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THERAPEUTIC POTENTIALS OF *OXALIS CORNICULATA* LINN. AS A MEDICINAL PLANT: A REVIEW

Afsana Karim Anika [1], Fatema Shorna [1], Shifat Sehrin Khan Upoma [1], Timothy Singh [1] and Pritesh Ranjan Dash [*2]

Department of Pharmacy [1], BRAC University, Dhaka - 1212, Bangladesh.
Department of Pharmacy [2], Jahangirnagar University, Savar, Dhaka - 1342, Bangladesh.

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Correspondence to Author:
Pritesh Ranjan Dash

Ph.D. Student,
Department of Pharmacy,
Jahangirnagar University, Savar,
Dhaka - 1342, Bangladesh.

E-mail: pritesh.ju@gmail.com

ABSTRACT: *Oxalis corniculata* Linn. is a medicinally important plant belonging to the family Oxalidaceae native to tropical and subtropical regions of the world. This paper briefly shows the botany, pharmacology, and therapeutic use of the herb. The review discloses that a varied array of phytochemical constituents have been extracted from the plant like glycosides, flavanoids, tannins, phytosterols, phenol, galactoglycero-lipid, volatile oil and fatty acids such as palmitic acid, oleic, linoleic, linolenic and stearic acids. The leaves contain flavonoids, isovitexine, and vitexine-2"- O-beta – D- glucopyrunoside. It holds essential activities like anti-inflammatory, anxiolytic, anti-epileptic, anti-fungal, anti-ulcer, anti-nociceptive, anti-cancer, anti-diabetic, hepatoprotective, anti-diarrhoeal, hypolipidemic, antioxidant, hypoli-pedemic, steroidogenic, cardioprotective, nephrotoxicity, diuretic, anti-microbial and wound healing has also been reported. These reports indicate that *Oxalis corniculata* has various therapeutic benefits and highlights the necessity for research and development on this plant.

INTRODUCTION: Since pre-historic age, various medicinal plants have been discovered to have pharmacological activities and are used for traditional medicine practices worldwide. It was found that 80 percent of the human population relies upon these plant extracts for their medicinal benefits [1]. The use of traditional medicines is still on the rise due to many reasons, which include adverse effects of new synthetic medicines, high cost of synthetic medicines, insufficient availability of certain medicines, and mostly because of drug resistance.

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However, medicinal plants are capable of synthesizing hundreds of chemical components where each of these components have different functions in biological science. But only a small percentage of these plants have been accessed and subjected to research for biological and pharmacological screening. *Oxalis corniculata* Linn. is highly used for its anti-oxidant, anti-fungal, anthelmintic, anti-inflammatory, analgesic, astringent, anti-cancer, depurative, diuretic, emmenagogue, anti-microbial, febrifuge, cardio-relaxant, lithon-tripic, stomachic and styptic properties worldwide [2].

It is also used for the treatment of influenza, fever, urinary tract infections, enteritis, diarrhea, traumatic injuries, sprains, and poisonous snake bites. A direct infusion can be used to help children get rid of hookworms. The plant is also used as an anti-scorbutic to treat patients with scurvy.

In addition, the leaves are used as an antidote to poisoning by the seeds of datura, arsenic and mercury. The juice made from the leaf is applied to insect bites, burns and skin eruptions. Moreover, an infusion of leaves is used to remove opacities of the cornea and is dropped into the eyes for itching lids. A decoction of leaves is further used as a gargle for the mouth. In this review paper, along with the pharmacological properties, the other necessary features regarding the plant can be well acknowledged and can be utilized for further research and study purposes [3-4].

Native Names:

Telugu	:	Ambotikura, Pulichintha, Pallachintha
Bengali	:	Amrul-sak, Amrulshak, Amrul, Tandichatom arak, Amrool
Hindi	:	Seh-patti, Tinpatiya, Anboti, Chukatripati, Bhilmori, Khatari
Sanskrit	:	Ambashta, Amlalonika, Amlapatrika, Amlika, Amlotaja, Cangeri
Malayalam	:	Poliyarala, Puliyaral, Puliyarala, Puliyarila, Pullampurachi
Oriya	:	Sialthur, Siakthur, Ambo chingari
Kannada	:	Huli-huniche, Hulihunice, Pullam-purachi-sappu, Teltuppi
English	:	Indian sorrel
Arabic	:	Hememdab, Hemda, Homadmad
Marathi	:	Ambali, Chicha
Urdu	:	Khatt-i-buti
Assamese	:	Changeritenga, Sarutengesi
Marathi	:	Umbuti, Ambuti, Bhinsarpati, Aambotee, Ambatachukaa
Tamil	:	Palaikiri, Puliyarail

Taxonomic Classification:

Kingdom	:	Plantae
Class	:	Magnoliopsida
Order	:	Geraniales
Family	:	Oxalidaceae
Genus	:	Oxalis L.
Species	:	*Oxalis corniculata* L.

FIG. 1: PLANT OF *OXALIS CORNICULATA* L.

FIG. 2: FLOWERS OF *OXALIS CORNICULATA* L.

Distribution: To begin with, Carl Linnaeus was the first person to define *Oxalis corniculata*. It is an eminent inhabitant and sustained weed due to its inflammable shell, prolonged flowering time, and adhesive seeds. However, several other species that are also included in the section corniculate are as follows- *O. stricta* L., *O. Exilis, A. Cunn*. and *O. dillenii* Jacq. *Oxalis corniculata* is dispersed in almost every country amidst all other vascular plant groups. Due to its huge distribution, it has become troublesome to get its local or native place. However, the presence of *Oxalis corniculata* is immensely found in the horticulture industry and is dispersed greatly through the whole of the high temperate regions of India [4]. These weeds are also spotted in Texas, south-eastern united-state, Ontario, Newfoundland to north Dakota, Florida, and the West Indies [5].

Phytochemical Constituents: Several phyto-chemical constituents have been found and isolated from the whole plant of *Oxalis Corniculata* Linn such as glycosides, phytosterols fatty acids, galactoglycerolipid, β-sitosterol, betulin, methoxy-flavones, 7-O-β-D- glucopyranoside-4- hydroxy-benzoic acid, ethyl gallate and apigenin [1]. The leaves of this plant contains isovitexine and vitexine-2”- O- beta – D- glucopyrunoside, citric acids, tartaric acid, calcium oxalate, flavones (acacetin and 7,4'- diOMe apigenin), flavonols

(3',4'-diOMe quercetin), glycoflavones (4'-OMe vitexin, 4'- OMeiso-vitexin and 3',4'-diOMe orientin) and phenolic acids such assyringic, phydroxybenzoic and vanillic acids. The availability of three C-glycosylflavones such as 6-C-glucosyl luteolin (isoorientin), 6-C-glucosylapigenin (isovitexin) and isovitexin 7- methyl ether (sertisin) in the plant was assured by studies around the globe [3]. Furthermore, ethanolic and methanolic extracts also dictated the availability of phytosterols, phenolic compounds, glycosides, flavonoids, volatile oil, calcium, proteins, amino acids, carbohydrates, fibers, and tannins [3].

Different Chemical Constituents of *Oxalis corniculata*: 1, 3

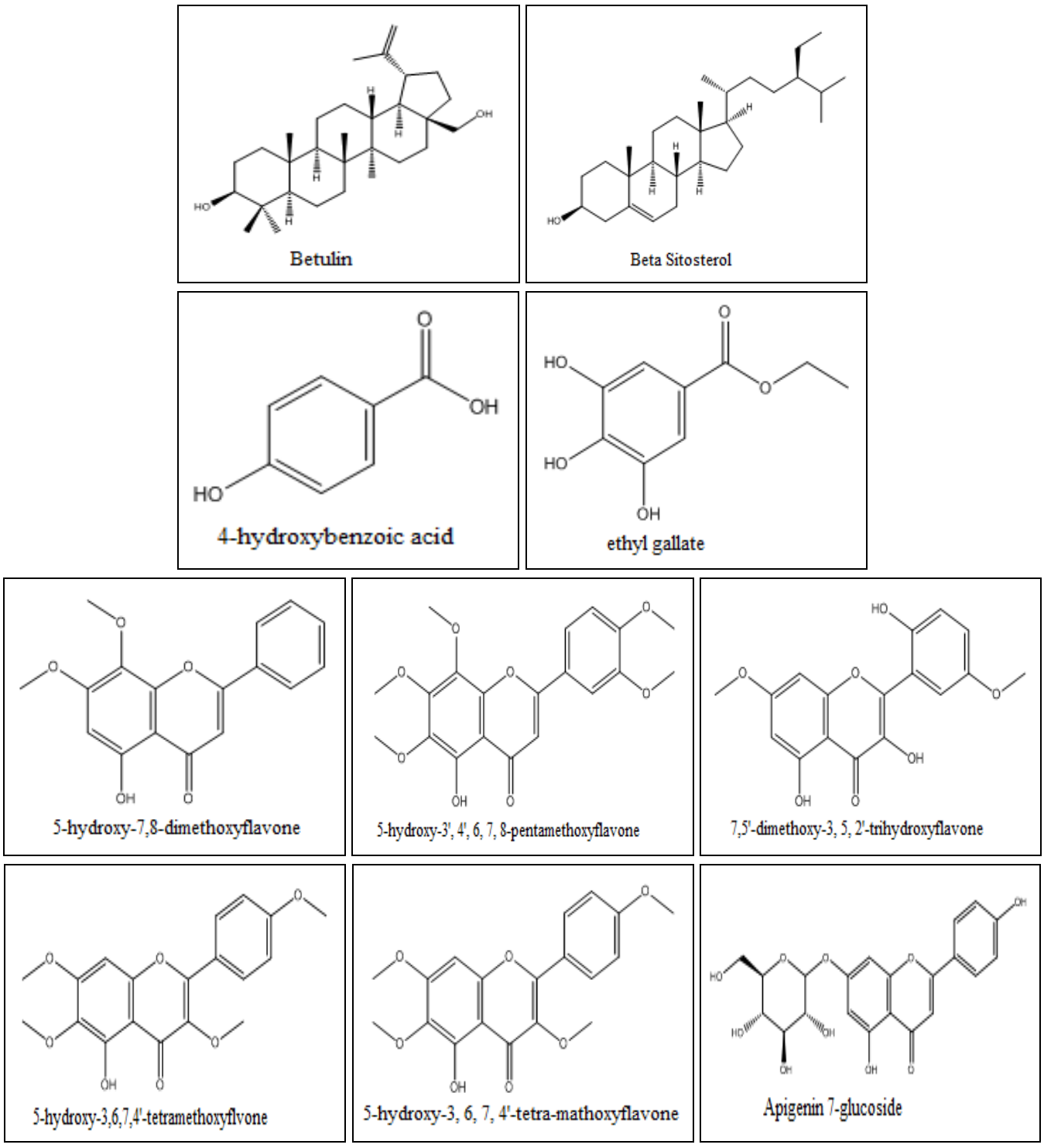

FIG. 3: DIFFERENT CHEMICAL CONSTITUENTS ISOLATED FROM *OXALIS CORNICULATA*

Pharmacological Effects:

Anti-diabetic Activity: Three groups of mice were taken into account to check the antihyperglycaemic activity of *Oxalis corniculata* plant which included normal (control), glucose-loaded and Streptozotocin-induced hyperglycaemic rats. In the placebo rats, when the extract was given, it showed a significant fall in blood glucose level at the last 8th h. In glucose loaded animals, blood glucose level showed reduction soon after 60 min of induction of the extract, and the maximum reduction was seen at 4th h with the extract. However, a significant decrease in blood glucose level was observed in streptozotocin-induced hyperglycaemic rats when compared with glucose loaded rat, stated by Mekap and his colleagues, proving it to be a potential anti-hyperglycemic agent.

Furthermore, continuous induction and administration of methanolic extracts and fractions for consecutive 14 days showed a significant reduction in total serum triglycerides, cholesterol, LDL, and VLDL levels but also showed an increase in total HDL and protein levels [6]. In addition to all these findings, Srikanth and his colleagues also concluded that the aqueous extract which was obtained from *Oxalis corniculata* Linn. plant was found to have potential inhibition activity against procaine pancreatic amylase. However, the authors also mentioned that the organic extracts did not show any significant inhibition activity in this study, which might suggest that the active principle possessing amylase inhibitory potential is extracted only in the aqueous extract [3].

Anti-cancer Activity: Kathiriya and his fellow researchers stated that the presence of methanolic extract from *Oxalis corniculata* Linn. was found to be potential to treat Ehrlich ascites carcinoma (EAC) which was previously induced in Swiss albino mice. The extract of the plant was found to be ineffective to HCEC but toxic and harmful to Hep2. It was evaluated that extract concentration of 0.042 mg/ml caused 49.48% cell death and 0.048 mg/ml caused 47.93% cell death respectively.

The authors evaluated the results and concluded that the methanolic extract of *Oxalis corniculata* Linn. had anticancer properties and was effective in preventing tumor growth in ascitic and solid tumor models [7].

Anti-amoebic Activity: Several compounds were isolated from *Oxalis corniculata* Linn. which were further evaluated to have anti-amoebic activity when tested upon cultures of *E. histolytica*. The compounds were identified by nuclear magnetic resonance, infrared, and mass spectrometry by Manna and his colleagues.

The authors also discovered that the mixture constituted of Oc-1, which was a mixture of saturated fatty acids C24 to C28; Oc-2, which was a mixture of long-chain alcohols C18 to C28; and Oc-3 which was a galacto-glycerolipid (GGL). Galacto-glycerlipid showed the strongest and highest anti-amoebic activity among all the other compounds [8].

Wound Healing Activity: Taranalli and his fellow researchers discussed the presence of alcoholic and petroleum ether extract in the *Oxalis corniculata* Linn. The plant which has been proven for its wound healing activity by using excision, resutured incision, and dead space wound models in rats. The extracts were given at the dose of 300 and 500 mg per kg in the model rats, and they showed significant wound healing activity by producing an increase in wound breaking, wound contraction rate and also showed a decrease in the epithelization period. In this study, both the extracts significantly increased the granuloma tissue breaking strength and hydroxyl proline content as compared to control [9].

Anti-implantation and Abortifacient Activity: Sharangouda and Patil talk about how petroleum ether and ethanol found in *Oxalis corniculata* Linn. plant extracts were administered orally to the model pregnant rats at 100 and 200 mg dose /kg bodyweight for 7 days to evaluate the anti-implantation activity. Almost all the treated groups showed significant anti-implantation activity about 76.42% when laparotomies on the 10th day with a high dose of petroleum ether extract.

Later, when the treatment was stopped, the rats which were given the implantation continued to pregnancy. The pregnant rats which received the treatment from day 8 to 14 of pregnancy showed abortifacient activity and showed a maximum effect of about 78.55% with a high dose of petroleum ether extract [10].

Anti-epileptic Activity: In order to discern the antiepileptic activity on Maximal Electroshock (MES) and Pentylenetetrazole (PTZ) induced seizures, *Oxalis corniculata* Linn. Leaves methanolic extracts were administered at doses of 200 and 400 mg/kg body weight in Albino Wistar rats as mentioned by Kumar and his associates. A subsequent subside in hind leg duration was discerned in MEOS, in the MES model, and a catastrophic fall in effect was seen with 400 mg/kg. Analogous dose contingent endeavors showed results in PTZ models, which showed linger in the colonic convulsion onset time. In both the tests complete protective effect against mortality was reported.

Thus from all this we can draw a conclusion stating that *Oxalis corniculata* L. possess antiepileptic effects on MES and PTZ induced convulsions, and its mechanism showed links to signal transduction process and potentiation of the activity of the GABA receptor [11]. With a view to discern the effect of methanolic extract of *Oxalis corniculata* Linn. On rat brains antioxidant enzymes upon induction of seizures by MES and PTZ a study was coordinated which lead to few findings, which showed a subside in the glutathione peroxidase, superoxide dismutase, glutathione reductase and catalase due to seizures but were subsequently restored upon administration of ethanol extract of *Oxalis corniculata* Linn. in treated rats as mentioned by Kumar and his colleagues. MEOC showed an appreciable decrease in the lipid peroxidation was observed in both models; on the contrary, the analogous dose-dependent result was obtained in PTZ models. In some instances, it is believed that the anticonvulsant activity of MEOC is present in antioxidant properties and can linger in a free radical generation that occurs in MES and PTZ induced epilepsy [12].

Anti-ulcer Activity: To check the anti-ulcer activity by utilizing ethanol-induced gastric mucosal ulcers and pylorus ligated ulcers, *Oxalis corniculata* Linn. Leaves aqueous and ethanolic extracts were induced in screened rats were given at a dose of 200, and 400 mg/kg body weight was done by Mahadik and his fellow associates. This gave us insights regarding a subsequent decrease in the gastric volume and depletion of the total acidity with both extracts and the catalase, and an elevation in the SOD levels and corresponding fall in the lipid peroxide level was observed in both the extracts [13].

Anti-inflammatory Activity: In the *in-vitro* method to determine the antioxidant and anti-inflammatory properties of *Oxalis corniculata* Linn. (Family: Oxalidaceae), the methanol extract of the whole plant was evaluated, as stated by Sakat and his fellow mates. Proteinase inhibitory action at various concentrations, albumin denaturation assay, and membrane stabilization assay was done guesstimate *in-vitro* anti-inflammatory activity. The IC_{50} value was obtained from linear regression analysis calculation, which inferred that the extract showed a substantial DPPH and nitric oxide radical scavenging activity in association with the IC_{50} values of 302.93 ± 4.17 and 73.07 ± 8.28 µg/ml respectively. Inhibition of Fe^{2+} induced lipid per-oxidation was done by the extract with IC_{50} value 58.71 ± 2.55 µg/ml. 25.62 ± 0.10 mg of gallic acid of the dry extract was estimated to be equivalent to that of the total phenol content.

Total flavonoids and flavonols were found to be 150.88 ± 12.61 and 150.16 ± 2.16 mg of rutin equivalents per gram of dry extract, respectively. The anti-inflammatory effect was elucidated by the extract by the stabilization of the red blood cell with the IC_{50} values of 288.04 ± 2.78 and 467.14 ± 9.56 µg/ml respectively and by the inhibition of the heat-induced albumin denaturation. The extract (IC_{50} = 435.28 ± 5.82 µg/ml) substantially impeded the proteinase activity. Thus is can be concluded that the flavonoids and related polyphenols present in the *O. corniculata* extract may attribute to its activity [14].

Anxiolytic Activity: *Oxalis corniculata* Linn. ethanolic extracts (100 and 300 mg/kg) displayed anxiolytic effect which showed an apparent increase in the square crossed numbers (controls= 24.33 ± 3.48) but with subsequent subside in the immobility (controls = 47.17 ± 4.29 sec), and fecal pallets (controls = 13.50 ± 0.96 fecal pellets) were observed in an open field test in contrast with control mice as demonstrated by Gupta and his colleagues.

In case of open arm test, we discerned an appreciable escalation in the number of entries (controls = 53.00 ± 2.67 sec) but observed a

subsequent subside in the closed arms of the elevated plus-maze test with control mice which exhibited a diminished amount of time spent (controls = 166.7 ± 4.30 sec) and also a number of entries (controls = 29.33 ± 1.05 entries). A decline in the fighting episode was observed (controls = 9.50 ± 0.62 fighting episodes) in comparison to control mice when ethanol extracts of *Oxalis corniculata* (100 and 300 mg/kg) were used.

Lastly, it was seen that the results for the anxiolytic effect for diazepam were analogous to that of ethanol extracts [15]. The study was designed using multiple anxiety paradigms with a view to assessing the anxiolytic effect of the Ethanolic extract of *Oxalis corniculata* Linn. (200 mg/kg and 400 mg/kg P.O) on male mice was done by Saisampath and his fellow associates. A dose-dependent increase in a number of entries was discerned in the number of entries and time elapsed was observed in the open arm compared to control groups when extract (200 mg/kg and 400 mg/kg) were given in elevated plus-maze. A considerable number of peripheral squares, central squares were crossed, and rearing was stepped up in the open field paradigm. Light dark exploration test revealed that the treated group discerned an elevation in time spent in the light compartment, number of crossings, and latency in contrast to that of the control group. The Hole board model revealed that mice with ethanolic extract of *Oxalis corniculata* (200 mg/kg and 400 mg/kg) demonstrated minified head dips [16].

Hepatoprotective Activity: A comparative study between thioacetamide-induced hepatotoxicity and aqueous and ethanolic leaves extracts of *Oxalis corniculata* Linn. (200 and 400 mg/kg) were done to access the hepatoprotective activity by Das and his fellow mates. When rats were treated with oral administration of *O. corniculata* aqueous and ethanolic leaves, extract at 400 mg/kg a perceptible reduction in SGPT (81.96 ± 3.15 and 72.05 ± 2.33 IU/L respectively), SGOT (146.42 ± 2.54 and 136.75 ± 1.37 IU/L respectively), ALP (241.86 ± 3.94 and 202.42 ± 5.37 IU/L respectively), GGTP (16.6 ± 0.49 and 15.02 ± 0.68 IU/L respectively) and total bilirubin (0.226 ± 0.00 mg/dL 0.288 ± 0.01 mg/dL respectively) levels were found to be lesser in contrast with that of the positive control, thioacetamide damaged rats. Dose-dependent necrosis was seen to occur when liver histology of the rats treated with the extract was studied [17].

Steroidogenic Activity: *Oxalis corniculata* Linn. does not modify or change the activity of body parts and thus can be administered for its steroidogenic function without any risk. This fact was verified by analyzing female albino rats on one of the endocrine organ-adrenal glands with this extract, and that organ performed its activity in the usual way [3].

Cardio Protective Effect: The defensive capability of aqueous extract of (*Oxalis corniculata* Linn. OCE) was assessed opposing isoproterenol (ISO) generated myocardial infarction in rats. Isoproterenol (200 mg/kg) at an interlude of 24 h for 2 days generated myocardial infarction in rats. For pre-treatment, rats were provided OCE orally for 30 days with the aid of an intragastric tube. The function of cardiac injury marker enzymes like creatine phosphokinase (CPK) and lactate dehydrogenase (LDH) were upscaled immensely, and the concentration of serum lipids was also enhanced, which was caused by isoproterenol. In addition, with the aid of OCE pretreatment, the concentration of CPK, LDL cholesterol, LDH, triglycerides, and total serum cholesterol was markedly lowered.

The function of lipogenic enzyme and glucose-6-phosphate dehydrogenase was also curtailed in ISO administered rats, and oxidative stress was also notably reduced by isoproterenol with the aid of OC. This was clear from the increased function of antioxidant enzymes (catalase and superoxide dismutase) and decreased concentration of lipid peroxidation products (TBARS and conjugated dienes). Excessive concentration of vitamin C, protein sulfhydryl groups, and reduced glutathione (GSH) was observed in OCE pre-treated rats. Myocardium performing in its usual way was observed in the rat, which was pre-treated with OCE [3].

Nephrotoxicity: Rashid studied the defensive capability and chemical constitution of *Oxalis corniculata* Linn. of methanol extract (OCME) on CCl_4-induced nephrotoxicity in the rat in this experiment. In OCME, tannins were missing, whereas the existence of cardiac glycosides,

flavonoids, alkaloids, steroids, saponins, phlobatannins, and terpenoids was established. 7.76 ± 0.36 (mg gallic acid equivalents/g extract) were the total phenolic substance. On the other hand, overall flavonoid contents reported were 6.92 ± 0.52 (mg rutin equivalents/g extract). Nephrotoxicity was created by intraperitoneal injection of CCl_4 (1 ml/kg b.w. 20% in olive oil) once a day for a total of seven days marked by increased levels of urinary specific gravity, nitrite, RBCs, creatinine, WBCs, urobilinogen, and protein. Protein and creatinine clearance was reduced, whereas serum level of creatinine, blood urea nitrogen, and urea were greatly elevated by CCl_4 therapy in kidney specimen. Lipid peroxidation and protein contents were elevated alongside histopathological damages. However, a decrease in the function of glutathione reductase, antioxidant enzymes, superoxide dismutase, catalase, glutathione peroxidase, peroxidase, glutathione concentration, and glutathione-S-transferase were observed. As phenolics has an antioxidant outcome, OCME has a defensive function averse to CCl_4-produced oxidative stress in rat [18].

Antifungal Activity: In the experiment done by Iqbal, the antifungal activity of the four plant extracts was different, but *Oxalis corniculata* Linn. displayed the most antifungal activity against A. niger as it inhibited the mycelail proliferation by 71-86% [19].

Anti-diarrhoeal Activity: Watcho saw the anti-diarrhoeal activity on castor oil-induced diarrhoeal rats and intestinal transits. The aqueous and methanolic extracts of *Oxalis corniculata* Linn. were administered orally at doses of 160, 320, and 640 mg/kg of body weight, and the aqueous extract showed better results. The extracts delayed diarrhea, lowered the incidence of defecation, wetness, and expulsion of charcoal meals through the small intestine [20].

Anti-nociceptive Activity: Kathiriya did hot water tail immersion test, and hot plate test on diabetic neuropathy rats and 49% decrease in tail flick latency and 40% less paw withdrawal was observed. For this, ethanolic extract of *Oxalis corniculata* Linn. was used at doses of 200 and 400 mg/kg body weight [21].

Antioxidant and Hepatoprotective Activity: Sampathkumar saw that the ethanolic and methanolic extract of *Oxalis corniculata* Linn. displayed high antioxidant activity in comparison to the ascorbic acid standard. The concentration of plant extract needed for inhibiting half of the DPPH radical scavenging effect (IC_{50}) was recorded as 30 mg/ml and 37 mg/ml for MEOC and standard ascorbic acid. This suggests that the MEOC retains higher antioxidant activity compared to ascorbic acid [22]. Borah did phos-phomolybdate method to find out the antioxidant potency of 3 different solvent extracts, using different standard *in-vitro* methods. Antioxidant constituents found were crude phenolics content (6.424 mg gallic acid eqvt. /gm dry wt. of the sample), phenolic acid (0.738 mg gallic acid eqvt. /gm drywt.), total flavonoids (0.814 mg rutin eqvt. /gm dry wt.) and glutathione (948.143 μM/gm fresh wt.). The vitamins showing antioxidant activity were vitamin C, found to be 0.414 mg/gm fresh wt. and vitamin E found to be 137.36 mg/gm fresh wt. [22]

The antioxidant activities of plant extracts have the power to prevent many diseases that occur because of oxidative stress and so the chemical composition of *Oxalis corniculata* Linn. methanol extract (OCME) and its various fractions; *Oxalis corniculata* n-hexane (OCHE), *O. corniculata* ethyl acetate (OCEE), *O. corniculata* chloroform (OCCE) and O. corniculata aqueous (OCAE) was used to determine the antioxidant potential by different *in-vitro* methods. Moreover, Khan induced hepatotoxicity with carbon tetrachloride (CCl_4: 1 ml/kg b.w., 20% in olive oil, seven doses) in rats with OCME to evaluate for the antioxidant ability. Flavonoids, alkaloids, terpenoids, saponins, cardiac glycosides, phlobatannins and steroids were present in OCME and the solvent affected the total content of phenolic and flavonoids. The sequence of solvents for phenolic contents was OCME > OCAE > OCCE > OCEE > OCHE while for flavonoids it was OCME > OCCE > OCAE > OCEE > OCHE.

Free radicals were scavenged by the extract/fraction in a dose-response curve in all models. Biochemical factors of serum such as alanine transaminase (ALT), alkaline phosphatase (ALP), aspartate transaminase (AST), lactate dehydrogenase (LDH), gamma-glutamyl-

transpeptidase (γ-GT), total bilirubin, cholesterol, and triglycerides were significantly increased while total protein and albumin were decreased by CCl_4. Treatment of CCl4 significantly decreased the liver contents of reduced glutathione (GSH) and activities of antioxidant enzymes; catalase (CAT), superoxide dismutase (SOD), glutathione peroxidase (GSHPx), glutathione- S-transferase (GST), glutathione reductase (GSR) and quinone reductase (QR) and elevated the thiobarbituric acid reactive substances (TBARS) contents and hepatic lesions. Using a supplement of OCME, it was possible to bring all the values to the control range. The outcomes of the study suggest the anti-oxidant potency of OCME and are evidenced by the scavenging of free radicals and hepatoprotective capacity [23].

CONCLUSION: Ancient literature dictates the different and various plants that have been identified, accessed, formulated, and consumed for their medicinal and curative purposes. This review was done with the mere purpose to list and document out the pharmacological and phytochemical properties of the medicinal plant, *Oxalis corniculata*. We discussed the wide variety of constituents that were isolated from the plant to access the therapeutic properties of the constituents individually. However, to date, not many medicines are developed from this plant due to the lack of proper elucidation, characterization, and information on this plant. Researchers should come forward for the possible development of potential drugs from *Oxalis corniculata*. Furthermore, extensive studies carried around the globe attributed to its potent therapeutic activity brings in the imminent need to carry out further investigation of the plant and develop prospective medicine in the near future for human prosperity.

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CONFLICTS OF INTEREST: Authors declare no conflict of interest.

AUTHOR'S CONTRIBUTION: The review was conducted under the supervision of Pritesh Ranjan Dash (PRD), who also designed the study. The abstract was done by a collaboration of Shifat Khan (SK) and Afsana Anika (AA). The introduction and phytochemical constituents of the paper was done by Fatema Shorna (FS). Serially, native names and taxonomical classification were searched and collected by Afsana Anika (AA) and SK, respectively. Next, the chemical constituents were explored, and the structures were drawn using ChemDraw by Timothy Singh (TS). In the next part, which is pharmacological activities of Oxalis Corniculata, FS contributed in the anti-diabetic, anti-cancer, anti-amoebic, wound healing and anti-implantation and abortifacient activity; TS contributed in the anti-epileptic, anti-inflammatory, anti-ulcer, anxiolytic and hepato-protective activities, AA contributed in Hypolipidemic, Steroidogenic, Cardioprotective and Nephro-toxicity effect. SK contributed to the antifungal, antidiarrheal, anti-nociceptic, antioxidant, and hepatoprotective activity. All authors read and approved the final manuscript.

REFERENCES:

1. Rahman MS, MMH Khan and Jamal MAHM: "Anti-bacterial evaluation and minimum inhibitory concentration analysis of *Oxalis corniculata* and *Ocimum santum* against bacterial pathogens," Biotechnology 2010; 9(4): 533-36.
2. Rehman A, Rehman A and Ahmad I: Antibacterial, Antifungal and Insecticidal Potentials of *Oxalis corniculata* and Its Isolated Compounds. International Journal of Analytical Chemistry 2015; 1-5.
3. Srikanth M, Swetha T and Veeresh B: Phytochemistry and pharmacology of *Oxalis corniculata* Linn: a review. Int J Pharm Sci Res 2012; 3(11); 4077-85.
4. Hemant B, Singh MK, Thakur D, Giri TK and Tripathi DK: the botany, chemistry, pharmacological and therapeutic application of *Oxalis corniculata* Linn– a review. In Journal of Phytomedicine 2011; 3: 01-08.
5. Hall DW, Vandiver VV and Sellers BA: Creeping wood sorrel, *Oxalis corniculata* L. Southern Yellow Wood Sorrel, *Oxalis florida* Salisb. SP 37, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida 1996; 01-02
6. Mekap SK, Sahoo S, Satapathy KB and Mishra SK: Evaluation of antidiabetic activity of *Oxalis corniculata* Linn. whole plant. Research Journal of Pharmaceutical, Biological and Chemical Sciences 2016; 7: 2142-52.
7. Kathiriya A, Das K, Kumar EP and Mathai KB: Evaluation of antitumor and antioxidant activity of *Oxalis corniculata* Linn. against ehrlich ascites carcinoma on Mice. Iran J Cancer Prev 2010; 3(4): 157-65.
8. Manna D, Dutta P, Basudeb A and Lohia A: A novel Galacto-Glycerolipid from *Oxalis corniculata* kills *Entamoeba histolytica* and *Giardia lamblia*. Antimicrobial Agents and Chemotherapy 2010; 54: 4825-32. 10.1128/ AAC.00546-10.

9. Taranalli AD, Tipare SV, Kumar S and Torgal SS: Wound healing activity of *Oxalis corniculata* whole plant extract in rats. Indian Journal of Pharma Sci 2004; 66: 444-46.
10. Sharangouda K and Patil S: Anti-implantation and Abortifacient Activities of *Oxalis corniculata* in albino rats. Nigerian Journal of Natural Products and Medicine 2019; 11(2007): 58-60
11. Kumar SKK and Kapoor RB: Study on phytochemical profile and anti-epileptic activity of *Oxalis corniculata* Linn. Int Journal of Biologi & Pharma Res 2010; 1: 34-37.
12. Kumar SKK and Kapoor RB: Effect of *Oxalis corniculata* Linn. extracts on antioxidant enzymes levels in rat brain after induction of seizures by MES and PTZ International Journal of Biopharmaceutics 2010; 1(2): 58-61.
13. Mahadik VJ, Patil SB and Naikwade NS: Evaluation of anti-ulcer activity aqueous and methanolic extract of *Oxalis corniculata* leaf in experimental rats. International Journal of Pharma Res and Develop 2011; 3(10): 98-104.
14. Sakat SS, Juvekar AR and Gamphire MN: *In-vitro* anti-oxidant and anti- inflammatory activity of methanolic extract of *Oxalis corniculata* Linn. International Journal of Pharmacy and Pharma Sciences 2010; 2(1): 146-55.
15. Gupta G, Kazmi I, Afzal M and Anwar F: Anxiolytic effect of *Oxalis corniculata* (Oxalidaceae) in mice. Asian Pacific Journal of Tropical Biomedicine 2012; 2(2): 837-40.
16. Sampath ST, Santosh P, Lahkar M, Ajaygodwin P, Kumar PS and Lingesh: Anxiolytic effect of ethanolic extract of *Oxalis corniculata* in mice. International Journal of Pharma and Bio Sciences 2011; 2(3): 281-90.
17. Das K, Kathiriya AK, Kumar EP, Benson MK and Einstein JW: Evaluation of hepatoprotective activity of aqueous and ethanolic extract of *Oxalis corniculata* against intoxication of thioacetamide induced rats. 2012; 22(2): 412-17.
18. Rashid M and Zehra H: Amelioration of CCl_4-induced nephrotoxicity by *Oxalis corniculata* in rat. Experimental and Toxicologic Pathology 2013; 65(3): 327-34.
19. Iqbal MC, Meiyalaghan S, Wijesekara KB and Abeyrante KP: Antifungal activity from water extracts of some common weeds. Pak Journal of Bio Sci 2001; 4: 843-45.
20. Watcho P, Nkouathio E, Telesphore B, Nguelefack SIW and Kamanyi A: Anti diarrhoeal activity of aqueous and methanolic extracts of *Oxalis corniculata* klotzch. in rats. Cameroon Journal of experimental Biology 2005; 01: 6-49
21. Sampathkumar V, Venumadhav V, Jagadeshwar K, Bhaskar B and Lankar M: Evaluation of antioxidant and antinociceptive activities of *Oxalis corniculata* Linn. In diabetic neuropathy rats. Int J of Pharm 2012; 8(2): 122-27.
22. Borah A, Yadav RNS and Unni BG: Evaluation of antioxidant activity of different solvent extracts of *Oxalis corniculata* L. Journal of Pharmacy Res 2012; 5(1): 93.
23. Khan MR, Marium A, Shabbir M, Saeed N and Bokhari J: Antioxidant and hepatoprotective effects of *Oxalis corniculata* against carbon tetrachloride (CCl4) induced injuries in rat. African Journal of Pharmacy and Pharmacology 2012; 6(30): 2255-67.

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