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Studies on biochemical analysis and antioxidant property in culinary fruit peels collected from Kannamagalam town of Vellore districts

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ABSTRACT

Recently many studies have been oriented toward improving methods and efficiency of recovery from different fruit industry wastes. The investigation carried out were mainly aimed at evaluating antioxidant ,carbohydrates and fiber composition of air dried medicinally significant domestics fruit peels orange, lemon, pomegranate, papaya and banana and their extracts. In this study, biochemical, carbohydrate, anti oxidant, fiber and antimicrobial activity of different fruit peel extract were carried out. Among them pomegranate peel extract gives maximum antimicrobial activity and orange peel shows higher antioxidant property, lemon has higher fiber content compared to other fruit peel extracts. Mostly all the fruit peel contain carbohydrate content in higher level. Hence, fruit peels can be used as therapeutic and effective medicine as it shows higher antimicrobial and antioxidant properties in it. So, fruit peels can be utilized in pharmaceutical industries for better future in a eco-friendly manner.

Keywords: Fruit Peels, Antioxidant Property Assay, Antimicrobial Activity

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INTRODUCTION

Fruits peels are important natural sources of antioxidants, dietary fiber and carbohydrates. Fruit peels that become wastes consequently add to the current severe pollution problem. Previous studies, however, showed that, in general, fruit peels contain higher concentrations of dietary fiber, carbohydrates and an antioxidant compound [1]. It is possible to utilize fruit peels as dietary fiber and antioxidant food additive to produce valuable food products for human being and they may play a role in the prevention of diabetes mellitus, cardiovascular diseases and cancer [2], [3]. Coronary Heart disease (CHD) have reduced risk or mortality which is linked to flavonoids which is commonly found in fruits and vegetables [4].The general objective of the study was to characterize peels of orange, lemon, pomegranate, papaya and banana as functional food ingredient in terms of nutrient composition, dietary fiber content and their fermentability in vitro as well as their phytonutrients and antioxidant activity, carbohydrates, and dietary fiber and anthocyanidins. The fruit peel is rich in fiber, minerals and carbohydrates especially pectin [5]. These studies have been conducted to obtain and assess the composition of dietary fiber-rich products obtained from by-products sources such as oranges, lemon, pomegranate, papaya and banana [6, 7, 8]. The antioxidant activity was determined using reducing antioxidant power (FRA) .Fruit peels are the outer covering of the fruits which behaves as a physical as well as a chemical barrier, antimicrobial and any for external pathogens to spoil the quality of fruit products [9].The prevention of hypertension and cerebral apoplexy can also be realized by banana peel [10]. Orange processing industries generate thousand tons of orange peel per year, which are marketed as animal feed [11]. Antioxidants are the chemical substances that reduce or prevent oxidation have ability to prevent the free radicals to damage in tissues. It also protect against cancer. These antioxidants are an especially important class of

preservatives because like bacterial or fungal rapidly occur in fruits .so causing of spoilage [12]. Bananas are rich in fiber, polyphenols and low protein but their composition varies according to the species and the variety as well as the maturation [13]. Banana peels contains of vitamins B6, B12, magnesium, potassium and also contain of more fiber. Another benefit of banana peels is that they contain tryptophan, which can increase serotonin levels. Having good blood serotonin levels can help reduce the risk of depression. Actually orange peel contains four times more fiber than the entire orange. Orange peels are against cancer namely as tangeretin which also help to fight UV rays and reduce the risk of skin cancer [14], [15]. The Wastes from agro-industries like wheat bran, sugarcane bagasse, rice bran, sorghum stems, saw dust, banana waste, orange peel, lemon peel can be used for pectinase production [16]. The fruit peels were considered as waste in the fruit industries. And, disposing them became a serious issue, as it lead to cause environmental pollution. On the other hand, it can be utilized in pharmaceutical field as it contains all the properties [17], [18], [19].

MATERIALS AND METHODS

Collection of fruit peels

12.753524 ° N, 79.161395 ° E

The Average summer temperature 40 °C (104 °F) of Kannamangalam the place helps for the growth of culinary fruits like papaya, pomegrante and banana in their respective seasons and average winter temperature 20 °C (68 °F) helps in the growth of citrus fruits like Orange and lemon in respective seasons. Fruit peels namely Orange (Madura pomifera), Pomegranate (Punica Granatum), papaya (carica papaya), Banana (Musa Babisiana), Lemon (Citrus Limetta) were collected from the juice shops and local markets and then other kind of damage, free from insects.

Preparation of fruit peels extract

The fruit peels under over investigation were washed with tap water followed by distilled water. The peels were cut into small pieces and dried. After few day complete removal of moisture the peels were shaded dried, coarsely powdered. It is weighed and stored in sterile containers for extraction. Each of the dried and powdered samples was extracted with various solvents (Toluene, Hexane, Ethyl acetate and Petroleum ether) for 96 hours. The extracts *were* concentrated using water bath set at 60°C. After that the respective extracts were weighed and percentage extractive values were determined.

BIO CHEMICAL ANALYSIS FOR CARBOHYDRATES FROM FRUIT PEELS

TEST FOR FLAVONOIDS

Test for alkaline reagent

To the extract, add few drops of sodium hydroxide (NaOH) solution, after that the formation of intense yellow colors turns to colorless because of the addition of some drops of dilute acetic acid which indicate the flavonoids present in our test solution

Ferric chloride test

Add few drops of ferric chloride solution with the extracted solution. Then the green color was formed by the addition of $FeCl_3$ indicates the presence of flavonoids.

PHENOLIC COMPOUNDS TEST

Ferric chloride test

To the extract add some drops of 5% ferric chloride ($FeCl_3$) solution. The dark green color will appear which indicates the phenol compounds are present in our solution

Lead acetate test

To the test solution and few drops of 10% lead acetate solution was added. White Precipitate indicates the phenolic compounds present in our solution

Gelatin test

To the sample extract solution and add some drops of 5% Gelatin solution. White Precipitate indicates the phenolic compounds present in our solution

AMINO ACID TEST

Test for Ninhydrin

1ml of sample solution and add with ninhydrin reagent. Purple color was appears which indicates the presence of amino acids.

PROTEIN AND CARBOHYDRATES ANALYSIS

Biurette test

To the extract, add 6% NaoH solution and violet colour appears when small drops of 1%$CuSO_4$ solution was added, which indicates the presence of protein.

Molisch's test

To the extract solution, and add few drops of alcoholic α-napthol. And 1ml of concentrated sulphuric acid was added slowly through the sides of the tube, purple color which turns to violet color ring was appears at the Junction of the solution.

TEST FOR ORGANIC ACIDS

Oxalic acid

To the extract, add few drops of 1% $Kmno_4$ and dilute H_2SO_4, colour disappears.

Malic acid

To the extract, add 2-3 drops of 40% $FeCl_3$ solution, appears yellowish colour.

TEST FOR INORGANIC ACIDS:

Sulphate Test

To the extract, add lead acetate reagent, white precipitate appears which is soluble in NaoH.

Carbonate test

To the extract, add dilute HCl solution, liberate CO_2 gas. Indicate the presence of carbonate.

QUALITATIVE ANALYSIS OF CARBOHYDRATE FROM FRUIT PEELS

Fehling's Test:

In a test tube, add 2 ml of the test carbohydrate solution and add equal volumes of Fehling A & Fehling B and place it in a boiling water bath for few minutes.. When the content of the test tube comes to boiling, mix them together and observe any change in color or precipitate formation. The production of yellow 'or brownish-red precipitate of cuprous oxide indicates the presence of reducing sugars in the given sample.

Benedict's Test:

In the test tube with 2 ml of Benedict's reagent, add 5-6 drops of the test carbohydrate solution and mix well. Place the test tube in a boiling water bath for 5 minutes and observe any change in color or precipitate formation. Cool the solution. Observe the colour change from blue to green, yellow, orange or red depending upon the amount of reducing sugar present in the test sample.

ESTIMATION OF FIBER CONTENT IN FRPreparation of culture filtrate:
To the extract solution, add 1ml of NaoH or dilute HCL solution is dissolved. To crude fiber consists largely of cellulose and lignin [97%] plus some mineral matter. It represent only 60 -80% of the cellulose and 4-8% of lignin. Estimation of the culture filtrate was boiled with 200ml sodium hydroxide solution for 3 minutes. That it after filtered through muslin cloth. And then washed with 25ml of 0.25% sulphuric acid, 50ml of water and 25ml of alcohol. Removing the residues and transferring to ashing dish and dried for 2 hour at 60c. After that it coaled the dish in a oven and weighed [w2].

ANTIOXIDANT PROPERTY ASSAY
The reducing power assay fruit has been used for the determination of the property of fruit peels under consideration with respect to ascorbic acid as the standard antioxidant. 5mg extracts of different fruit peels were mixed with 2.5mlof phosphate buffer and also with potassium ferric cyanide. This extract was kept in water bath at 50°C for 20 minutes. After cooling the mixture at room temperature 2.5ml of 10% trichloroacetic acid was added and further centrifuged at 3000rpm for 10 minutes. The supernatant [2.0ml] was separated in a clean test tube and mixture with distilled water [2.5ml] and prepare [0.5ml] ferric chloride solution. The observed for uv-spectrophotometer at 595nm. The control was prepared for each fruit peels by expect samples and mixing all other remaining components in the same manner.

Antimicrobial activity for fruit peels
Agar well diffusion assay was carried out to determine antibacterial activity of fruit peel extracts. Gram positive Staphylococcus aureus and were screened for their susceptibility to peel extracts. In brief, 24 hours old Nutrient broth cultures of test bacteria were aseptically swab inoculated on sterile Nutrient agar plates followed by punching wells of 6mm diameter using a sterile cork borer. 100µl of peel extracts and (25%, in sterile water) transferred into labeled wells. The plates were incubated at 37°C for 24 hours in upright position and the zone of inhibition formed around the wells was measured.

RESULTS AND DISCUSSION

Figure:1 showing different fruit peel powder

Table:1 Biochemical Analysis Of Fruit Peels

S.No	Name Of Tests	Procedure	Observation	O	L	Po	Pa	b
1	FLAVONOIDS TEST i.Alkaline reagent test for flavonoids	1.Test solution +Few drops of NaoH solution 2.Testsolution +Fewdrops of $FeCl_3$solution	1.Yellow color 2.Green color	+ –	+ –	+ –	+ –	+ –
2	.PHENOLIC COMPOUNDS i.Ferric chloride test iiLead acetate test iii.Gelatin test	1. Test solution +Few drops of neutral 5% $Fecl_3$ 2.Testsolution+10%few of drops of lead acetate solution 3.Test solution+10% few drops of gelatin	1.Green colour 2.White precipitate 3.White precipitate	- -	- -	- -	- -	- -
3	AMINO ACID Ninhydrin test	1.Testsolution +few drops of 5% ninhydrin test	Violet color	-	-	-	-	-
4	PROTEIN TEST Biuret test	Test solution+4% NaoH +few drops of 1% $CuSO_4$	Violet color	-	-	-	-	-
5	CARBOHYDRATE TEST Molisch's test	Test solution +few drops of alcoholic napthol +0.2 ml con.H_2SO_4	Purple to violet color rings appear	+	+	+	+	+
6	ORGANIC TEST i.Oxalic acid ii.Malic acid	1.Test solution +few drops of 1% $kmno_4$+dis.H2SO4 2.Test solution+2 to 3 drops of 40% $FeCl_3$solution	1.Purple color disappears 2.Yellowih color	- -	+ -	+ -	+ -	+ -
7	INORGANIC ACID i.Sulphate test ii.Carbonate test	1.Test solution +lead acetate reagent 2.Test solution+ diluted HCl	1.White precipitate appears which is soluble in NaoH Liberate CO2 gas	-	-	-	-	-

O-Orange; L- Lemon; Po-Pomegranante; Pa-Papaya;B-Banana
+ve=positive (present); _ve=negative (absent)

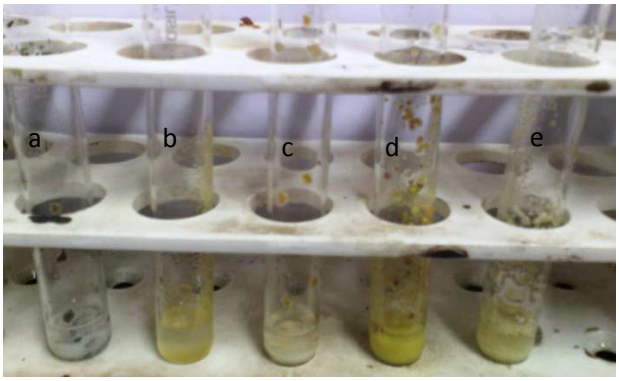


Fig 2: a-banana peel-(+); b-orange peel-(+); c-papaya peel(+); d-pomegranate peel-(+); e-lemon results of lead acetate
+ve=positive (present); _ve=negative (absent)

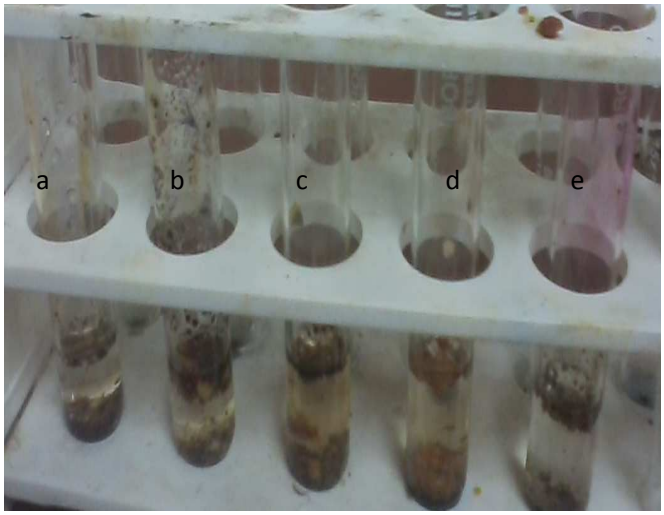


Fig.3 a-orange peel-(+); b-lemon peel –(+); c-papaya peel-(+) ; e-pomegranate-(+); d-banana-(+) result of oxalic acid
+ve=positive (present); _ve=negative (absent)

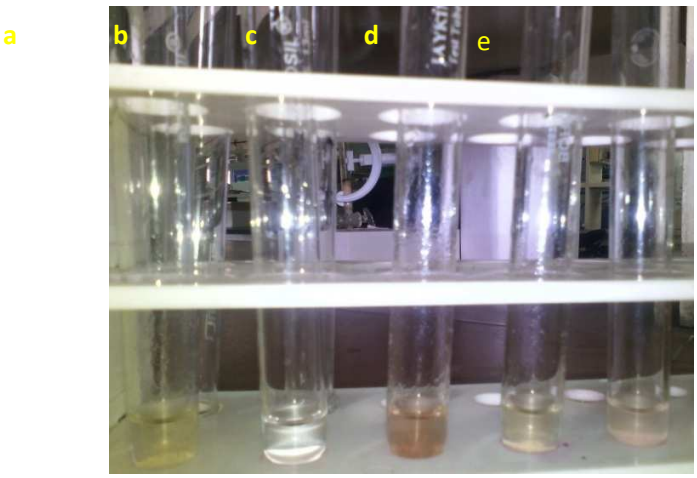


Fig.4: a-orange peel – (+); b-lemon peel -(+); c-pomegranate –(+); d-papaya-(+) e-banana-(+) results of sulphate test
+ve=positive (present); _ve=negative (absent)

Table 2: shows results of carbohydrate test of different fruit peel extract

S.No.	Name of Test	Procedure	Observation	Orange	Lemon	Pomegranate	Papaya	Banana
1	Benedicts test	Test solution+5to6 drop benedict	Yellow/orange red	+	+	+	+	+
2	Fehling's test	Test solution+2ml of fehling and B solution	Brownish red precipitate	+	+	+	+	+

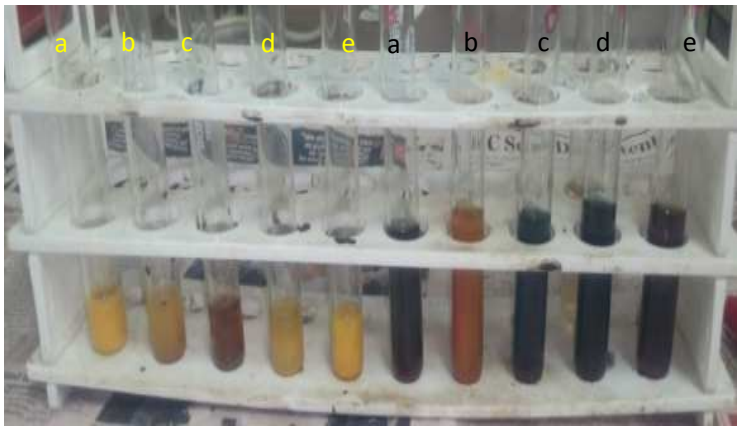


Fig.4: Shows the results of Carbohydrate

Table 3: The fiber content in different fruit peel extracts

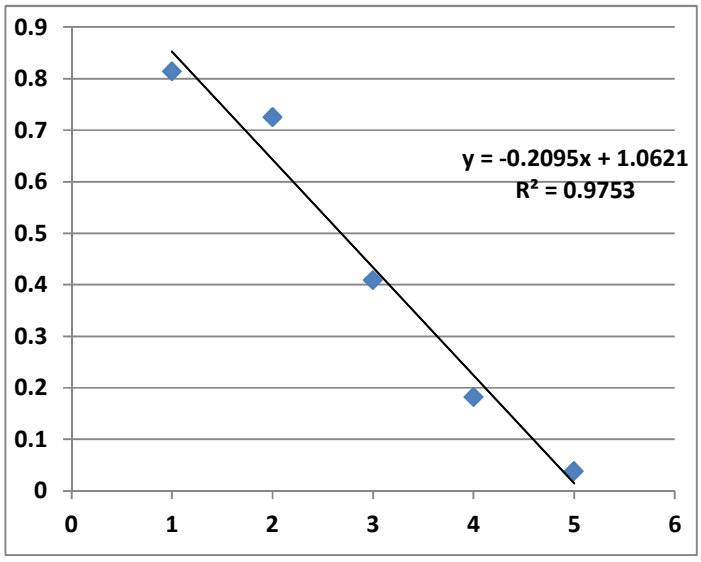
S.NO	SAMPLES	RESULT(GRAMS)	RESULT(MILIGRAMS)
1.	Orange	0.0224	23.4
2.	Lemon	0.0350	35.0
3.	Pomegranate	0.0236	22.5
4.	Papaya	0.0227	22.6
5.	Banana	0.0228	22.7

ANTIOXIDANT ASSAY

Table 4: The antioxidant property of different fruit peel extracts

S.NO	SAMPLES	RESULT
1.	Control	0.000
2.	Orange	0.814
3.	Lemon	0.725
4.	Pomegranate	0.409
5.	Papaya	0.182
6.	Banana	0.038

Antioxidant Activity



.1.Orange peel; 2.Lemon; 3. Pomegranate; 4.Papaya; 5.Banana
Fig.5: Shows the result of antioxidant activity

This study was used to configure the nutrients like carbohydrate fiber and antioxidant activity in fruit peels .Among them pomegranate peel extract gives maximum antimicrobial activity and orange peel shows higher antioxidant property, lemon has higher fiber content compared to other fruit peel extracts. Mostly all the fruit peel contain carbohydrate content in higher level. Hence, fruit peels can be used as therapeutic and effective medicine as it shows higher antimicrobial and antioxidant properties in it. So, fruit peels can be utilized in pharmaceutical industries for better future in an eco-friendly manner.

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