



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Research Article

Antioxidant Activity of Hydro-Alcoholic Root Extract of *Clitoria ternatea* Linn. Plant

Debananda Champpatisingh^{*1}, Dr. Ranjit Mohapatra², Priti Murmu³, Rakesh Kumar Pani⁴, Prasanta Kumar Biswal⁵

^{1,2} University Department of Pharmaceutical Sciences, Utkal University, Vani Vihar, Bhubaneswar, Odisha.

^{3,4} KIIT School of Pharmacy, KIIT University, Bhubaneswar, Odisha.

⁵ Dadhichi College of Pharmacy, Vidya Vihar, Sundargram, Cuttack, Odisha.

ARTICLE INFO

Published: 02 July 2026

Keywords:

Clitoria ternatea Linn.,
hydro-alcoholic root extract,
antioxidant activity

DOI:

10.5281/zenodo.21141326

ABSTRACT

Oxidative stress plays an important role in chronic diseases associated with increased lipid peroxidation. *Clitoria ternatea* Linn. contains various antioxidants and bioactive compounds, which exert many functions, such as counteracting oxidative stress, anti-proliferative and anti-inflammatory activities. This study evaluated the antioxidant activity of hydroalcoholic root extract *C. ternatea* (HARCT). The antioxidant activity was analyzed by using the methods; total phenol content, total flavonoid content, DPPH method, Hydroxyl radical scavenging assay, superoxide assay and nitric oxide radical scavenging assay. Results obtained on the antioxidant studies on HARCT on TPC was 112.54 GAE mg/g and TFC was 92.1 QE mg/g; the plant part (root) showed more phenolics than flavonoids content. The IC₅₀ values of DPPH assay was 32.95 µg/ml, superoxide assay was 55.38 µg/ml, hydroxyl assay was 53.60 µg/ml and nitric oxide assay was 28.53 µg/ml respectively which represent the free radical scavenging properties of the extract. So, it is observed that hydroalcoholic root extract of *Clitoria ternatea* have the source of natural antioxidants combating the free radicals.

INTRODUCTION

Disease is the inability of cells or tissues normal physiological function under a controlled environmental condition. This is due to the imbalance between the oxidants/free radicals and the neutralizing substances/antioxidants in the

body [1]. The free radicals are generated continuously via normal physiology and pathological processes. Free radicals can be defined as potentially damaging chemical species containing an unpaired electron. Free radicals are generally electrically charged and they tend to

*Corresponding Author: Debananda Champpatisingh

Address: University Department of Pharmaceutical Sciences, Utkal University, Vani Vihar, Bhubaneswar, Odisha

Email ✉: debanandach@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



neutralize themselves by reacting with other substances there by causing oxidation [2].

Reactive species of oxygen, nitrogen and the recently identified reactive sulfur species (RSS) are well known to induce oxidative damage to lipids, proteins and DNA [3]. These reactive species could be free radicals or non-radical oxidants.

Among ROS, the major players are free radicals such as superoxide radicals ($O_2^{\cdot-}$), hydroxyl radicals ($\cdot OH$) and non-radical oxidant such as hydrogen peroxide (H_2O_2) & singlet oxygen (1O_2). Major RNS are nitric oxide (NO) and peroxynitrite ($ONOO^-$) apart from others [4]. RSS include thiyl radical (RS) [4,5,6].

The deleterious effect of free radicals cause alteration of organic biomolecules such as the polyunsaturated fatty acids in membrane lipids, oxidation of proteins, DNA strand breakage, RNA oxidation, mitochondrial depolarization and apoptosis. They are accelerating aging, cancer, diabetes, cardiovascular diseases, neurodegenerative diseases, wound and inflammation [7,8,9].

Antioxidants are those molecules that inhibit, decrease, delay or completely scavenge the action of free radicals and oxidants and protect the body from oxidative damage [10]. For example; scavenging enzymes such as DPPH, Superoxide dismutase (SOD), Catalase (CAT), glutathione peroxidase (GPx), Nitric oxide radical scavenging, Hydroxyl radical scavenging etc. or chemicals inhibiting the activities of oxidant generating enzymes such as xanthine oxidase and polyphenols.

Plants are the natural resources of various medicinally active moieties for the treatment of diseases. Natural antioxidants obtained from plants are mainly from polyphenols, present in

fruits, roots, nuts, seeds, barks and leaves [11]. Plant polyphenols can act as reducing agents against the oxidants, metal chelators against the metals and also singlet oxygen quenchers. These polyphenols include flavonoids, anthraquinones, anthocyanidins, xanthones coumarins, tocopherols and organic acids [12].

Clitori ternatea Linn. is a traditional medicinal plant belonging to family Fabaceae. The biological activities of *C. ternatea* was reported as follows: memory enhancer, diuretics, treatment of asthma and bronchitis, antimicrobial, insecticidal, anxiolytics, sedatives, anticonvulsants, anti-stress, antipyretics, anti-inflammatory and antidiabetic activities [13,14,15]. The root of the plant has anti-inflammatory, analgesic, and antipyretic values with a bitter taste [16,17].

Hence this present study aimed to investigate the total phenolic contents, total flavonoid contents and in-vitro antioxidant activities of the hydro-alcoholic root extract of *C. ternatea* plant.

MATERIALS AND METHODS:

Collection of Plant parts and preparation of extract

Roots of *C. ternatea* were collected from the medicinal garden of U.D.P.S, Utkal University, Bhubaneswar, Odisha. The plant material was authenticated by Chief Scientist, Dr. Nabin Kumar Dhal, IMMT, BBSR, Odisha, India (voucher number; IMMT-002/22). Then Cleaning, washing, and room temperature drying were done on the *C. ternatea* roots in the shade until aridity. The material was crushed and sieved through sizes 10 and 40 meshes. The coarsely ground substance was sieved and then kept in an airtight container until needed.



500 g of dried and coarsely powdered *C. ternatea* root was extracted in a Soxhlet apparatus using a solvent of ethanol (70): water (30) ratio. The hydro-alcoholic root extract of *C. ternatea* (HARCT), 11.27% w/w was obtained by drying the extract in a water bath after it was dried in a rotary evaporator with decreased pressure.

Reagents

Chemicals, such as 1, 1-Diphenyl-2-picrylhydrazyl, Methanol, Ethylenediamine tetra acetic acid (EDTA), Thiobarbituric acid (TBA), Nitro blue tetrazolium (NBT), Phosphate buffered saline (PBS) were purchased from Sigma Chemical Co., Sodium dihydrogen phosphate, Disodium hydrogen phosphate, Trichloro acetic acid (TCA), Ethanol, Methanol were purchased from E. Merck Co., Folin-ciocalteu reagent, Gallic acid and Ascorbic acid were purchased from SD Fine chemicals & other chemicals used were of analytical grades.

EVALUATION OF ANTIOXIDANT ACTIVITY

Total Phenolic Content (TPC)

Total phenolic content was determined by using Folin-Ciocalteu reagent. Different dilutions of standard gallic acid were prepared (1 mg/ml). The reaction mixture was prepared by mixing 1 ml aliquots of gallic acid (10-100 µg/ml), 5 ml of Folin-Ciocalteu reagent (diluted 10-fold) and 4 ml of sodium carbonate solution (60 g/l). The blue coloured reaction mixture was incubated at 37 °C for 30 min and absorbance was measured at 765 nm in multimode microplate reader (Synergy H1MF, Biotek, USA). Gallic acid was used as standard to plot calibration curve and total phenolic content was expressed as mg/g gallic acid equivalent (GAE) [18].

Total Flavonoid Content (TFC)

Total flavonoid content was determined according to standard protocol with slight modification. Different concentrations (20-100 µg/ml) of quercetin were prepared in ethanol from its stock solution (1 mg/ml). 0.5 ml of 2% aluminium chloride was added and incubated for 1 h at room temperature. The absorbance was measured at 420 nm in multimode microplate reader (Synergy H1MF, Biotek, USA). Quercetin was used as standard and total flavonoid content was expressed as mg/g quercetin equivalent (QE) [19].

1, 1-diphenyl -2-picrylhydrazyl (DPPH) radical scavenging activity

The free radical scavenging activity of hydro-alcoholic root extract of *C. ternatea* was tested using a 1,1-diphenyl-2-picryl hydrazyl (DPPH) technique. Add 24 mg of DPPH in 100 ml of methanol to prepare the stock solution and filtered the stock solution using methanol, then measure the absorbance at 517 nm (0.973). From the stock solution take 3 ml of DPPH solution and combined with 20-100 µL of root extract in a test tube, which was prepared from 1 mg/ml stock extract solution. After that the tubes were kept for 30 min in dark place. Then the absorbance was determined at 517 nm [20]. Radical scavenging activity was determined by using the following formula

$$\% \text{ inhibition of DPPH radical} = \frac{A_{br} - A_{ar}}{A_{br}} \times 100$$

Where, A_{br} is the absorbance of control before reaction and A_{ar} is the absorbance of standard after reaction.

Superoxide Radical Scavenging Activity

Hydro-alcoholic root extracts of *C. ternatea* (20-100 µg/ml each) were prepared from stock solution (1 mg/ml) and mixed with 1 ml of NADH (468 µM



in 100 mM PBS) and 1 ml of nitroblue tetrazolium (NBT) (156 μ M NBT in 100 mM PBS). The reaction was initiated by adding 100 μ l of phenazine methosulphate (PMS) (60 μ M PMS in 100 mM PBS) to the reaction mixture and incubated for 5 min. The absorbance was recorded at 560 nm in multimode microplate reader (Synergy H1MF, BioTek, USA). Quercetin was used as reference drug [21]. Radical scavenging activity was determined by using the following formula

$$\% \text{ inhibition of SOD radical} = \frac{A_{br} - A_{ar}}{A_{br}} \times 100$$

Where, A_{br} is the absorbance of control before reaction and A_{ar} is the absorbance of standard after reaction.

Hydroxyl Radical Scavenging Activity

Hydro-alcoholic root extracts of *C. ternatea* (20-100 μ g/ml each) were prepared from stock solution (1 mg/ml) and mixed with 100 μ l of 2-deoxy-2-ribose (28 mM in 50 mM PBS), 1 ml of Fe-EDTA solution (1:1, 200 μ M ferrous ammonium sulfate and 1 mM EDTA), 100 μ l H_2O_2 (1 mM) and 100 μ l ascorbic acid (0.22%). The reaction mixture was incubated at 37 $^{\circ}$ C for 1 h. After incubation, 1 ml of ice-cold TCA (10% w/v) was added to terminate the reaction. The mixture was heated at 100 $^{\circ}$ C for 20 min and allowed to cool. The absorbance was recorded at 532 nm in multimode microplate reader (Synergy H1MF, BioTek, USA). Ascorbic acid was used as reference drug [22]. Radical scavenging activity was determined by using the following formula

$$\% \text{ inhibition of Hydroxyl radical} = \frac{A_{br} - A_{ar}}{A_{br}} \times 100$$

Where, A_{br} is the absorbance of control before reaction and A_{ar} is the absorbance of standard after reaction.

Nitric Oxide Radical Scavenging Activity

Hydro-alcoholic root extracts of *C. ternatea* (20-100 μ g/ml each) were prepared from stock solution (1 mg/ml) and 3 ml of sodium nitroprusside (10 mM in PBS) was added and incubated at 25 $^{\circ}$ C for 150 min. To the reaction mixture, 1 ml of Griess reagent (1% sulphanilamide, 2% phosphoric acid and 0.1% naphthylethylene diamine dihydrochloride) was added and absorbance was recorded at 546 nm in multimode microplate reader (Synergy H1MF, BioTek, USA). Quercetin was used as reference drug [23]. Radical scavenging activity was determined by using the following formula

$$\% \text{ inhibition of Nitric oxide radical} = \frac{A_{br} - A_{ar}}{A_{br}} \times 100$$

Where, A_{br} is the absorbance of control before reaction and A_{ar} is the absorbance of standard after reaction.

RESULTS:

Total Phenolic Content (TPC)

TPC values of hydro-alcoholic root extracts of *C. ternatea* was expressed as mg GAE/g. TPC of *C. ternatea* was recorded 112.54 mg GAE/g (Table 1).

Total Flavonoid Content (TFC)

TFC values of hydro-alcoholic root extracts of *C. ternatea* was expressed as mg QE/g. TFC of *C. ternatea* was recorded 92.1 mg QE/g (Table 1).

Table 1. Biochemical Estimation of TPC & TFC of HARCT

Plant	Extract	Plant parts	TPC (GAE; mg/g)	TFC (QE; mg/g)
<i>C. ternatea</i>	Hydro-alcoholic	Root	112.54	92.1



TPC- total phenolic content, TFC-total flavonoid content, GAE-gallic acid equivalent and QE- quercetin equivalent.

DPPH Radical Scavenging Activity

DPPH radical scavenging assay of hydro-alcoholic root extracts of *C. ternatea* was shown in Table 2.

Table 2: IC₅₀ values (µg/ml) of root of *C. ternatea* in DPPH Assay

Samples	Concentration (µg/ml)	% inhibition	IC ₅₀ value (µg/ml)	Ascorbic acid IC ₅₀ (µg/ml)
HARCT	20	32.56 ± 2.32	32.95 ± 0.75	18.53 ± 0.52
	40	61.06 ± 1.69		
	60	79.46 ± 1.98		
	80	98.91 ± 2.13		
	100	114.57 ± 1.45		

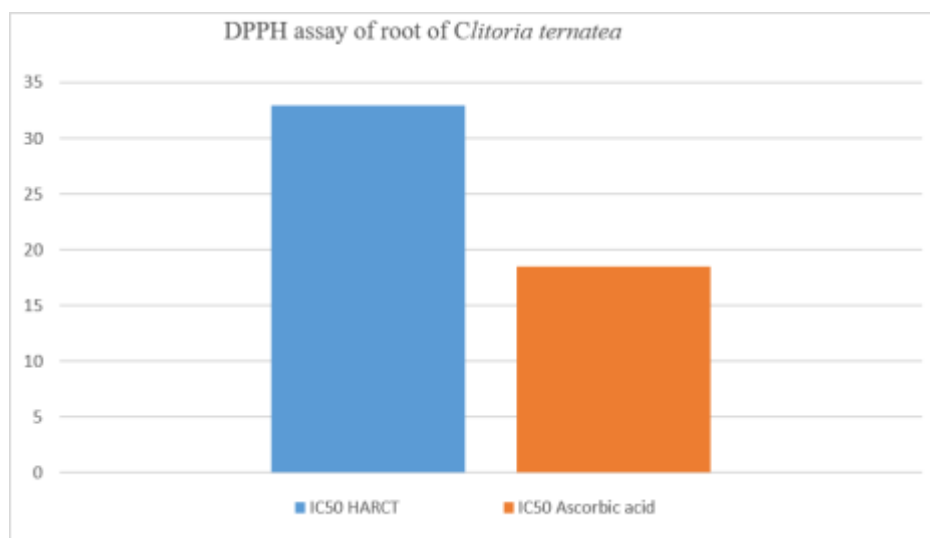


Figure 1: DPPH assay of hydro-alcoholic root extracts of *C. ternatea*. Ascorbic acid was used as reference drug.

Superoxide Radical Scavenging Activity

Superoxide radical scavenging assay of hydro-alcoholic root extracts of *C. ternatea* was shown in Table 3. In Superoxide radical scavenging assay of

In DPPH radical scavenging assay of *C. ternatea*, the IC₅₀ values of hydro-alcoholic extract of root was recorded 32.95 µg/ml. The results were comparable to the IC₅₀ value of standard drug ascorbic acid (18.53 ± 0.52 µg/ml) for *C. ternatea* (Figure 1).

C. ternatea, the IC₅₀ values of hydro-alcoholic extract of root was recorded 55.38 ± 0.72 µg/ml. The results were comparable to the IC₅₀ value of standard drug Quercetin 50 ± 0.46 µg/ml for *C. ternatea* (Figure 2).

Table 3: IC₅₀ values (µg/ml) of root of *C. ternatea* in SOD assay

Samples	Concentration (µg/ml)	% inhibition	IC ₅₀ value (µg/ml)	Quercetin IC ₅₀ (µg/ml)
HARCT	20	20.66 ± 2.51	55.38 ± 0.72	50 ± 0.46
	40	28.33 ± 1.52		
	60	60.66 ± 1.52		
	80	73.33 ± 4.93		
	100	87.66 ± 2.51		

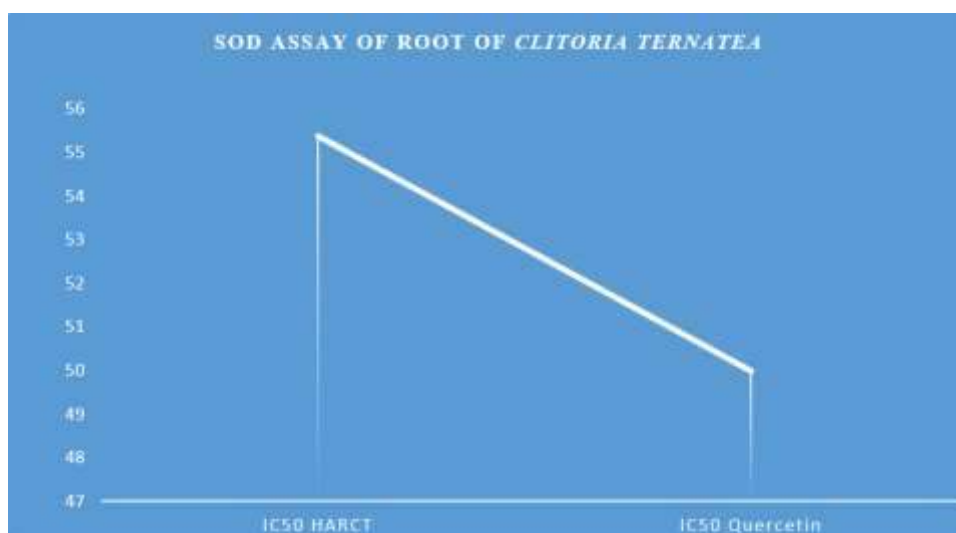


Figure 2: SOD assay of hydro-alcoholic root extracts of *C. ternatea*. Quercetin was used as reference drug.

Hydroxyl Radical Scavenging Activity

In hydroxyl assay, the radical scavenging activities of hydro-alcoholic root extracts of *C. ternatea* was shown in Table 4. In hydroxyl radical scavenging

assay of *C. ternatea*, the IC₅₀ values of hydro-alcoholic extract of root was recorded 53.60 ± 0.28 µg/ml. The results were comparable to the IC₅₀ value of standard drug Quercetin 60 ± 0.52 µg/ml for *C. ternatea* (Figure 3).

Table 4: IC₅₀ values (µg/ml) of root of *C. ternatea* in Hydroxyl assay

Samples	Concentration (µg/ml)	% inhibition	IC ₅₀ value (µg/ml)	Quercetin IC ₅₀ (µg/ml)
HARCT	20	23.66 ± 1.15	53.60 ± 0.28	60 ± 0.52
	40	29.66 ± 1.52		
	60	62.66 ± 1.52		
	80	73.33 ± 4.93		
	100	88.33 ± 1.52		

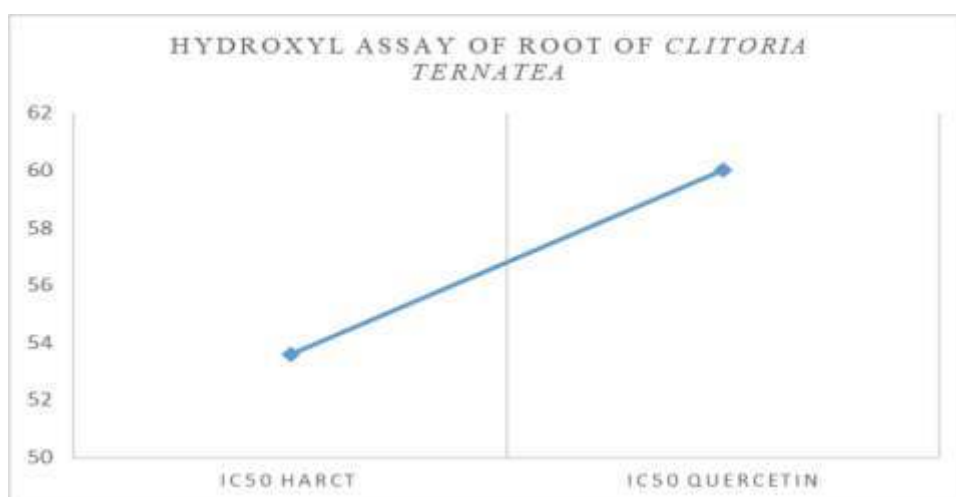


Figure 3: Hydroxyl assay of hydro-alcoholic root extracts of *C. ternatea*. Quercetin was used as reference drug.

Nitric Oxide Radical Scavenging Activity

In nitric oxide assay, the radical scavenging activities of hydro-alcoholic root extracts of *C.*

ternatea was shown in Table 5. In nitric oxide radical scavenging assay of *C. ternatea*, the IC₅₀ values of hydro-alcoholic extract of root was recorded $28.53 \pm 0.84 \mu\text{g/ml}$. The results were

comparable to the IC₅₀ value of standard drug Quercetin $60 \pm 0.42 \mu\text{g/ml}$ for *C. ternatea* (Figure 4).

Table 5: IC₅₀ values ($\mu\text{g/ml}$) of root of *C. ternatea* in Nitric oxide assay

Samples	Concentration ($\mu\text{g/ml}$)	% inhibition	IC ₅₀ value ($\mu\text{g/ml}$)	Quercetin IC ₅₀ ($\mu\text{g/ml}$)
HARCT	20	38.66 ± 2.51	28.53 ± 0.84	60 ± 0.42
	40	61.66 ± 11.01		
	60	76.33 ± 5.03		
	80	84.66 ± 4.50		
	100	94.33 ± 3.05		

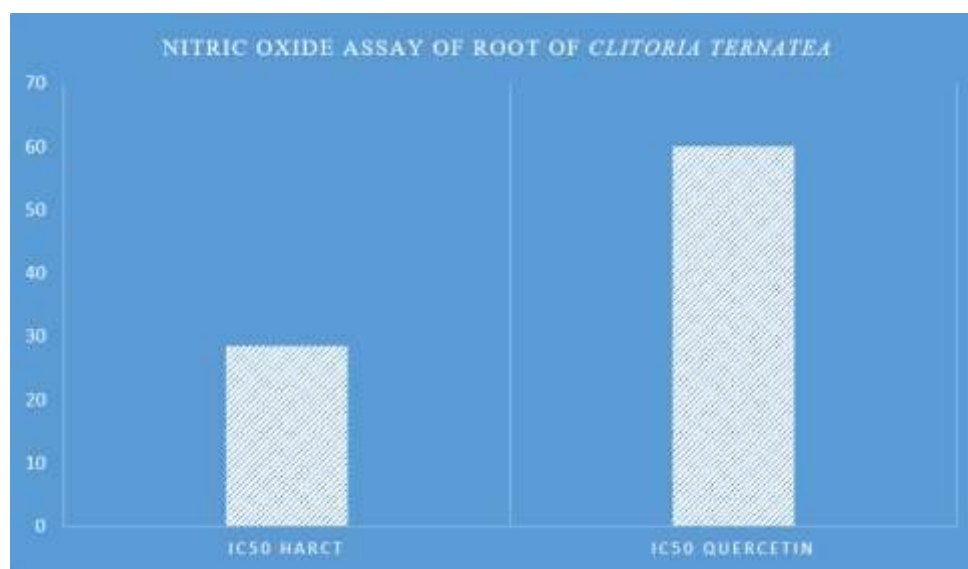


Figure 4: Nitric oxide assay of hydro-alcoholic root extracts of *C. ternatea*. Quercetin was used as reference drug.

DISCUSSION

Biochemical Estimation of *C. ternatea*

In human physiological system, free radicals and reactive oxygen species (ROS) are generated due to imbalance between formation and neutralization of prooxidants. To nullify the effect of free radicals, exogenous natural antioxidants rich in phenolics and flavonoids are supplemented mainly from diet. These exogenous antioxidants neutralize free radicals and reverse the metabolic disorders to protect the cells from lipid peroxidation [24].

Total Phenolic Content (TPC)

In the present investigation, TPC of hydro-alcoholic extracts of root of *C. ternatea* was estimated by using standard gallic acid and expressed in terms of gallic acid equivalent (GAE). The results revealed that the hydro-alcoholic root extracts of *Clitoria ternatea* possess high content of phenolic compounds 112.54 mg/g shown in Table 1. The presence of phenolic compounds in plants may attribute to free radical scavenging activities by donating hydrogen atoms, electrons, or chelating metal ions. Thus, high phenolic content established positive correlation between antioxidant potential of the plant extracts and its role in management of oxidative stress related chronic diseases.



Total Flavonoid Content (TFC)

In the present study, TFC of hydro-alcoholic extracts of root of *C. ternatea* was estimated. Standard drug quercetin was used to calculate TFC and the results were expressed as Quercetin gram equivalent (QE). The results revealed that the hydro-alcoholic root extract of *Clitoria ternatea* possess 92.1 mg/g content of flavonoid compounds shown in Table 1. Flavonoids play crucial role in suppressing ROS production by up regulating antioxidant enzymes or chelating metal ions involved in free radical formation. In current study, the flavonoids in hydro-alcoholic extract of root of *C. ternatea* plant justifies its significant antioxidant potential.

In-Vitro Antioxidant Activities of *Clitoria ternatea*

In human physiological system, free radicals are generated due to metabolism, different pathological conditions and may develop oxidative stress. Oxidative stress can be overcome by many synthetic drugs but these are associated with adverse effects. So, there is an increasing demand of natural plant-based antioxidants. Antioxidant activities of plant extracts may not be evaluated by only a single method due to the complexity of the phytochemicals. Therefore, different *in vitro* antioxidant assays are used to evaluate antioxidant activities of the plant extracts.

In the present study, *in vitro* antioxidant activities such as 2,2-diphenyl-1-picrylhydrazyl (DPPH), superoxide (SOD), hydroxyl (OH), nitric oxide (NO) assays were performed to establish the radical scavenging activities of hydro-alcoholic root extracts of *Clitoria ternatea*.

DPPH Radical Scavenging Activity

DPPH radical scavenging assay is one of the most efficient, simple, and relatively inexpensive method for screening of antioxidant activities of plant extracts. DPPH radical assay is based on reduction of DPPH radical (purple) in the presence of antioxidants to produce reduced form of DPPH (yellow). In DPPH assay, the hydro-alcoholic root extract of *Clitoria ternatea* showed the inhibition percentage with IC₅₀ values 32.95 µg/ml whereas, IC₅₀ values standard ascorbic acid showed IC₅₀ values 18.53 µg/ml shown in Fig. 1.

Superoxide Radical Scavenging Activity

SOD radical is one of the strongest reactive oxygen species that directly or indirectly damage biomolecules by forming hydroxyl, peroxy nitrite and singlet oxygen. SOD radicals are generated from dissolved oxygen in PMS-NADH coupling and measured by their ability to reduce NBT (yellow) to formazan (blue). As shown, the hydro-alcoholic root extract of *Clitoria ternatea* showed the inhibition percentage with IC₅₀ value 55.38 µg/ml whereas, IC₅₀ value standard quercetin showed IC₅₀ value 50 µg/ml shown in Fig. 2.

Hydroxyl Radical Scavenging Activity

Hydroxyl radicals are produced from hydrogen peroxide and cause lipid peroxidation, enzyme inactivation by oxidation of thiol (-SH) groups. Also, it can cause mutagenesis, carcinogenesis and cytotoxicity in cells. In hydroxyl radical scavenging assay, the hydro-alcoholic root extract of *Clitoria ternatea* showed the inhibition percentage with IC₅₀ value 53.60 µg/ml whereas, IC₅₀ values standard quercetin showed IC₅₀ values 60 µg/ml shown in Fig. 3.

Nitric Oxide Radical Scavenging Activity

Nitric oxide is highly reactive radical produced by endothelial cells and phagocytes. The high level of



nitric oxide radicals leads to oxidative tissue damage and associated with inflammation and carcinoma. Also, it reacts with superoxide radicals to form highly reactive peroxy nitrite anion. The hydro-alcoholic root extract of *Clitoria ternatea* showed the inhibition percentage with IC₅₀ values 28.53 µg/ml whereas, IC₅₀ values standard quercetin showed IC₅₀ values 60 µg/ml shown in Fig. 4.

CONCLUSION

On the basis of *in vitro* antioxidant activities of hydro-alcoholic root extracts of *Clitoria ternatea* was performed by using different antioxidant assays such as DPPH, superoxide, hydroxyl and nitric oxide assay. It was concluded that *Clitoria ternatea* exhibited highest inhibition towards free radical scavenging and reducing power activities. The highest radical scavenging potential of the *Clitoria ternatea* was attributed to high content of phenolic than flavonoids contents as evidenced from estimation of total phenolic and total flavonoid content.

REFERENCES

1. Kurutas EB. The importance of antioxidants which play the role in cellular response against oxidative/nitrosative stress: Current state. *Nutrition Journal*. 2015;15(1):71. <https://doi.org/10.1186/s12937-016-0186-5>.
2. Cheeseman KH & Slater TF. An introduction to free radical biochemistry. *British Medical Bulletin*. 1993;49(3):481–493.
3. Pallavi S, Ambuj BJ, Rama SD and Mohammad P. Reactive oxygen species, oxidative damage, and antioxidative defense mechanism in plants under stressful. *Journal of Botany*. 2012:1-26. <https://doi.org/10.1155/2012/217037>.
4. Lu J, Lin PH, Yao Q & Chen C. Chemical and molecular mechanisms of antioxidants: Experimental approaches and model systems. *Journal of Cellular and Molecular Medicine*. 2010;14(4):840–860.
5. Carocho M and Ferreira ICFR. A review on antioxidants, prooxidants and related controversy: Natural and synthetic compounds, screening and analysis methodologies and future perspective. *Food and Chemical Toxicology*. 2013;50:15-25.
6. Craft BD, Kerrihard AL, Amarowicz ZR & Pegg RB. Phenol-based antioxidants and the in vitro methods used for their assessment. *Comprehensive Reviews in Food Science and Food Safety*. 2002;11(2):148–173.
7. Ames BN. Dietary carcinogens and anticarcinogens: oxygen radicals and degenerative diseases. *Science*. 1983;221:1256–1264.
8. Stadtman ER. Protein oxidation and aging. *Science*. 1992;257:1220–1224.
9. Sun Y. Free radicals, antioxidant enzymes and carcinogenesis. *Free Radical Biology and Medicine*. 1990;8:583–599.
10. Lobo V, Patil A, Phatak A, Chandra N. Free radicals, antioxidants and functional foods: Impact on human health. *Pharmacognosy Reviews*. 2010;4(8):118–126. <https://doi.org/10.4103/0973-7847.70902>.
11. Pratt DE, Hudson B. Natural antioxidants not exploited commercially. In: Hudson B, editor. *Food antioxidants*. 1st ed. (Elsevier, Amsterdam). 1990:171-192.
12. Hertog MGL, Feskens EJM, Hollman PCH, Katan MB & Kromhout D. Dietary antioxidant flavonoids and risk of coronary heart disease: the Zutphen elderly study. *Lancet*. 1993;342:1007–1011.
13. Devi BP, Boominathan R and Mandal SC. Anti-inflammatory, analgesic and antipyretic properties of *Clitoria ternatea* root. *Fitoterapia*. 2003;74(4):345-349.
14. Jain NN, Ohal CC, Shroff SK, Bhutada RH, Somani RS, Kasture VS and Kasture SB. *Clitoria ternatea* and the CNS, *Pharmacology, Biochemistry and Behaviour*. 2003;75:529-536.
15. Giurgea C. The nootropic approach to the pharmacology of the integrative action of the brain. *Cond Reflex*. 1973;8:108-15.



16. Nagappa AN, Thakurdesai PA, Rao NV and Singh J. Antidiabetic activity of Terminalia catappa Linn fruits. *J Ethanopharmacol.* 2003;88:45-50.
17. The Wealth of India. A Dictionary of Indian Raw Material and Industrial product. 2003;6:207-216.
18. Hung PV, Duy TL. Effects of drying methods on bioactive compounds of vegetables and correlation between bioactive compounds and their antioxidants. *Int. Food Res.* 2012;19:327-332.
19. Chang CC, Yang MH, Wen HM and Chern JC. Estimation of total flavonoid content in propolis by two complementary colorimetric methods. *J. Food Drug Anal.* 2002;10:178-182.
20. Blois MS. Antioxidant determinations by the use of stable free radical. *Nature.* 1958;181:1199-1200.
21. Nishimiki M, Rao NA and Yagi K. The occurrence of superoxide anion in the reaction of reduced phenazine methosulphate and molecular oxygen. *Biochem. Biophys. Res. Commun.* 1972;46:849-853.
22. Halliwell B, Gutteridge JM and Aruoma OI. The deoxyribose method: a simple test-tube assay for determination of rate constants for reactions of hydroxyl radicals. *Anal. Biochem.* 1987;165:215-219.
23. Green LC, Wagner DA and Glogowski J. Analysis of nitrate, nitrite and nitrate in biological fluids. *Anal. Biochem.* 1982;126:131-138.
24. Gangwar M, Gautam MK, Sharma AK, Tripathi YB, Goel RK and Nath G. Antioxidant capacity and radical scavenging effect of polyphenol rich Mallotus philippensis fruit extract on human erythrocytes: an in vitro study. *Sci. World J.* 2014:1-12.

HOW TO CITE: Debananda Champpatisingh, Dr. Ranjit Mohapatra, Priti Murmu, Rakesh Kumar Pani, Prasanta Kumar Biswal, Antioxidant Activity of Hydro-Alcoholic Root Extract of Clitoria ternatea Linn. *Plant, Int. J. of Pharm. Sci.*, 2026, Vol 4, Issue 7, 458-467. <https://doi.org/10.5281/zenodo.21141326>

