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PHYTOCHEMICAL SCREENING AND ANTIOXIDANT POTENTIAL OF SELECTED *CHENOPODIUM* SPECIES

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Keywords:

Chenopodium album, *Chenopodium murale*, *Chenopodium giganteum*, Antioxidant activity, Phytochemical screening, Frap assay

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ABSTRACT: *Chenopodium album*, *Chenopodium murale*, and *Chenopodium giganteum* are annual herb. Almost 250 different species of *Chenopodium* can be found all over the world. They are grown for many purposes, including some for their green leafy vegetables and others for the grains they provide. The phytochemicals, proteins, carbohydrates, tannins, flavonoids, alkaloids, steroids, terpenoids, and saponins have attracted a lot of interest because of their significant application to the preservation of human health. The present study deals with phytochemical screening and measuring antioxidant potential on the extract of root, stem, and leaf of selected *Chenopodium* species. The antioxidant potential was analyzed using the ferric-reducing antioxidant power (FRAP) assay activity. The antioxidant capacity of the root, stem and leaf extracts increased with increasing concentration; the values calculated µmol/ml $FeSO_4$ equivalent (µmol/ml $FeSO_4$/gdw) using a standard curve. Using recognized methodologies and procedures, the phytochemical analysis of the various extracts of *Chenopodium album*, *Chenopodium murale*, and *Chenopodium giganteum* was performed.

INTRODUCTION: Two natural antioxidants, particularly vitamins E and C, are known to be essential for preserving human health [1]. Polyphenols/flavonoids, which are naturally occurring in plants and plant-derived products, have potent antioxidant properties and can help prevent several cardiovascular disorders. The largest and most significant metabolites, such as sugars, protein, lipids, and starch, are crucial and fundamental for plant growth. Several primary metabolites are essential in pharmaceutical compounds like antipsychotic medications because they act as precursors or pharmacologically active metabolites [2].

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Young *Chenopodium giganteum* shoots and leaves can be eaten cooked like spinach, another Amaranthaceae plant. The majority of the saponins and oxalic acid are destroyed during cooking, especially if the food is cooked for two minutes at 100°C [3]. To prevent excessive blood pressure, the Na/K ratio in the body is extremely important. It is advised to keep the Na/K balance under one. Due to its Na/K ratio, which is below one, *C. album* use will probably reduce high blood pressure circumstances [4].

Flavonoids have great taxonomic importance among secondary products because of their distributional, structural, and enzymatic characteristics. Compared to other plant products and noted that while flavonoids provide fewer features than the amino acid sequence of a protein like cytochrome-C, they do have the advantage that their structure can be determined much more quickly [5]. Isoleucine, Lysine, phenylalanine, leucine, tyrosine, tryptophan, threonine, histidine,

valine, and methionine are the ten amino acids that are necessary. All of these amino acids are found in *C. album*. The green matter of C. album is a valuable high-protein product [6]. Non-polar phenols, lipids, alkaloids, lignins, flavonoids, saponins, and glycosides are among the major classes of phytoconstituents. Vysochina has provided information on the flavonoid composition and current scientific knowledge of the biological activities of the *C. album* species of the global flora [7]. Kaempferol, quercetin, and isorhamnetin 3-0-glycosides are the primary flavonoids found in *C. album*. Several species are distinguished by their flavones. Because it includes flavonoids, cinnamic acids amides, and apo carotenoids, *Chenopodium* spp. is an exciting source of raw materials [8]. The crude extract of *C. album* was separated and chromatographed by Ibrahim *et al*. 2007 Eight flavonoid compounds were isolated [9]. This study aims to evaluate the antioxidant potential and preliminary phytochemical Screening of selected *Chenopodium* species.

MATERIALS AND METHODS:

Collection of Plant Materials and Identification: During April 2022, healthy plants of *C. album,C. giganteum*, and *C. murale* were collected from Jaipur, Rajasthan, and authenticated by Dr. Praveen Mohil, Assistant Professor, Department of Botany, University of Rajasthan, Jaipur, India. The plant samples were well-preserved in the departmental herbarium of the Department of Botany, University of Rajasthan, Jaipur, India. The plant's leaves, stem, and roots were manually trimmed. The leaves stem and root was cleaned of adhesions, dirt, and other surface imperfections with cold water, and then they were dried in the shade and pulverized with a mechanical grinder. The powder was preserved until utilization in an airtight container.

Chemicals, Reagents, and Instruments: A Shimadzu UV-visible spectrophotometer-1800, an electronic analytical weighing balance, a volumetric flask, micropipettes, a conical flask, test tubes, beakers, measuring cylinder, Whatman no.1 filter paper, Glass marker, Tissue roll, Cuvettes, and other tools were used in this research study. The chemicals and reagents used in the study were Sodium Acetate Trihydrate, Glacial Acetic Acid, Hydrochloric Acid (HCl), 2,4,6-tripyridyl-s-triazine (TPTZ), Ferrous Sulphate heptahydrate ($FeSO_4.7H_2O$), and Ferric Chloride Hexahydrate ($FeCl_3.6H_2O$). All the chemicals were purchased and all used were of analytical grade.

Determination of the Ferric-Reducing Antioxidant Power (FRAP):

Preparation of Extract: At room temperature, one gram of dried powder was soaked separately in 10 ml of acetone for 24 h. The resultant extracts were filtered with no. 1 Whatman filter paper and let dry at room temperature. The filtrates were collected and concentrated at room temperature. The extracts were weighed and the percentage extractive values were calculated. A stock solution of crude extracts containing 1 mg/ml was prepared and kept at 4°C for later use by dissolving in acetone. The working solutions (50, 100, 150, 200, 300, and 400 µg/ml of the extracts) were prepared from the stock solution using the appropriate dilution.

Preparation of Reagents for FRAP Assay: Acetate buffer 300 mM, pH 3.0: 0.31g sodium acetate trihydrate was dissolved in distilled water, and added 1.6 ml of glacial acetic acid was made the volume of 100 ml with distilled water using a volumetric flask. 2, 4, 6-tripyridyl-s- triazine (TPTZ) solution: 156.20 mg TPTZ powder was dissolved in water with help of a conical flask and added 0.17 ml HCl and made the volume was 100 ml was with distilled water. $FeCl_3.6H_2O$: 270.3 mg of ferric chloride was dissolved in 50 ml of distilled water.

The FRAP Assay Procedure: The methodology is providing Benzie and strain explanation with some modifications [10]. Different concentrations of the acetone extract of *Chenopodium* species and various fractions (50, 100, 150, 200, 300, and 400 µg/ml) were added 1ml acetate buffer, 300 µl ferric chloride, and 300 µl TPTZ solution. Mix well and then dark incubated at 37°C for 15 min.

The reaction mixture was kept for 10 min at room temperature and filtrated with filter paper. The blue color solution was read absorbance (which ranged from light blue to dark blue) Shimadzu UV-visible spectrophotometer measured at 593 nm compared to a blank. As a reference, 1 mmol ferrous sulfate was employed. The following formula was used to get the percentage of extractive values: -

$$\text{Extractive values (g/gdw) \%} = (W_2/W_1) \times 100$$

Where, W_1 = weight of plant powder, W_2 = weight of crude extract residue obtained after solvent removal.

Preparation of Standard Calibration Curves: To make a standard solution of 1 mmol ferrous sulfate, 0.0278 g of $FeSO_4$. $7H_2O$ were dissolved in 100 ml of distilled water. The working stock solutions (50 µmol, 100 µmol, 150 µmol, 200 µmol, 300 µmol, and 400 µmol) were prepared using appropriate dilutions of the distilled water. Various working stock solutions were added 1ml acetate buffer, 100 µl ferric chloride, and 100 µl TPTZ solution and mix well. All test tubes were dark incubated at 37^0C for 15 min, 10 min at room temperature, and filtrated with filter paper. Shimadzu UV-spectrophotometer measurements were made in comparison to a blank to determine the absorbance at 593 nm (light blue to dark blue color). Absorbance *vs*. concentration was utilized to create the standard curve. The Ferric-Reducing Antioxidant Power concentration was expressed as µmol/ml $FeSO_4$ equivalent (µmol/ml $FeSO_4$/gdw) using a standard curve equation: y= 0.0031x + 0.1896, R^2= 0.9933. Three times the test was administered.

Preliminary Phytochemical Screening:

Preparation of Extract: The macerated method was used for the preparation of extracts. 1g dried and mild powder was soaked separately in 30 ml of hexane, acetone, methanol, and water for 24 h with helped shaker. Centrifuged 10 min with 1500 rpm. The collected filtrates were concentrated at room temperature and preserved for subsequent use in a freezer. The extracts were weighed and the percentage extractive values were calculated (% of dry weight basis). By dissolving in hexane, acetone, methanol, and water various stock solution of crude extracts containing 1 mg/ml was prepared and kept at 4°C for later use. The following formula was used to get the percentage of extractive values:

$$\text{Extractive values (g/gdw) \%} = (W_2/W_1) \times 100$$

Where, W_1 = weight of plant powder, W_2 = weight of crude extract residue obtained after solvent removal.

Qualitative Analysis of Primary and Secondary Metabolites: The presence of carbohydrates, proteins, flavonoids, alkaloids, tannins, Phyto-steroids, terpenoids, and saponins using the established protocols Harborne JB, 1998 [11].Each of the extracts in the respective solvent and the following tests were performed: -

Test for Carbohydrates:

Fehling's Test: 2ml of extract in a clean test tube was taken. After adding 2 ml of each Fehling's solution (A & B), the mixture was placed in a boiling water bath for about 10 minutes. A rusty brown color or red precipitate indicated the presence of carbohydrates.

Benedict's test: A clean test tube was utilized to contain 2 ml of the extract. Benedict's solution was put in a few drops. For around five minutes, test tubes were placed in a bath of boiling water. The presence of carbohydrates was indicated by a red precipitate or coloration.

Test for Proteins:

Biuret Test: A clean test tube was used to add two ml of the extract. 20% KOH solution and one ml of 0.5% $CuSO_4$ were added and mixed thoroughly. A pale-yellow color indicated the presence of proteins.

Xanthoprotein Test: A few drops of conc. H_2SO_4haveadded 2 ml of extract. A yellow color precipitate indicates the presence of proteins.

Test for Alkaloids: One ml of extract was mixed with a few drops of Wagner's reagent. An alkaloid was present if a reddish-brown precipitate formed.

Test for Flavonoids: The 10% lead acetate solution is added in a few drops to the 1 ml extract. The presence of flavonoids is indicated by a precipitate that is yellow in coloration.

Test for Tannins: Added a few drops of 5% ferric chloride solution to the 2 ml extract. A dark green color indicates the presence of tannins.

Test Forsteroids: 2 ml of chloroform and 2 ml of concentrated H_2SO_4 were added to 2 ml extract. The formation ofred color and yellowish-green interface recognizes the presence of steroids.

Test for Terpenoids: In the test tube, 2 ml of the extract was mixed with 1 ml of chloroform and 1 ml of concentrated H_2SO_4. The interface's reddish-brown color denotes the presence of terpenoids.

Test for Saponins: 2 ml of extract was mixed with 2 ml of distilled water. The appearance of frothing is an indicator that saponins are present.

Statistical Analysis: All Qualitative analyses of primary and secondary metabolites and determination of antioxidant Potential by FRAP assay were conducted in triplicates. The means and standard deviations of the experimental results were presented. Microsoft Excel and Microsoft Word 2019 were used for statistical and graphical evaluations.

RESULTS AND DISCUSSION:

The Ferric-Reducing Antioxidant Power (FRAP):

The Percentage of Extractive Values: The percentage of extractive values in acetone solvent with all the extracts was calculated and mentioned in **Table 1** & **Fig. 1.**

TABLE 1: THE EXTRACTIVE VALUES IN PERCENTAGES OF VARIOUS CHENOPODIUM SPECIES

***Chenopodium* Species**	**% Extractive values**		
	Leaves	**Stem**	**Root**
Chenopodium album	2.617 ± 0.009	2.403 ± 0.003	1.947 ± 0.013
Chenopodium murale	2.384 ± 0.107	1.410 ± 0.014	1.320 ± 0.002
Chenopodium giganteum	5.633 ± 0.026	1.317 ± 0.010	1.35 ± 0.002

All % Extractives values were indicated as Mean ± Standard deviation forms.

The percentage of extractive value was found to be maximum in the leaves of the *Chenopodium* species. Compared to other species, the maximum percentage extractive value was found in the leaves (5.633 ± 0.026) of *Chenopodium giganteum*, while the minimum was found in the stem (1.317 ± 0.010) of *Chenopodium giganteum.*

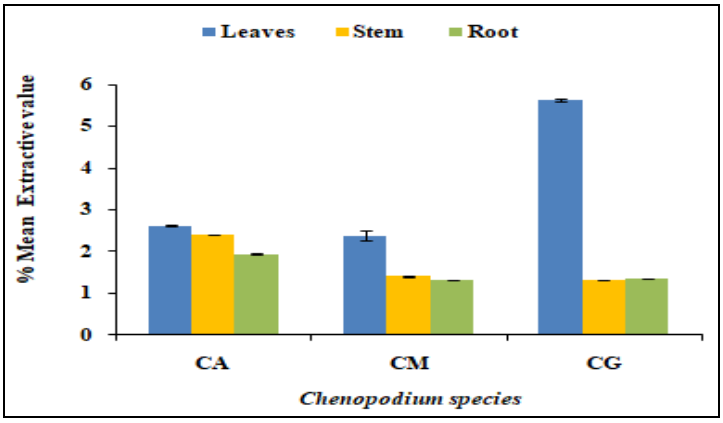

FIG. 1: % MEAN EXTRACTIVE VALUE IN ACETONE SOLVENT OF SELECTED *CHENOPODIUM* SPECIES. CA- *Chenopodium album*, CM- *Chenopodium murale*, CG- *Chenopodium giganteum*

Determination of Standard Calibration Curves: **Fig. 2** and **3** show that the blue color intensifies as the concentration of ferrous sulfate increases. The darker the blue color, the higher the antioxidant capacity. TPTZ (Fe^{3+}) changes to TPTZ (Fe^{2+}) to produce a blue color, which shows its antioxidant capacity. Using produced dilutions; a calibration curve was drawn using the absorbance and concentrations (**$FeSO_4.7H_2O$** µmol/ml). **Fig. 4** demonstrates the linearity of the FRAP for the standard solution.

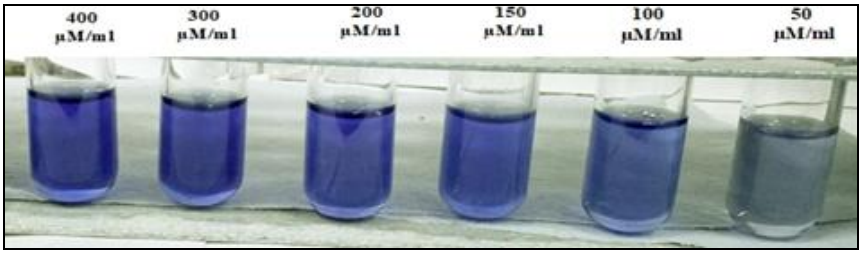

FIG. 2: RESULT OF WORKING STANDARDS SOLUTION DIFFERENT CONCENTRATIONS OF $FESO_4.7H_2O$ FOR FRAP ASSAY

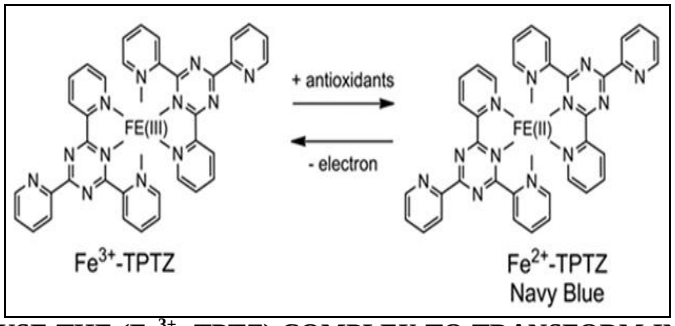

FIG. 3: ANTIOXIDANTS CAUSE THE (F_E^{3+}- TPTZ) COMPLEX TO TRANSFORM INTO (F_E^{2+}- TPTZ) COMPLEX [12]

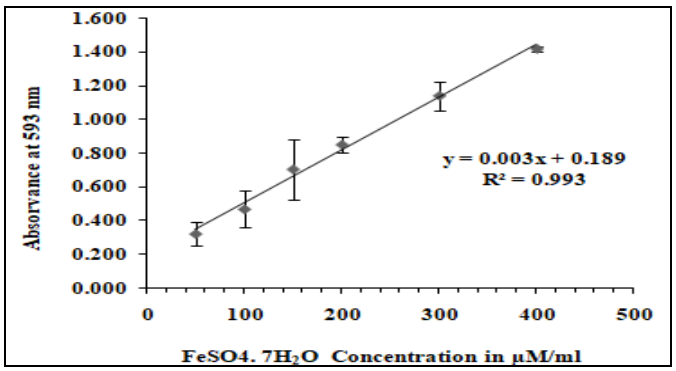

FIG. 4: LINEARITY OF FRAP FOR A STANDARD SOLUTION (µM OF $F_ESO_4.7H_2O$). Bars show the standard deviation from the standard deviation (n= 3).

Determination of FRAP: The concentrations of antioxidants with a ferric-reducing ability equal to those of µmol Fe (II)/gdw were used to express the antioxidant activity. The FRAP values were measured using the given method.

At low pH, when a ferric-tripyridyl-s-triazine (Fe^{III}-TPTZ) complex is changed to the ferrous (Fe^{II}) form, a bright blue color with an absorption maximum of 593 nm is developed [13]. A higher value of FRAP indicates a higher antioxidant potential in plants. The Ferric-Reducing Antioxidant Potential (FRAP) of *Chenopodium album* root, stem, and leaves in acetone extracts is displayed in **Table 2** and **Fig. 3.**

Chenopodium album leaves showed the highest antioxidant potential of all the extractives. The FRAP values for the root, stem, and leaves of *Chenopodium album* were, respectively, 221.828 ± 0.012, 320.699 ± 0.080, and 374.946 ± 0.091 µmol Fe (II)/g at 400 µg/ml concentration. The antioxidant potential of *Chenopodium album* was found in increased order root < stem < leaves.

TABLE 2: THE FRAP ASSAY EXTRACT OF *CHENOPODIUM ALBUM*

Concentration µg/ml	Frap Value µmol Fe (II)/gdw		
	Root	Stem	Leaves
50	16.237 ± 0.020	44.839 ± 0.041	100.323 ± 0.304
100	51.828 ± 0.023	80.000 ± 0.137	136.452 ± 0.284
150	79.677 ± 0.057	106.989 ± 0.166	189.247 ± 0.234
200	99.355 ± 0.091	172.258 ± 0.226	234.731 ± 0. 222
300	149.785 ± 0.035	248.387 ± 0.200	298.602 ± 0.185
400	221.828 ± 0.012	320.699 ± 0.080	374.946 ± 0.091

Data was reported as Mean ± Standard deviation (n=3).

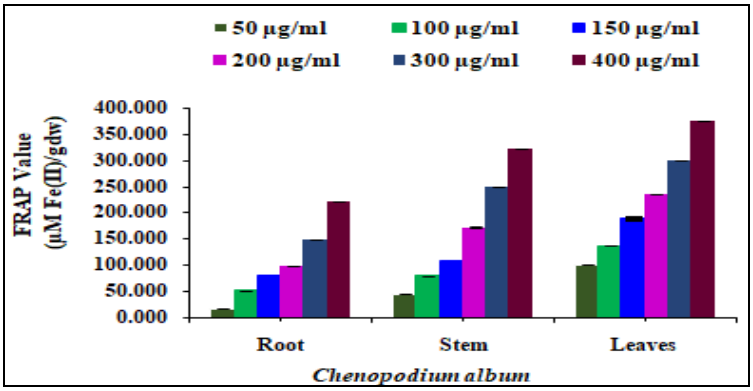

FIG. 5: THE FRAP VALUES IN VARIOUS CONCENTRATIONS OF *CHENOPODIUM ALBUM* OF ROOT, STEM, AND LEAF EXTRACT

The FRAP values of *Chenopodium murale* root, stem, and leaves in acetone extracts are displayed in **Table 3** and **Fig. 4**. *Chenopodium murale* leaves showed the highest antioxidant potential of all the extractives. The FRAP values for the root, stem, and leaves of *Chenopodium murale* were, respectively, 208.710 ± 0.209, 335.914 ± 0.201, and 449.892 ± 0.120 µmol Fe (II)/g at 400 µg/ml concentration. The antioxidant potential of *Chenopodium murale* was found in increased order root < stem < leaves.

TABLE 3: THE FRAPVALUES EXTRACT OF *CHENOPODIUM MURALE*

Concentration µg/ml	Frap Value µmol Fe (II)/gdw		
	Root	Stem	Leaves
50	66.882 ± 0.165	80.323 ± 0.123	76.108 ± 0.036
100	103.763 ± 0.146	165.054 ± 0.111	124.731 ± 0.008
150	127.204 ± 0.158	199.462 ± 0.121	171.720 ± 0.102
200	139.785 ± 0.168	263.441 ± 0.183	233.871 ± 0. 206
300	179.892 ± 0.179	316.774 ± 0.212	385.269 ± 0.083
400	208.710 ± 0.209	335.914 ± 0.201	449.892 ± 0.120

Data was reported as Mean ± Standard deviation (n=3).

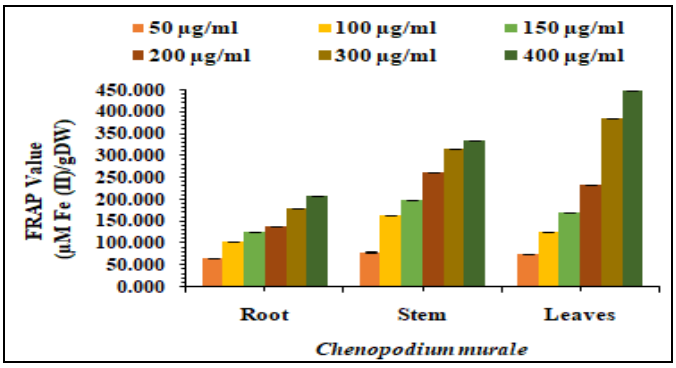

FIG. 6: FRAP VALUES IN VARIOUS CONCENTRATIONS OF *CHENOPODIUM MURALE* OF ROOT, STEM, AND LEAF EXTRACTS

The FRAP assay of *Chenopodium giganteum* root, stem, and leaves in acetone extracts are displayed in **Table 4** and **Fig. 7**. *Chenopodium giganteum* leaves showed the highest antioxidant potential of all the extractives. The FRAP values for the root, stem, and leaves of *Chenopodium giganteum* were, respectively, 172.151±0.268, 187.312±0.431, and 384.194±0.237 µmol Fe (II)/g at 400 µg/ml concentration. The antioxidant potential of *Chenopodium giganteum* was found in increased order root < stem < leaves.

TABLE 4: THE FRAP VALUES EXTRACT OF *CHENOPODIUM GIGANTEUM*

Concentration µg/ml	Frap Value µmol Fe (II)/gdw		
	Root	Stem	Leaves
50	78.172 ± 0.223	64.516 ± 0.254	41.075 ± 0.072
100	96.667 ± 0.170	101.398 ± 0.239	89.785 ± 0.109
150	112.043 ± 0.197	117.742 ± 0.307	133.118 ± 0.135
200	125.054 ± 0.189	133.333 ± 0.363	195.914 ± 0.142
300	144.624 ± 0.259	160.000 ± 0.412	308.387 ± 0.223
400	172.151 ± 0.268	187.312 ± 0.431	384.194 ± 0.237

Data was reported Mean ± Standard deviation (n=3).

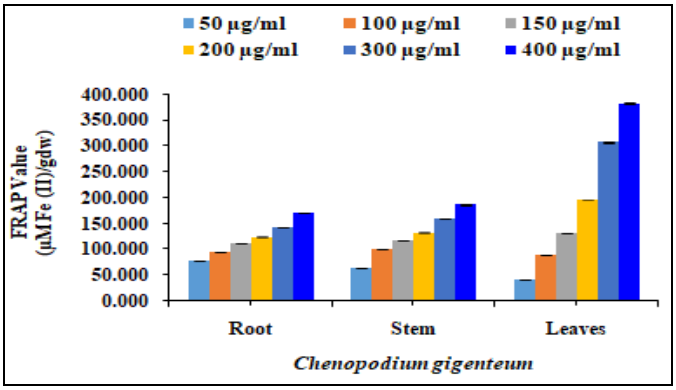

FIG. 7: FRAP VALUES IN VARIOUS CONCENTRATIONS OF *CHENOPODIUM GIGANTEUM* OF ROOT, STEM, AND LEAF EXTRACTS

The highest antioxidant capacity was found in the leaves of all three species of *Chenopodium*. The highest antioxidant capacity was found in the leaves of *Chenopodium Murale* (449.892 ± 0.120). This study suggested that the FRAP assay showed great consistency, was easy to use, and could be finished in a very short period.

Preliminary Phytochemical Screening: *Chenopodium album, Chenopodium murale,* and *Chenopodium giganteum* plant extracts (root, stem, and leaf) were used for the study. Using four different solvents for phytochemical analysis

namely- hexane, distilled water, methanol, and acetone.

The Percentage of Extractive Values: The percentage of extractive values in hexane, water, methanol, and acetone solvents with all the extracts of *Chenopodium album*, *Chenopodium murale*, and *Chenopodium giganteum* were calculated and mentioned in **Table 5, 6**, **7** & **Fig. 8, 9** and **10**. The percentage of extractive values was found to be maximum in the methanolic extracts. The maximum percentage extractive value was found in the leaves of *Chenopodium album* methanolic extract (36.410±0.030); while the minimum was found in the root of *Chenopodium murale* hexane extract (0.890±0.002). The percentage of extractive values was found in increased order root < stem < leaves.

TABLE 5: THE PERCENTAGE EXTRACTIVE VALUESEXTRACTS OF *CHENOPODIUM ALBUM*

Solvent	% Extractives values of *Chenopodium album*		
	Root	Stem	Leaves
Hexane	1.443 ± 0.006	1.937 ± 0.009	3.627 ± 0.013
Distilled water	6.903 ± 0.007	18.847 ± 0.012	19.840 ± 0.015
Methanol	14.147 ± 0.036	24.983 ± 0.051	36.410 ± 0.030
Acetone	1.637 ± 0.004	2.450 ± 0.010	4.510 ± 0.017

All results indicated g/gdwpercentage as Mean ± SD.

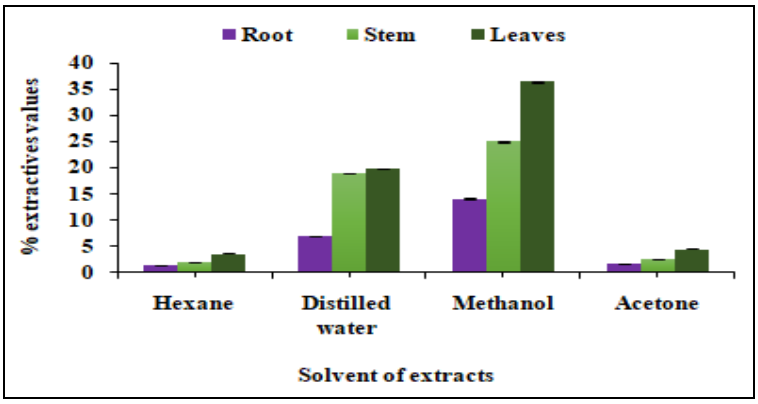

FIG. 8: % EXTRACTIVE VALUES IN HEXANE, DISTILLED WATER, METHANOL, AND ACETONE SOLVENTS OF CHENOPODIUM ALBUM *EXTRACTS*

TABLE 6: THE PERCENTAGE EXTRACTIVE VALUES EXTRACTS OF *CHENOPODIUM MURALE*

Solvent	% Extractives values of *Chenopodium murale*		
	Root	Stem	Leaves
Hexane	0.890 ± 0.002	1.403 ± 0.005	2.603 ± 0.002
Distilled water	1.807 ± 0.003	14.410 ± 0.017	21.777 ± 0.013
Methanol	22.147 ± 0.096	23.250 ± 0.081	34.917 ± 0.063
Acetone	3.403 ± 0.014	3.780 ± 0.007	8.020 ± 0.033

All results indicated g/gdw percentage as Mean ± SD.

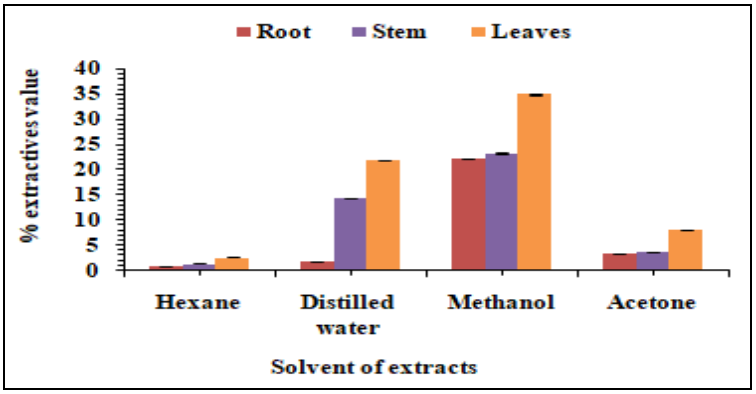

FIG. 9: % EXTRACTIVE VALUES IN HEXANE, DISTILLED WATER, METHANOL, AND ACETONE SOLVENTS OF *CHENOPODIUM MURALE* EXTRACTS

TABLE 7: THE PERCENTAGE EXTRACTIVE VALUES EXTRACTS OF *CHENOPODIUM GIGANTEUM*

Solvent	% Extractives values of *Chenopodium giganteum*		
	Root	Stem	Leaves
Hexane	1.463 ± 0.006	4.320 ± 0.006	6.783 ± 0.025
Distilled water	6.727 ± 0.020	16.937 ± 0.046	22.170 ± 0.008
Methanol	10.887 ± 0.043	13.223 ± 0.028	25.283 ± 0.129
Acetone	2.280 ± 0.006	3.133 ± 0.010	8.017 ± 0.015

All results indicated g/gdw percentage as Mean ± Standard deviation.

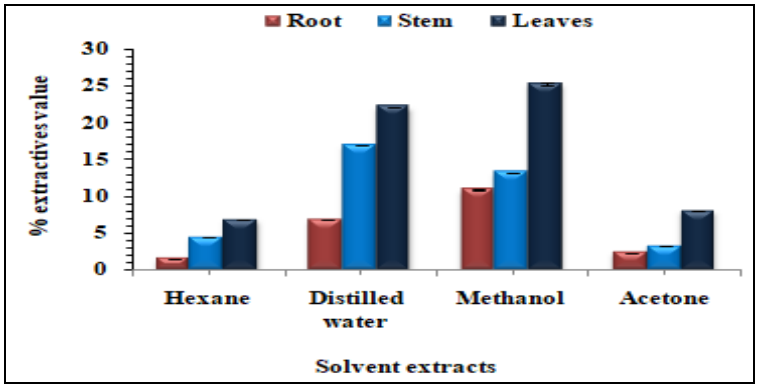

FIG. 10: % EXTRACTIVE VALUES IN HEXANE, DISTILLED WATER, METHANOL, AND ACETONE SOLVENTS OF *CHENOPODIUM GIGANTEUM* EXTRACTS

Phytochemical Analysis: Several phytochemicals, including proteins, carbohydrates, tannins, flavonoids, alkaloids, steroids, terpenoids, and saponins were identified through qualitative phytochemical analysis of the different *Chenopodium album*, *Chenopodium murale*, and *Chenopodium giganteum* extracts utilizing accepted methods and techniques. **Table 8, 9**, and **10** displays the phytoconstituents found in various extracts.

TABLE 8: PHYTOCHEMICAL ANALYSIS FOR THE VARIOUS SOLVENT EXTRACTS OF *CHENOPODIUM ALBUM*

Phytochemical	Hexane			D. Water			Methanol			Acetone		
	*RE	SE	LE	RE	SE	LE	RE	SE	LE	RE	SE	LE
Protein	–	–	–	+	+	+	+	+	+	+	+	+
Carbohydrates	–	–	–	+	+	+	+	+	+	+	+	+
Tannins	–	–	–	+	+	+	+	+	+	+	+	+
Flavonoids	–	–	–	+	+	+	+	+	+	+	+	+
Alkaloids	–	–	–	+	+	+	+	+	+	+	+	+
Steroids	–	–	–	+	+	+	+	+	+	+	+	+
Terpenoids	+	+	+	+	+	+	+	+	+	+	+	+
Saponins	–	–	–	+	+	+	+	+	+	+	–	–
(+) indicates presence				(-) indicates the absence of phytochemical								

TABLE 9: PHYTOCHEMICAL ANALYSIS FOR THE VARIOUS SOLVENT EXTRACTS OF *CHENOPODIUM MURALE*

Phytochemical	Hexane			D. Water			Methanol			Acetone		
	*RE	SE	LE	RE	SE	LE	RE	SE	LE	RE	SE	LE
Protein	–	–	–	+	+	+	+	+	+	+	+	+
Carbohydrates	–	–	–	+	+	+	+	+	+	+	+	+
Tannins	–	–	–	+	+	+	+	+	+	+	+	+
Flavonoids	–	–	–	+	+	+	+	+	+	+	+	+
Alkaloids	–	–	–	+	+	+	+	+	+	+	+	+
Steroids	+	+	+	+	+	+	+	+	+	+	+	+
Terpenoids	+	+	+	+	+	+	+	+	+	+	+	+
Saponins	–	–	–	+	+	+	–	–	–	–	–	–
(+) indicates presence				(-) indicates the absence of phytochemical								

TABLE 10: PHYTOCHEMICAL ANALYSIS FOR THE VARIOUS SOLVENT EXTRACTS OF *CHENOPODIUM GIGANTEUM*

Phytochemical	Hexane			D. Water			Methanol			Acetone		
	*RE	SE	LE	RE	SE	LE	RE	SE	LE	RE	SE	LE

Protein	–	–	–	+	+	+	+	+	+	+	+	+
Carbohydrates	–	–	–	+	+	+	+	+	+	+	+	+
Tannins	–	–	+	+	+	+	+	+	+	+	+	+
Flavonoids	+	+	+	+	+	+	+	+	+	+	+	+
Alkaloids	+	+	+	+	+	+	+	+	+	+	+	+
Steroids	–	–	–	+	+	+	+	+	+	+	+	+
Terpenoids	–	–	–	+	+	+	+	+	+	+	+	+
Saponins	–	–	–	+	+	+	–	–	+	–	–	–
(+) indicates presence				(-) indicates the absence of phytochemical								

*RE- Root extract, SE- Stem extract, LE- Leaf extract, D. Water- Distilled water.

For determining the active constituents in various solvents and their extractives, preliminary phytochemical screening of plants is highly helpful. Methanolic, acetone, and distilled water extracts contain the majority of the active phytoconstituents.

CONCLUSION: The root, stem, and leaf of *Chenopodium album*, *Chenopodium murale*, and *Chenopodium giganteum* may be employed as a widely available source of natural antioxidants, suggest the present study.

The medicinal plant *Chenopodium album*, *Chenopodium murale* and *Chenopodium giganteum* are promising due to their wide range of pharmacological actions and their potential for use in a variety of medical procedures. The highly identified active metabolites could be further investigated for research by collecting samples with quantitative phytochemical methods and characterization investigations.

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REFERENCES:

1. Anal Parimal Desai and Shuchi Desai: UV Spectroscopic Method for Determination of Vitamin C (Ascorbic Acid) Content in Different Fruits in South Gujarat Region. Int J Environ Sci Nat Res 2019; 21(2): 040-044.
2. Chaouch MA and Benvenuti S: The Role of Fruit By-Products as Bioactive Compounds for Intestinal Health. Foods 2020; 9: 1716.
3. Dabulici CM, Srbu I and Vamanu E: The Bioactive Potential of Functional Products and Bioavailability of Phenolic Compounds. Foods 2020; 9: 953.
4. Wang, Zheng, Ando, Akira, Takeuchi, Atsuko, Ueda and Hiroshi: Effects of cooking conditions on the relationships among oxalate, nitrate, and lutein in spinach. Food Science and Technology Research 2018; 24(3): 421–425.
5. Gharibzahedi SMT and Jafari SM: The importance of minerals in human nutrition Bioavailability, food fortification, processing effects and nano encapsulation. Trends Food Sci Technol 2017; 62: 119–132.
6. Pires AF, Marnotes NG, Rubio OD, Garcia AC and Pereira CD: A review on the vaporization of whey and second cheese whey. Foods 2021; 10: 1067.
7. Dinika I, Verma DK, Balia R, Utama GL and Patel AR: Potential of cheese whey bioactive proteins and peptides in the development of antimicrobial edible film composite: A review of recent trends. Trends Food Sci Technol 2020; 103: 57–67.
8. Cutillo F, Abrosca B, Dellagreca M, Marino CD, Golino A and Previtera L and Zarrellia A: Cinnamic acid amides from *Chenopodium album*: effect on seed germination and plant growth. Phytochemistry 2003; 64: 138-1387.
9. Ibrahim LF, Kawashty SA, Baiuomy AR, Shabana MM, El Eraky WI and El Negoumy SI: A comparative study of the flavonoids and some biological activities of two Chenopodium species. Chem Natural Compounds 2007; 43: 24-28.
10. Benzie IFF and Strain JJ: The ferric reducing ability of plasma (FRAP) as a measure of Antioxidant Power, The FRAP Assay, Analytical Biochemistry 1996; 70-76.
11. Harborne JB: Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Edition 3rd 1998; 1-150.
12. Lissi E, Salim-Hanna M, Pascual C and Del Castillo MD: Free Radicals Biol. Med 1995; 16: 581-590.
13. Halliwell B and Gutteridge JMC: Free Radicals Biol. Med 1995; 18: 125-126.

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