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Review Article

Cyperus Rotundus LINN: A Medicinal Plant: A Review

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ABSTRACT

Ayurveda, or the science of life, takes a holistic approach to healthy living. It discusses the physiology and pathology of diseases, as well as their treatments. Several diseases have been treated with plant extracts based on traditional medicine since ancient times. Cyperus rotundus L. (Cyperaceae family) is a colonial, perennial herb. As science and cutting-edge technologies advanced, different herbal extracts and chemical constituents of herbs were identified as therapeutic targets. Cyperus rotundus, also known as mustaka, is an ancient herb found in tropical and subtropical regions around the world. The tuberous and aerial parts of the herb have been found to have a variety of pharmacological properties. The synergistic actions of the Cyperus compounds provide an advantage over a single compound.

Key Words: *Cyperus rotundus, Ayurveda, Pharmacological activity, Phytochemical*

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INTRODUCTION

Herbal medicine is a major component in all traditional medical systems, and a common element in Siddha, Ayurvedic, Homeopathic, Naturopathic, Traditional Chinese medicine, and Native American medicine. Plant materials are used throughout developed and developing countries as home remedies, over-the counter drug products and raw materials for the pharmaceutical industry, and represent a substantial proportion of the global drug market. A perfect example of medicinal plant credited with innumerable medicinal qualities validated by modern science and used since ancient times is *C.rotundus* Linn. Family - *Cyperaceae* are the largest family in the monocotyledons consisting of 109 genera and approximately 5,500 species [1]. *C.rotundus* L., (Family-Cyperaceae), also known as purple nutsedge or nutgrass, is a common perennial weed with slender, scaly creeping rhizomes, bulbous at the base and arising singly from the tubers which are about 1-3 cm long. The tubers are externally blackish in colour and reddish white inside, with a characteristic odour. The stems grow to about 25 cm tall and the leaves are linear, dark green and grooved on the upper surface. Inflorescences are small, with 2-4 bracts, consisting of tiny flowers with a red-brown husk. The nut is three-angled, oblongovate, yellow in colour and black when ripe. *C.rotundus* is indigenous to India, but are now found in tropical, subtropical and temperate regions [2]. In Asian countries, the rhizomes of *C. rotundus*, which are used as traditional folk medicines for the treatment of stomach and bowel disorders, and inflammatory diseases, have been widely, investigated [3-5]. *C. rotundus* is a traditional herbal medicine used widely as analgesic, sedative, antispasmodic, antimalarial, stomach disorders and to relieve diarrhoea [6-7]. The tuber part of *C. rotundus* is one of the oldest known medicinal plants used for the treatment of dysmenorrheal and menstrual irregularities [8-9]. Infusion of this herb has been used in pain, fever, diarrhoea, dysentery, an emmenagogue and other intestinal problems [10]. It is a multipurpose plant, widely used in traditional medicine around the world to treat stomach ailments, wounds, boils and blisters [11-14]. A number of pharmacological and biological activities including anti-*Candida*, anti-inflammatory, antidiabetic, antidiarrhoeal, cytoprotective, antimutagenic, antimicrobial, antibacterial, antioxidant, cytotoxic and apoptotic, anti-pyretic and analgesic activities have been reported for this plant [15-24]. Previous phytochemical studies on *C.rotundus* revealed the presence of alkaloids, flavonoids, tannins, starch, glycosides and furochromones, and many novel sesquiterpenoids [25- 29].
Edible Parts: Rhizome

PHYTOCHEMICAL CONSTITUENTS & MEDICINAL USES

According to the Ayurveda, *C. rotundus* rhizomes are considered astringent, diaphoretic, diuretic, analgesic, antispasmodic, aromatic, carminative, antitussive, emmenagogue, litholytic, sedative, stimulant, stomachic, vermifuge, tonic and antibacterial. It may be a good remedy for indigestion in the light of constituents present in it, for example,

there are many enzymes for carbohydrates and minerals which act as catalyst for various biochemical reactions and helps indigestion. It is also useful for dietary management of psychotic diseases and metabolic disorders [30]. They are used in treatment of Nausea and vomiting, dyspepsia, colic, flatulence, diarrhoea, dysentery, intestinal parasites, fever, malaria, cough, bronchitis, renal and vesical calculi, urinary tenesmus, skin diseases, wounds, amenorrhoea, dysmenorrhoea, deficient lactation, loss of memory, insect bites, food poisoning, indigestion, nausea, dysuria, bronchitis, infertility, cervical cancer and menstrual disorders, and the aromatic oils are made of perfumes and splash [31-35]. Several chemical compounds have been isolated from world's worst weed *C. rotundus* [36] and some of these chemicals possess medicinal properties and are used in Latin America, China, India and elsewhere [37-39]. Various preparations of *C.rotundus* have been used for centuries in perfumes, spices and traditional medicines in India, China, Arab and Africa. It is also an important ingredient of anti-aging Ayurvedic neutraceutical Chyavanprash [39]. Different phytochemical studies on *C.rotundus* revealed the presence of alkaloids, flavonoids, tannins, starch, glycosides, furochromones, monoterpenes, sesquiterpenes, sitosterol, fatty oil containing a neutral waxy substance, glycerol, linolenic, myristic and stearic acids [25, 29, 40-41]. The major compounds isolated from essential oil and the extracts of *C.rotundus* rhizome are Alpha-cyperone, Alpha-rotunol, Beta-cyperone, Beta-pinene, Beta-rotunol, Beta-selinene, Calcium, Camphene, Copaene, Cyperene, Cyperenone, Cyperol, Cyperolone Cyperotundone Dcopadiene, D-epoxyguaiene, D-fructose, D-glucose, Flavonoids, Gamma-cymene, Isocyperol, Isokobusone, Kobusone, Limonene, Linoleic-acid, Linolenic-acid, Magnesium, Manganese, C. rotunduskone, Myristic-acid, Oleanolic-acid, Oleanolic-acid-3-oneohesperidoside, Oleic-acid, P-cymol, Patchoulenone, Pectin, Polyphenols, Rotundene, Rotundenol, Rotundone, Selinatriene, Sitosterol, Stearic-acid, Sugeonol, Sugetriol [42-45]. *C.rotundus* contains an essential oil that provides for the characteristic odour and taste of the herb, comprised mostly sesquiterpene hydrocarbons, epoxides, ketones, monoterpenes and aliphatic alcohols. Sesquiterpenes include selinene, isocurcumenol, nootkatone, aristolone, isorotundene, cypera-2,4(15)-diene, and norrotundene, as well as the sesquiterpene alkaloids rotundines A-C. Other constituents include the ketone cyperadione, and the monoterpenes cineole, camphene and limonene. *C.rotundus* has also been shown to contain miscellaneous triterpenes including oleanolic acid and sitosterol, as well as flavonoids, sugars and minerals [44-45]. The chemical composition of the volatile oils of *C.rotundus* has been extensively studied and four chemotypes (H-, K-, M-Otypes), of the essential oils from different parts of Asia have been reported [46-52]. The H-type from Japan was found to contain a-cyperone (36.6%), ß-selinene (18.5%), cyperol (7.4%) and caryophyllene (6.2%). The M-type from China, Hong Kong, Japan, Taiwan and Vietnam had a-cyperone (30.7%), cyperotundone (19.4%), ß-selinene (17.8%), cyperene (7.2%) and cyperol (5.6%). The Otype from Japan, Taiwan, Thailand, Hawaii and the Philippines was characterized by cyperene (30.8%), cyperotundone (13.1%) and ß-elemene (5.2%). In addition, the Hawaiian O-type had cyperotundone (25.0%) and cyperene (20.7%) as the major compounds. Finally, the K-type, also from Hawaii, was dominated by cyperene (28.7%), cyperotundone (8.8%), patchoulenyl acetate (8.0%) and sugeonyl acetate (6.9%) [47-48].

PHARMACOLOGICAL & BIOLOGICAL ACTIVITY

ANTIMUTAGENS AND RADICAL SCAVENGERS

This study evaluates mutagenic and antimutagenic effects of aqueous, total oligomers flavonoıds (TOF), ethyl acetate and methanol extracts from aerial parts of Cyperus rotundus with the Salmonella typhimurium assay system. The different extracts showed no mutagenicity when tested with Salmonella typhimurium strains TA98, TA100, TA1535 and TA1538 either with or without the S9 mix. On the other hand, our results showed that all extracts have antimutagenic activity against Aflatoxin B1 (AFB1) in TA100 and TA98 assay system, and against sodium azide in TA100 and TA1535 assay system. TOF, ethyl acetate and methanol extracts exhibited the highest inhibition level of the Ames response induced by the indirect mutagen AFB1. Whereas, ethyl acetate and methanol extracts exhibited the highest level of protection towards the direct mutagen, sodium azide, induced response. In addition to antimutagenic activity, these extracts showed an important free radical scavenging activity towards the 1, 1-diphenyl-2-picrylhydrazyl (DPPH) free radical. TOF, ethyl acetate and methanol extracts showed IC50 value of 15, 14 and 20 g/ml, respectively[49].

ANTIMALARIAL

Activity-guided investigation of Cyperus rotundus tubers led to the isolation of patchoulenone, caryophyllene or-oxide, 10, 12-peroxycalamenene and 4, 7-dimethyl-l-tetralone. The antimalarial activities of these compounds are in the range of ECso 10-4-10 -6 M, with the novel ndoperoxide sesquiterpene, 10, 12-peroxycalamenene, exhibiting the strongest effect at ECso 2.33 × 10 -6 M [50].

ANTIDIARRHOEAL

The methanol extract of Cyperus rotundus rhizome, given orally at the doses of 250 and 500 mg/kg b.w., showed significant antidiarrhoeal activity in castor oil induced diarrhoea in mice. Among the fractions, tested at 250 mg/kg, the petroleum ether fraction (PEF) and residual methanol fraction (RMF) were found to retain the activity, the latter being more active as compared to the control. The ethyl acetate fraction (EAF) did not show any antidiarrhoeal activity. [51]

ANTIDIABETIC ACTIVITY

In light of the traditional claim of Cyperus rotundus in the treatment of diabetes, investigations were carried out to evaluate its effect on alloxan induced hyperglycemia in rats. Oral daily administration of 500 mg/kg of the extract (once a day for seven consecutive days) significantly lowered the blood glucose levels. This antihyperglycemic activity can be attributed to its antioxidant activity as it showed the strong DPPH radical scavenging action in vitro [52].

ANTIBACTERIAL ACTIVITY

Cyperus rotundus has many different uses and these were based on the different parts of plant. The medical uses of cyperus have been used in medicine for thousands of years. The parts of the cyperus used are its leaves, seeds and oil. The Extraction process was carried out by steam distillation. Optimum organic extractant determined. The collected oil was identified via Thin Layer Chromatography (TLC) using a mixture of ethylacetate: toluene (1:9) as chromatographic eluent. This study was designed to extract and identify of essential cyperus oil from Cyperus rotundus .The Antibacterial activity of Cyperus oil was studied for various microorganisms (Staphylococcus aureus , Klebsiella pneumoniae, Proteus vulgaris, Streptococcus pyogenes, Eschirichia coli and Pseudomonas aeruginosa using inhibition zone method (Aromatogram). The MIC and MBC for each microbe were estimated. The oil of C. rotundus was shown a remarkable activity against gram-positive bacteria, less antibacterial activity was found against gram–negative bacteria and no activity was observed with the oil against Pseudomonas aeruginosa and Proteus vulgaris. Novel method for extraction and identification of chemical composition for Iraqi Cyperus oil was conducted. The study of the biological activities of this oil is very important because of needing to be determined whether there is any correlation between the biological activities and one or more of the chemical compounds purified from Cyperus rotundus oil [53].

ANTIOXIDANT ACTIVITY

Antioxidant activity of Cyperus rotundus rhizomes extract (CRRE) was evaluveted in a series of in vitro assay involving free radicals and reactive oxygen species and IC50 values were determined. CRRE exhibited its scavenging effect in concentration dependent manner on superoxide anion radicals, hydroxyl radicals, nitric oxide radical, hydrogen peroxide, and property of metal chelating and reducing power. The extract was also studied for lipid peroxidation assay by thiobarbituric acid–reactive substances (TBARS) using young and aged rat brain mitochondria. The extract was also effective in preventing mitochondrial lipid peroxidation induced by FeSO4 ascorbate in concentration dependent manner. The results obtained in the present study indicate that C. rotundus rhizomes extract can be a potential source of natural antioxidant [54].

OVICIDAL AND LARVICIDAL ACTIVITIES

The ovicidal and larvicidal efficacy of essential oils extracted from the tubers of Cyperus giganteus and Cyperus rotundus Linn was studied on eggs and fourth instar larvae of Aedes albopictus. The eggs and larvae were exposed to serial concentration of the oils ranging from 5-150 ppm and kept under observation for 24 h. Both the oils showed remarkable ovicidal and larvicidal activities indicated by EC50 values of <5 ppm and LC50 and LC90 values of <20 ppm. The results obtained suggest that the essential oils of these Cyperus species can serve as a potential source of natural mosquitocidal agents[55].

WOUND HEALING ACTIVITY

To evaluate the wound healing activity of extract of tuber parts of Cyperus rotundus. It is a well-known plant in Indian traditional medicine. On the basis of traditional use and literature references, this plant was selected for evaluation of wound healing potential. An alcoholic extract of tuber parts of Cyperus rotundus was examined for wound healing activity in the form of ointment in three types of wound models on rats: the excision, the incision and dead space wound model. The extract ointments showed considerable difference in response in all the above said wound models as comparable to those of a standard drug nitrofurazone ointment (0.2 % w/w NFZ) in terms of wound contracting ability, wound closure time and tensile strength [56].

CONCLUSION

The pleiotropic activities of mustaka and its constituents as ethnomedicine were determined by the advancement of scientific methodologies and various in vitro and in vivo preclinical animal models. Although many C. rotundus metabolites have been identified, only a few have been thoroughly investigated for molecular mechanism/mode of action. C. rotundus has also been used in combination with other plants to treat a variety of diseases. C. rotundus's reported cytotoxic/toxicological effects should be considered. However, there has been little research into the pharmacokinetic and pharmacodynamic properties of mustaka and its chemical constituents. A thorough review of the literature on Cyperus rotundus revealed that it is a popular remedy among various ethnic groups, Ayurvedic and traditional practitioners.

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