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COMPARATIVE ANTIOXIDANT PROPERTIES ANALYSIS OF BYPRODUCTS OF SELECTED FRUITS

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ABSTARCT
Fruits and vegetables are a very good source of Antioxidant compounds including polyphenolics, flavanoids, anthocyanins ect. Fruit peels and seeds are rich in these compounds and being a byproduct of food industries they act as a promising raw material for producing antioxidants.[1] Mangoes are the the native of Asia and Africa which is tropical in nature and bear fruits. After the processing of mangoes for various food products, peel and seeds are generated as by products.[2] These peel and kernel are reported to increase the shelf life of paneer and ghee.[3] Aloe vera has been proved to show therapeutic effect and has been effective in treatment of inflammation and sclerosis as it contain bioactive components called antioxidants which delay or prevent the oxidation of cellular substrates.[4] Bananas are considered as most affordable and widely available fruit which is considered as an important source of nutrition worldwide. Bananas are cultivated for therapeutic and consumption purposes and thus generates a huge amount of peel as by product.[5, 6] All these by products can be explored to check their antioxidant activity and compared with a well known antioxidant to enhance its antioxidant activity by making a combination of different extracts. This paper will discuss the comparative analysis of total phenolic compounds, total flavonoid content and total antioxidant activity present in various industry by products i. e. Banana peel, Mango peel and Mango Kernel. This paper also shows the comparative analysis with a known antioxidant source, Aloe vera with these by products. The results indicated that Mango kernel shows the antioxidant activity better than other by products and even more than the aloe vera extract.

ABBREVIATIONS:
TCP Total phenolic content
TFC Total flavonoid content
GAE Gallic acid equivalent
RE Rutin equivalent.

INTRODUCTION
Natural antioxidants, especially in fruits and vegetables have gained increasing interest among consumers and the scientific community because epidemiological studies have indicated that frequent consumption of natural antioxidants is associated with a lower risk of cardiovascular disease and cancer.[7] The defensive effects of natural antioxidants in fruits and vegetables are related to three major groups: vitamins, phenolics, and carotenoids. Ascorbic acid and phenolics are known as hydrophilic antioxidants, while carotenoids are known as lipophilic antioxidants.[8]

Recent studies on cultured mammalian cells and animals indicate that polyphenolic compounds from numerous fruits and vegetables exert several health-promoting functions, including reducing the risks of cancer and heart and neurodegenerative diseases.[9] Besides that, epidemiological studies also show positive associations between intake of fruits and vegetables and reduced mortality rate from heart diseases, common cancers, and other degenerative diseases.[10, 11] The free-radical scavenging capability and consequent antioxidant properties of the phenolics play an important role in protecting the cells and tissues from oxidative stress and other biological effects associated with these chronic diseases.[12]

The contents of phenolic compounds and their antioxidant activity in selected by products of food industry have been poorly investigated. Therefore, testing their antiradical properties is of interest, primarily in order to find new sources of natural antioxidants.

DNA is continuously attacked by reactive species that can affect its structure and function severely. Structural

modifications to DNA mainly arise from modifications in its bases that primarily occur due to their exposure to different reactive species. Guanine is frequently attacked by reactive species, producing a plethora of lethal lesions. DNA damage by reactive species has created profound interest in the medicinal fraternity because of the involvement of reactive species in different pathological conditions such as cancer, aging, neurodegenerative diseases, rheumatoid arthritis, etc. Reactive species such as free radicals, one-electron oxidants, different chemicals, etc., can react with different components of DNA to produce a plethora of DNA lesions. These reactive species can modify bases, induce inter and intra strand crosslinks, promote DNA–protein crosslinks and create strand break.[13]

MATERIAL AND METHODS

Sample preparations: 40 gm sample of banana peel, mango kernel, mango peel and aloe vera leaf gel were weighed and mascinerated. All the samples were dissolved in 500ml Ethanol and kept on shaker at room temperature for 48 hours. The extract was filtered with whatman filter paper and the filterate was concentrated using rotary vaccum evaporator. The final concentration was made to 0.1mg/ml by dissolving the extract in ethanol.

Determination of total phenolic content: The determination of TPC of the ethanolic extract was performed by using Folin-Ciocalteu reagent.[14] Briefly, 1ml of extract was prepared with 1.8 ml of Folin-Ciocalteu reagent (10 fold diluted) and kept for 5 min at 25 degree Celsius. Later 1.2 ml of 15% Sodium Carbonate was added to the reaction mixture and kept for 90 min at RT and the absorbance was measured at 765nm. The concentration of the TPC was determined as mg of gallic acid equivalents (GAE) per gm FW.

Determination of total flavonoid content: TFC of ethanolic extract was determined by using the aluminium chloride colorimetric method.[15] Briefly, 0.5 ml of the extract, 1.5 ml of methanol, 0.1 ml of 10% aluminium chloride, 0.1 ml of 1 M potassium acetate and 2.8 ml of distilled water were mixed for 5 min by vortexing. Reaction mixture was kept at RT for 30 min and the absorbance was measured at 415 nm. The results were expressed as mg of rutin equivalents (RE) per gm FW.

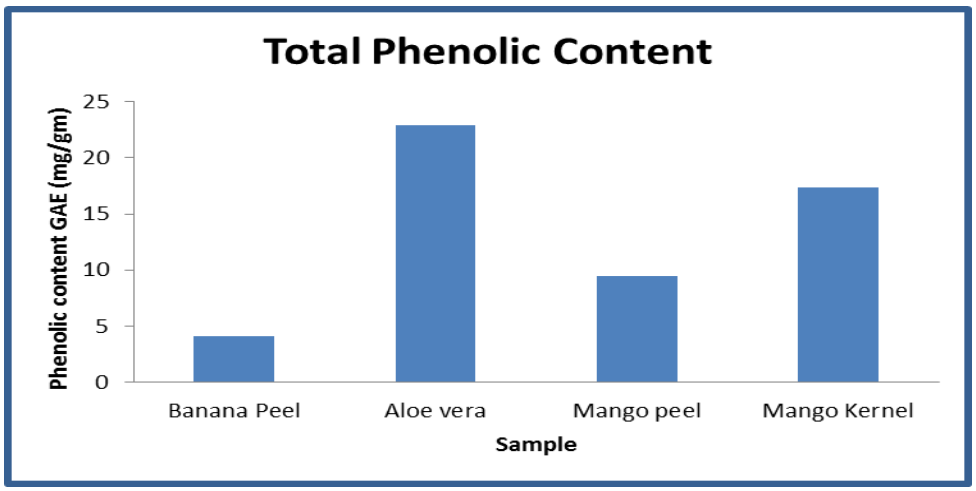
Determination of Total Antioxidant Activity: Different concentration of ascorbic acid (25-125µg/ml) in distilled water were prepared as standard. 0.3ml of extracts was taken in test tubes. Reagent was prepared by mixing 10ml of 0.6M sulphuric acid, 10ml of 28mM sodium phosphate, 10ml of 4mM ammonium molybdate into a beaker. 3ml reagent solution was added to the tubes. 0.3 ml reagent of methanol served as blank. All the tubes were incubated at 95ºC for 90 min. Tubes were cooled to room temperature. Optical density was measured at 695nm using UV Spectrophotometer.

RESULTS

Total phenolic content: The variation of the total phenolic content of all the ethanolic extracts is presented in Table 1. TPC of the extract was expressed as mg GAE/g FW. The results show that there is significant amount of Phenolics in Mango kernel and aloe vera leaves contain maximum amount of phenolics.

Table 1: Total phenolic content.

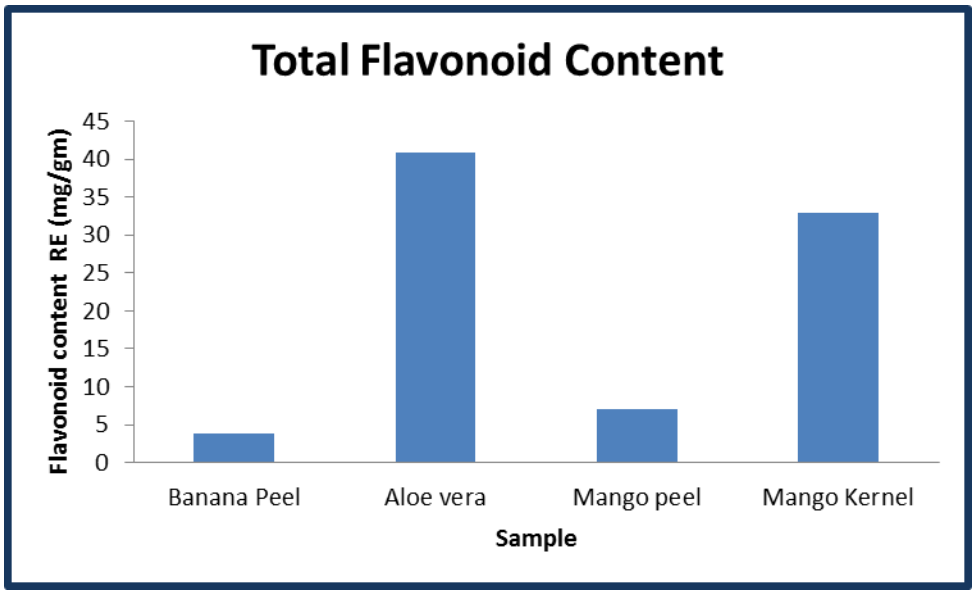
Sample conc. (mg/ml)	Phenolic content GAE (mg/gm)			
	Banana Peel	Aloe vera	Mango peel	Mango Kernel
0.1	4.12 ± 0.03	22.9 ± 0.04	9.42 ± 0.01	17.4 ± 0.03



Total flavonoid content: The variation of flavonoid content of ethanolic content of various samples is shown in table 2. TFC of the extracts was expressed as mg RE/g FW. The TFC in all the samples varied considerably, and Mango kernel and Aloe vera contains maximum flavonoid content.

Table 2: Total flavonoid content.

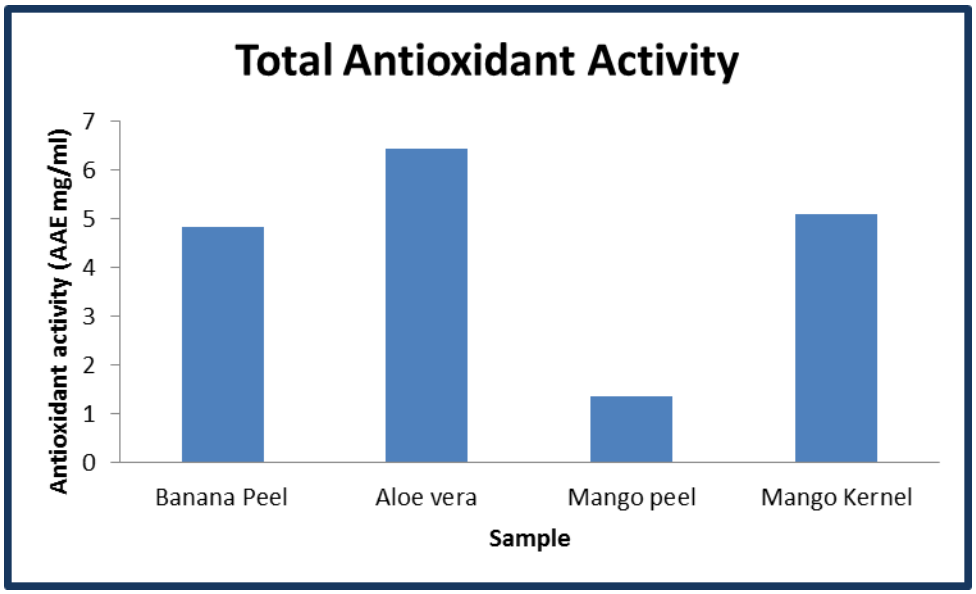
Sample conc. (mg/ml)	Flavonoid content RE (mg/gm)			
	Banana Peel	Aloe vera	Mango peel	Mango Kernel
0.1	3.76 ± 0.23	40.86 ± 0.21	7.02 ± 0.24	33 + 0.1



Total Antioxidant Activity: The variation in total antioxidant activity of ethanolic extracts of different samples is shown in table 3. Maximum Antioxidant activity is shown by Aloe vera extract followed by Mango kernel extract.

Table 3: Total Antioxidant activity.

Sample conc.(mg/ml)	Total Antioxidant Activity (AAE mg/gm)			
	Banana Peel	Aloe vera	Mango peel	Mango Kernel
0.1	4.82 ± 0.06	6.43 ± 0.04	1.36 ± 0.02	5.1 ± 0.01



DISCUSSION

Mango kernel extract has shown good amount of antioxidant which is comparable with the well known antioxidant source, Aloe vera. Mango kernel is a byproduct of mango powder, pickle, jam etc industry and thus is a low cost raw material. The raw material i.e Mango kernel being inexpensive and easily available should be regarded as potential nutraceutical resource, capable of offering significant nutritional dietary supplements. Also the natural antibiotics in the form of phenols and flavonoids can be easily extracted and thus it offers opportunities to formulate value added products in

nutraceutical and food applications to enhance health benefits.

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