm. Antioxidants in the extracts react with DPPH and convert 1,1- diphenyl-2-picrylhydrazyl (deep violet color) to 1,1- diphenyl-2-picrylhydrazine, a stable molecule (yellow color or bleached product) by accepting an electron or hydrogen radical at a very rapid rate resulting in a decrease in absorbance at 517 nm [30].

Table 5: Antioxidant activity using DPPH assay

S. No.	Name of Extract	IC_{50} Values
1.	Banana Extract juice	784.77±1.2 µg/ml

Conclusion

In this study, nutritional value and antioxidant property of *Musa balbisiana* inflorescence were investigated. The results of present investigation indicate that banana extract fresh juice is a good source of minerals. The extract of *Musa balbisiana* has the capacity to scavenge free radicals and to reduce oxidants as the DPPH assays exhibited antioxidant activity. Therefore, MBI may be incorporated as functional ingredient of diet and useful as therapeutic agents in treating free radical related pathological damages. However, further biological studies and structure elucidations are required to explore the beneficial effect in human health.

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