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Comparison Of Phytochemical And Antioxidant Properties Of Three Tropical Fruits (Apple, Banana, Papaya) Blended With Milk With Peels And Without Peels

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Abstract: ***The increasing curiosity in useful biological activity of plant phenolics and favonoids outlined the necessity of determining their contents in tropical fruits.***

The study comprised of three tropical fruits- Apple, Banana and Papaya blended in milk.

The antioxidant properties of ethanolic extracts of apple, banana, papaya blended with milk with peels and without peels were determined by two methods: reducing power and total antioxidant capacity.

In the results of reducing power method it was reported that banana without peels blended in milk showed highest absorbance of 0.883±0.774 as compared to other two fruits whereas papaya with peels exhibit lowest absorbance of 0.004±0.003 as compared to other extracts.

Similarly, in the results of total antioxidant capacity method it was reported that papaya with peels blended in milk showed highest absorbance of 0.746±0.21 as compared to other two fruits whereas apple with peels exhibit lowest absorbance of 0.097±0.25 as compared to other extracts.

The results justifies the fruit and peels also have potent antioxidant properties that can be therapeutically applicable in the indigenous system of medicines.

Keywords: tropical fruits, antioxidant, peels, milk.

I. INTRODUCTION

The tropical fruits are the fruits grown in tropical climates. Most of the biologically active substances, such as antioxidant are present in fruits.

The common type of antioxidant found in fruit are carotenoids, phenolic, vitamin A, B,C and E. fruit which is rich in natural antioxidants gained increasing interest among consumers and the scientific community because it is vital in reducing the occurrence of degenerative diseases like cardiovascular diseases, inflammation, ageing and cancer.

The cultivated apple, Malus domestica, belongs to the Rosaaceae (Rose) Family along with pear, quince, loquat and medlar. Apple about 100gms contains 107mg of potassium, 14gms of carbohydrates, 52gm of calories and also a nice source of vitamin C. The average apple contains about 5gms of fiber, important in normal bowel function. Flavanoid content may play an important role in preventing many kinds of cancer, heart diseases and stroke.

Banana (Musa Acuminata) is the fourth most important food crop in the world after rice, wheat and maize with a world production of around 80 million metric tons. In the world India is the largest producer of banana with an annual production of 23.205 million metric tons from an area of 0.647 million hectares. Bananas are a caloric dense fruits. They are a good source of potassium and magnesium. About 100 gms bananas consist of about 89gms calories, 22.8gms of carbohydrates, 2.6 gms of fibres, 358mg of potassium, 27 mg

of magnesium. The high potassium content promotes bone health too. Bananas are also known to stimulate cell proliferation which thickens the stomach mucosa and is a barrier against stomach acids.

Papaya (Carica papaya) belongs to the fruits and vegetables class; it is highly abundant and invaluable plant that is prevalent throughout tropical Africa. Practically every part of the papaya plant is of economic value. The usefulness of fruits, roots and several parts of this plant has been largely reported.

The fruit is rich in vitamin C, E and minerals (potassium). It contains 270mg of potassium, 3mg of sodium, 5mg of phosphorus. It also contains pepsin and chymotrypsin, strong proteolytic enzymes. A brew of papaya leaves have a good effect on asthma. The antioxidant zeaxanthin, found in papaya filters out blue ray lights and also play a crucial role in eye health.

II. LITERATURE REVIEW

A study on evaluation of antioxidant activity of some tropical fruit peel extracts and optimization of extraction conditions for recovery of antioxidants from the selected fruit peel. Due to the extensively growing of many fruit processing industries, the fruit peels are often removed as a waste residue. Hence, the research has shift to focus on fruit residues as potential source of natural antioxidant replacing the synthetic one which may poses several side effects. Extraction was done on selected tropical fruits peels including rambutan, banana, mangosteen, logan to evaluate their antioxidant activity. Rambutan with ethanol extract possesses highest antioxidant activity which is 77.21 ± 0.17 % as compared to longan (73.24 ± 0.11%), mangosteen (46.97 ± 0.29) and banana (41.65 ± 0.22) for ethanolic extraction. Thus, rambutan was chosen to be continued with screening and optimization process. Single factor experiment using the one factor at a time (OFAT) method was done to study the effect of solvent to solid ratio (300:10 to 300:50 mL/g), extraction temperature (78 to 85oC) and extraction time (120 to 360 minutes). Next, central composite rotatable design (CCRD) coupled with Response Surface Methodology (RSM) was applied to optimize the extraction conditions on the antioxidant activity of rambutan peels. From the result, the highest antioxidant activity of about 96.12 ± 0.013 % was found at optimum conditions of solvent to solid ratio, 300:33 (mL/g); extraction temperature, 81oC and extraction time, 262.95 minutes. Based on statistical analysis, the extraction temperature was the most significant ($p<0.0001$) parameter condition affecting antioxidant activity and R2 value of 0.9810 denoted that the model developed was adequate in optimizing the extraction conditions of antioxidant properties from rambutan peels.

III. METHODOLOGY

A. CHEMICALS REQUIRED

- ✓ Ethanol
- ✓ Distilled water
- ✓ Ferric Chloride
- ✓ Sulphuric acid(concentrated)
- ✓ Glacial acetic acid
- ✓ Folin-colcalteu Reagent
- ✓ Potassium Ferricyanide
- ✓ Trichloro acetic acid
- ✓ Phosphate buffer
- ✓ Ammonium molybedate
- ✓ Hydrochloric acid
- ✓ Dragendroff reagent
- ✓ Ammonia(diluted)
- ✓ Acetic anhydride
- ✓ Sodium phosphate

B. PLANT MATERIAL

Papaya, banana, papaya and milk were collected from local markets of Lucknow. The fruits were washed with water thoroughly and blended in milk with and without their peels separately. Now, these blended fruits were dried in sunlight. The dried materials were grinded separately and kept in air tight containers. The dried materials were then utilized for making extracts.

C. PRELIMINARY SCREENING

5 gm dried powder was soaked in 25 ml ethanol for 10-12 hours. Kept on shaker for 2 hours. Filter through the Whatman filter paper. Collect the etahnolic extract. Kept it at 4℃ for further analysis.

- ✓ Phenols; Take 5ml of ethanolic extract + 2ml $FeCl_3$, blue precipate indicated presence of phenols.
- ✓ Saponins; Take 1ml of each ethanolic extract + 5ml distilled water. Frothing persistence indicated the presence of saponins.
- ✓ Terepenoid; Take 1ml of each ethanolic extract + few drops of H_2SO_4. Reddish brown colouration indicates the presence of terepenoids.
- ✓ Cardiac Glycosidase; Take 1ml of each ethanolic extract + few drops of H_2SO_4 + 1ml glacial acetic acid + 1ml $FeCl_3$. Brown color indicates the presence of cardiac glycosides.
- ✓ Alkaloid; Take 1ml of each ethanolic extract + 1% HCl + 1 ml of Dragondroff reagent. Orange precipitate indicates the presence of alkaloids.
- ✓ Flavanoid test; Take 1ml of each ethanolic extract + 5ml ammonium hydroxide + few drops of concentrated H_2SO_4. Yellow indicates presence of flavonoids.

D. ANTIOXIDANT ACTIVITY

REDUCING POWER

The reducing power of the extracts was determined as described by Lobo et al., (2010). 2.5ml of the ethanolic extracts in 1ml of distilled water were mixed with phosphate buffer (2.5 ml, 0.2 M, pH 6.6) and 1% potassium ferricyanide. Mixtures were incubated at 50ºC for 20 minutes in incubator. 2.5 ml of trichloroacetic acid were added to mixture and then centrifuged at 3000 for 10 mins. 2.5 ml of distilled water and

0.5 ml of ferric chloride were mixed. Absorbance of the mixture was measured at 700nm after 10 mins. Higher absorbance indicates a higher reducing power. In the assay, the color of test solution changes to various shades of blue depending on the reducing power of each extract.

TOTAL ANTIOXIDANT CAPACITY

According to Shirwarker et al., (2006) total antioxidant capacity was determined. 0.1ml of extracts was combined with 1ml of reagent solution (0.6Msulphuric acid, 28mM sodium phosphate and 4mM ammonium molybdate) in eppendroff tubes. The tubes were incubated at 95ºC for 90 mins in the incubator. Absorbances were measured at 700nm against blank at room temperature.

IV. EXPERIMENTAL RESULTS

PHYTOCHEMICAL SCREENING ANALYSIS

The results of phytochemical screening is shown in the table1.

S No.	Phytochemical test	Apple (with peel)	Apple (without peel)	Banana (with peel)	Banana (without peel)	Papaya (with peel)	Papaya (without peel)
1.	Phenols	+	-	+	+	+	+
2.	Terepenoids	+	+	+	+	+	+
3.	Alkaloids	+	+	+	+	+	+
4.	Flavanoids	+	+	+	+	+	+
5.	Saponins	-	-	-	-	-	-
6.	Cardiac Glycosidase	+	+	+	+	+	+

Table 1: Phytochemical assay results

In accordance to Lobo et al., 2010 the tests for presence of various phytochemical constituents were carried out on ethanolic extracts of the three fruits with peels and without peels blended in milk respectively and it was found that preliminary various bioactive compounds like phenolics, terepenoids, alkaloids, flavonoids, cardiac glycosides and fruits without peels blended in milk showed the presence of phytochemicals such as cardiac glycosides, flavonoids, terepenoids and alkaloids.

DETERMINATION OF ANTIOXIDANT ACTIVITY

The antioxidants play an important role in inhibiting free radicals and antioxidant activity prevent oxidative damage to major biomolecules and afford significant protection against oxidative damage. The antioxidant activity of the extracts was determined by the method of Lobo et.al (2010) for determination of reducing power and Shirwarker et al., 2006 for determination of total antioxidant capacity.

DETERMINATION OF REDUCING POWER

The reducing power of a compound serves as significant indicator of its potential antioxidant activity. Increased absorbance of the reaction mixture indicates increased reducing power. (Lobo et al., 2010).

S. No.	EXTRACT NAME	ABSORBANCE AT 100% CONC.	AT 75% CONC.	AT 50% CONC.	AT 25% CONC.
1.	A. W.P.	0.533±0.144	0.399±0.144	0.266±0.144	0.133±0.144
2.	A.WT.P.	0.850±0.234	0.623±0.234	0.425±0.234	0.212±0.234
3.	B.W.P.	0.503±0.340	0.377±0.340	0.251±0.340	0.125±0.340
4.	B.WT.P.	0.883±0.774	0.662±0.774	0.441±0.774	0.220±0.77
5.	P.W.P.	0.004±0.003	0.003±0.003	0.002±0.003	0.001±0.003
6.	P.WT.P.	0.623±0.425	0.467±0.425	0.311±0.425	0.155±0.425

Values are readings±S.D. (n=4)

Table 2: Reducing Power

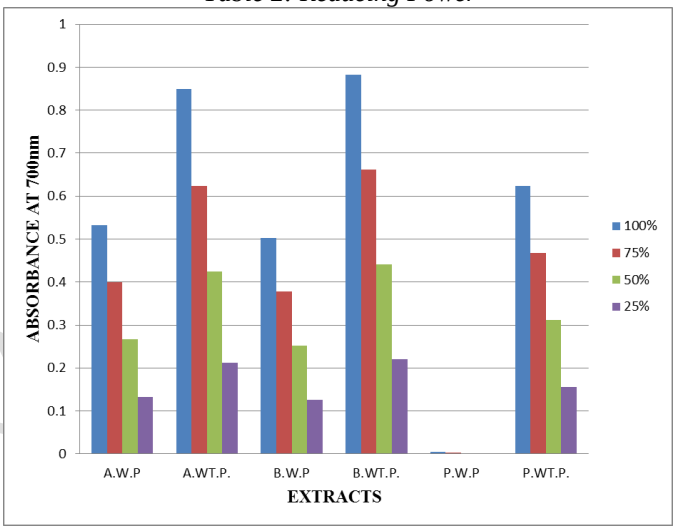

Figure 1: Antioxidant activity determined by reducing power assay

In the graph 1,

- ✓ A.W.P. – Apple With Peel
- ✓ A.WT.P. – Apple Without Peel
- ✓ B.W.P. – Banana With Peel
- ✓ B.WT.P. – Banana Without Peel
- ✓ P.W.P. – Papaya With Peel
- ✓ P.WT.P – Papaya Without Peel

Total antioxidant capacity

The total antioxidant capacity of extracts was calculated based on the formation of phosphomolybdenum complex which was measured spectrophotometrically at 695nm.

(Shirwarker et al., 2006). It is reported that extracts blended without peel shows lower absorbance and extracts blended with peel shows appreciable absorbance except for apple. Papaya with peels showed the highest absorbance whereas apple with peels and papaya without peels gave minimum absorbance.

The total antioxidant capacity was measured by spectrophotometric method. (Shirwarker., 2006).

Sr .no.	Extract name	ABSORBANCE At 100% conc.	At 75% conc.	At 50% conc.	At 25% conc.
1.	A.W.P.	0.097±0.25	0.072±0.25	0.048±0.25	0.024±0.25
2.	A.WT.P.	0.296±0.	0.222±0.	0.148±0.0	0.074±

		08	08	8	0.08
3.	B.W.P.	0.704±0.19	0.528±0.19	0.352±0.19	0.176±0.19
4.	B.WT.P.	0.237±0.06	0.177±0.06	0.118±0.06	0.059±0.06
5.	P.W.P.	0.746±0.21	0.559±0.21	0.373±0.21	0.186±0.21
6.	P.WT.P.	0.100±0.81	0.075±0.81	0.05±0.81	0.025±0.81

Values are readings±S.D. (n=4).

Table 3: Total antioxidant capacity

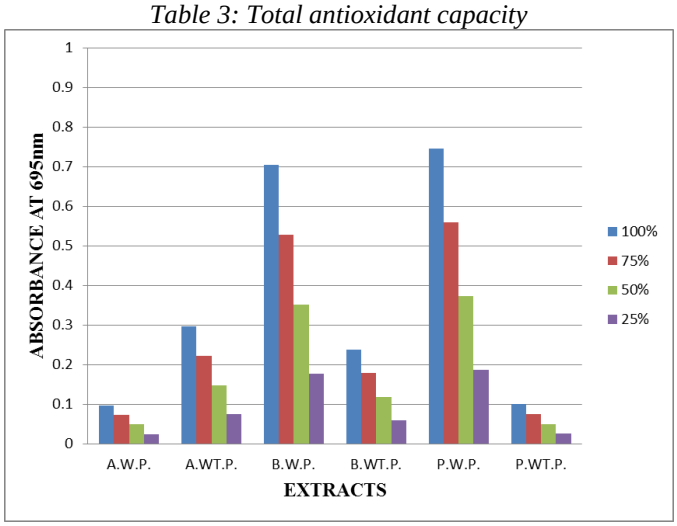

Figure 2: Antioxidant activity determined by total antioxidant capacity method.

In the graph.2,

- ✓ A.W.P. – Apple With Peel
- ✓ A.WT.P. – Apple Without Peel
- ✓ B.W.P. – Banana With Peel
- ✓ B.WT.P. – Banana Without Peel
- ✓ P.W.P. – Papaya With Peel
- ✓ P.WT.P – Papaya Without Peel

V. COLCLUSION

This paper focus on fruit residues as a potential source of natural antioxidant replacing the synthetic one which may poses several side effects.

Tropical fruits are grown in tropical climates and contain most of the biologically active substances, such as antioxidants etc. Despite stem, bark, leaves, pulp and other part of fruit, peels are preferable as it is the major byproduct causing environmental problem. The discarded fruit peels are easily available and mostly contain potential antioxidants.

Antioxidant activities contain bioactive compounds which defense against a variety of stresses usually caused by pathogens or unfavorable environmental conditions.

Antioxidants prevent free radical induced tissue damage by preventing the formation of radicals, scavenging them, or by promoting their decomposition. Synthetic antioxidants are recently reported to be dangerous to human health. Thus the search of effective, nontoxic natural compounds with antioxidative activity has been intensified in recent years. In addition to endogenous antioxidant defense systems, consumption of dietary and plant derived antioxidants appears to be a suitable alternative. Dietary and other components of plant from a major source of antioxidants. The traditional Indian diet, fruits and medicinal plants such as tea are rich sources of natural antioxidants: high intake of fruits with functional attributes including high level of antioxidants in antioxidants in fruits is one strategy that is gaining importance.

Apple peels are often discarded in the production of processed apple products, but clearly they possess high levels of antioxidant and bioactive compounds. Waste apple peels from applesauce and canned apple manufacture should be regarded as a valuable product.

It can be concluded that banana peel had also good antioxidant potential, though varietal differences were observed. Hence banana peel can be exploited for their nutritional and antioxidant components.

Medicinal benefits of banana peel include relief from pain, swelling, itching, bruising, wrinkles and sunburn as banana peel is rich in dietary fibre, proteins, essential amino acids, polyunsaturated fatty acids and potassium.

The constituents of the extracts of *C. papaya* contain compounds and micronutrients which may be responsible for their observed antioxidant activities.

This study firstly reported extracts of tropical fruits has very strong antioxidant activity suggesting that the potential as food additives to increase antioxidant activity in foods.The antioxidant activity and phytochemical constituents of edible portions of three tropical fruits were determined. Extracts of fruit samples were screened for selected phytochemicals. The antioxidant activities were high in fruits blended without peels by reducing power assay.

Thus, the antioxidant activity of a system gives a measure of its protective abilities against degenerative/ oxidative reactions induced by oxidizing agents. However, most human cells unlike plant cells do not generate adequate amounts of antioxidants to protect them against oxidative reactions.

VI. FUTURE SCOPE

Polyphenolic compounds have attained great attention from investigators because of their antiviral, antifungal, antibiotic, antitumor, anti inflammatory, antimutagenic and antioxidant activities.

Alkaloids in plants, commonly act as bioprotective neurotoxins, which attacked the unique nervous system of the herbivores while remaining immune to the toxin. The presence of alkaloids are commonly found in fruit parts of the plant.

Terepenoid protects plants by acting toxins and feeding deterrents to herbivores and mammals.

Apples and especially apple peels, have been found to have a potent antioxidant activity and can greatly inhibit the growth of liver and colon cancer cells.

Bananas and papayas are rich in vitamin C, vitamin A, and mineral compositions. Bananas contain more of the carotenoid, lutein, etc.

Papayas can be important source of vitamin C, vitamin A, and Magnesium.

These nutritional values of papaya help to prevent the oxidation of cholesterol. Papaya is rich in iron, calcium, a

good source of vitamins A,B and C. The extracts of unripe papaya contains terepenoids, flavonoids, carbohydrates, glycosides, saponins, and steroids.

Papaya peels can be used in many home remedies and cosmetics such as in sunscreen and soothing slave, muscle relaxant as well as in fighting dandruff problems too.

The analysis of banana peels indicated that peels exhibit high antioxidant activity. Hence it can be exploited for their nutritional and antioxidant components.

After standardized extraction procedures the desired portions can be attained and to eliminate the unwanted materials. the extractions may be used as a medicinal agents in forms of tinctures or fluids or can be incorporated in capsules and tablets.

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