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Original Research

Assessment of phytochemical screening and antioxidant potential of *Heteropogon contortus* (L.) whole plant

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Abstract: *Heteropogon contortus* (L.) belongs to the family Poaceae, which is known to have bioactivities like an anti-inflammatory, antioxidant, membrane, and mast cell stabilization, antimicrobial, and many more. The aim of the present study is to explore the occurrence of phytochemicals and antioxidant activity by using the whole plant (including leaf, stem, and root) crude extract in three different solvents (methanol, hydroethanol, and aqueous). Using standard methods, the presence of various bioactive compounds was determined. Quantitative evaluation of total phenol, flavonoid, and tannin content was done by using spectrophotometric techniques. For antioxidant property analysis, *in vitro* techniques like ferric reducing antioxidant potential (FRAP) assay, 2,2-diphenyl-1-picrylhydrazyl (DPPH), and metal chelation assay were used. In plant extract preparation, the green color extract of methanol with solid consistency was observed to have the highest % yield of 4.46 %, followed by hydroethanolic (3.86 %), and aqueous extract (2.95 %). Various phytocompounds (e.g., alkaloids, steroids, phenols, flavonoids, glycosides, carbohydrates, and resins) were observed in higher concentrations in methanol, hydroethanol, and aqueous extract. Out of all extracts, the methanol extract was observed to have the highest flavonoid (30.07 ± 0.09 mg quercetin equivalent (QE)/g), phenol (34.12 ± 0.028 mg of the gallic acid equivalent (GAE)/g), and tannin (26.61 ± 0.008 mg of the tannic acid equivalent (TAE)/g) content. In DPPH and metal chelation assay, the effective inhibitor was the methanol extract (42.94 ± 0.0061 µg/ml, 100.57 ± 0.085 µg/ml) in order of potency inhibitory concentration (IC50) while the FRAP value was observed maximum in the hydroethanol extract (258.41 ± 0.0085 mg/g). Thus, overall investigation of the plant extracts shows that the occurrence of a variety of phytochemicals having antioxidant properties makes the plant a promising candidate for usage in traditional medicine.

Keywords: antioxidant activity; *Heteropogon contortus*; phytochemical screening; secondary metabolites

1. Introduction

An equilibrium between free radicals as well as antioxidants is essential for the proper physiological functions in the living beings. If free radicals suppress the body's capability to control them, an ailment recognized as oxidative stress results [1, 2]. Scientific evidences have projected that in oxidative stress conditions, radicles of oxygen like hydroxyl radical (OH•), peroxyl radicals (H_2O_2•) and superoxide anions (O^{2-}) are formed in the biological systems [3]. These free radicals harmfully alter the DNA, proteins, and lipids and as a result of this number of human diseases are induced. Many of the deteriorating diseases that worry human race have their source in detrimental free radical reactions for example various types of cancer, inflammatory joint diseases, senile dementia, diabetes, asthma, atherosclerosis and deteriorating eye disease as per evidences [4].

Naturally derived antioxidants have proved to be very effective in extenuating damaging processes associated with the oxidative stress, either in the crude extract form or chemical components [5]. The pursuit for the plant-derived antioxidants has received a lot of attention and efforts in order to detect the phytochemicals that have high potential in the scavenging of free radicals often linked with various diseases [6].

Traditional medicine (TM) comprises of various health practices, methods, facts and beliefs including plants, animals and/or mineral-based medicines, psychic therapies that are used singularly or in amalgamation to uphold well-being, as well as to detect, prevent or treat sickness [7]. Utilizing plant parts or whole plant as a source of medicine is being in practice from a long time, particularly in developing countries where drugs are usually inaccessible or costly, compelling people to use traditional remedies [8]. Traditional herbal medicines (THM) are natural plant driven ingredients with slight or without industrial processing that are being utilized in the treatment of various sicknesses within local or regional remedial practices [9].

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Plants produce a lot of chemical compounds for various defensive functions like protection from insects, fungi, microbial diseases and herbivorous animals. These chemical compounds are called as phytochemicals [10]. A large number of phytochemicals which have shown potential bioactivity have been recognized for many years of rigorous research [11]. Phytochemicals include various types of chemical compounds like flavonoids, carotenoids, phenols, saponins, glycosides, tannins, alkaloids, steroids, etc. which possess different properties (anti-cancerous, anti-arthritic, antimicrobial and many others) which can be important for mankind [12-15].

Heteropogon contortus (L.) which is placed in the Poaceae family, with common names like Black speer grass in English, Kher in Hindi (India), is in use as a source for healing ailments in the several regions of the world. This grass has been reported to be useful for its anti-inflammatory, antioxidant, membrane and mast cell stabilization, antimicrobial and antidiuretic properties. South African Zulu tribe use the extracts of this grass in treating wounds, burns and rheumatism. It is beneficial in toothache, fever, muscular pain, anti-inflammation, hypertension, haematological disorders and scorpion sting etc. It is also been reported that steam distillation product of whole plant parts cures asthma [16, 17]. Hence, the present research shows the existence of phytochemicals and their antioxidant activity in different solvents of whole plant crude extract of *H. contortus*.

2. Experimental

2.1 Collection of plant material

The entire plant of *H. contortus* was taken from wild in the month of August and September in 2019 from the Banasthali Vidyapith campus, Rajasthan. The plant's identification and authentication were done from Botany Department of Banasthali Vidyapith with voucher number BURI 1391/ 2021, and plantarum number Syst. Veg. 2: 836 1817.

2.2 Preparation of plant extracts

After collection, whole plant material was rinsed in running tap water 2-3 times to remove all dirt. Then the plant material was shade dried for 3-4 days. By using the grinder, dried sample was crushed into fine powder and kept in a sealed waterproof container. Approximately, 30 gm of powder (10 gm from each leaf, stem, and root) was placed in soxhlet thimble then successive extraction was carried out using 300 ml each of three solvents methanol, hydroethanol (50:50), and water for 1-2 working days. After this the suspension was filtered and dried with the help of rotary evaporator for further experimentation work [18].

2.3 Qualitative analysis of phytochemicals

All the primary (amino acids, carbohydrates, and proteins) and secondary metabolites (saponin, alkaloids, phenols, steroids, terpenoids, tannins, etc.) were qualitatively analysed in low, moderate, and high amount from the methanol, hydroethanol, and aqueous extract of *H. contortus* by the help of different tests [19-22].

2.4 Quantitative estimations of the phytochemicals

2.4.1 Total phenol content (TPC) estimation

The TPC was determined with the help of Folin-Ciocalteu (FC) method with some minor modification. Extracts of *H. contortus* were taken in separate aliquots of hydroethanol, methanol, and aqueous. About 0.5 ml of the FC reagent and 20 % of 1 ml sodium carbonate solution was added to the test samples. The reaction mixture was allowed to stand for 2 min and required volume was made up by adding 12.5 ml distilled water. Further incubate the samples for 2 hrs at the room temperature (RT) and their absorbance was recorded at 720 nm. The outcomes were represented as gallic acid equivalents (GAE/g) per gram of extract [23, 24].

2.4.2 Total flavonoid content (TFC) estimation

The TFC was estimated by a colorimetric assay which includes aluminium chloride ($AlCl_3$). To different aliquots of *H. contortus* extracts, 1.5 ml of sodium nitrite solution (5 %), 0.15 ml of aluminium chloride solution (10 %), and 1 ml of sodium hydroxide solution (1M) was added. The sample was incubated for 20 minutes at RT, and its absorbance was taken at 415 nm. The content of flavonoid was expressed in the terms of quercetin equivalent (QE/gm) per gram of the extract [25, 26].

2.4.3 Total tannin content (TTC) estimation

The TTC was estimated by using standard procedure with some minor modifications. Aliquots of (20, 40, 60, 80 and 100 µl) hydroethanol, methanol and the aqueous extracts were used and mixed with 0.5 ml of Folin Denis reagent. This reaction mixture was incubated for 5 min later 15 % of sodium carbonate (Na_2CO_3) was added and tubes were incubated in dark at the RT for 30 min. The absorbance was measured at 700 nm and TTC was expressed as tannic acid equivalents per gm (TAE/g) of the extracts [27, 28].

2.5 Antioxidant activity determination

2.5.1 2,2-diphenyl-1-picrylhydrazyl (DPPH) test

The DPPH radical scavenging activity was done with the help of standardized protocol [29]. In different sample solutions of (1 mg/ml) plant extracts, 2 ml of the DPPH methanol solution (4 mg/100 ml) was added. The samples were shaken vigorously for about 10 min and incubated in dark for further 30 min. After incubation, the absorbance of the samples was recorded at 517 nm. Ascorbic acid was taken as the standard for this assay. The determination of IC_{50} value was done by using linear regression equation analysis. The calculation of the inhibition % of the reaction mixture was done by using the below mentioned formula:

$$DPPH\ radical\ scavenging\ activity = \frac{(Abs\ of\ control\ reaction - Abs\ of\ sample)}{Abs\ of\ control} X100$$

where, Abs is the absorbance

2.5.2 Ferric reducing antioxidant power (FRAP) assay determination

The ferric reducing antioxidant potential assay (FRAP) was carried out by the method of Tanruean *et al.* [30]. The FRAP reagent mixture was made by adding 300 mM of acetate buffer, 10 mM of 2,4,6-tripyridyl-S-triazine (TPTZ) in 40 mM of HCl and 20 mM of $FeCl_3.6H_2O$ at 37 ºC in the ratios of 10:1:1. About 1.5 ml of newly prepared FRAP reagent and 1.4 ml of 300 mM of pH 3.6 acetate buffer was added to different volumes (15-300 µl) of the plant extracts. A very strong bluish colour complex was developed due to the reduction of Fe^{3+} TPTZ complex to Fe^{2+} and an increase in the absorption was determined by spectrophotometer at 700 nm. The antioxidant activity was calculated using the linear calibration graph, and represented as m mol of the ascorbic acid equivalent per gm (AAE/g) of sample.

2.5.3 Metal chelating activity determination

The metal chelating activity of separate extracts of *H. contortus* along with EDTA as the standard was carried out by using the protocol of Farag *et al.* [31]. Different concentration of plant extracts and the standards (20, 40, 60, 80, 100 µl) were taken and mixed with the 3.7 ml of the methanol solution each. Then 0.1 ml of 2 mM ferrous chloride ($FeCl_3$) and 0.2 ml of the 5 mM ferrozine was mixed to the samples. Allowed the samples to stand for 10 min at RT and the absorbance (Abs) was recorded by using spectrophotometer at 562 nm. The calculation of the % chelation was done as follows:

$$Metal\ chelating\ activity = \frac{(Abs\ of\ control\ reaction - Abs\ of\ sample)}{Abs\ of\ control} X100$$

2.6 Statistical analysis

All the tests were done in 3 parallel measurements and their values were represented as Mean ± Standard deviation (SD). The values of IC_{50} were calculated by linear regression extrapolation in Microsoft Excel 2010. The difference obtained between the results were further analysed statistically by the one-way ANOVA, which was done by using the IBM SPSS (20) statistical program. The significance level was considered significant at $p \leq 0.05$.

3. Results

3.1 Plant extracts preparation

The green colour extract of methanol with solid consistency observed to have highest % yield of 4.46 %. The hydroethanolic extract colour and consistency varied from green to solid with % yield of 3.86 % whereas in dark green colour aqueous extract with solid consistency, the % yield was found to be 2.95 % (Table 1 and Fig. 1).

Table 1. Extractive value determination of different extracts of *H. contortus.*

Plant name	Different extracts	Boiling point	Colour	Consistency	% Yield (g/50g)	Odour
Heteropogon contortus L.	Methanol	78 ºC	Green	Solid	4.46 %	Characteristics
	Hydroethnaol	75 ºC	Green	Solid	3.86 %	
	Aqueous	100 ºC	Dark green	Solid	2.96 %	

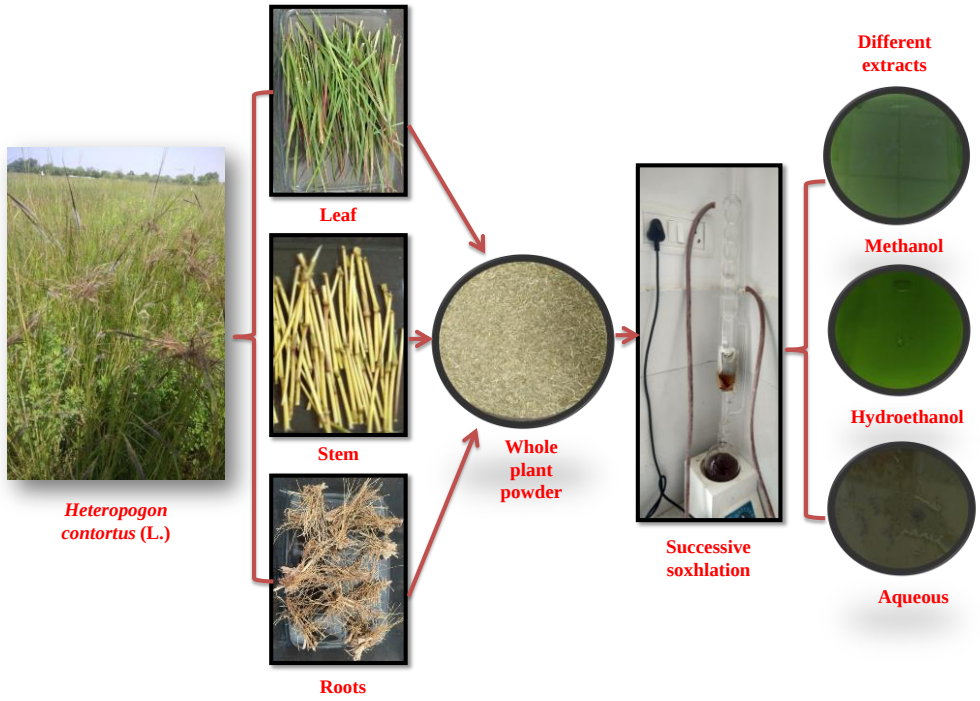

Figure 1. Preparation of different extracts of *H. contortus*

Table 2. Phytochemical analysis of three extracts of *H. contortus.*

Types	Phytochemical compounds	Phytochemical test	Test Indications	Methanol	HE	Aqueous
Primary metabolites	**Amino acids**	Ninhydrin test	Aliphatic primary amine and amino acids	–	–	–
	Proteins	Xanthoproteic test	Amino acids with aromatic nucleus	–	–	–
	Carbohydrates	Molisch′s test	Pentose	+ +	–	+
		Fehling's test	Reducing sugar	–	+	–
Secondary metabolites	**Saponins**	Foam test	Saponin	–	+	+ +
	Alkaloids	Mayer's test	Nicotine, morphine, and heroin	+	+	+
		Wagner's test	Nicotine, quinolone, and anhalonine	+ +	+	+ +
	Phenols	Ferric chloride test	Phenol group	+ +	+ +	+ +
		Lead acetate test	Phenolic compounds	+ +	+ +	+ +
	Steroids	Liebermann-Burchard test	Sterol	+ +	+	+
	Terpenoids	Salkowski′s test	Triterpenoid	+	+	+
	Cardiac glycosides	Keller – Killiani test	Cardiac glycosides	+	+ +	+
	Triterpenes	Salkowski′s test	Triterpene	+	+	+
	Flavonoids	Alkali test	Common flavonoids	+ +	+ +	+ +
	Tannins	Ferric chloride test	Catechic tannin	+	+	+
	Resins	Acetic anhydride test	Resins, esters of fatty acid	+	+ +	+
	Anthraquinones	Borntrager′s test	Anthraquinones	–	–	–
	Phlobatannins	HCl test	Phlobatannins	–	–	–

(+) moderate, (+ +) high concentration and (–) absent. HE: hydroethanol

3.2 Evaluation of phytochemicals

The phytochemical analysis results of whole plant extracts of *H. contortus* are tabulated in table 2. The result showed that the methanol, hydroethanol, and aqueous extracts were rich in alkaloid, phenol, and flavonoid phytochemicals. Steroids and carbohydrates were also found to be in high amount in methanolic extract whereas presence of cardiac glycosides and resins in higher amount were observed in hydroethanolic fraction of *H. contortus.*

3.3 Quantitative estimation of phytochemicals

3.3.1 Total phenol content evaluation

Total phenolic content of *H. contortus* varied significantly among all the three extracts. Phenolic content was exceptionally higher in methanol extract (34.12 ± 0.028 mg

Table 3. Quantative estimation of phytochemicals in different extracts of *H. contortus.*

Extracts and standards	TFC (QE)/g	TPC (GAE)/g	TTC (TAE)/g
Methanolic extract	30.07 ± 0.009^{c}	34.12 ± 0.028^{c}	26.61 ± 0.008^{b}
Hydroethanolic extract	24.17 ± 0.028^{b}	22.92 ± 0.008^{b}	13.9 ± 0.008^{a}
Aqueous extract	9.94 ± 0.028^{a}	11.72 ± 0.008^{a}	9.69 ± 0.008^{a}
Ascorbic acid	99.67 ± 0.007	_	_
Gallic acid	_	97.52 ± 0.007	_
Tannic acid	_	_	102 ± 0.0081

Values (means of three determinants) followed by the different letters are differing significantly at $p < 0.05$

GAE/g) followed by hydroethanol (22.92 ± 0.008 mg GAE/g) and the aqueous extract (11.72 ± 0.008 mg GAE/g) as shown in Table 3. The results of TPC were determined by the linear association between the absorbance and the concentration with standard equation of y = 0.005x + 0.5534 and R^2 value of 0.995 (Fig. 2A).

3.3.2 Total flavonoid content evaluation

Quantitative estimate of the TFC of whole plant extracts of *H. contortus* is shown in the Table 3. The methanol extract (30.07 ± 0.009 mg QE/g) has shown the greater amount of flavonoid content followed by hydroethanol (24.17 ± 0.028 mg QE/g) and the aqueous extract (9.94 ± 0.028 mg QE/g). The TFC was calculated by the help of graph as shown in Fig. 2B with standard equation of y = 0.0154x + 0.3565 and R^2 value of 0.998.

3.3.3 Total tannin content evaluation

The results revealed that the methanol extract (26.61 ± 0.008 mg TAE/g) showed the higher amount of tannin content which is about twice than the hydroethanol (13.9 ± 0.008 mg TAE/g) and aqueous extract (9.69 ± 0.0081 mg TAE/g) as shown in table 3. The TTC was calculated by the help of graph shown in Fig. 2C with the equation of the standard curve y = 0.0026x + 0.0688 and R^2 value of 0.995.

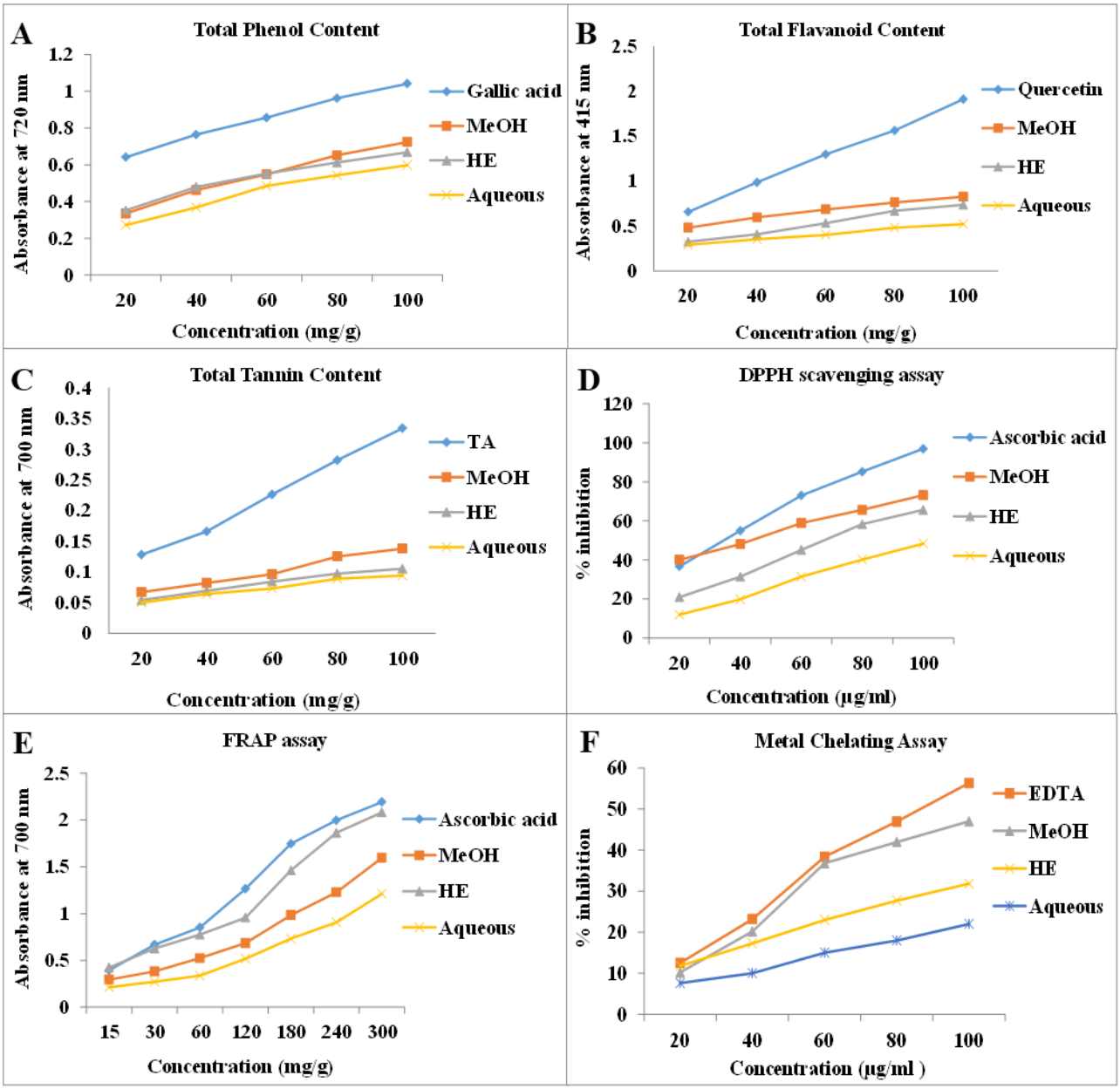

Figure 2. Quantitative estimation of phytochemicals and evaluation of antioxidant activities of whole plant extracts of *H. contortus*. (A) Total phenol content (TPC); (B) Total flavonoid content; (C) Total tannin content; (D) DPPH antioxidant activity; (E) Ferric reducing antioxidant potential (FRAP) assay; (F) Metal chelation activities. (MeOH: methanol, HE: hydroethanol, TA: tannic acid, EDTA: ethylenediamine tetraacetic acid).

3.4 Evaluation of the antioxidant activity

3.4.1 DPPH free radical scavanging assay

Antioxidant activity of the whole plant extracts of *H. contortus* is given in table 4 and represented in fig. 2D. Methanol extract of whole plant has shown the better scavenging activities with IC_{50} value of 42.94 ± 0.0061 µg/ml followed by hydroethanolic extract with IC_{50} value of 69.97 ± 0.0036 µg/ml. The poor DPPH scavenging activity was observed in aqueous extract with IC_{50} value of 102.25 ± 0.006 µg/ml. Though, the antioxidant potential of all the fractions was noted to be lower than the standard ascorbic acid.

Table 4. Antioxidant potential of whole plant in different extracts of *H. contortus*.

Extracts and standards	IC_{50} (µg/ml)		% inhibition
	DPPH	Metal chelation assay	FRAP (mg AAE/g)
MeOH	42.94 ± 0.0061[a]	114.15 ± 0.0085[a]	181.27 ± 0.0081[b]
HE	69.97 ± 0.0036[b]	169.84 ± 0.0089[b]	258.41 ± 0.0085[c]
Aqueous	102.25 ± 0.0061[c]	253.26 ± 0.0077[c]	120.31 ± 0.044[a]
Ascorbic acid	34.47 ± 0.0045	-	275.87 ± 0.0082[a]
EDTA	-	86.1 ± 0.0163	-

Values (means of three determinants) followed by different letters are differing significantly at $p < 0.05$. MeOH: methanol, HE: hydroethanol, EDTA: ethylenediaminetetraacetic acid

3.4.2 Ferric reducing antioxidant potential (FRAP) assay

In this study, the highest reducing potential (258.41 ± 0.0085 mg/g) was shown by hydroethanolic extract of the *H. contortus* followed by MeOH (181.27 ± 0.0081 mg/g) and then the aqueous extracts (120.31 ± 0.044 mg/g). The reducing potential of the *H. contortus* extracts was lower than the standard but was found to be significant in quantity. As shown in Fig. 2E and table 4, the methanol, hydroethanol and aqueous extracts exhibited poor reducing ability with their increasing concentration.

3.4.3 Metal chelating assay

The results of the iron chelation showed that the methanol extracts had the greatest ability to chelate metal iron with minimum IC_{50} value of 114.15 ± 0.0085 µg/ml that was trailed by hydroethanolic extract (169.84 ± 0.0089 µg/ml). The aqueous extract exhibited the poor chelation activity with the IC_{50} value of 253.26 ± 0.0077 µg/ml. From the results (Table 4 and Fig. 2F), it was determined that the all extracts had greater value of IC_{50} than the standard which denoted to their lower chelating activity than the standard but it was noted to be significant at $p < 0.05$.

4. Discussion

Medicinal plants play a crucial role in maintaining the people's health as well as refining the quality of human life in various forms of medicines because of the presence of profuse number of various phytochemicals. Phytocompounds are commonly occurring in minimum concentration in plants. The method of extraction allows obtaining extracts with fewer changes to the functional properties and greater yield of phytocompounds required. The solvent extractability is majorly depending upon the solubility of the particular compound in the selected solvents. Hence, hot extraction method was preferred for the present study due to its higher extraction efficiency, low solvent consumption capacity and requirement of less time in comparison to other methods [32-34]. These chemical compounds possess potential bio-activities and also have disease preventive properties [35]. Occurrence of different phytochemicals makes plant valuable for traditional use in the cure of various ailments. The phytochemical analysis performed on the extracts of whole plant of *H. contortus* revealed the occurrence of various biological active components which are identified as to exhibit diverse range of medicinal as well as physiological properties. We have found that methanol, hydroethanol, and aqueous extracts of plant possess phenols, flavonoids, and alkaloids in high amount while anthraquinones, proteins, amino acids, and phlobatannins were not found in appropriate amount. Alkaloids are remarkably linked with medicinal benefits for centuries. One of the known biological properties of alkaloids is their cytotoxicity [36]. Analgesic properties are shown by them which able to reduce headaches associated with hypertension [37]. Hydroxylated phenolic substances are known as flavonoids having potential health benefits. They also have effective antioxidant properties which are linked with free radical-scavenging action and protect cells against oxidative damage and show strong anticancer activities [38]. Phenolic phytochemicals are some of the major and most universal class of plant metabolites. Pharmacological activities such as, anti-inflammation, anti-aging, anti-carcinogen, anti-atherosclerosis, etc. are shown by them [39]. Numerous researches have designated the antioxidizing properties of the therapeutic plants which are found to be rich in the phenolic compounds. Natural antioxidants such as phenolic acids, flavonoids, tocopherols etc. majorly derived from medicinal plants in the form of phenolic compounds [40]. Glycosides are identified for lowering the blood pressure and having laxative, diuretic and antiseptic properties [41]. Steroids have shown antibacterial properties and are also accountable for central nervous system (CNS) activities [42]. The plant extracts also indicated the presence of saponins which are known to perform inhibitory effect on inflammations and also have anti-diabetic effects [43]. Tannins in plants are used for healing of wounds, ulcers, haemorrhoids, frost-bite and burns. The classification of terpenoids is based on the number of isoprene units that ranged from one to many such as monoterpenoids (isoprene unit: 2), sesquiterpenoids (isoprene unit: 3), diterpenoids (isoprene unit: 4), triterpenoids (isoprene unit: 6), and tetraterpenoids (isoprene unit: 8). Terpenoids found to be effective in inhibiting tumor cells directing proteins, signalling pathways, and enzymes by activating DNA repair mechanisms [14]. The resins, secreted by various plants are utilized on a wide scale as fragrances, ingredients of cosmetic preparations, as adhesives, as coating materials, and as remedies for sterility, unusual pain, unwanted

abortion etc. in folk medicine [44]. The content of flavonoid, phenol and tannin were found to be in significant amount in the methanolic extract of *H. contortus* due to their several health-promoting activities.

In DPPH assay, the addition of antioxidants containing sample with DPPH reagent solution changes the purple colour to yellow [45]. The methanol (MeOH) extract of *H. contortus* whole plant extract had the maximum scavenging potential in a concentration-dependent manner. FRAP assay evaluates the reducing power of an antioxidant as it binds with ferric tripyridyl-S-triazine (Fe^{3+}- TPTZ) complex forming a coloured ferrous tripyridyl-S-triazine (Fe^{2+}-TPTZ) complex. With the increasing concentration of plant extract, the reducing power of sample increases and it is determined by the increase in absorbance of reaction mixture at 700 nm [46]. The result obtained from current study revealed the highest antioxidant potential by the hydroethanol extract of the whole plant of *H. contortus.*

In our study it was determined that the methanol extract showed substantial capacity to chelate ferrous ions followed by rest extracts of *H. contortus*. In metal chelating assay, the formations of reactive oxygen free radicals are reduced by chelation of the metal ions using chelating agents. Ferrozine was added to $FeSO_4$, which forms a complex with ferrous ions (Fe^{2+}) [47]. The metal ion (Fe^{2+}) exhibits the capacity to direct the formation of free radicals by loss or gain of the electrons. So, in metal chelation assay, we observed the reduction by the development of a violet coloured Ferrozine–Fe^{2+} complex [48].

In this respect, Ahomafor *et al*. [49] reported the greater antioxidant activity through DPPH method at 500 mg/ml with highest percentage inhibition of 57.16 ± 53 % in methanol extract of *H. contortus* L. Similarly, the observation of antioxidant through metal chelation assay, FRAP, and DPPH was found to be in favour with the results of Ghante *et al*. [50] in methanolic extract of *H. contortus* L. On the other side, Chaudhary and Janmeda [51] determined the *in vitro* antioxidizing activity of four separate parts of *Euphorbia neriifolia* through hydrogen peroxide (H_2O_2), DPPH, FRAP, metal chelation, superoxide and nitric oxide assay and revealed the best results in methanolic extract of the plant in comparison to other extracts. Similarly, Pracheta *et al*. [52] reported the best DPPH (76.2 ± 0.07 %), and H_2O_2 (69.0 ± 0.01 %) assay values from hydroethanolic extract of *Euphorbia neriifolia* leaf. The results reported by Mahdi-Pour *et al*. [53] were in favour of the current study as it reported that the methanolic extract of all different parts of *Lantana camara* exhibited greater radical scavenging activity. Thus, it was evident from the *in-vitro* study that *H. contortus* possess strong antioxidant properties and can be considered as a potential source for medicinal and nutritional functions.

5. Conclusion

The goal of this current research was to detect the presence of phytochemicals and their antioxidant potential in *H. contortus* extracts. The outcomes of our study determined that the methanol and hydroethanolic extracts of *Heteropogon contortus* have a potent scavenging and reducing capacity against DPPH, and FRAP and transition metal chelation capacity. Presence of different phytocompounds (alkaloid, flavonoids, and phenols) being responsible for the remarkable antioxidant activity of these extracts. This is the first study to report the comparative account of qualitative, quantitative estimation of phytochemicals and scavenging potential between the different extracts of whole plant *H. contortus*. Thus, it can be utilized as an effective source of naturally occurring antioxidants to treat various illnesses. However, further investigation on the identification and isolation of specific phytocompounds and also the *in-vivo* studies is required to be done in order to prove the functional properties of different phytocompounds as an antioxidant against free radicals associated diseases.

Declarations

Author Contribution: PY performed literature survey and experiments. PC and DK prepared the manuscript and PJ supervised the experimental work and refined the manuscript.

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Conflict of Interest: The authors have declared that no conflict of interest exists.

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