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EXPLORING THE POTENTIAL OF FOUR MEDICINAL PLANTS FOR ANTIOXIDANT ENZYMES ACTIVITY, PROXIMATE AND NUTRITIONAL COMPOSITION

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A study was conducted to evaluate the antioxidant enzymes activity, proximate and nutritional composition of four medicinal plants, which may contribute to folk pharmacological use in the treatment of different diseases. Plant samples were extracted and antioxidant enzymes like superoxide dismutase (SOD), peroxidase (POD), polyphenol oxidase (PPO) and ascorbate peroxide (APX) activity were estimated. Medicinal plants were also analysed for moisture, ash, protein, fibre, carbohydrate, and fats contents. Plant samples were wet digested and mineral composition in terms of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sodium (Na) was determined. The results revealed that antioxidant activity, proximate and nutritional composition differs significantly among tested medicinal plants extract. The leaves of medicinal plants showed more proximate composition (moisture contents, crude protein, fats contents), nutrient accumulation (N, P, K, Ca, Mg and Na), and antioxidant enzymes (POD, PPO, and APX activity). Among medicinal plants, *Tribulus terrestris* L. showed the highest amount of crude protein, crude fibre, gross energy, and N and Ca contents. Maximum K, Mg, Na contents, POD, PPO and APX activity was observed in *Cenchrus ciliaris* L. The ash, fats, phosphorus and SOD activity was more in *Euphorbia hirta* L. While, *Cyperus rotundus* L. produced maximum carbohydrates concentration among the tested plants. It is concluded that the target medicinal species had emerged as a good source of the antioxidant and nutritive source, which could play an important role in human nutrition. The extracts of these plants parts can be used in the synthesis of mineral and antioxidant-containing drugs and medicines. This study will provide a baseline for the pharmacology industry.

Key words: antioxidants, Cholistan Desert, folk medicine, medicinal plants, minerals

INTRODUCTION

The Cholistan Desert of Bahawalpur is a part of the world's seventh largest desert, the Great Desert, which is extended about an area of 26,000 km^2 of the southern border of Punjab, Pakistan. The desert climate is xeric, harsh, hot and arid (Arshad *et al.* 2007, Hameed *et al.* 2011). Its soil is rated as poor because it contains negligible amounts of organic matter, macro, and micronutrients. Natural flora of the Cholistan Desert consists of many kinds of grass and perennial shrubs, which are adapted to a variety of environmental stresses like extreme aridity, salinity, temperature, nutrients deficiencies and frequently used to cure chronic and acute diseases (Arshad *et al.* 2007).

Ethnopharmacologically characteristics of the plants of the Cholistan Desert is almost non-existent except very few reports. Many plants of the Cholistan Desert are frequently used by the local inhabitants through using traditional knowledge. Plant-derived products are considered to be major source of modern drugs. Those products possessed biological activity in terms of vermicidal, anthelmintic, antibacterial, and antifungal activities (Immanuel and Elizabeth 2009, Qureshi *et al*. 2010). Among medicinal flora of the Cholistan Desert, *Cyperus rotundus* L. is composed of several pharmacologically active substances *viz*. pinene, cyperol, isocyperol, cyperone, rotundene, rotundenol, rotundone, selinatriene, and sitosterol (Hameed *et al.* 2011, Immanuel and Elizabeth 2009, Kumar *et al.* 2010). Its roots are used to cure cough, ingestion, dysentery, diarrhoea, epilepsy, cholera, and flatulence. Its stem had a potential to cure wound, sores, erysipelas and common fever. While, whole plant parts are used to treat blood disorder (Immanuel and Elizabeth 2009). *Euphorbia hirta* is nutritionally rich and composed of diterpene polyesters and other terpenes (Immanuel and Elizabeth 2009). It is widely used as a medicinal herb as its whole plant parts possessed potential to treat cough, bronchitis, piles, nausea and vomiting, skin inflammation and boils (Immanuel and Elizabeth 2009, Kumar *et al.* 2010). *Tribulus terrestris* is used in homeopathic medicines as a libido enhancing supplement (Kumar *et al.* 2010). Its roots and leaves are used to improve blood circulation, heart and sexual health. *Cenchrus ciliaris* is the most acceptable and nutritious grass of the Cholistan Desert, and possesses anodyne, diuretic, emollient, anti-inflammatory, antibacterial, and anthelmintic properties (Arshad *et al.* 2007). Its underground runner is used to relief against body pain, urinary tract infection, and menstrual disorders (Arshad *et al.* 2007, Immanuel and Elizabeth 2009).

Medicinal plants produce different antioxidative compounds to rectify reactive oxygen species (ROS) in order to stay alive under environmental stress. Recent research focused on discovering an adequate antidote in the form of antioxidants from natural origins to treat different diseases and to check aging signs. The screening of medicinal and foods plants for antioxidant properties have been observed progressively in the last few decades. Various types of medicinal plants have their individual nutrient constitution beyond having pharmacologically significance. These nutrients are necessary for corporeal operations of the human body. The phytochemicals like fats, proteins, and carbohydrates also play a significant role in satiating human demands for energy and life practice (Adnan *et al.* 2010).

The Cholistan Desert of Bahawalpur, Pakistan is rich in medicinal plants but due to the lack of knowledge, people of this area are not well aware of beneficial aspects of these medicinal plants. Keeping in view the above facts, the present study was conducted to evaluate the nutritional and proximate composition and antioxidant activity of commonly occurred medicinal plants in the Cholistan Desert, Bahawalpur, Pakistan.

MATERIALS AND METHODS

Collection of medicinal plants: The plant's root, leaves, and stems samples of *Cyperus rotundus*, *Tribulus terrestris*, *Cenchrus ciliaris*, and *Euphorbia hirta*. were collected from surrounding desert area of the Islamia University of Bahawalpur, Punjab, Pakistan, located at latitude: 29.38° N, longitude: 71.76° E, and 123 m elevation above the sea level. The specimens were identified according to flora of Pakistan (Hameed *et al.* 2011) (Table 1). Rhizospheric soil sample representing the growth zone of each selected medicinal plant were analysed and data are presented in Table 2.

Proximate analysis: The roots, leaves, and stems samples were washed with tap and distilled water. These samples were finely ground manually and analysed for moisture and ash contents by following the recommended methods of Association of Official Analytical Chemists (Horwitz 1977). The mois-

Table 1
Medicinal plants of the Cholistan Desert, Pakistan used in the experiment along with their families, habitat, life span, and life form

Scientific name	Family	Vernacular name	Habit	Life span	Life form
Cyperus rotundus	Cyperaceae	Nutgrass	sedge	perennial	hemicryptophyte
Cenchrus ciliaris	Poaceae	Buffel grass (Dhaman)	grass	perennial	hemicryptophyte
Tribulus terrestris	Zygophyllaceae	Puncture vine, Devil weed	herb	annual	therophyte
Euphorbia hirta	Euphorbiaceae	Asthma weed, Dudhi	herb	annual	therophyte

The data is taken from Hameed *et al.* (2011)

Table 2
Physico-chemical characteristics of rhizospheric soil of medicinal plants of the Cholistan Desert, Pakistan

Characteristics	*Cyperus rotundus*	*Cenchrus ciliaris*	*Tribulus terrestris*	*Euphorbia hirta*
Textural class	silt loam	silt loam	sandy loam	sandy loam
pHs	8.1	8.1	8.2	8.2
ECe (dS m^{-1})	1.42	1.34	1.30	1.21
Total nitrogen (%)	0.04	0.02	0.02	0.03
Available P (mg kg^{-1})	10.23	9.58	9.64	9.61
Extractable K (mg kg^{-1})	132.2	125.8	126.7	117.7

ture content of plant tissues was assessed by taking plant samples and weighing before and after incubation in an oven at 50 °C and incubated for overnight followed by cooling in a desiccator. For ash content, samples were weighed before and after incineration in a muffle furnace at 600 °C and cooled in desiccators. Crude protein was estimated by multiplying the % N with a factor of 6.25 (Khanzada *et al.* 2008). For estimation of crude fibre content, 2 g of sample along with 1.25% H_2SO_4 (200 mL) was boiled for 30 min. The NaOH (200 mL) was added in filtrate residues and boiled for 30 min to dissolve alkali and acid soluble components and filtered. The residue was oven dried at 105 °C and placed in a muffle furnace at 500 °C for 3 h. Crude fibre content was calculated through using equation described by Ashraf *et al.* (2013). For determination of fat contents, dried plant sample was extracted with petroleum ether by using a Soxhlet apparatus to eliminate the ether-soluble component and dried at 70 °C in an oven to a constant weight (Ashraf *et al.* 2013). Total carbohydrates were determined by subtracting the values of crude protein, crude fibre, fat, moisture and ash content from a factor of 100 (Dastagir *et al.* 2013). Gross energy was calculated by using the formula described by Garrett and Johnson (1983).

Determination of antioxidant activity: For determination of antioxidant activity, plant root and leaves samples (0.5 g) were taken in pre-cooled mortar on the ice and 5 ml of pre-cooled phosphate buffer solution was added. The samples were homogenised on ice and centrifuged at 10,000 rpm for 20 min at 4 °C. The supernatant was used to determine superoxide dismutase (SOD) activity by following method of Zhang *et al*. (2008). According to this method, 0.1 mL of extract supernatant was mixed with 0.25 mL H_2O_2 and 2.73 mL reaction solution (prepared from nitro blue tetrazolium (NBT) chloride, riboflavin, methionine, and ethylene diamine tetra acetic acid). The solution was incubated in a light box for fifteen minutes and absorbance was taken on spectrophotometer (Model G6860A, Agilent Technologies Cary 60 UV-Vis, Australia) at 560 nm.

The method of Zhou and Leul (1999) was employed for the determination peroxidase (POD) activity of plant extract. The 0.1 mL of enzymes extract along with 0.1 mL guaiacol (1.5%), 0.1 mL H_2O_2 (300 mM) and 2.7 mL phosphate buffer (50 mM) were taken in test tubes. Samples absorbance was noted on spectrophotometer at 470 nm. The method of Mayer *et al.* (1966) was used to determine polyphenol oxidase (PPO) activity by mixing supernatant extract (0.1 mL) with chlorogenic acid up to 3 mL final volume and absorbance was taken at 265 nm. While, ascorbate peroxidase (APX) activity was determined according to Nakano and Asada (1981). For APX activity, 0.1 mL enzyme extracts with 0.1 mL of ascorbate acid (7.5 mM), 0.1 mL of H_2O_2 (300 mM) and 2.7 mL of phosphate buffers were mixed and absorbance was determined by spectrophotometer at 290 nm.

Mineral quantification: For evaluation of nutritional composition, plant samples were wet digested (Wolf 1982). The volume of the digested plant extract was made to 50 mL in volumetric flasks and preserved for further mineral analysis. Mineral composition of roots, leaves and stems were determined as follows: N through micro-Kjeldahl method; P by treating the digested samples with Barton reagents as described by Jackson (1962); K, Na, and Ca were determined by Flame Photometer (BWB technologies, UK, Ltd.) and Mg was measured with atomic absorption spectrophotometer (Agilent Technologies, Australia).

Statistical analysis: The data was analysed using statistical package Statistix 8.1 by applying the completely randomised design. Least significant difference test (LSD) was applied to calculate the non-significant difference at 5% probability (Steel and Torrie 1986).

RESULTS

The medicinal plants, *viz*. *Cyperus rotundus*, *Tribulus terrestris*, *Cenchrus ciliaris*, and *Euphorbia hirta* were selected on basis of their local medicinal use as herbal remedies for the treatments of diseases. *C. rotundus* and *T. terrestris* belong to perennial life span and hemicryptophyte life form collected from silt loam soil whereas, *C. ciliaris* and *E. hirta* belong to annual life span and therophyte life form collected from sandy loam soil (Tables 1 and 2).

Proximate composition

The proximate analysis of various parts of medicinal plants as represented by Table 3 showed that the leaves had the highest moisture contents, crude

Table 3
Proximate composition of medicinal plants of the Cholistan Desert, Pakistan

Proximate composition	Plant tissue	*Cyperus rotundus*	*Cenchrus ciliaris*	*Tribulus terrestris*	*Euphorbia hirta*	LSD value
Moisture contents (%)	Roots	9.15^{b}	41.2^{a}	8.19^{b}	7.17^{c}	0.9720
	Stems	13.04^{b}	49.17^{a}	8.67^{c}	7.81^{d}	0.7122
	Leaves	10.83^{b}	58.31^{a}	9.34^{c}	10.16^{bc}	0.8265
Ash contents (%)	Roots	10.30^{b}	9.42^{c}	5.87^{d}	17.26^{a}	0.8727
	Stems	8.91^{d}	10.20^{c}	12.05^{b}	13.56^{a}	0.9433
	Leaves	11.43^{bc}	11.67^{b}	10.67^{c}	15.56^{a}	0.7914
Carbohydrate contents (%)	Roots	38.68^{a}	15.79^{c}	22.54^{b}	13.54^{d}	0.5733
	Stems	30.29^{a}	14.81^{c}	12.00^{d}	16.53^{b}	0.7828
	Leaves	41.47^{a}	12.41^{d}	19.33^{c}	35.33^{b}	0.3491
Crude protein (%)	Roots	4.08^{c}	6.60^{b}	8.52^{a}	7.29^{b}	0.7501
	Stems	7.89^{b}	3.08^{c}	10.59^{a}	2.73^{c}	0.5962
	Leaves	9.67^{c}	15.12^{b}	16.44^{a}	8.16^{d}	0.7236
Fats contents (%)	Roots	7.04^{b}	3.60^{d}	5.04^{c}	8.16^{a}	0.7258
	Stems	8.65^{b}	5.55^{d}	8.33^{c}	11.22^{a}	0.6850
	Leaves	8.94^{b}	5.79^{c}	8.17^{b}	16.22^{a}	0.6081
Crude fiber (%)	Roots	25.84^{d}	48.32^{c}	56.57^{a}	54.75^{b}	1.1610
	Stems	31.83^{d}	39.89^{c}	60.07^{a}	48.15^{b}	1.2653
	Leaves	17.65^{c}	35.23^{b}	44.07^{a}	8.82^{d}	1.3171
Gross energy (Kcal g^{-1})	Roots	393.4^{c}	371.3^{d}	421.3^{a}	404.5^{b}	5.2315
	Stems	398.9^{c}	384.5^{d}	439.5^{a}	419.5^{b}	7.8451
	Leaves	391.9^{c}	360.1^{d}	450.7^{a}	420.3^{b}	11.257

LSD = least significant difference; data are mean values of three replicates ($p \le 0.05$); Means sharing the same letter (s) do not differ significantly according to least significant test.

protein, and fats contents ranged from 9.3 to 58.3%, 8.2 to 16.4% and 5.8 to 16.2%, respectively. The stem of tested medicinal plants showed more crude fibre contents and gross energy as compared to leaves and roots that ranged from 31.8 to 60.0% and 398.9 to 439.5 Kcal g^{-1}, respectively. More carbohydrate contents were recorded in plant roots, which ranged from 9.42 to 17.3% and 13.54 to 38.7%, respectively. Among medicinal plants, *T. terrestris* showed the highest amount of crude protein contents, crude fibre contents, and gross energy in roots, stem, and leaves. Maximum ash and fats contents were observed in roots, stem, and leaves of *E. hirta*. While, maximum carbohydrate contents in roots, stem, and leaves were recorded of *C. rotundus*.

Nutritional composition

The minerals composition in terms of primary and secondary macronutrients in leaves, stem and roots of medicinal plants were recorded (Table 4). The results revealed that leaves of medicinal plants were more enriched with minerals as compared to stem and roots. The N contents of medicinal plants ranged from 0.65 to 1.36% in roots, 0.44 to 1.69% in stem and 1.31 to 2.63% in leaves. Maximum N content of roots, stems, and leaves was observed from *T. terrestris* compared to other tested medicinal plants. The detected P contents in medicinal plants ranged from 0.41 to 0.57% in roots, 0.43 to 0.55% in stem and 0.46 to 0.83% in leaves. Maximum P contents were accumulated in roots and leaves of *E. hirta*. Phosphorus contents in stem of *C. ciliaris* were

Table 4
Macro minerals of medicinal plants of the Cholistan Desert, Pakistan

Minerals composition*	Plant tissue	*Cyperus rotundus*	*Cenchrus ciliaris*	*Tribulus terrestris*	*Euphorbia hirta*	LSD value
N content (%)	Roots	0.65^{c}	1.06^{b}	1.36^{a}	1.17^{b}	0.1203
	Stems	1.26^{b}	0.49^{c}	1.69^{a}	0.44^{c}	0.0958
	Leaves	1.55^{c}	2.42^{b}	2.63^{a}	1.31^{d}	0.1163
P contents (%)	Roots	0.41^{c}	0.41^{c}	0.50^{b}	0.57^{a}	0.0511
	Stems	0.45^{b}	0.55^{a}	0.43^{b}	0.51^{a}	0.0548
	Leaves	0.47^{c}	0.54^{b}	0.46^{c}	0.83^{a}	0.0436
K contents (%)	Roots	0.32^{c}	1.08^{a}	0.46^{b}	0.44^{b}	0.0950
	Stems	0.77^{c}	1.36^{a}	0.73^{c}	1.13^{b}	0.1189
	Leaves	0.83^{c}	1.48^{a}	1.16^{b}	0.63^{d}	0.0969
Na contents (%)	Roots	0.18^{b}	0.22^{a}	0.08^{d}	0.12^{c}	0.0354
	Stems	0.16^{a}	0.19^{a}	0.05^{b}	0.09^{b}	0.0483
	Leaves	0.21^{b}	0.58^{a}	0.06^{c}	0.07^{c}	0.0429
Ca contents (%)	Roots	0.38^{b}	0.42^{b}	0.63^{a}	0.42^{b}	0.0852
	Stems	0.51^{bc}	0.41^{c}	1.16^{a}	0.53^{b}	0.1014
	Leaves	0.45^{c}	0.53^{bc}	1.80^{a}	0.59^{b}	0.0902
Mg contents (μg g^{-1})	Roots	1552.7^{b}	1803.0^{a}	1148.7^{d}	1252.7^{c}	48.380
	Stems	1352.3^{b}	1508.7^{a}	1245.3^{c}	1028.7^{d}	54.443
	Leaves	2129.0^{b}	2275.7^{a}	1600.7^{c}	1126.3^{d}	45.724

*mineral composition in roots, stem and leaves of target medicinal plant was evaluated; N = nitrogen; P = phosphorus; K = potassium; Ca = calcium; Mg = magnesium; Na = sodium; data are mean values of three replicates ($p \leq 0.05$); Means sharing the same letter (s) do not differ significantly according to least significant test; LSD = least significant difference

Table 5
Antioxidant enzymes activity of medicinal plants of the Cholistan Desert, Pakistan

Antioxidant enzymes activity	Plant tissue	*Cyperus rotundus*	*Cenchrus ciliaris*	*Tribulus terrestris*	*Euphorbia hirta*	LSD value
SOD (units g^{-1} FW)	Roots	100.2^{b}	78.8^{c}	63.9^{d}	139.5^{a}	5.7137
	Leaves	106.6^{b}	27.9^{d}	36.7^{c}	136.7^{a}	5.7900
POD (µmol min^{-1} mg^{-1} protein)	Roots	3.94^{b}	8.59^{a}	4.16^{b}	2.84^{c}	0.8222
	Leaves	3.12^{c}	15.31^{a}	11.66^{b}	3.74^{c}	0.8553
PPO (units mg^{-1} protein)	Roots	0.216^{b}	0.323^{a}	0.113^{c}	0.256^{ab}	0.0686
	Leaves	0.287^{b}	2.220^{a}	0.322^{b}	0.044^{c}	0.0883
APX (units g^{-1} FW)	Roots	196.9^{a}	200.8^{a}	175.9^{b}	197.3^{a}	5.8493
	Leaves	195.6^{d}	238.6^{a}	231.3^{b}	209.9^{c}	4.7793

SOD = superoxide dismutase; POD = peroxidases; PPO = polyphenol oxidase; APX = ascorbate peroxidase; LSD = least significant difference; data are mean values of three replicates ($p \leq 0.05$); Means sharing the same letter (s) do not differ significantly according to least significant test

also maximum and statistically similar to *E. hirta*. The *C. ciliaris* also reported maximum accumulation of K in roots, stem, and leaves. The K contents in roots, stem and leaves of medicinal plants ranged from 0.32 to 1.08%, 0.73 to 1.36% and 0.63 to 1.48%, respectively.

Among secondary macronutrients, Ca and Mg contents were significant among various parts of medicinal plants. The calcium and magnesium contents ranged from 0.38 to 0.63% and 1,148.7 to 1,803.0 µg g^{-1}, respectively in roots, 0.41 to 1.16% and 1,028.7 to 1,508.7 µg g^{-1}, respectively in the stem and 0.45 to 1.80% and 1,126.3 to 2,275.7 µg g^{-1}, respectively in leaves of tested medicinal plants. Maximum Ca contents were observed in roots, stem, and leaves of *T. terrestris*, whereas the *C. ciliaris* reported maximum Mg contents in roots, stem, and leaves. The Na contents were also detected in various parts of plants and found maximum in roots, stem, and leaves of *C. ciliaris*. The Na contents in the stem of *C. ciliaris* was statistically non-significant as compared to Na contents in the stem of *C. rotundus*.

Antioxidant enzymes activity

The antioxidant enzyme's activity in leaves and roots of four medicinal plants presented in Table 5 revealed significant variation among the medicinal plants. The SOD activity ranged from 63.9 to 139.5 unit g^{-1} FW in leaves and 27.9 to 136.7 unit g^{-1} FW in roots of tested medicinal plants. Maximum SOD activity was observed in roots and leaves of *E. hirta*. The POD activity was more in leaves of medicinal plants and ranged from 3.12 to 15.31 μmol min^{-1} mg^{-1} protein, whereas in plants roots, it ranged from 2.84 to 8.59 μmol min^{-1} mg^{-1} protein. *C. ciliaris* showed maximum POD activity in leaves and roots as compared other plants. The PPO and APX activity was more in leaves of medicinal plants, which ranged from 0.05 to 2.22 unit mg^{-1} protein and 195.6 to 238.6 unit g^{-1} FW, respectively. The APX activity in roots was non-significant among the tested plants. Maximum PPO and APX activity were observed in roots and leaves of *C. ciliaris*. The PPO activity in roots of *C. ciliaris* was statistically similar to the *E. hirta*.

DISCUSSION

In the present study, medicinal plants, *viz*. *Cyperus rotundus*, *Tribulus terrestris*, *Cenchrus ciliaris*, and *Euphorbia hirta* were selected to study their nutritional composition and antioxidant enzymes activity. Selection of these plant species was made on basis of their local fame in medicinal use as herbal remedies. The habitant of the Cholistan Desert uses different parts of these medicinal plant to cure a digestive tract problem, respiratory diseases, mental illness, skin disorder, hormonal imbalance, and blood disorders (Immanuel and Elizabeth 2009, Kumar *et al.* 2010).

The current study revealed that tested medicinal plants are enriched with proximate contents and these contents were variable among the tested medicinal plants. This variation could be due to several soil and moisture factors, and genetic potential of target species. In spite of these factors, proximate analysis shows that target plants are good source of minerals, proteins, lipids, carbohydrates and gross energy. The concentration range of proximate attributes was similar to the concentration found in the findings of Hannah and Krishnakumari (2015). High ash contents point out that tested medicinal species are a good source of inorganic minerals. Gross energy values are based on the fats, protein and carbohydrates contents. The highest gross energy was present in *T. terrestris* thus it is important to the source of food, medicine, fibres and other items, which can be used in industries.

Nutrients play an essential role in the medicinal value of plants to cure disease and improve human health. The analysis of minerals in present study revealed that leaves of target plants were more enriched with minerals as compared to stem and roots. The tested plants showed variations regarding mineral composition as highest K, Na, and Mg contents were observed in *C. ciliaris*. The *T. terrestris* reported maximum N and Ca contents, whereas maximum P was accumulated by *E. hirta*. Similar to our study, Ashraf *et al.* (2012) reported a similar range of macronutrient concentration in *Haloxylon salicornicum* L. collected from the Cholistan Desert. Minerals compositions of tested plants were comparable to highly valued medicinal *Berberis* species fruits in Himalayan, India (Andola *et al.* 2011). The nutrients like N, P, Ca, and Mg accumulated in plants are required to repairs wound, for strong bones and teeth, the building of red blood cells and for body mechanisms (Hannah and Krishnakumari 2015). Potassium is an activator of many enzymes and maintains cardiovascular function, heartbeat and blood pressure (Vaskonen 2003). Sodium contents were also detected in target plants, which is necessary to retain the equilibrium of the physical fluids system and proper functioning of nerve and muscle (Idris *et al.* 2010).

Dietary consumption of high antioxidant-based plant product is helpful in prevention of complex diseases like cancer and cardiovascular diseases (Carocho and Ferreira 2013, Kris-Etherton *et al.* 2002). Medicinal plants are rich in wide range of secondary metabolites, *viz*. phenolic compounds such as flavonoids, tannins, lignans, phenolic acids, which have multiple biological activity including antioxidative activity. In the present study, antioxidant potency of tested medicinal plants was investigated to support its traditional uses as an antioxidant source. Results revealed that tested plants, *viz*. *C. rotundus*, *C. ciliaris*, *T. terrestris*, and *E. hirta* demonstrated activity of SOD, POD, PPO, and APX. Antioxidant activity of these plants may be due to their compounds, such as terpenoids, saponins, alkaloids, and phenolic contents, which are powerful antioxidant compounds and positively correlated with antioxidant activity (Khasawneh *et al.* 2011). Previously, total phenolics and flavonoids in *C. rotundus* was reported by Yazdanparast and Ardestani (2007). *C. rotundus* also possess anti-neoplastic properties helpful in cancer therapy (Mannarreddy *et al.* 2017). Rayed *et al.* (2010) reported rich amount of phenols and flavonoids in leaves stems, flowers, and roots of *E. hirta*. This plant possesses antioxidant activity and act as scavenger of free radical (Soare *et al.* 1997). Traditional use of *E. hirta* plant extracts non-cytotoxic according to IC50 value adapted from National Cancer Institute (NCI) as reported by Perumal *et al.* (2013). *T. terrestris* showed anti-inflammatory, anti-tumor, and anticarcinogenic effect and was used for treatment of kidney and urinary cancers (Kumar *et al.* 2006). Oral admiration of alcohol extracts *C. ciliaris* up to 5000 mg/kg (LD50) did not produce any sign of toxicity and was considered safe for human use (Awaad *et al.* 2016).

The overexpression of antioxidant enzymes could be complicated in amelioration of environmental stresses as the Cholistan Desert is characterised as xeric, harsh, and hot and may produce tolerance in plants. Medicinal plants are easily available and a potential source of antioxidant whose phytochemicals and antioxidant may act individually or synergistically to cure disease through their pharmacological properties.

CONCLUSION

The present study revealed the fact that the medicinal plants of the Cholistan Desert, Pakistan (*Tribulus terrestris*, *Cenchrus ciliaris*, and *Euphorbia hirta*) are a rich source of antioxidant activity, proximate and minerals nutrition that would serve as potent free radical scavengers and make these species as a promising source of antioxidants and nutrition. The extracts of these plants parts can be used in the synthesis of nutritious and antioxidant-containing folk medicine. Furthermore, such popular plant species could be essential for analysing the bio-active constituent, pharmacology and biological activities which may lead to new and potential drugs for humanity in future.

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