Phytochemical Analysis of Selected Banana Varieties

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Abstract— *The word "banana" is a general term comprising a number of species or hybrids in the genus Musa of family Musaceae. Many studies reported that banana is a good source of phenolic compounds, which are having potential health benefits in human beings. The phytochemical composition of eight banana varieties was investigated. Quantitative estimation of phytochemicals revealed that highest alkaloid and tannin content was noticed in variety Nendran (3.76% and 4.40 mg/100g respectively). Whereas, variety Rasakadali exhibited highest flavonoid content (9.49 mg/100). Total phenol and saponin content was found higher in variety Kadali (0.82% and 11.6 mg/100g respectively).*

Keywords—Phytochemical, Total alkaloids, Flavonoids, Saponins, Total phenols, Tannins.

I. INTRODUCTION

Banana, a wonderfully sweet fruit with firm and creamy flesh that come prepackaged in a yellow jacket, available for harvest throughout the year consists mainly of sugars and fibers which make it a source of immediate and slightly prolonged energy (Idise *et al*., 2011).

India ranks first in production and third in area among fruit crops (DAC, 2014). The banana production in India in 2013-2014 is 297.24 lakh tones. Tamil Nadu is the top banana producing state (5655.00 thousand tones) followed by Maharashtra (4830.60 thousand tones) and Gujarat (4225.49 thousand tones). Total production of banana in Kerala was 472.93 tones (NHB, 2014). When banana is consumed, reduces depression, anaemia, blood pressure, stroke risk, kidney malfunctions, constipation and diarrhoea due to presence of phytochemicals present it.

The "phyto" of the word phytochemicals is derived from the Greek word phyto, which means plant. Therefore, phytochemicals are plant chemicals. Phytochemicals are defined as bioactive nonnutrient plant compounds in fruits, vegetables, grains and other plant foods that have been linked in reducing the risk of major chronic diseases (Rui, 2013).

Phytochemicals are promoted for the prevention and treatment of many health conditions, including cancer, heart disease, diabetes and high blood pressure. There is some evidence that certain phytochemicals may help to prevent the formation of potential carcinogens (substance that cause cancer), block the action of carcinogens on their target organs or tissue, or act on cells that suppress cancer development (Premier, 2010). Hence, the present study is an evaluation of phytochemicals present in selected banana varieties mostly consumed in Kerala.

II. MATERIALS AND METHODS

Selection of banana varieties

Eight ripe banana varieties used for table purpose are selected for the study. The varieties selected were Palayankodan(AAB), Rasakadali (AB), Robusta(AAA), Poovan (AAB), Nendran (AAB), Kadali(AA), Red banana (AAA) and Padatti (AAB). The banana varieties were selected when the characteristic fruit colour develops and they were procured from Instructional Farm, College of Agriculture, Vellayani and also from local markets in Thiruvananthapuram. To assess the phytochemical composition of banana varieties, the following parameters such as total alkaloids, flavonoids, saponins, total phenols and tannins were selected.

Preparation of the extract

The fresh and ripened fruits were removed from dust particles and peeled off. They were cut into small pieces, from which a 25g fruit sample was taken and ground well with the help of and mortar and pestle and the extraction of banana was carried out using 50 ml petroleum ether, methanol and distilled water as solvents. Extracts were centrifuged at 5000rpm for 20 minutes. The supernatant extracts were kept overnight for incubation at room temperature.

Estimation of total alkaloids

Method suggested by Harborne (1973) was used for estimating alkaloids. 5g of the sample was weighed into a 250 ml beaker and 200 ml of 10% acetic acid in ethanol was added, covered and allowed to stand for 4 hours. This was

filtered and the extract was concentrated on a water bath to one-quarter of the original volume. Concentrated ammonium hydroxide was added drop wise to the extract until the precipitation was complete. The whole solution was allowed to settle and the precipitate was collected and washed with dilute ammonium hydroxide and then filtered. The residue obtained is dried and weighed.

Estimation total flavonoids

To 1 ml of the sample extract added 4 ml of distilled water and 0.30 ml of sodium nitrite. After 5 minutes, 2 ml of 1M sodium hydroxide was treated and diluted to 10 ml with distilled water. Quercetin was used as reference standard. The absorbance of the reaction was measured at 510 nm using UV/Visible spectrophotometer. The flavonoid content was expressed as mg of QE/g of extract.

Estimation of saponins

Method suggested by Obdoni and Ochuko (2001) was used for estimating saponins. 20g of sample powder was taken in a conical flask and 100 ml of 20% aqueous ethanol was added. The samples were heated over a hot water bath 4 hrs with continuous stirring at about 55^0C. The mixture was filtered and the residue re extracted with another 200 ml 20% ethanol. The combined extracts were reduced to 40 ml over water bath at about 90 ± 2^0C. The concentrate was transferred into a 250 ml separating funnel and 20 ml of diethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process was repeated. 60 ml of n-butanol was added. The combined n- butanol extracts were washed twice with 10 ml 5% aqueous sodium chloride. The remaining solution was heated in a water bath. After evaporation the samples were dried in the oven to a constant weight and the saponin content was calculated as percentage.

Estimation of Total phenols

The total phenolic compounds of the banana samples were determined by the method given by Slinkard and Slingleton (1997). To 1 ml extract in a volumetric flask, added 1 ml of folin-ciocalteau reagent and mixed thoroughly. After 3 minutes 3 ml of Na_2CO_3 (2%) was added and allowed to stand for 2 hours with intermittent shaking. The absorbance was measured at 760 nm in a spectrophotometer

Estimation of Tannins

To 0.1 ml of the sample extract in a 10 ml volumetric flask added 7.5 ml of distilled water , 0.5 ml of Folin- ciocalteau reagent and 1 ml of 35% Na_2Co_3 and made up to 10 ml with distilled water. The mixture was shaken well and kept at room temperature for 30 minutes. A set of reference standard solutions of gallic acid (20, 40, 60, 80 and 100 µg/ml) were prepared in the same manner as described earlier. Absorbance for test and standard solutions were measured against blank at 725 nm with an UV/ Visible spectrophotometer. The tannin content was expressed in terms of mg of GAE/g of extract (Sadasivam and Manickam , 2008).

Statistical analysis

All the analyses were done in triplicates and the data obtained were analyzed statistically using means, One-way Analysis of Variance (ANOVA) test.

III. RESULTS AND DISCUSSION

Alkaloids are organic compounds that contain nitrogen, and are physiologically active with sedative and analgesic properties. They are used in relieving pains, anxiety and depression (Jisika *et al*., 2000). Alkaloids are toxic due to their stimulatory effects, leading to excitation of cells and neurological dysfunction (Ekam and Ebong, 2007). From the beginning of civilization, alkaloids have been of great interest to human because of their pronounced physiological and medicinal properties

In the present study, significant differences were found to exist between the varieties with respect to alkaloid content. The highest alkaloid content was observed for the variety Nendran (3.76 per cent) and lowest for Red banana (0.84 per cent) (Table 1).

Significant differences were observed in the total flavonoid content of banana varieties studied. The variety Rasakadali (9.49mg/100g) was found to be having maximum flavonoid content and variety Red banana (3.58mg/100g) showed least amount of flavonoid content (Fgure. 1). The study is in close agreement with the findings of Merlene *et al*. (2012) who had found that Rasthali had highest content of flavonoid (4.7µm) followed by Pacha vazhapazham (3.58µm).

Saponins are a group of secondary metabolites found widely distributed in the plant kingdom. They form a stable foam in aqueous solutions such as soap, hence the name 'saponin'. Saponins may be considered as part of plant's defense systems, and as such have been included in a large group of protective molecules found in plants named phyto anticipins or phyto protectants (Dubois and Wagner, 2000).

Table.1: Total alkaloid, saponin and tannin content of banana varieties

Sl.No	Name	Alkaloid (%)	Saponin (%)	Tannin (mg/100g)
1	Palayankodan (AAB)	1.54	0.35	4.28
2	Rasakadali (AB)	2.51	0.62	2.09
3	Robusta (AAA)	2.77	0.35	3.93
4	Poovan (AAB)	2.68	0.65	3.30
5	Nendran (AAB)	3.76	0.77	4.40
6	Kadali (AA)	1.44	0.82	2.60
7	Red banana (AAA)	0.84	0.73	1.66
8	Padatti (AAB)	3.72	0.22	2.27
CD(0.05)		**0.446**	**0.041**	**0.363**

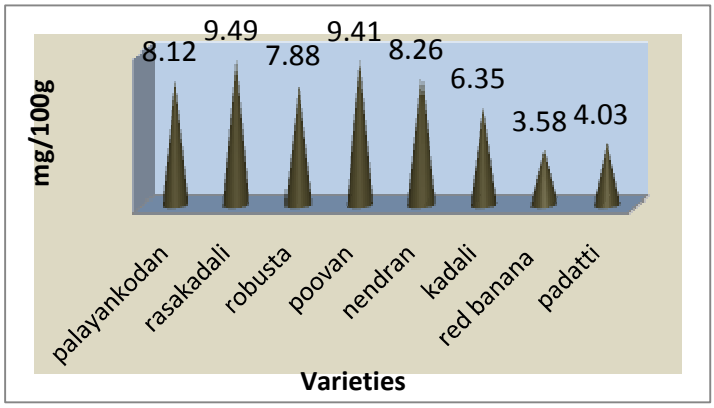

Fig.1: Total flavonoid content of banana varieties

Saponin mixtures present in plants and plant products posses diverse biological effects when present in the animal body. Findings of the present study revealed that highest saponin content was observed in variety Kadali (0.82 per cent) and lowest in variety Padatti (0.22 per cent). Adeniji et al. (2007) conducted a study on anti- nutrients in banana flour and found that PITA 17 is lowest (1.66%) in saponin, while PITA 24 (4.97%) is highest in saponin content (Table 1).

Phenols are the products of secondary metabolism of plants, play a vital role in the reproduction, growth and defense mechanism and also contribute to the colour of plants. In addition to their functions in plants, phenolic compounds in our diet may reduce the risk of chronic diseases such as cancer, heart disease and diabetes. Fruits and vegetables are good source of dietary phenolics (Rui, 2013).

Plant phenolic compounds are classified as simple phenols or polyphenols based on the number of phenol units in the molecule. The plant phenolics comprise simple phenols, coumarins, lignans, condensed and hydrolysable tannins, phenolic acids and flavonoids (Slivova et al., 2005).

In the present study, highest phenol content was observed for the variety Kadali (11.6mg/100g) and the lowest for Palayankodan (Figure 2). Total phenol content of variety Pinang Awak was found to be 5.9mg/GAE and also the content of phenolics in Pisang Awak was higher than that of *Musa sapient* (Darsini *et al*., 2012).

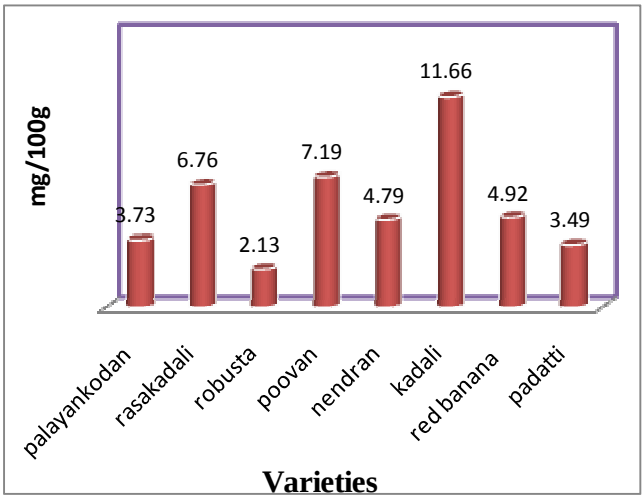

Fig.2:Total phenol content of banana varieties

Tannins do not act as pro oxidants and in fact react very rapidly to quench the hydroxyl radicals. *In vitro* studies have shown that tannin protein complexes in the gastro intestinal tract and provide persistent antioxidant activity, Phenolic content, particularly tannins which are responsible for astringency taste of unripe fruits which decreased with ripening mainly due to polymerization rendering them insoluble and undetectable to taste (Parimala and Sobha, 2010).

The results of present study revealed that variety Nendran (4.40 mg/100g) showed highest tannin content and were significantly different from the other varieties. The lowest tannin content was noticed in variety Red banana

(1.66mg/100g) (Table 1). A study conducted by Khawas et al. (2014) reported that tannin content of banana samples differed significantly with stages of development and the highest amount was recorded at stage I (0.59 mg/100g) which declined with maturity (0.21mg/100g). The decrease in tannin content with advancement of growth reduces the astringency property. Agnieszha and Borowska (2008) revealed that tannins play an essential role in shaping the sensory properties of fruits and fruit products. They are responsible for the tart taste and changes in the colour of fruit and fruit juices. They have been reported to be responsible for decreases in feed intake, growth rate, feed efficiency, net metabolizable energy and protein digestibility in experimental animals (Jackson, 2003). Therefore, foods rich in tannins are considered to be of low nutritional value. Tannins have also been reported to exert other physiological effects, such as to accelerate blood clotting, reduce blood pressure, decrease the serum lipid level and modulate immune responses. The dosage and kind of tannins are critical to these effects (Donovan et al., 2006).

IV. CONCLUSION

The present study indicated that banana is the potent source of novel bioactive compounds like total alkaloids, flavoniods, saponins, total phenols and tannins with wide range of medicinal properties, in particular, the high free radical scavenging activity. Other phytochemicals such as anthocyanin, delphinidin, cyanidin and catecholamines) have also been identified in ripe banana pulp (Kanazawa and Sakakibara, 2000).

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