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Comparative analysis of antioxidant and antidiabetic activity for apple (Malus domestica), banana (Musa paradisiaca) & kiwi (Actinidia deliciosa)

Imran Patel[1*], Omkar Padse[2], Yogesh Ingole[1]
[1]*Department of Biotechnology, Sinhgad College of Science, Pune- 411041*
[2]*Department of Biotechnology, Fergusson college, Pune .411006*
Correspondence Email: imranpatelq@gmail.com

Abstract- The fruit juices have been ascribed to have the potential of scavenging free radicals. This antioxidant potential was detected for various extracts of fruit juices. The methanolic extract of *banana (Musa paradisiaca)*, *kiwi (Actinidia deliciosa)* and *apple (Malus domestica)* were checked for the polyphenolic contents. The aim of this study was to evaluate antioxidant and antidiabetic potential of these fruits which constitute the fruit industry wastes. The fresh green and yellow *banana (Musa paradisiaca)* fruit were treated with 70% acetone which was partitioned with chloroform and ethyl acetate sequentially. The antioxidant activities of the extract were evaluated by using the 1 diphenyl-2-picrylhydrazyl (DPPH) free radical elimination test & FRAP analysis. Antidiabetic study was analyzed using alpha amylase inhibitory assay. Results of the study revealed free radical scavenging activity of alcoholic extract of *banana (Musa paradisiaca)* was highest. This present study indicates promising antioxidant potentials of alcoholic extracts of *banana (Musa paradisiaca)*, *apple (Malus domestica)* and *kiwi (Actinidia deliciosa)* manifested by elevation of reduced glutathione (GSH) content. The findings of present investigation further suggest that the unripe *banana (Musa paradisiaca)* extracts may have higher antioxidant potency than ripe one.

Index Terms- *Apple (Malus domestica), Banana (Musa paradisiaca), kiwi (Actinidia deliciosa),* Total phenolic, antidiabetic, antioxidant, flavonoids, etc.

1. INTRODUCTION

Free radicals and reactive oxygen species (ROS) can react with Lipid, Protein, Sugar, Nucleic acid causing inactivation of enzyme, changes in genetic material and tissue damage. Tropical plant may protect itself from the oxidative stress caused by strong sun shined high temperature by producing large amount of antioxidant [1]. The fruit juices have been described to have the potential of scavenging free radicals [2].

Apple (Malus domestica) fruit is rich in bioactive compound especially in polyphenols. It is an established fact that supplementation of diet with fruits and vegetables prevent atherosclerosis and other diseases [2]. Disorders related to macrophages, the leukocyte activation action with the antioxidant effect of *apple (Malus domestica)* has been discussed. It was shown that consumption of *apple (Malus domestica)* fruit lowered blood triglycerides levels by 15% compared with control. All these data indicate that consuming *apple (Malus domestica)* fruit may be beneficial in cardiovascular disease. The reports suggest that consuming two or three *apple (Malus domestica)* fruit per day for 28 days reduced platelets aggregation response to collagen. It was demonstrated that consumption of certain berries and fruits such as blueberries, mixed grape and *kiwi (Actinidia deliciosa)* fruit, was asscociated with increased plasma hydrophilic (H^-) or lipophilic (L^-) antioxidant capacity (AOC) measured as oxygen radical absorbance capacity (ORAC) [3]. AOC in the postprandial state and consumption of an energy source of macronutrients containing no antioxidant was associated with a decline in plasma AOC [4]. In our recent studies, different fruits like *apple (Malus domestica), banana (Musa paradisiaca)* & *kiwi (Actinidia deliciosa)*fruit were tested for antioxidant and antidiabetic potential. There are a number of reports dealing with comparison of different varieties and cultivators of *kiwi (Actinidia deliciosa)*fruit. The comparison was based on the amount of bioactive compounds present in order to evaluate their compositional characteristics especially as a possible "health fruit". The mechanism of ethylene biosynthesis, ethylene production during ripening period of fruit and the effect of ethylene on ripening has also been correlated. With the production of

ethylene in crisp hard to soften peach, the softening of pear and low temperature treatment has been related to antioxidant potential [5].

2. MATERIALS AND METHODS

2.1 Collections of Materials and Preparation of Extracts

Apple (Malus domestica), banana (Musa paradisiaca) and *kiwi (Actinidia deliciosa)* fruits were obtained from the local market and were identified by the college botanist. The pulp and peels were taken from the fruits i.e 300 g of each respectively at green with a trace of yellow stage were heated in 1ml of distilled water for 2 min. The fruit was homogenized with 70 % acetone twice at room temperature in electric blenders. The extract in 70 % acetone were then filtered and concentrated to 200 ml. This extract were partitioned into a $CHCl_3$ and water using electric shaker and then extracted with aqueous saturated ethyl acetate. Final extraction was carried out with methanol dilution.

2.2 *DPPH Radical scavenging assay*

The radical scavenging activity of fruits was measured in terms of hydrogen donating or radical scavenging ability. Different concentrations of samples were taken. To about 5 ml of 0.1 mM methonolic solution DPPH was added and shaken vigorously. After incubation at 27ºc for 20 min, the Absorbance was measured at 517 nm. The radical scavenging inhibition was calculated [6].

2.3 FRAP Assay

The reducing capacity of fruit was determined. Various concentration of the extracts were added to 2.5 ml of 0.2M sodium phosphate buffer pH 6.6 and 2.5 ml of 1 % potassium ferricyanide solution. The contents were vortexed well and incubated at 50ºC for 20 min. After incubation, 2.5 ml of 10 % TCA was added to all the tubes and centrifugation was carried out at 3000 rpm for 10 min. Thereafter to 5 ml of the supernantant, 5 ml of deionizes water was added. To this 1 ml of 1 % ferrec chloride was added to each test tube and incubated at 35ºC for 10 min. take the absorbance at 700nm increased absorbance indicates the increased reducing power [1,2].

2.4 Total phenolic content

By folin ciocalteau method:- For the determination of total phoyphenol the adjusted method Lachman et al. 2000c with Folin Ciocalteau reagent was used. Sample 0.5 ml was pipetted out into 50 ml volumetric flask and diluted with distilled water .Then 2.5 ml of follin ciocalteau reagent was added and after agitation 7.5 ml of 20 % sodium carbonate solution was added. After 2 hr standing at laboratory temperature absorbance of sample was measured on the spectro at 765 nm. Results were expressed as gallic acid.

By EBC method.

CMC/ EDTA : 10 g CMC and 2 g EDTA was diluted in water for 1.5 Hrs in 1000 ml volumetric flask and filtered.CMC with low viscosity (Merck Germany) was used. Ammonium ferric citrate solution: 3.5 g Ammonium ferric citrate (green powder) was diluted in water in 100 ml volumetric flask. Ammonia solution 1 part of concentrated ammonia solution was diluted in 2 parts of distilled water .Total phenolic was calculated and measured at the absorbance 600 nm [7].

2.5 Total flavonoids content.

Total flavonoid content was performed. According to it 0.5 ml of each extract was mixed with 0.5 ml of 2 % $AlCl_3$ in methanol and was incubated for 10 min at room temperature. Absobance was taken at 368 nm [8].

2.6. Alpha amylase inhibitory assay.

This assay was tested for different concentration of fruit extracts. The inhibitory activity was analyzed. Samples of different concentration were incubated with 0.01% alpha amylase and 1% starch solution. Controls were prepared having no extracts as inhibitors [9].

3. RESULTS & DISCUSSION:

The aim of this study was to evaluate the antioxidant and antidiabetic potential of potent fruit extracts by carrying out DPPH and FRAP assay. The methanolic extracts were treated with above reagents to calculate their comparative activities. It has been observed that antioxidant potential of any extract is due to presence of potent flavonoids and phenolics. The samples were assayed for total content of phenolic and flavonoids and following results were obtained.

3.1. Total phenolic content:

Different concentrations of the extract were analysed to determine the content of phenolics. Above results show that *banana (Musa paradisiaca)* showed highest amount of phenolics as compared to *apple (Malus domestica)* and *kiwi (Actinidia deliciosa)*. This was

significant value for its antioxidant activity [10].

	Conc.	Total content (mg) in gallic acid equivalent
APPLE (MALUS DOMESTICA)	1%	2.02 ± 0.03
	3%	3.30 ± 0.07
	5%	5.26 ± 0.03
BANANA (MUSA PARADISIACA)	1%	1.35 ± 0.05
	3%	4.47 ± 0.05
	5%	7.10 ± 0.06
KIWI (ACTINIDIA DELICIOSA)	1%	2.08 ± 0.1
	3%	3.67 ± 0.02
	5%	4.77 ± 0.02

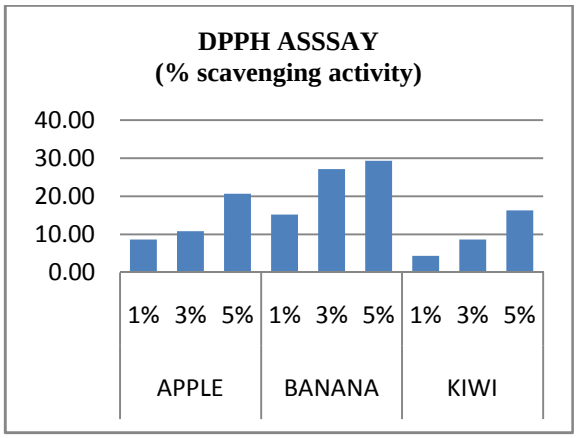
3.2. ***Total flavonoid content***

It could be observed from the table below that *kiwi (Actinidia deliciosa)* had the highest content of flavonoids which contributes to its antioxidant activity. All the results have been expressed in gallic acid equivalents[11]. It has also been observed that the peels of these fruits show higher antioxidant and antidiabetic activity with comparison the fruit pulp. It could be suggested that the peel content would have been containing higher flavonoids content.

	Conc.	Total content (mg) gallic acid equivalent
APPLE (MALUS DOMESTICA)	1%	0.14 ± 0.03
	3%	0.16 ± 0.01
	5%	0.17 ± 0.02
BANANA (MUSA PARADISIACA)	1%	0.13 ± 0.02
	3%	0.14 ± 0.03
	5%	0.16 ± 0.01
KIWI (ACTINIDIA DELICIOSA)	1%	0.14 ± 0.04
	3%	0.18 ± 0.02
	5%	0.19 ± 0.02

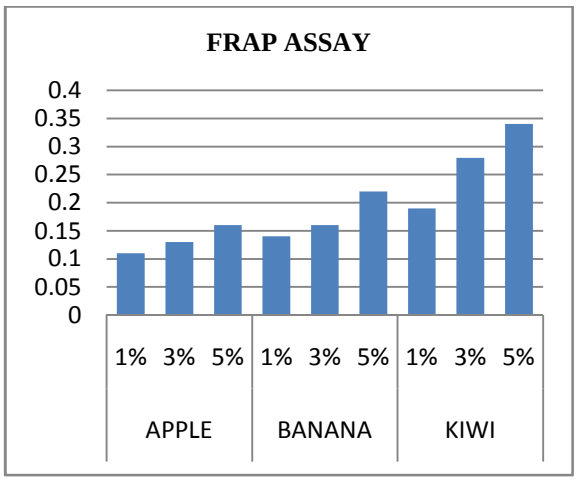
3.3. DPPH assay

Phenolics and flavonoids present inside the fruit extracts are suggested to be the potent scavengers of DPPH. It could be suggested further that due to presence of free phenoxy group containing phenolics must have increased the free radical scavenging activity [12]. *Banana (Musa paradisiaca)* showed maximum radical scavenging activity as compared to *kiwi (Actinidia deliciosa)* and *apple (Malus domestica)*.



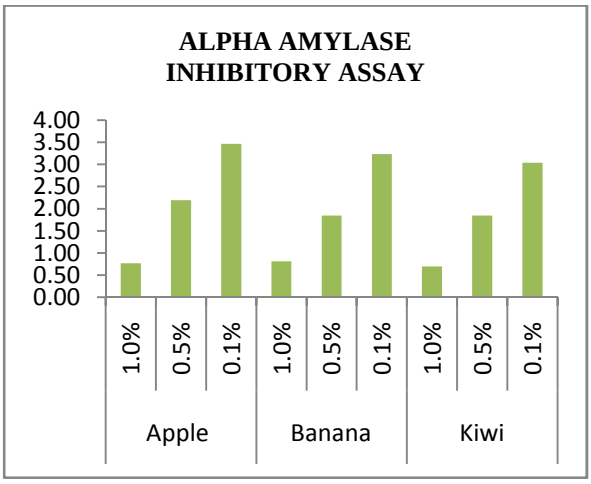
3.4. FRAP assay

FRAP assays determine higher reducing potential of chemicals. The reducing potential of methanolic extracts was measured at different concentrations. The higher reducing potential is correlated with higher amount of polyphenolics. The reducing power was found maximum for *kiwi (Actinidia deliciosa)* in comparison to *apple (Malus domestica)* and *banana (Musa paradisiaca)*. The content of few tannins may also have added to the activity.



3.5. Alpha amylase inhibitory assay.

This assay determines the inhibition of alpha amylase which breaks starch into glucose. The assay describes the antidiabetic potential of extracts from the fruits. It was observed that all the extracts showed similar inhibitory activity. This shows that all the three extracts had antidiabetic activity.



4. CONCLUSION

The presence of flavonoids and phenolic compounds positively correlates with the increase in antioxidant potential of fruits. It can be concluded from the study that all 3 fruits have higher content of phenolics and flavonoids which has increased their antioxidant potential that is observed in DPPH and FRAP assays. It has been proved that *banana (Musa paradisiaca)* extracts had highest free radical (DPPH) scavenging activity while *kiwi (Actinidia deliciosa)* fruit extract had higher reducing potential as compared to the other two which is seen in FRAP assay. It can also be concluded that *apple (Malus domestica)* extracts showed highest alpha amylase inhibitory activity which describes its antidiabetic potential.

Potential drugs have been designed in the recent era that carries higher antioxidant and antidiabetic potential but unfortunately they come with extra benefits of side effects. Herbal extracts have proved themselves as potent medicine which can easily replace the synthetic drugs.

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