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# Assaying the Antioxidant Activity of Banana Peel

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## ABSTRACT

The fresh green and yellow banana peel of five different varieties of (Musa, CV, Cavendish) fruits were treated with 70% ethanol, further partitioned with chloroform and ethylacetae (EtoAc) sequentially. The antioxidant activities of the extracts were evaluated by using hydroxyl radical scavenging activity, lipid peroxidation assay, estimation of vitamin C, catalase, peroxidase. The EtoAc extract of type-III and water extract of type-IV had shown the antioxidant activity.

**Key words:** Banana, vitamin C, ethylacetae, peroxidase, catalase

## INTRODUCTION

There is a great interest in the role of antioxidants in human health which has prompted research in the fields of food sciences and horticulture to assess fruit and vegetable antioxidants (Kalt *et al*., 1999). Fruits and vegetables contain many different antioxidants components. For example, some flavonoids (including flavones, isoflavones, flavonones, anthocyanins, catechin and isocatechin) that are frequent components in the human diet have demonstrated strong antioxidant activities (Kris-Etherton *et al*., 2002). Phenolics are the most wide spread secondary metabolites in the plant kingdom. This diverse group of compounds has received much attention as potential natural antioxidants (Sanchez-Moreno *et al*., 2000). The antioxidant activity of phenolics is mainly because of their redox properties which allow them to act as reducing agents, hydrogen donors, singlet oxygen and metal chelators. Their antioxidant activity is generally based on the number and location of hydroxyl groups present as well as the presence of a 2-3 double bond and 4-oxo function (Karadeniz *et al*., 2005).

Bananas are one of the most popular fruit carries a number of beneficial pharmacological effectand comes with a set of variety and it is distributed all over the world. It grows in humid low land to upland tropical areas (Banerjee *et al*., 2010). Being as a tropical plant, banana protects itself from the oxidative stress caused by strong sunshine and high temperature by producing large amounts of antioxidants (Mokbel and Hashinaga, 2005). Active constituents may present in different plant part like fruit, flower, bark, root etc (Banerjee *et al*., 2010). The medicinal parts used are fruits as well as peels, leaves and the juice from corm. The root is used as an anthelmintic and for reducing bronchocele. The fruit has been used as part of anti-ulcer diet. Anti microbial and antibiotic properties are found in the peel and pulp of fully ripe banana (Ferdinand *et al*., 2009). Banana peel is an under utilized source of phenolic compounds. It accounts for 40% of the total weight of fresh banana and these are used as fertilizer or discarded in many countries. According to National Cancer Standard Institute banana peel extract is described as a non-toxic to normal human cells, so it can be utilized as a natural source of antioxidants (Lee *et al*., 2010). It contains various antioxidant compounds such as gallocatectin and dopamine and it is also the rich

source of total phenolics and this in turn reflects their antioxidant activity. Several flavonoids have been reported-gallocatechin, catechin and epicatechin. Of these, gallocatechin exhibited the greatest antioxidant activity and was much higher in banana peel (Someya *et al.*, 2002).

## MATERIALS AND METHODS

The fresh unripe and fresh ripe bananas were collected from banana growing fields in and around Bangalore. They were screened for their variety at Garden City College, Department of Botany and identified as.

**Varieties:**
**Type I:** *Musa cavendisii* (AAA)
**Type II:** *Musa pardisia* (Diploid)
**Type III:** *Musa acumanate*×*Musabulbisiania* (AAB)
**Type IV:** *Musa bulbisiania*×*Musa acuminates* (ABB)
**Type V:** *Musa sapientum* var. *Paradisica*

**Extraction:** The peel tissue of various types of fresh banana fruit (300 g) at green with the trace of yellow stage were selected and was cut into pieces and then heated in 1 L of distilled water for 2 min for the protein coagulation. The peel was homogenized and extracted with 70% acetone, filtered and concentrated to 200 mL.

Followed by partitioned into chloroform ($CHCl_3$) and $H_20$, then extracted with aqueous saturated ethyl acetate. Ethyl acetate, water and chloroform extracts were collected and used for the determination of antioxidants activity.

**Antioxidant assay using hydroxyl radical scavenging activity:** The method described by Hutadilok-Towatana *et al.* (2006). Various amounts of test samples were mixed with 134 μL of 30 mM $KH_2PO_4$. KOH buffer (pH-7.4) 67 μL of 17 mM deoxyribose, 33 μL of 34 mM $H_2O_2$, 33 μL of 1.2 mM EDTA and 67 μL of 300 μM $FeCl_3$. A 67 μL of aliquot of 0.6 mM ascorbic acid was then added to start the reaction. After incubation at 37°C for 1 h, the product of the hydroxyl radical attack on deoxyribose were determined by adding 333 μL of 1%(w/V) TBA (Thiobarbituric acid) in 50 mM NaOH, followed 333 μL of 2.8% (w/v) TCA (Trichloroacetic acid). After further incubation at 80°C for 20 min, the reaction mixtures were centrifuged. The absorption of the clear supernatants was then measured at 532 nm. A parallel assay omitting the test sample acted as a control, where as the normal reaction mixture with outdeoxyribose was used as a sample blank.

**Antioxidant assay using lipid peroxidation assay:** This assay was done by Liu and Ng (2000) method. The 0.3 mL of the test sample was mixed with 0.1 mL of 10 μM $FeSO_4$ and 0.1 mL of 0.1 mM ascorbic acid at 37°C for 1 h. The reaction was then stopped by addition of 0.75 mL of 28% (w/v) trichloroacetic acid (TCA) and 0.5 mL of 1% thiobarbituric acid (TBA), successively. The mixture was then heated at 100°C for 45 min. After centrifugation, all precipated proteins were removed and the colour was measured at 532 nm. The percent inhibition was calculated.

**Estimation of vitamin C, catalase and peroxidase:** It was done by the method described by Sadasivam and Manickam (1996).

## RESULTS AND DISCUSSION

In the present study, several biochemical constituents and free radical scavenging activities of five varieties of banana were evaluated. Free radicals are involved in many disorders like cancer, AIDS etc. Antioxidants due to their scavenging activity are useful for the management of diseases.

Vitamin C, potential antioxidant having an ability to scavenge a wide range of reactive oxygen species, like peroxide anion, singlet oxygen and hydrogen peroxide and acts as a chain breaking antioxidant. This chain breaking antioxidant property impairs with the formation of free radicals in the process of formation of intracellular substances throughout the body, including collagen, bone matrix and tooth dentine (Beyer, 1994). The quantitative determination of ascorbic acid in plant extracts shows that they are good source of ascorbic acid.

Figure 1 shows the values of vitamin C of the all varieties of banana. From the figure it is clear that concentration of vitamin C is maximum in EtoAc extract of type-III, whereas the other all shown the concentration in a considerable amounts.

Figure 2 shows the values of catalase of the all varities of banana. From the figure it is clear that the concentration of catalase was maximum with water extract of type-IV. Expect type-I (EtoAc) all others have shown very less. Catalase is one of the most important antioxidant enzymes scavenging the active oxygen species in plant cells (Huang *et al*., 2007). Catalase may be major antioxidant enzyme involved in plant defense mechanism because it is induced during heating and persists during cold storage (Sala and Lafuente, 2000).

Figure 3 shows the values of peroxidase indicated that the maximum activity was found with EtoAc of type-III and the chloroform extract of type-I shown the second next, whereas the other types shown less values. Peroxidase participates in a great number of physiological processes, such

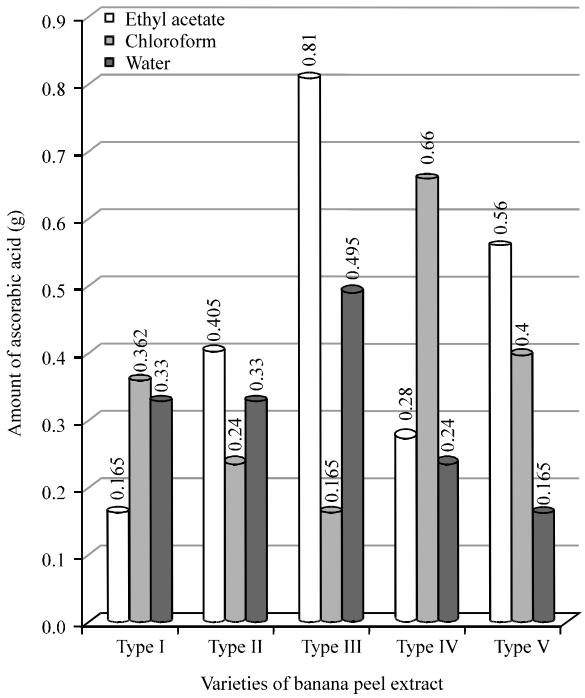


Fig. 1: Concentration of vitamin C in varieties of banana peel extracts

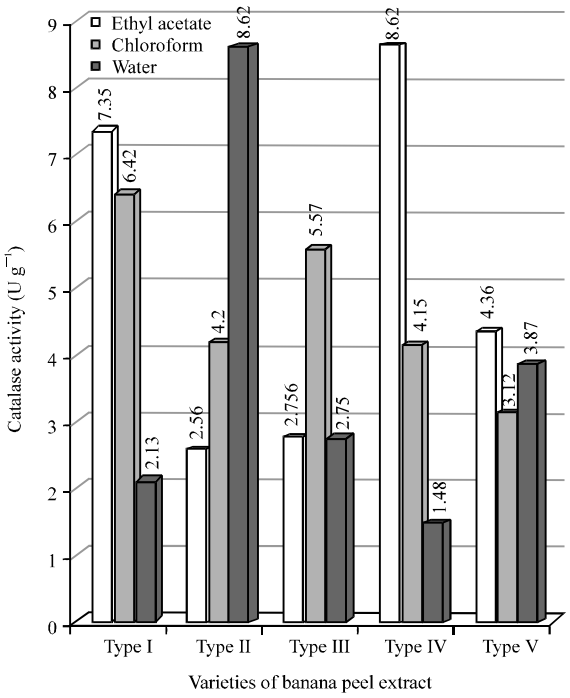


Fig. 2: Catalase activity in varieties of banana peel extracts

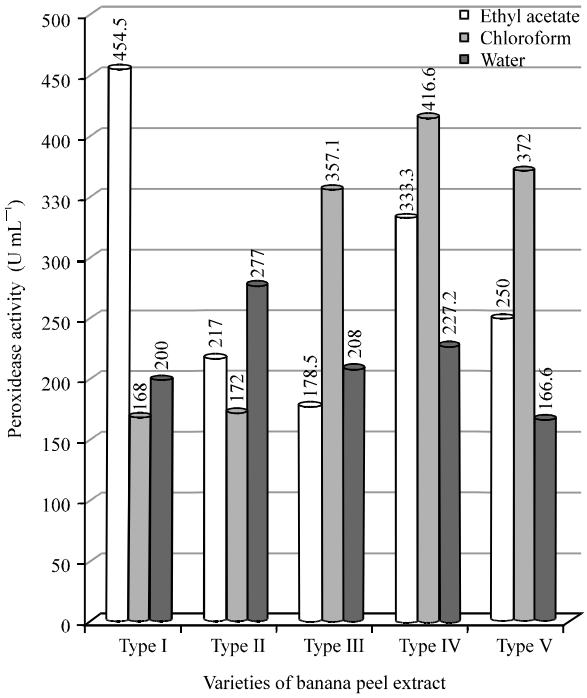


Fig. 3: Peroxidase activity in varieties of banana peel extracts

as the biosynthesis of lignin and ethylene, defense against pathogens and wounding, auxin metabolism and stress response (Rathod and Yesane, 2011). Peroxidase is recognized to be one of the most heat stable enzymes in plant and its resistance to heat has been reported by

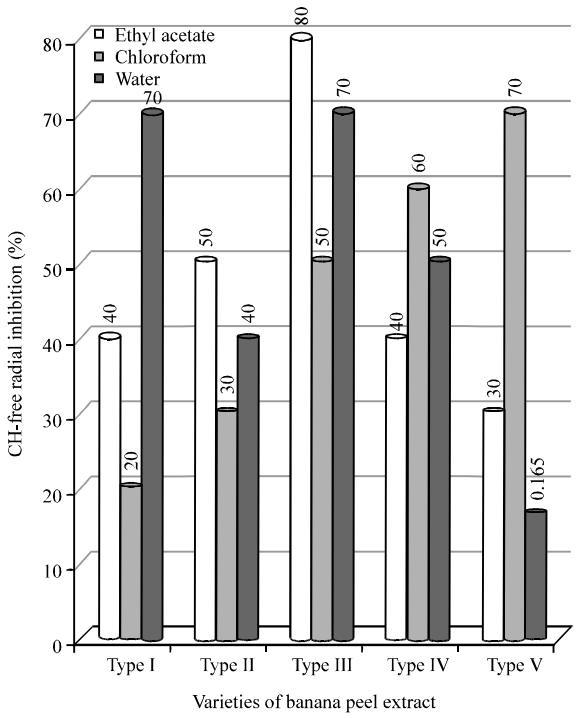


Fig. 4: Percentage of hydroxyl radical scavenging in varieties of banana peel extracts

a numerous workers (Muftugil, 1985). It is reported that peroxidase activity increased when higher temperatures were applied to *Phalaenopsis* fruits (Ali *et al*., 2005). The activation of peroxidase is correlated to the defense responses of fruit in presence of pathogens (Muftugil, 1985).

Figure 4 shows the values of hydroxy radical scavenging activity of different varieties of banana. It indicates that maximum was found with ethylacetae extract of type III and chloroform extract of type I and V, where as others II and IV has shown very less activity. The OH radicals have been implicated to play a critical role in the physiological control of cell function (Droge, 2002). The OH radicals react with extremely high rate constants, indiscriminately with almost every type of molecule found in living cells: Sugars, amino acids, phospholipids, DNA bases organic acids and may change normal physiological functions of the cells. Moreover in rheumatic arthritis and related disorders, the reaction of nitric oxide with super oxide generates peroxide nitrite which under acid condition often found in regions of inflammation and ischemia yields hydroxyl radicals (Brown-Galatola and Hall, 1992). The hydroxyl radicals thus generated in the above reaction are believed to contribute to membrane damage of the cells in the region of inflammation. The redox active antioxidants like ascorbate, glutathione, urate, flavonoids, tocpherol, carotenoids andhydroxycinnamic acids present in plants may be the contributing factors for scavenging of OH-radicals (Gacche and Dhole, 2006).

Figure 5 shows the results of lipid peroxidation assay. The data showed that the water extract of type III and type IV were maximum, than the ethyl acetate extract of type III, where as the other type I and type III had showed maximum lipid peroxidation activity. In addition to their free radical scavenging activities, we also evaluated the plant extracts for their abilities to protect biomolecules from oxidative damage, by performing lipid peroxidation assays. Oxidation of

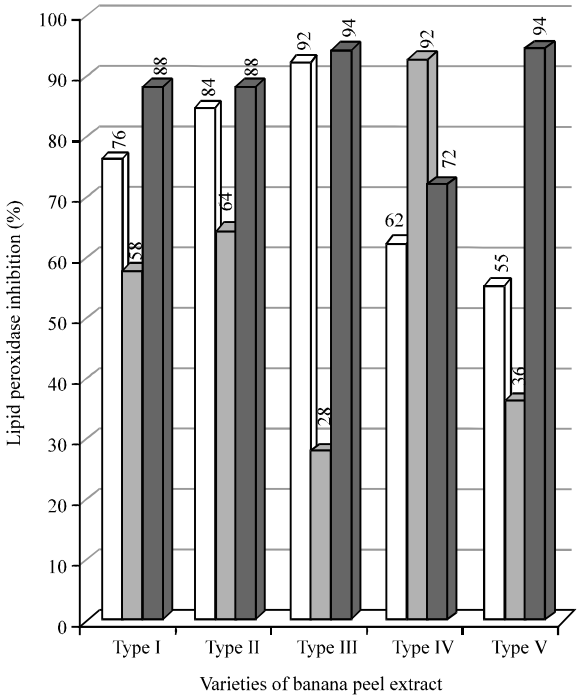


Fig. 5: Percentage of lipid peroxidation in varieties of banana peel extracts

unsaturated fatty acids in biological membranes leads to the formation and propagation of lipid radicals, uptake of oxygen, rearrangement of the double bonds in unsaturated lipids and eventual destruction of membrane lipids with production of breakdown products.

## CONCLUSION

From the study, it is clear that, among five varieties, ethyl acetate extract of type-III showed the higher concentration of vitamin-C and peroxidase and catalase was maximum in water extract of type-IV. The free radical scavenging activity was found maximum in ethyl acetate extract of type-III and chloroform extract of type-I and type-V. Water extract of type-III and IV has shown the maximum lipid peroxidation activity. From the above, we can conclude as the above tested varieties of banana have the significant antioxidant and free radical scavenging activity. Based on the results we can suggest as the samples can be into considerations for the pharmacological preparations of antioxidants.

We have shown in our present study that banana peel is highly rich in catalase and peroxidase enzymes. Therefore the impact of these antioxidants can be used favorably by man kind by making consciousness effort to leave the inner peel while consuming the bananas. Secondly, the presence of antioxidants in inner peel of banana could be the main source of removing toxic free radicals that may be constantly generated during the growth of banana to maturity. This could be the primordial reason for banana to be left fresh at room temperature even if for more number of days in tropical countries, given that tropical countries are relatively warm than their counterparts which are temperate, the chances of various bacteria and other microorganisms are kept at bay from attacking the banana fruit.

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