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FREE RADICAL SCAVENGING ACTIVITY OF PULPS AND PEELS OF SOME SELECTED VEGETABLES COMMONLY USED IN PAKISTAN

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ABSTRACT:-The aim of this study was to estimate the antioxidant activity of peels and pulps of pumpkin, turnip, potato, full ripe radish pod, unripe radish pod, bitter gourd, sweet potato, purple skin sweet potato, turmeric, green chilli, red chilli and unripe pumpkin grown in Pakistan. The antioxidant activity of these vegetables were determined by using UV-visible spectrophotometer. The highest Total Phenolic Content of vegetables pulps and peels were found 6.395 mg/g and 4.613 mg/g in radish pod and potato, respectively. The higher Total Flavonoid Content of vegetables pulps and peels were determined 5.420 % and 6.33 % in potato and purple skin sweet potato. The sweet potato pulps gave maximum 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity with IC_{50} 13.258 mg/mL. The purple skin sweet potato peel showed the highest 2,2-diphenyl-1-picrylhydrazyl radical activity with IC_{50} 9.54mg/mL. The correlation coefficient determined were 0.69, 0.41 and 0.64 between Total Phenolic Contents, Total Flavonoids Contents and 2,2-diphenyl-1-picrylhydrazyl of peels and pulps of vegetables respectively.

Key Words: Free radical scavenging activity; Total phenolic content; Total flavonoid content; Vegetable pulps and peels.

INTRODUCTION

Antioxidants are nutrients i.e minerals and vitamins as well as enzymes in protein of human body that help in the chemical reactions. These are main ingredients that enhance the foods products quality and stability of fats and fatty food [Vertuani et al., 2004; Scheibmeir et al., 2006]. Total antioxidant activity, metal, radical scavenging effects and reducing power as well as activities destructive to species of active oxygen i.e the hydroxyl radical, superoxide anion, and hydrogen peroxide are widely used for this purpose. Free radicals are produced in normal and or pathological cell metabolism. Free radicals and reactive oxygen species are produced by processes such as exogenous chemicals or endogenous metabolic in human body. With the help of oxidizing biomolecules these radicals cause oxidative damage effects, and causing death of cell and tissue damage [Georgetti et al., 2007]. Reactive oxygen species such as super oxide anions (O2-), hydroxyl radicals (HO), hydrogen peroxide (H_2O_2) and hypochlorous acid (HClO) are physiological metabolites formed during aerobic life as result of the metabolism of oxygen [Mondal et al., 2004; Heo et al.,2005; Scheibmeir et al., 2006].

Neutrophils are the most abundant type of granulocytes and white blood cells of mammals. They produce free radicals to attack and destroy pathogens, while the liver uses free radicals for detoxification

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[Valko et al., 2007]. It was reported that vegetables and fruits consistently had been existed to be protective against disease of coronary heart and cancers. While evidence which obtained with oxidation model (in vitro) for disease of heart had determined that many plant flavonols. It belonging to the class of flavonoids, e.g quercetin, rutin, and myricetin were strong antioxidants as compared to the traditional vitamins. [Vinson et al., 1998]. Chloroform, acetone and ethanol extract of leaves of E. aureum is proven effective against free radicals. Ethanol extract was found to possess highest antioxidant potential compared to chloroform and acetone [Das et al., 2015].

Trolox (syntheticantioxidant) is oftenly used as a reference compound, but generally identified antioxidants i.e vitamin C and quercetin. Metal ions chelation power is indirect method for determine antioxidant activity. Flavonoids are capable to chelate Fe^{2+}or Cu^{2+}ions made them inactive to take part in free radical reactions. However, there were studies had been conducted for the plant under Loganiaceae family, for example, Anthocleista nobilis was claimed to effectively cure fever, diarrhea and stomach ache in West Africa [Ngwoke et al 2015]. The presence of many biochemicals (polyphenols) is attributed to the useful effect of some vegetables. The plant sources along with polyphenol exist many bioactive substances that help in the protection of disorders [Ullah and Khan, 2008]. Other component that increases the benefit of some vegetables is flavonoid. Different kinds of flavonoids are recorded in vegetables which contain antioxidant properties. These are more effective in prevention from fat accumulation in blood vessels and reduce risk of heart disease stroke [Terao et al., 2008]. Oxidative stress causes death of cells via prolonged elevations of intra-cellular calcium concentrations [Sakanashi et al., 2008]. The richest soruces of natural antioxidant are green leafy vegetables, cereal crops, wheat, roots spices, oilseed, herbs, circus fruits, sweet potatoes as well as brightly colour fruits, and tomatoes. Fresh and green vegetables are the best antioxidants source that assits in clear free radicals which are linked with cell damage [Ginter, 2008]. The consumption of the some fresh vegetables prevent the body from many disorders i.e cancers. Vegetables contained high concentration of redox active antioxidants i.e flavonoids, carotenoids, ascorbic acids, and polyphenols which fight against dangerous oxidative damage of plants cells [Odukoya, et al., 2007; Karadenz, 2005].

The main objectives of this study to investigate the antioxidant activity, total phenolic and total flavonoids content from these selected local vegetable pulps and peels in Pakistan.

MATERIALS AND METHODS

All chemicals and reagents (Sodium hydroxide, Gallic acid, Sodium nitrite, Aluminum chloride, Ferrous chloride, Sodium carbonate, Butylated hydroxyl toluene, 2,2-diphenyl-1-picrylhydrazyl (DPPH) solution, Folin- Ciocalteu reagent, Distilled water, Deionized water, Sodium hydroxide, Catechin, Methyl alcohol) used were of Merck (Darmstadt, Germany) and Sigma Aldrich unless stated. UV-Spectrophotometer: U-2001 Spectrophotometer (Hitachi Instruments Inc. Tokyo,

Japan.), The absorbances were determined by spectrophotometer at different wavelength i.e 755nm ,515nm, and 510nm.

Vegetables Samples

Twenty samples of fresh vegetables pulps and peels were collected from the market to conduct this study. The vegetables used for analysis were pumpkin, turnip, potato, full ripe radish pods or fruit of radish, unripe radish pods, bitter gourd, sweet potato, purple skin sweet potato, turmeric, green chilli, red chilli and unripe pumpkin. (Table 1).

Preparation of Extracts

The pulps and peels of vegetables were dried at room temperature. For analysis dried vegetables were ground into powder with the help of blender and their weights were noted. Soxhlet extraction method was employed for preparation of extract of some selected local vegetables. Then extracts of vegetables were filtered through filter paper, then concentrated under the reduced pressure at 45^{0}C with the help of rotary evaporator. The extracts were dried, weighed and kept at 4^{0}C in dark place. The vegetables extracts were used to determine antioxidant activity by the following methods. Butylated hydroxyl toluene was used as a positive control in the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay.

Total Phenolic Contents

The Total Phenolic Contents (TPC) of pulps and peels of vegetables determined by procedure Folin Ciocalteu (F-C) that was described by Chaovanalikit and Wrolstad (2004). The extracts solution 0.52 ml of each vegetable was dissolved into the mixtures of 0.512 ml of F-C reagent and 7.5 ml of water. The mixture was placed at 27^{0}C for 10 min and then 1.5 ml of 20% Na_2CO_3 was added. The mixture was heated in a water bath at 40^{0}C for 20 min and then cooled in an ice bath. Absorbance was noted at wavelength 755nm by using spectrophotometer. The TPC was found with the help of gallic acids calibration curve.

Table1. Vegetables Selected for Study

Sr. No.	Vegetables	Scientific name	Family	Part used
1	Potato (Alu)	Solanumtuberosum	Solanaceae	Pulp peel
2	Sweet-potato (Shakarkandi)	Ipomoeabatatas	Convolvulaceae	Pulp peel
3	Turnip (Shaljam)	Brassica napus	Brassicaceae	Pulp peel
4	Bitter gourd (Karela)	Momordica Charantia	Cucurbitaceae	Pulp peel
5	Pumpkin (Kadoo)	Cucurbitapepo	Cucurbitaceae	Pulp peel
6	Radish pods (Full ripe Mongray)	Raphanussativus	Cruciferae	Pulp
7	Unripe Radish pods (Mongray)	Raphanussativus	Cruciferae	Pulp
8	Purple skin sweet potato (Shakarkandi)	Ipomoea batatas	Convolvulaceae	Pulp peel
9	Unripe pumpkin (Kadoo)	Cucurbitapepo	Cucurbitaceae	Pulp peel
10	Green chilli (Sabazmirch)	Capsicum annum	Solanaceae	Pulp
11	Red chilli (Laalmirch)	Capsicum annum	Solanaceae	Pulp
12	Turmeric (Haldi)	Curcuma longa	Zingiberaceae	Peel pulp

Total Flavonoids Content

Total flavonoids of vegetables (pulps & peels) were calculated using the following procedure which described by author [Dewanto et al., 2002]. 1 ml solution of extract mixed with 5ml distilled H2O. Then each solution of 0.31 ml of 5% $NaNO_2$,0.6 ml of 10% AlCl3 and 2 ml of 1M NaOH was added at 5 mint duration and filled up with distilled water. The absorbance of solution was measured at 510 nm with spectrophotometer and procedure was repeated three times.

DPPH Radical Scavenging Assay

Free radical scavenging activity of vegetables extracts was determined by the procedure explained [Bozin et al., 2006; Villano et al., 2007]. The samples were mixed with 1 milliliter of 2,2-diphenyl-1-picrylhydrazyl (DPPH) solution and filled up with 95% methanol, in order to make 4ml final volume. Absorbance of sample solution and blank solutions were noted after 1hour at room temperature. Butylated hydroxyl toluene (BHT) was used as a positive control. Three replicates values of each sample were recorded. The disappearance of DPPH (2,2-diphenyl-1-picrylhydrazyl) was determined using spectrophotometrically at a wavelength of 515 nm which was shown in figure 2 . The inhibition of free radical by DPPH in percentage was determined in following way (%) = 100 X (A blank – A sample / A blank)

IC50 value indicated the concentration of extract that caused 50% neutralization of this DPPH radicals and it was calculated by plot graph between inhibition percentage against concentration.

STATISTICAL ANALYSIS

The experimental results of vegetables were determined as mean values along with standard deviation (means values ± SD). All measurements of the vegetables samples were replicated for three times. The data of vegetables samples were statistically analyzed. The correlation analysis was done between antioxidant data of pulps and peels of some selected vegetables samples.

RESULTS AND DISCUSSION

The antioxidant activity of different vegetables pulps and peels was estimated by using different methods such as Total Phenolic Content, Total Flavonoids, and DPPH Radical Scavenging Activity. The results are described in the proceeding sections.

Total Phenolic Contents in Vegetables Pulps

The amount of total phenolic contents (TPC mg/g) of different vegetables pulps samples are presented in the (Table 2).The amount of TPC from radish pods pulp to red chilli pulp was ranged from 6.395 mg/g to 0.767 mg/g of dry matter. The highest TPC 6.395 mg/g was extracted from radish pods, whereas the minimum TPC 0.767 mg/g was extracted from red chilli pulp. The Figures 1 & 2 demonstrates the standard calibration curve and comparison of different vegetables pulps. The pulps of sweet potato, turnip, bitter gourd, turmeric and green chilli gave the TPC values, 4.214mg/g, 4.051 mg/g, 2.913 mg/g, 1.208mg/g and 1.922 mg/g, respectively. As Kaur et al., were estimated TPC in Turnip (127.0

mg/100g), Radish (54.5 mg/100g), Potato (149.8 mg/100g) and Garlic (145.0 mg/100g) [Kaur and Kapoor, 2002]

Table 2. Total Phenolic Content in Vegetables Pulps

Sr. No.	Name of Vegetables	TPC in Pulps (mg/g)
1	Potato	5.064 ± 0.115
2	Sweet potato	4.214 ± 0.177
3	Turnip	4.051 ± 0.363
4	Bitter gourd	2.913 ± 0.142
5	Pumpkin	1.678 ± 0.162
6	Radish pod (Full ripe)	6.395 ± 0.174
7	Unripe radish pod	1.505 ± 0.257
8	Purple skinsweet potato	1.138 ± 0.016
9	Unripe pumpkin	1.161 ± 0.014
10	Green chilli	1.922 ± 0.137
11	Red chilli	0.767 ± 0.106
12	Turmeric	1.208 ± 0.147

Note: Each value is Means ± Standard deviation

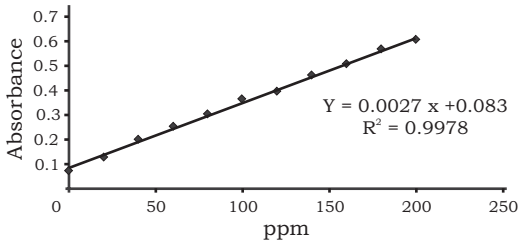

Figure 1. Standard Calibration Curve for Gallic Acid

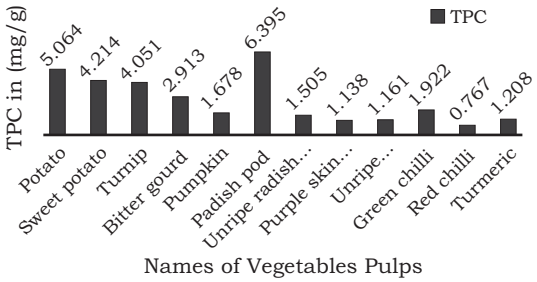

Figure 2. TPC in Vegetables Pulps

Total Phenolic Contents in Vegetables Peels

The Total Phenolic Contents in peels (TPC mg/g) of different vegetables are given in the (Table 3).The TPC in potato peel and unripe pumpkin peel was ranged from 4.613 mg/g to 0.287 mg/g, respectively. The highest TPC 4.613 mg/g was extracted from peel of potato while the minimum TPC 0.287 mg/g was determined from peel of unripe pumpkin. The pumpkin peel showed high amount of TPC than that of unripe pumpkin. Similarly sweet potato peel (3.475 mg/g) contained more TPC value as compared to purple skin sweet potato peel(1.211 mg/g) as shown in (Figure. 3).

Table 3. Total Phenolic Content in Peels of Vegetables

Sr. No.	Name of Vegetables	TPC in peel (mg/g)
1	Potato	4.613 ± 0.142
2	Sweet potato	3.475 ± 0.018
3	Turnip	1.049 ± 0.099
4	Bitter gourd	1.515 ± 0.130
5	Pumpkin	2.683 ± 0.128
6	Purple skin sweet potato	1.211 ± 0.184
7	Unripe pumpkin	0.287 ± 0.162
8	Turmeric	1.116 ± 0.072

Note: Each value is Mean ± SD

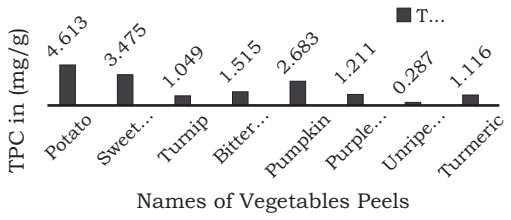

Figure 3. TPC in Peels of Vegetables

Total Flavonoid Content in Vegetables Pulps

It has been recognized that flavonoids show antioxidant activity and their effects on human nutrition and health are considerable. The mechanisms of action of flavonoids are through scavenging or chelating process. The total flavonoids contents of vegetables pulps are given in the (Table 4).The higher percentage of TFC (5.420 %)was found in potato while the minimum percentage of TFC was existed in sweet potato pulp (1.183 %).The total flavonoid content in different vegetables pulps are shown in (Figure.5).The pulps of, pumpkin(4.429 %), green chilli (3.560 %) and turmeric(3.494 %) showed highest amounts of TFC. The standard calibration curve of catechin is given below in (Figure. 4). Ghasemzadeh et al.,(2012) investigated TFC in red chilli, green chilliand turmeric 0.0939%, 0.014% and 0.0094% respectively.

Table 4. Total Flavonoid Content in Pulps of Vegetables

Sr. No.	Name of Vegetables	TFC in Pulps (%)
1	Potato	5.420 ± 0.092
2	Sweet potato	1.183 ± 0.031
3	Turnip	2.889 ± 0.049
4	Bitter gourd	3.877 ± 0.065
5	Pumpkin	4.429 ± 0.075
6	Ripe Radish pod	2.577 ± 0.043
7	Unripe radish pod	1.792 ± 0.053
8	Purple skinned sweet potato	2.486 ± 0.042
9	Unripe pumpkin	2.231 ± 0.037
10	Green chilli	3.560 ± 0.043
11	Red chilli	1.992 ± 0.033
12	Turmeric	3.494 ± 0.059

Note: Each value is means ± SD
SD = Standard deviation

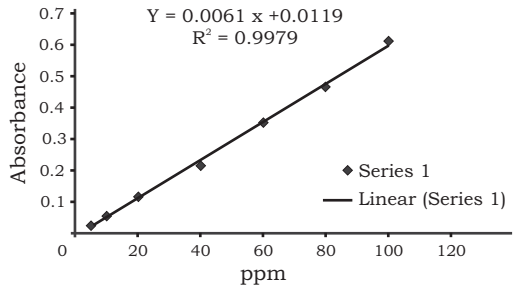

Figure 4. Standard calibration curve for Catechin

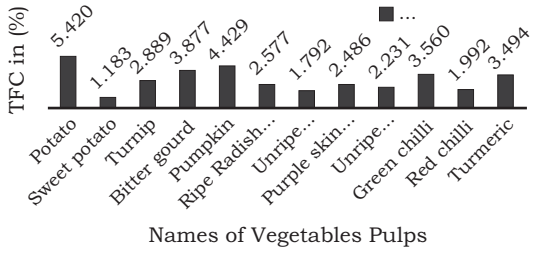

Figure 5. TFC in Vegetables Pulps

Total Flavonoid Content in Vegetables Peels

The TFC in purple skinned sweet potato and unripe pumpkin peels was found 6.33 % to 1.117%, respectively. The peel of purple skinned sweet potato contained the maximum amount 6.33 % of TFC, while unripe pumpkin had lowest amount 1.117%

Table 5. Total Flavonoid Contentin Peels of Vegetables

Sr. No.	Name of Vegetables	TFC in Peels in (%)
1	Potato	2.587 ± 0.043
2	Sweet potato	2.879 ± 0.048
3	Turnip	1.669 ± 0.028
4	Bitter gourd	3.592 ± 0.061
5	Pumpkin	6.166 ± 0.104
6	Purple skin sweet potato	6.337 ± 0.034
7	Unripe pumpkin	1.117 ± 0.045
8	Turmeric	1.976 ± 0.067

Note: Each value is means ± Standard deviation

of TFC. The total flavonoid content of other selected vegetables peels are listed in the (Table 5). The TFC values in vegetables peels are shown in (Figure.6).

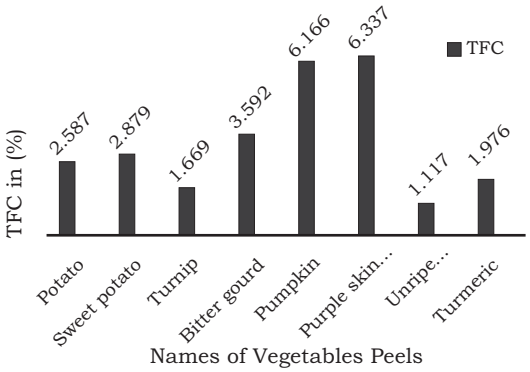

Figure 6. TFC in Vegetables Peels

DPPH Radical Scavenging Activity in Vegetables Pulps

DPPH is a organic free radical with the colour of deep violet, which produces maximum absorption at λ 515 -528 nm and obtaining proton from hydrogen donor, it loses chromospheres and yield yellow. Free radical scavenging activity enhances with increase concentration of vegetables extracts which providing 50% inhibition IC50 are given in (Table 6).The (Figure 7,8) showed graph and best fit model calibration curve of BHT and antioxidant activity of sweet potato pulp. The pulps of sweet potato and radish pods found appreciable radical scavenging capacity at the test concentration IC50 (13.258 mg/ml and 6.5938 mg/ml, respectively). DPPH comparison in the (Figure 9) represented that pulps of sweet potato (13.258 mg/ml) and turmeric (8.31 mg/ml) showed maximum DPPH radical scavenging activity than that of potato pulp (2.522 mg/ml) and unripe radish pod pulp (3.15 mg/ml). Ghasemzadeh et al.(2012) reported that DPPH of red chili, green chili and turmeric were found as 786.6 mg/ml, 524 mg/ml and 506.6 mg/ml respectively.

Table 6. DPPH Radical Scavenging Activity in Vegetables Pulps

Sr. No.	Sample name	IC50 mg/ml	BHT
1	Potato	2.522±0.0145	
2	Sweet potato	13.258±0.0167	
3	Turnip	5.095±0.0398	
4	Bitter gourd	4.1942±0.0138	
5	Pumpkin	3.2046±0.0145	
6	Full ripe Radish pod	6.5938±0.0121	
7	Unripe radish pod	3.1588±0.0162	
8	Purple skin sweet potato	6.994±0.0123	1.6882±0.0155
9	Unripe pumpkin	4.4550±0.0149	
10	Green chilli	4.8092±0.0142	
11	Red chilli	5.6013±0.0129	
12	Turmeric	8.3194±0.0161	

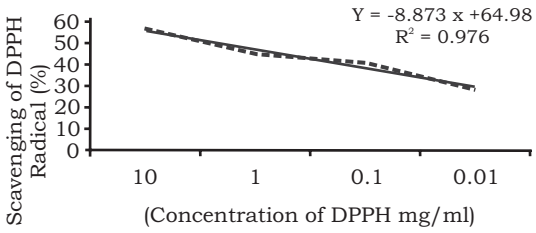

Figure 7. Calibration Curve of BHT

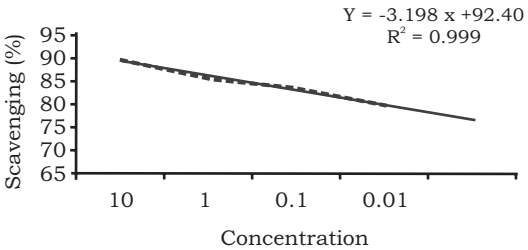

Figure 8. Scavenging curve of sweet potato pulp

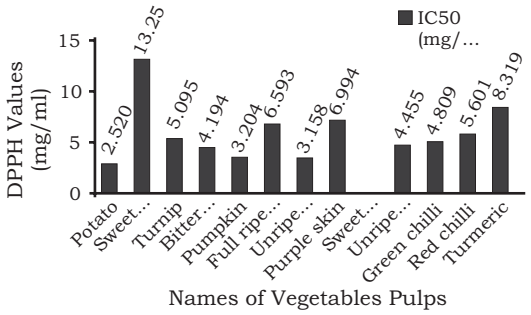

Figure 9. Comparison of DPPH values in vegetables pulps

DPPH Radical Scavenging Activity in Peels of Vegetables

The DPPH radical scavenging activity with IC50 in peels are given in (Table 7). The scavenging curve of DPPH free radical potato peel extract is given in (Figure 10). The pumpkin and turnip peels contained radical scavenging capacity attest concentration from IC50 (3.399 mg/ml to 5.114 mg/ml, respectively. The purple skin sweet potato peel showed the highest DPPH radical activity with IC50 (9.54mg/ml) while pumpkin peel showed the lowest activity with IC50 (3.399 mg/ml). The graph in (Figure 11) which was given below determined antioxidant activity of different selected vegetables peels in term of DPPH radical scavenging activity with IC50.

Table 7. DPPH Radical Scavenging Activity in peels of Vegetables

Sr. No.	Vegetables Name	IC_{50} (mg/ml)	BHT
1	Potato	4.011±0.109	
2	Sweet potato	4.101±0.0198	
3	Turnip	5.114±0.0125	
4	Bitter gourd	5.689±0.0157	
5	Pumpkin	3.399±0.0188	1.68826±0.0155
6	Purple skin sweet potato	9.543±0.0141	
7	Unripe pumpkin	3.654±0.0127	
8	Turmeric	6.976±0.0148	

Note: Each value is Mean ±SD
SD=Standard deviation

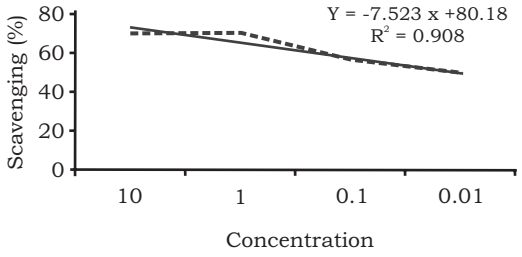

Figure 10. Scavenging Curve of Potato peel

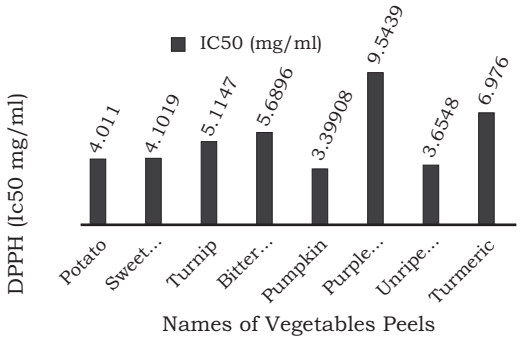

Figure 11. DPPH in Peels of Vegetables

Comparison of TPC, TFC and DPPH in Vegetables Pulps

The amounts of TPC, TFC and DPPH in vegetables pulps are given in the (Table 8).The highest amount of TPC 6.395 mg/g was extracted from radish pods pulp.The maximum TFC 5.420 % was found in potato. The sweet potato pulp showed the DPPH radical scavenging activity with IC50 (13.25mg/ml) while as potato pulp indicated the lowest activity with IC50(2.522 mg/ml). A comparison of TPC, TFC and DPPH in vegetables pulps was clearly demonstrated by graph in (Figure.12).

Table 8. Comparison of TPC, TFC and DPPH in Vegetables Pulps

Sr. No.	Sample name	TPC (mg/g)	TFC(perc%)	DPPH (IC50) (mg/ml)
1	Potato	5.064 ± 0.115	5.420 ± 0.0921	2.522 ± 0.0145
2	Sweet potato	4.214 ± 0.177	1.1837 ± 0.0312	13.25 ± 0.0167
3	Turnip	4.051 ± 0.363	2.889 ± 0.0491	5.095 ± 0.0398
4	Bitter gourd	2.913 ± 0.142	3.877 ± 0.0659	4.1942 ± 0.0138
5	Pumpkin	1.678 ± 0.162	4.429 ± 0.0752	3.204 ± 0.0146
6	Radish pods	6.395 ± 0.174	2.577 ± 0.0438	6.593 ± 0.0121
7	Unripe radish pods	1.505 ± 0.257	1.792 ± 0.0532	3.158 ± 0.0162
8	Purple skin sweet potato	1.138 ± 0.0162	2.486 ± 0.0422	6.994 ± 0.0123
9	Unripe pumpkin	1.161 ± 0.0141	2.231 ± 0.0379	4.455 ± 0.0149
10	Green chilli	1.928 ± 0.137	3.560 ± 0.0432	4.809 ± 0.0142
11	Red chilli	0.767 ± 0.106	1.992 ± 0.0338	5.601 ± 0.0129
12	Turmeric	1.208 ± 0.147	3.49 ± 0.0594	8.319 ± 0.0161

Note: Each value is Mean ± SD *SD = Standard deviation*

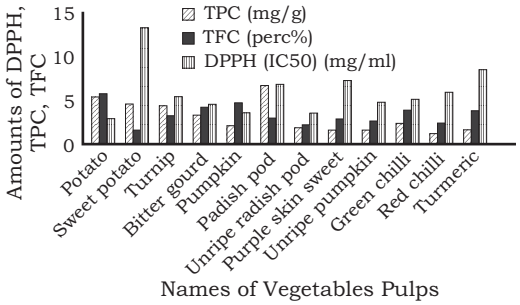

Figure 12. TPC, TFC and DPPH in Vegetables Pulps

Comparison of TPC, TFC and DPPH in Vegetables Peels

The TPC, TFC and DPPH in vegetables peels are listed in the (Table 9). The TPC 4.613 mg/g and TFC 2.587 % was extracted from potato peel. Purple skin sweet potato peel showed the highest DPPH radical scavenging activity with IC50 (9.54mg/ml) while pumpkin peel showed the lowest activity with IC50(3.399 mg/ml).The (Figure 13) showed maximum and minimum values of TPC, TFC and DPPH in different vegetables peels

Table 9. Comparison of TPC, TFC and DPPH in Peels of Vegetables

Sr. No.	Name of Vegetables	TPC (mg/g)	TFC (%)	DPPH(IC50) (mg/ml)
1	Potato	4.613 ± 0.142	2.587 ± 0.043	4.011 ± 0.109
2	Sweet potato	3.475 ± 0.0183	2.879 ± 0.048	4.101 ± 0.0198
3	Turnip	1.049 ± 0.099	1.669 ± 0.028	5.114 ± 0.0125
4	Bitter gourd	1.515 ± 0.130	3.592 ± 0.061	5.689 ± 0.0157
5	Pumpkin	2.683 ± 0.128	6.166 ± 0.104	3.399 ± 0.0188
6	Purple skin sweet potato	1.211 ± 0.184	6.337 ± 0.0344	9.543 ± 0.0141
7	Unripe pumpkin	0.287 ± 0.162	1.117 ± 0.0453	3.654 ± 0.0127
8	Turmeric	1.116 ± 0.072	1.976 ± 0.0674	6.976 ± 0.0148

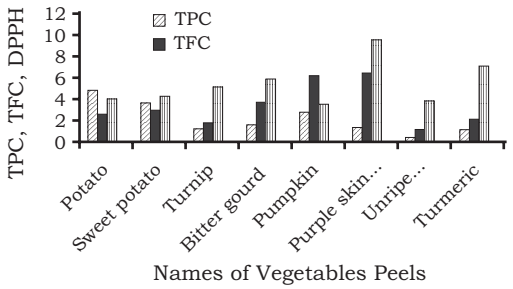

Figure 13. TPC, TFC and DPPH in vegetables peels

STATISTICAL ANALYSIS

Correlation in TPC, TFC and DPPH Values

The correlation (r) analysis among the values of TPC,TFC and DPPH for peels and pulps of different selected vegetables (Table 10 &11) was done using statistical package. The correlation coefficient determined were 0.69, 0.41 and 0.64 between TPCs, TFCs and DPPHs of peels and pulps of vegetables respectively. The TPCs and DPPHs values gave good positive correlation.

Table 10. TPC, TFC and DPPH Values of Peels of Selected Vegetables

Sr. No.	Name of Vegetables	TPC in Peel (mg/g)	TFC in Peel (%)	DPPH in Peel (mg/ml)
1	Potato	4.613	2.587	4.011
2	Sweet potato	3.475	2.879	4.101
3	Turnip	1.049	1.669	5.114
4	Bitter gourd	1.515	3.592	5.689
5	Pumpkin	2.683	6.166	3.399
6	Purple sweet potato	1.211	6.337	9.543
7	Unripe pumpkin	0.287	1.117	3.654
8	Turmeric	1.116	1.976	6.976

Table 11. TPC, TFC and DPPH values of pulps of Selected Vegetables

Sr. No.	Vegetables	TPC in Pulp (mg/g)	TFC in Pulp (%)	DPPH in Pulp (mg/ml)
1	Potato	5.064	5.420	2.522
2	Sweet potato	4.214	1.1837	6.994
3	Turnip	4.051	2.889	5.095
4	Bitter gourd	2.913	3.877	4.194
5	Pumpkin	1.678	4.429	3.204
6	Unripe pumpkin	1.161	2.231	4.455
7	Purple sweet potato	1.138	2.486	13.25
8	Turmeric	1.208	3.494	8.319

Correlation coefficient (r)

- TPC (peels vs pulps) = 0.6905
- TFC (peels vs pulps) = 0.4135
- DPPH (peels vs pulps) =0.6439

CONCLUSION

The research study was conducted to determine the antioxidant activity from peels and pulps of the selected vegetables i.e pumpkin, turnip, potato, full ripe radish pods, unripe radish pods, bitter gourd, sweet potato, purple skin sweet potato, turmeric, green chilli, red chilli and unripe pumpkin by using UV-visible spectrophotometer. The highest TPC 6.395 mg/g was extracted from radish pod pulps, whereas the minimum TPC 0.767 mg/g was extracted from red chilli pulps. The highest TPC 4.613 mg/g was extracted from peels of potato while the minimum TPC 0.287 mg/g was determined from peels of unripe pumpkin. The higher TFC 5.420 % was found in potato pulp while the minimum TFC 1.183 % was existed in

sweet potato pulps. The TFC from purple skin sweet potato and unripe pumpkin peels were found 6.33 % and 1.117 %, respectively. The pulps of sweet potato showed maximum13.258 mg/ml DPPH radical scavenging activity with IC50 and potato pulps contained minimum 2.522 mg/ml DPPH radical scavenging activity with IC50.The pumpkin peel showed the lowest DPPH radical activity with IC50(3.399 mg/ml).The TPCs and DPPHs values gave good positive correlation.

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