



Ethnobotany, Phytochemistry, Pharmacology and Therapeutic Potential of *Su'ad Kūfī* (*Cyperus rotundus* L.): An Insight

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Background: *Cyperus rotundus*, an important medicinal plant belonging to the Cyperaceae family, is therapeutically used in many traditional systems of medicine, such as Unani medicine, Ayurveda, Siddha, Homeopathy, Chinese medicine, etc.

Aim: The prime goal of this review is to provide a scientific basis and classical references for clinical use and further scientific exploration of *Cyperus rotundus*.

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Materials and Methods: This systemic review was carried out after searching Unani classical and other ethnobotanical literature and published research work available on PubMed, SCOPUS, Science Direct, Google Scholar, Research Gate, etc.

Results: *Cyperus rotundus* L. is the accepted botanical name of *Su'ad Kūfi*, *Nagarmotha*, or Nutgrass as referred in Unani and other traditional medicines. It is grown in India, China, the Philippines, Thailand, Taiwan, Indonesia, Korea, Vietnam, Malaysia, the Pacific Islands, South America, Africa, the Middle East, North America, Mexico, Australia, New Zealand, and Europe. Usually, the rhizome of this important medicinal plant is therapeutically used for various ailments, including indigestion, constipation, dysentery, neurogenic gastralgia, skin diseases, mental weakness, cardiac weakness, nervine weakness, palpitation, weakness of stomach, flatulence, retention of urine, amenorrhea, dribbling of urine, etc. It contains many important secondary metabolites, including flavonoids, tannins, glycosides, monoterpenes, sesquiterpenes, sitosterol, alkaloids, saponins, terpenoids, essential oils, sugar, protein, amino acids, etc., which have been reported to possess antibacterial, anti-tumour, anticonvulsant, antidiabetic, anti-diarrhoeal, anti-inflammatory, antilipidemic, antimalarial, anti-obesity, antioxidant, hepatoprotective, cardioprotective, and neuroprotective pharmacological activities.

Conclusion: It is concluded that abundant bioactive compounds identified and separated from *Cyperus rotundus* possess potential medicinal values on different systems of the body.

Keywords: *Su'ad Kūfi*; *Cyperus rotundus*; ethnopharmacology; therapeutic uses; bioactive compounds; Unani medicine.

1. INTRODUCTION

Cyperus rotundus L., an important medicinal plant belonging to the Cyperaceae family, is extensively used in various traditional systems of medicine for the treatment of several ailments [1,2]. The Cyperaceae family describes nearly 5000 species. The genus name 'Cyperus' is derived from a Greek word, whereas the species name 'rotundus' is derived from a Latin word, which refers to the round shape of the tuber [3]. *Cyperus rotundus* is a pestiferous perennial weed that is frequently available in agricultural land in temperate and subtropical regions. It is a smooth, erect, glabrous, grass like, fibrous rooted perennial herb that grows up to 15-60 cm of height and reproduces widely through rhizomes and tubers. The stems can reach a height of about 25 cm, with linear, dark green, leaves. The inflorescences are modest, with 2-4 bracts and tiny flowers with a red-brown husk. The nut fruit is three-angled, oblong-ovate, yellow, and black color [4,5]. This plant is the reservoir of industrially and medicinally epochal phytoconstituents. Many advanced techniques such as steam distillation, solvent extraction, pressured liquid extraction, etc. are being used to obtain extracts from this medicinal plant [6]. Many studies have reported that *C. rotundus* yields several constituents, including diterpenoids, triterpenoids, steroids, quinonoids, alkaloids, saccharides, phenolics and phenolic glycosides, monoterpenoids, sesquiterpenoids, flavonoids, phenylpropanoids, etc [1,2,7]. Its essential oil contains flavonoids, terpenoids,

sesquiterpenes, α -cyperone, α -rotunol, β -rotunol, cyperotundone sitosterol, cyperene, cyperol, nootkatone, valencene, etc [8,9]. The essential oil obtained from the rhizome of *C. rotundus* is extensively used in traditional systems of medicine to treat various disorders, such as stomach pain, wounds, boils, blisters, etc. In addition, essential oil is explored in the food industry as aromas and flavors, in the cosmetic industry as ingredients for fine fragrances and decorative cosmetics, in the pharmaceutical industry as medications and aromatics. Rhizomes of the plant are used as astringent, diaphoretic, diuretic, analgesic, antispasmodic, aromatic, carminative, antitussive, emmenagogue, lithotriptic, sedative, stimulant, stomachic, vermifuge, tonics, antibacterial, etc. Moreover, this plant has also been reported to have numerous pharmacological activities, such as anti-fungal, anti-inflammatory, antidiabetic, anti-diarrheal, cytoprotective, antimutagenic, antimicrobial, antioxidant, cytotoxic, apoptotic, anti-pyretic, and analgesic effects [10]. The plant has also been explored to treat bronchitis, infertility, amenorrhea, dysmenorrhea, memory loss, renal and vesical calculi, urinary tenesmus, skin diseases, wounds, insufficient lactation, food poisoning, dysuria, vomiting, colic, flatulence, dysentery, intestinal parasites, malaria, etc [11]. Hence, the current review has been carried out to comprehensively summarize the information, including taxonomy, morphology, geographical distribution, traditional uses, phytochemistry, and pharmacological activities of *C. rotundus*.

2. METHODOLOGY

This study was conducted by exploring all forms of accessible written, electronic, and internet literature. Both modern and Unani classical literature were explored for its description, identification, temperament, pharmacological actions, and therapeutic uses. Additionally, in-depth literature was collected by reconnoitering the key words *Cyperus rotundus*, *Nagarmotha*, Nutgrass, and *Su'ad Kūfi* in conjugation with its taxonomy, medicinal uses, bioactive constituents, and pharmacological

activities via various renowned search engines, viz., PubMed, Google Scholar, Science Direct, Scopus, Research Gate and other databases (Table 1 & Fig. 1). A valid binomial with author citation was verified using the standard database "World Flora" [12] (<http://www.worldfloraonline.org>). The Unani terminologies were written as per the Standard Unani Medical Terminology published by the Central Council for Research in Unani Medicine in association with the World Health Organization.

Table 1. List of reviewed literature

Type of literature	Title/ Source	Author
Classical Unani literature Keywords: Botanical description, Temperament, Pharmacological properties, Therapeutic uses, Dose, Compound formulations (n = 11)	Muhīt-i-A'zam, Vol. III	Mohammed Azam Khan (1722-1807 AD)
	The Unani Pharmacopoeia of India, P-I, Vol-V	Anonymous (Published by Dept. of Ayush, Ministry of H & FW, Govt. of India)
	Makhzan al-Mufridat (Kitab-ul-Advia), 3 rd Ed.	Mohammad Kabiruddin (1889-1976 AD)
	Khazā'in al-Adwiya, Vol. IV	Najmul Ghani Khan (b. 1859 AD)
	Al-Jami al-Mufridat al-Adwiya wa al-Aghzia, Vol. III	Ibn al-Betar (1197-1248 AD)
	Makhzan al-Mufridat wa Murakkabat	Mohammad Ghulam Nabi
	Hamdard Pharmacopoeia of Eastern Medicine	Mohammad Said (1920-1998 AD)
Botanical Literature Keywords: Taxonomy, Botanical description, Geographical distribution, Ethnobotany, Ethnopharmacological uses, Habitat (n = 5)	National Formulary of Unani Medicine, P-II, Vol-I	Anonymous (Published by Dept. of Ayush, Ministry of H & FW, Govt. of India)
	National Formulary of Unani Medicine, P-VI	Anonymous (Published by Dept. of Ayush, Ministry of H & FW, Govt. of India)
	National Formulary of Unani Medicine, P-V	Anonymous (Published by Dept. of Ayush, Ministry of H & FW, Govt. of India)
	Bayan al-Adwiya	Ram Lubhaya
	The weed flora of Egypt. Cairo	Boulos L and El-Hadidi MN
Published articles Keywords: Botanical description, Morphology, Pharmacognosy, Bioactive compounds, Pharmacological activities (n = 30)	Indian Medicinal Plants: An Illustrated Dictionary, 1st Ed.	C. P. Khare
	Indian Medicinal Plants, 2 nd Ed. Vol. IV	K. R. Kirtikar and B. D. Basu
	Medicinal Plants Phytochemicals Methods	E. E. Jarald and S. E. Jarald J. B. Harborne
	PubMed, Science Direct, SCOPUS, Research Gate and Google Scholar	

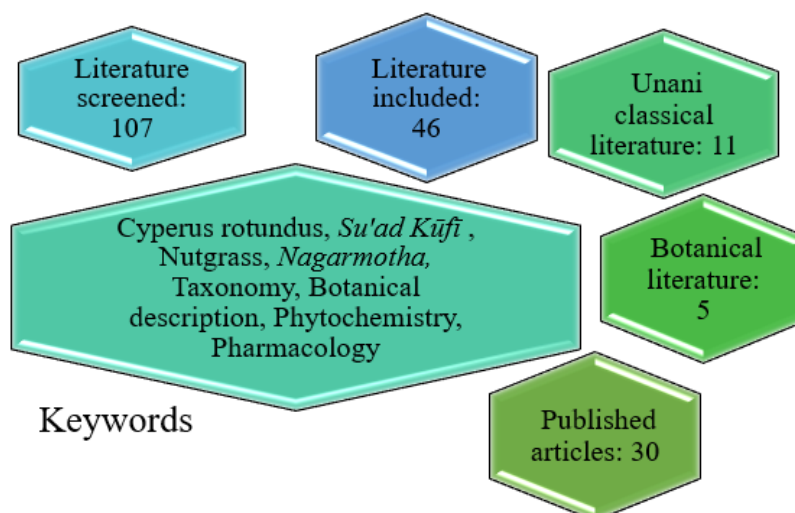


Fig. 1. Search strategy used for a systematic review of *Cyperus rotundus* L.

3. RESULTS AND DISCUSSION

Cyperus rotundus L. is the accepted botanical name of *Su'ad Kūfi* or Nutgrass. Its synonyms are *Chlorocyperus rotundus* (L.) Palla, *Pycrus rotundus* (L.) Hayek, *Cyperus agrestis* Willd. ex Spreng. & Link, *Cyperus bicolor* Vahl, *Schoenus tuberosus* Burm. f., *Cyperus comosus* Sm., *Cyperus rudoi* var. minor Boeckeler, *Cyperus stoloniferus* var. pallidus Boeckeler [13].

3.1 Taxonomy

Kingdom : Plantae
 Subkingdom : Tracheobionta
 Super-division : Spermatophyta
 Division : Magnoliophyta
 Class : Liliopsida
 Subclass : Commelinidae
 Order : Cyperales
 Family : Cyperaceae
 Genus : *Cyperus*
 Species : *C. rotundus* [3]

3.2 Vernacular Names

Arabic : *Qrāhul Jaml* [14] *Su'ad* [15,16] *Su'ad Kūfi* [17,18]
 Ayurveda : *Musta*, *Mustaka*, *Ambhoda*, *Jaldhara* [19]
 Bengali : *Motha* [20]
 Chinese : *HiangFouTse* [20]
 English : Nutgrass [19,21]
 Hindi : *Motha* [15], *Nagar Motha* [16]

Persian : *Mushakkak Zīr-i-Zamīn* [14,16,17], *Mushk Zamīn*, *Mushakkak* [15,18]
 Sanskrit : *Musta*, *Mustaka* [21]
 Suryani : *S'adā* and *Farja* [14]
 Unani : *Fināras*, *Aqarqūn* [14,17]
 Urdu : *Su'd Kūfi* [22]

3.3 Botanical Description

3.3.1 Macroscopic

The stem appeared as aerial shoots, subterranean rhizomes or tubers, solid glaucous or glabrous, without the distinction of nodes and internodes. The rhizome has several wiry, stiff, slender roots that are bluntly conical, with the exterior dark brown or black in colour, while the interior is light brown that emits a fragrant aroma and a mildly pungent flavour. The coarse and fine powders of the same have a coffee-brown hue with a fragrant aroma and mildly pungent flavour [4,22]. Leaves of the plant are simple, alternate, tristichous with parallel veins and truant ligule. Flower bisexual, light yellow with truant perianth. Inflorescence sessile, spikelet in the shape of terminal umbel-like arrays. The bracts are green, erect, sheath less, and resemble like the leaves in an alternating tristichous pattern. Fruiting is most notably apparent during the rainy season [3]. The dry, single-seeded fruit of the nutgrass is widely obovoid, trigonous, and grayish black (Fig. 2).



Fig. 2. Vegetative and reproductive stage (a & b), flowering and fruiting of *Cyperus rotundus* L. (c, d & e)

3.3.2 Microscopic

Rhizome exhibits a single layer of epidermis followed by 2 to 6 layers of suberised sclerenchymatous cells packed with a dark brown substance. The ground tissue of the cortex is comprised of circular to oval, thin-walled parenchymatous cells with minute intercellular spaces. The wide central zone beneath the endodermis is composed of round to oval, thin-walled parenchymatous cells with intercellular spaces having several collaterals and closed vascular bundles. Xylem vessels are narrowed with an oblique pore and have simple reticulate and scalariform thickening. This region is also loaded with simple round to oval starch grains measuring 6-28 μ in diameter and a considerable number of pigmented cells filled with reddish-brown content [22].

3.4 Geographical Distribution

C. rotundus is a cosmopolitan weed that thrives on the continents of India, China, the Philippines, Thailand, Taiwan, Indonesia, Korea, Vietnam, Malaysia, the Pacific Islands, South America, Africa, the Middle East, North America, Mexico, Australia, New Zealand, and Europe in tropical, subtropical, and temperate climates (Fig. 3). It is native to India and grows at an altitude of 1800 m, being abundant in the sandy, moist soil of

Punjab, Oudh, and Bengal. It is an invasive species, and because of their abundance and growing frequency, it is referred as the "World's Worst Weed". The 40,000 kg/ hectare of underground plant material produced by *Cyperus* weed fills the soil with its tangled rhizomes and roots [1,10,17].

3.5 Ethnobotany

Tribal people in India's central and southern regions are exploring *Cyperus* weed's medicinal properties from lifelong and have exploited the same to cure conditions like digestive problems, joint pain, and wound healing [1]. According to ethnobotanical and pharmacological research, *C. rotundus* is explored traditionally for treating pain [23], fever, inflammation, diarrhoea [24] and diuresis [25]. In Indian traditional medicines, the rhizomes are used to treat blood disorders, inflammation, diarrhoea, palpitation, bronchitis, amenorrhoea and dysmenorrhoea [14]. In traditional Chinese medicine (TCM), the rhizomes are commonly deployed to treat irregular menstruation, dysmenorrhoea, stomach pain, breast soreness, and liver disease [9]. The roots are used in traditional medicine in West Asia to cure blood disorders, thirst, fever, and leprosy [5]. The tubers in Egyptian traditional medicine are exploited as an aphrodisiac, diuretic, sedative, carminative, stimulant, tonic,

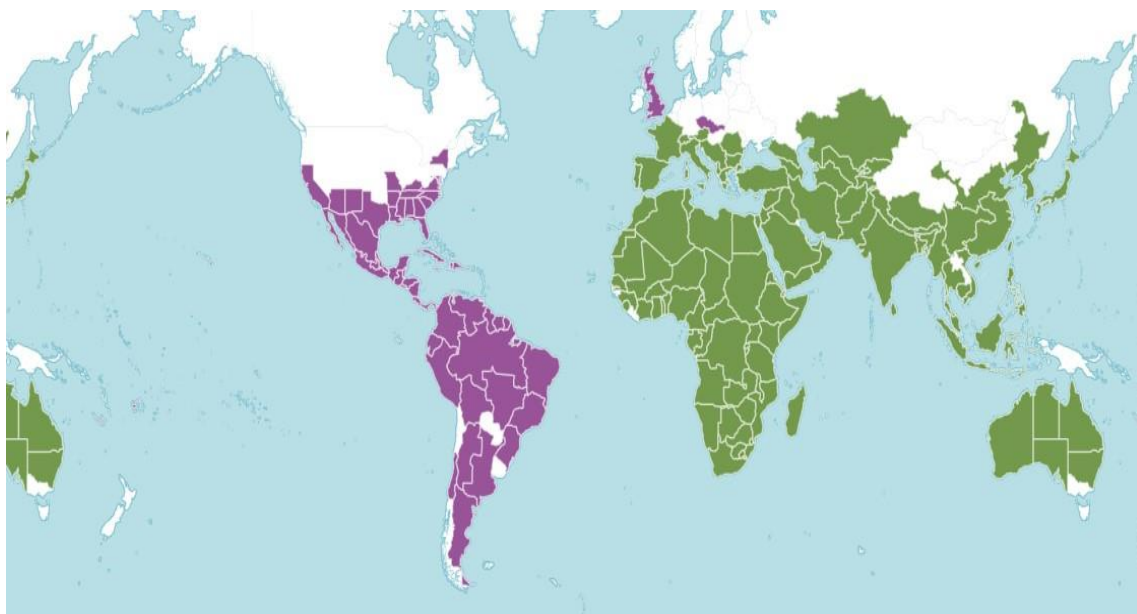


Fig. 3. Geographical distribution of *C. rotundus* L. (world map from: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:305797-1> in the world (The green surface symbol map shows native to that area and violet represent to the Introduced in area of *C. rotundus* L.)

and for the treatment of renal colic and stomachaches [26]. This plant is a commonly quoted species in ethnobotanical and pharmacological studies on the Brazilian medicinal flora [27].

3.6 Parts Used

Roots and rhizomes of *C. rotundus* L. are commonly used for various therapeutic purposes [14,15,21].

3.7 Therapeutic Uses in Unani Medicine

In Unani medicine, it is therapeutically used for the treatment of mental weakness, cardiac weakness, nerve weakness, palpitation, weakness of stomach, flatulence, retention of urine, amenorrhoea, dribbling of urine, etc [14,17,18,28].

3.8 Compound Formulations

In Unani medicine, several compound formulations are prepared by adding *C. rotundus* as an ingredient (Table 2).

3.9 Phytochemical Constituents

C. rotundus is the reservoir of several phytoconstituents, including fat, gum resins,

carbohydrates, essential oils, flavonoids, saponins, terpenoids, sesquiterpenes, fibers, etc. The plant is the pool of essential oils, 1,8 cineole, 4a, 5 α -oxidoeudesm-1 l-en-3a-ol, alkaloids, α -cyperone, β -cyperone, α -pinene, β -pinene, β -rotunol, α -Selinene, β -selinene, camphene, cyprotene, acopaene, cyperene, aselinene, rotundene, valencene, cyperol, gurjunene, trans-calamenene, dcadinene, gcalacorene, cadalene, amurolene, gmuurolene, cyperotundone, mustakone, isocyperol, acyperone, 4,11-selinnadien-3-one and 1,8-cineole, valeranal, myrtenol and sesquiterpene hydrocarbons (Caryophyllene). It also contains γ -cymene, isocyperol, isokobusone, kobusone, linoleic acid, linolenic acid, p-cymol, mustakone, a novel saponin, oleanolic acid, oleic acid, oleanolic acid-3-O-neohesperidoside, and pectin. Among the substances found in the plant are polyphenols, rotundene, rolundenol, rotundone, selinatriene, sitosterol, stearic acid, sugeonol, and sugetriol [1,3].

3.10 Pharmacological Activities

3.10.1 Antioxidant activity

The current study reveals that both aqueous and ethanolic extracts of *C. rotundus* rhizomes have antioxidant and free radical scavenging property, with the ethanolic extract being more obvious.

These discrepancies in activity could be attributed to variances in the phytoconstituents contained in each extract. According to the findings of this investigation, both aqueous and

ethanolic extracts have high antioxidant activity against free radicals such as reactive oxygen species and reactive nitrogen species [29].

Table 2. Compound preparations containing *C. rotundus*

S. No.	Compound formulation	Dose	Actions and therapeutic uses	Reference
1.	<i>'Arq Ambar</i>	60 ml	General tonic, helps in weakness of heart, brain and liver	[30]
2.	<i>'Arq Hara Bhara</i>	125 ml along with 25 ml <i>Sharbat Ejaz</i>	It is useful in tuberculosis, liver and lung diseases	[31]
3.	<i>Halwa-i-Supari Pak</i>	12-25 g in morning along with 250 ml of milk	Kidney and gall bladder diseases, male sexual dysfunctions	[31]
4.	<i>Jawārish-i-Kāfūr</i>	5-10 g	Stomachic, carminative, helps in perverted digestion, dyspepsia and flatulence	[32]
5.	<i>Labūb Kabīr Khās</i>	6 g along with 60 ml <i>Mā' al-Laḥm Khās</i> or milk once a day	Aphrodisiac, nervine tonic, tonic for vital organs, kidney and vesical, weakness of kidney, vesical and vital organs	[33]
6.	<i>Labub-i-Kabir</i>	5 g before breakfast along with 250 ml of milk	Brain and nervine tonic, semenagogue, aphrodisiac, liver and general tonic	[31]
7.	<i>Ma'jūn Azaraqī</i>	3 g twice a day after meal	Useful in facial paralysis and paralysis	[31]
8.	<i>Ma'jūn Bawāsīr</i>	5-10 g	Haemostyptic, astringent, helps in diarrhoea and haemorrhoids	[32]
9.	<i>Ma'jūn Chob Chīni</i>	5 g before breakfast along with 250 ml of milk	Nervine tonic, antirheumatic, antiarthritic, antispasmodic, depurative.	[31]
10.	<i>Ma'jūn Fanjanosh</i>	5 g	Useful in piles and digestive system disorders	[31]
11.	<i>Ma'jūn Jalinus Luluṭ</i>	5 g in the morning along with 250 ml of milk	Aphrodisiac, nervine tonic, general tonic, depurative, complexion brightener	[31]
12.	<i>Ma'jūn Kalkalanj</i>	5 g followed by 125 ml of <i>Arq Brinjasif</i>	Effective in dropsy, diuretic and analgesic for colicky pain	[31]
13.	<i>Ma'jūn Khadar</i>	5 g	Numbness	[31]
14.	<i>Ma'jūn Khubs al-Hadīd</i>	3-5 g	Styptic for bleeding piles, stomachic, liver tonic, digestive, appetizer	[31]
15.	<i>Ma'jūn Kundur</i>	5 g twice a day preferably along with <i>Kushta Khubs-ul-Hadīd</i> or <i>Kushta Baiza Murg</i> one tablet for quick effect	Kidney and gall bladder tonic, prevent incontinence of urine	[31]
16.	<i>Ma'jūn Lūluvī</i>	5 g	Aphrodisiac, nervine tonic, helps in weakness of nerve and sexual debility	[32]

S. No.	Compound formulation	Dose	Actions and therapeutic uses	Reference
17.	<i>Ma'jūn Masīhi</i>	5-10 g	Analgesic, useful in lumber pain	[32]
18.	<i>Ma'jūn Muqawwī wa Mumsik</i>	1-1/2 g before sexual intercourse along with 250 ml of milk	Male sexual dysfunctions	[31]
19.	<i>Ma'jūn Murawweh-ul-Arwāh</i>	1 g along with <i>Ma-ul-Laham Do Atisha</i> (60 ml) or 250 ml of milk	Enhances heat of the body, aphrodisiac, brain tonic, cardiac stimulant, liver and stomach tonic	[31]
20.	<i>Ma'jūn Nisyān</i>	5 g	Amnesia, brain tonic, enhances memory	[31,32]
21.	<i>Ma'jūn Nisyān</i>	5 g	Brain tonic, useful in amnesia	[32]
22.	<i>Ma'jūn Regmāhī</i>	5-10 g	Aphrodisiac	[30]
23.	<i>Ma'jūn Zanjabīl</i>	10 g	Stomachic, useful in weakness of stomach, polymenorrhoea and metritis	[31]
24.	<i>Naushdaru-i-Lūlūṭ</i>	5 g	Cardiac stimulant, cephalic tonic, stomachic and liver tonic, antidysentery	[31]
25.	<i>Naushdāru-i-Sāda</i>	10 g	Stomachic, bowel tonic, curative for dysentery	[33]
26.	<i>Ravghan Ahmar Jadīd</i>	Q.S. for external use only	Analgesic, nervine tonic, useful in arthritis, weakness of nerve and infantile tuberculosis	[30]
27.	<i>Sanūn Muqawwī Dandān</i>	Applied on the teeth and gum at bed time	Strengthening of tooth and gum	[33]
28.	<i>Shabābī</i>	6 g	Aphrodisiac, spermatogenic, general and nervine tonic	[33]
29.	<i>Sharbat-i-Faulād</i>	Adult - 20 ml twice a day Children - 10 ml twice a day	Haematopoietic, stomachic, liver tonic	[31]
30.	<i>Sufūf-i-Ḥabis</i>	5 g	Heavy menstrual bleeding	[31]

3.10.2 Anti-obesity activity

In a study, it was observed that *C. rotundus* extract standardized for 5% total Stilbenoids (Piceatannol, Scirpusin A, and Scirpusin B) has anti-obesity activity. The extract proved beneficial in lowering body weight and BMI in obese people. *C. rotundus* rhizome extract inhibited adipogenic activity in differentiated 3T3 L1 adipocytes *in vitro* and could minimize body weight gain in obese mice. Although stilbenes have been demonstrated to have anti-obesity activity in *in vitro* and *in vivo* models. This is the first time, an extract comprising Piceatannol and dimeric Stilbenoids, particularly Scirpusin A and Scirpusin B, has been observed to be active. According to the findings, an herbal composition derived from the rhizomes of *C. rotundus* including Piceatannol, Scirpusin A, and Scirpusin

B could be a strong and safe health adjuvant for the treatment of hypercholesterolemia and obesity in humans. As a result, *C. rotundus* extract is safe for human ingestion and effective in the treatment of obesity and hypercholesterolemia [34].

3.10.3 Antimicrobial activity

Many studies revealed that *C. rotundus* extracts possess potential antimicrobial activities against various strains, including *Bacillus cereus*, *Staphylococcus epidermidis*, and *Escherichia coli* [35].

3.10.4 Neuroprotective activity

The protective effects of N-acetyl-L-cysteine (NAC) was investigated against 3, 4-

methylenedioxymethamphetamine (MDMA)-induced neurotoxicity in rats. The rats' brains were taken at the end of the study, and the levels of Bcl-2, Bax, and caspase-3 expression in the hippocampi were assessed. NAC pretreatment reduced MDMA-induced hyperthermia substantially. NAC significantly reduced the MDMA-induced increase in distance travelled in the Morris water maze (MWM); however, the observed increase in escape latency was not significant. The decrease in time spent in the target quadrant was significantly reduced in MDMA animals. NAC protected against MDMA-induced cell death and increased the expression of Bax and Caspase-3, while decreasing the expression of Bcl-2. This research suggested that NAC may be useful in the treatment of neurotoxicity in MDMA users [36].

3.10.5 Anti-inflammatory activity

A study confirms the anti-inflammatory effects of the methanolic extract of *C. rotundus* rhizome in an animal model of carrageenan-induced paw oedema. *C. rotundus* exhibited anti-inflammatory characteristics similar to non-steroidal anti-inflammatory drugs, including Indomethacin. It is also suggested that the mechanism of action of *C. rotundus* is related to the suppression of histamine, serotonin, and prostaglandin formation. The results showed that methanolic extract greatly reduced oedema when compared to the reference standard, Indomethacin. The findings of the study provide rationale for the use of this plant in the treatment of inflammatory diseases [37].

3.10.6 Anti-diarrhoeal activity

The methanol extract of *C. rotundus* rhizome, administered orally at 250 and 500 mg/ kg b. w., demonstrated considerable antidiarrheal activity in mice against castor oil-induced diarrhoea. The petroleum ether fraction (PEF) and residual methanol fraction (RMF) were found to preserve activity when evaluated at 250 mg/ kg, with the latter being more active than the control. The ethyl acetate fraction (EAF) lacked antidiarrheal efficacy [38]. Another study, Daswani et al. (2011) investigated the anti-diarrheal effect of *C. rotundus* tubers on enteropathogenic *Escherichia coli*, and *Shigella flexneri*. The anti-diarrheal activity was determined by assessing the adhesion of these pathogens to HEP-2 cells. The decoction inhibited bacterial adhesion and invasion of HEP-2 cells. The decoction also influenced cholera toxin synthesis and heat labile toxin activity. Because *C. rotundus* decoction did

not have significant anti-microbial activity, the anti-diarrheal action was discovered to be exerted via mechanisms other than direct killing of germs [39].

3.10.7 Anti-nociceptive activity

The anti-nociceptive activity of hydro-methanol extract of *C. rotundus* was examined at three distinct dosages (50, 100, and 200 mg/kg; p.o.) against thermally induced (hot plate and tail immersion) and chemically induced (formalin) nociception models in mice. As reference analgesics, morphine sulphate (5 mg/kg, i.p.) and diclofenac sodium (10 mg/kg, i.p.) were used. The present study found that all the dose levels of the test drug had a substantial central and peripheral anti-nociceptive impact. The effect was immediate, long-lasting, and statistically significant, especially at 100 and 200 mg/kg. Considering these observations, it appears that *C. rotundus* includes elements with promising antinociceptive effect. This study supports the plant's traditional use in the treatment of painful ailments [40].

3.10.8 Anti-diabetic activity

The hypoglycemic activity of the ethanolic extract of *C. rotundus* was evaluated on streptozotocin (STZ) induced diabetic mice. The biomarker enzymes, SGOT and SGPT rise due to metabolic alterations in the liver, which results in enzyme leakage from tissues to the blood. The administration of the extract and glibenclamide reduced enzyme activity in STZ-treated rats. The results showed that the extract can lower the levels of marker enzymes and confirmed the possibility that the ethanolic extract can improve liver functions. In comparison to the normal control group, the ethanolic extract (250 and 500 mg/kg) and standard glibenclamide (10 mg/kg) significantly reduced the raised blood glucose levels at 0 min, 30 min, 60 min, and 120 min. The ethanolic extract at dose levels of 250 and 500 mg/kg exhibited considerable antidiabetic activity, improvement in body weight, and reduction in elevated biochemical markers, such as SGPT, SGOT, cholesterol, and triglyceride levels, suggesting that it could be useful in the treatment of diabetes [41].

3.10.9 Antiplatelet activity

In the *in vitro* platelet aggregation investigation, *C. rotundus* EtOH extract (CRE) inhibited collagen, thrombin, and/ or AA-induced platelet aggregation significantly and concentration-dependently. The most effective inhibitor of its

eight constituents on collagen, thrombin, and AA-induced platelet aggregation was discovered to be (+)-nootkatone. Furthermore, mice given CRE and (+)-nootkatone had noticeably longer bleeding periods. Additionally, (+)-nootkatone significantly inhibited the ex vivo platelet aggregation of rats. This study shows that CRE and its main ingredient, (+)-nootkatone have antiplatelet properties, and it raises the possibility that using these drugs therapeutically could help prevent cardiovascular disorders linked to platelets [42].

3.10.10 Anti-ulcer activity

The ethanol induced method was used to analyse two dose levels of *C. rotundus* chloroform extract, 200 and 400 mg/kg, using Ranitidine (50mg/kg) as standard. The standard and test medications were given orally for 14 days. *C. rotundus* extract contains alkaloids, flavonoids, terpenoids, and glycosides. The inclusion of flavonoids, terpenoids, alkaloids, and saponin glycoside could explain the considerable increase in antiulcer efficacy of *C. rotundus* extract. Flavonoids are among the cytoprotective materials whose antiulcerogenic activity has been thoroughly demonstrated. It is hypothesized that these active chemicals can increase mucus, bicarbonate, and prostaglandin secretion while also counteracting the degrading effects of reactive oxidants in the gastrointestinal lumen. As a result, the antiulcer action of *C. rotundus* extract could be related to its flavonoid concentration [43].

3.10.11 Anticonvulsant activity

The anticonvulsant activity of *C. rotundus* rhizomes against maximum electroshock (MES) and pentylenetetrazole (PTZ) produced tonic seizures in albino rats was investigated. The extract's anticonvulsant action was determined by monitoring (in seconds) the length of tonic flexion, tonic extensor, clonus, stupor, and recovery phase in rats. The presence of flavonoids, vitamins, and carbohydrates was discovered during a phytochemical analysis of the ethanol extract. The ethanol extract (100 mg / kg, p.o.) considerably reduced hind limb extension and convulsion duration, which was comparable to the conventional drugs, phenytoin (25 mg / kg, i.p.) and diazepam (4 mg /kg, i.p.). The ethanol extract of *C. rotundus* rhizomes was found to be useful in the treatment of epilepsy [44].

3.10.12 Antimalarial activity

C. rotundus aqueous crude extract (CRE) possesses strong antimalarial properties. In a 4-day suppressive test, the maximum parasitemia inhibition was seen at 400 mg/ kg. The plasmodium berghei ANKA-infected mouse model responded better to chemotherapeutic treatment when CRE and dihydro-artemisinin (DHA) were combined. Additionally, CRE and DHA together have been shown to prolong mean survival time (MST) and inhibit packed cell volume (PCV), body weight loss, and hypothermia induced. These results also back up the conventional wisdom that *C. rotundus* can treat malaria [45].

3.10.13 Ovicidal and Larvicidal activity

The effectiveness of essential oils derived from the tubers of *C. rotundus* and *C. giganteus* on the eggs and fourth-instar larvae of *Aedes albopictus* (Skuse) was investigated. The eggs and larvae were observed for 24 hours after being subjected to a series of oil concentrations ranging from 5-150 ppm. Indicated by EC50 values of <5 ppm and LC50 and LC90 values of <20 ppm, respectively, both oils demonstrated remarkable ovicidal and larvicidal effects. The findings point to a possible source of natural mosquitocidal agents in the essential oils of certain *Cyperus* species [46].

4. CONCLUSION

After going through many Unani classical and other published literature, it is concluded that *C. rotundus* is extensively used for various therapeutic purposes. Several published literatures revealed that different extracts prepared with the rhizome of *C. rotundus* exhibited various pharmacological activities like antioxidant, anti-obesity, anti-microbial, anti-inflammatory, analgesic, antimalarial, larvicidal, anti-convulsant, anti-ulcer, anti-platelet, anti-diarrhoeal, neuroprotective, etc. which might be due to the presence of numerous secondary metabolites.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Abbasi H, Kabir H. Unani Perspective and new research of *Sa'ad Kūfi* (*Cyperus rotundus*): A review. *Journal of Drug Delivery and Therapeutics*. 2018; 8 (6): 378-381. Available:<http://dx.doi.org/10.22270/jddt.v8i6.2059>
2. Pirzada AM, Ali HH, Naeem M, Latif M, Bukhari AH, Tanveer A. *Cyperus rotundus* L.: Traditional uses, phytochemistry, and pharmacological activities, *Journal of Ethnopharmacology*. 2015; 174: 540-560. Available at <http://dx.doi.org/10.1016/j.jep.2015.08.012>
3. Satyanarayan P, Subash S, Kumar Madan SA. A review of medicinal properties on *Musta* (*Cyperus rotundus* Linn.) AYUSHDHARA. 2019; 6 (3): 2235-2341.
4. Ahmed R, Ahmed MW, Khan AS, Ahmad A. *Cyperus rotundus* commonly used drug in Unani medicine, *Journal of Drug Delivery and Therapeutics*. 2023;13 (8): 81-84.
5. Babiaka SB, Moumbock AFA, Gunther S, Ntie-Kang F. Natural products in *Cyperus rotundus* L. (Cyperaceae): An update of the chemistry and pharmacological activities. *RSC Advances*. 2021;11(25): 15060–15077. Available:<https://doi.org/10.1039/d1ra00478f>
6. Harborne JB. *Phytochemicals Methods*. London: Chapman and Hall Ltd. 1973;49-188.
7. Ansari T, Asif M, Saleem M, Ahmed NZ, Meena R. *Rubus moluccanus* L.: A valuable medicinal plant of traditional system of medicine. *Nat Prod Res*. 2023; 11: 1-11. DOI: 10.1080/14786419.2023.2291706
8. Tsoyi K, Jang HJ, Lee YS, Kim YM, Kim HJ, Seo HG, et al. (+)-Nootkatone and (+)-valencene from rhizomes of *Cyperus rotundus* increase survival rates in septic mice due to heme oxygenase-1 induction. *J Ethnopharmacol*. 2011;137(3):1311-1317.
9. Xue BX, He RS, Lai JX, Mireku-Gyimah NA, Zhang LH, Wu HH. Phytochemistry, data mining, pharmacology, toxicology and the analytical methods of *Cyperus rotundus* L. (Cyperaceae): A comprehensive review. *Phytochem Rev*. 2023;15: 1-46. DOI: 10.1007/s11101-023-09870-3
10. Ali AE, Hajar UI. Extraction of *Cyperus rotundus* rhizomes oil, identification of chemical constituents and evaluation of antimicrobial activity of the oil in North Kordofan State. *International Journal of Advanced Research in Chemical Science*. 2014; 1 (9): 18-29.
11. Sivapalan SR. Medicinal uses and pharmacological activities of *Cyperus rotundus* Linn. - A review. *International Journal of Scientific and Research Publications*. 2013; 3 (5): 1-8.
12. *Cyperus rotundus* Linn. Available at: <http://www.worldfloraonline.org>. [Accessed October 11, 2024]
13. *Cyperus rotundus* Linn. [Available at: <http://www.powo.science.kew.org>. [Accessed October 11, 2024]
14. Khan MA. *Muhīt-i-A'zam*, vol. III. New Delhi: Central council for research in Unani Medicine, Dept. of AYUSH, Ministry of H & FW, Govt. of India. 2014; 95-97.
15. Ghanī MN. *Khazā'in al-Adwiya*. vol. IV. New Delhi: Central Council for Research in Unani Medicine, Dept. of AYUSH, Ministry of H & FW, Govt. of India. 2010;364-366.
16. Baitar I. *Al-Jami Li Mufridat al-Advia wa al-Aghzia*. vol. III (Urdu Translation by CCRUM). New Delhi: Central Council for Research in Unani Medicine, Dept. of AYUSH, Ministry of H & FW, Govt. of India. 1999; 46, 47.
17. Kabiruddin M. *Makhzan al-Mufridat (Kitab-ul-Advia)*, 3rd ed. New Delhi: Idara Kitab al-Shifa. 2014; 400.
18. Nabi MG. *Makhzan al-Mufredat wa Murakkabat*. New Delhi: Central Council for Research in Unani Medicine, Dept. of

- AYUSH, Ministry of H & FW, Govt. of India. 2007: 237.
19. Khare CP. Indian medicinal plants: An Illustrated Dictionary, 1st ed. New Delhi: Springer Science + Business Media, Pvt. Ltd. 2007: 195.
 20. Kirtikar KR, Basu BD. Indian Medicinal Plants, 2nd ed. vol. IV. New Delhi: Periodical Experts Book Agency. 2012: 2638-2640.
 21. Jarald EE, Jarald SE. Medicinal plants. New Delhi: CBS Publishers & Distributors; 2006: 103.
 22. Anonymous. The Unani Pharmacopoeia of India, part -I, vol. V. New Delhi: Dept. of AYUSH, Ministry of H & FW, Govt. of India. 2008; 75: 76.
 23. Bieski IGC, Rios Santos F, de Oliveira RM, Espinosa MM, Macedo M, Albuquerque UP, et al. Ethnopharmacology of medicinal plants of the Pantanal region (Mato Grosso, Brazil). Evidence-Based Complementary and Alternative Medicine. 2012;1-36. Available:<https://doi.org/10.1155/2012/272749>
 24. Bezerra JJJ, Pinheiro AAV. Traditional uses, phytochemistry, and anticancer potential of *Cyperus rotundus* L. (Cyperaceae): A systematic review. South African Journal of Botany. 2022; 144:175-186.<https://doi.org/10.1016/j.sajb.2021.08.010>.
 25. Umair M, Altaf M, Abbasi AM. An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab-Pakistan. PloS One. 2017;12 (6): e0177912. Available:<https://doi.org/10.1371/journal.pone.0177912>
 26. Boulos L, El-Hadidi MN. The weed flora of Egypt. Cairo: The American University in Cairo Press. 1984: 58.
 27. Bezerra JJJ, de Oliveira AFM. Ethnobotanical uses of Cyperaceae species in Brazilian traditional medicine. Journal of Herbal Medicine. 2023; 41 (100692). Available:<https://doi.org/10.1016/j.hermed.2023.100692>
 28. Ram lubhaya G. Bayan al-Adwiya. New Delhi: Idara Kitab al-Shifa; 2019: 277, 278.
 29. Hema N, Avadhani R, Ravishankar B, Anupama N. A Comparative analysis of antioxidant potentials of aqueous and ethanolic extracts of *Cyperus Rotundus* (L.). Asian Journal of Biomedical and Pharmaceutical Sciences. 2013; 3 (21): 7-11.
 30. Anonymous. National Formulary of Unani Medicine, part V. New Delhi: Dept. of AYUSH, Ministry of H & FW, Govt. of India. 2008; 107, 134, 150.
 31. Said HM. Hamdard Pharmacopoeia of Eastern Medicine. New Delhi: Sri Satguru Publications; 1997: 117, 155, 205, 244, 259, 261, 264, 266-269, 279, 281-285, 287, 290, 299, 300.
 32. Anonymous. National Formulary of Unani Medicine, part II, vol I. New Delhi: Dept. of AYUSH, Ministry of H & FW, Govt. of India; 2007; 1, 2, 73, 74, 77, 78, 88.
 33. Anonymous. National Formulary of Unani Medicine, part VI. New Delhi: Dept. of AYUSH, Ministry of H & FW, Govt. of India. 2011: 60, 69, 86.
 34. Majeed M, Nagabhushanam K, Bhat B, Ansari M, Pandey A, Bani S, Mundkur L. The anti-obesity potential of *Cyperus rotundus* extract containing Piceatannol, Scirpusin A and Scirpusin B from Rhizomes: Preclinical and Clinical Evaluations. Diabetes Metab Syndr Obes. 2022; 15 (1): 369-382. <https://doi.org/10.2147/dmso.s348412>
 35. Sharma SK, Singh AP. Antimicrobial investigations on rhizomes of *Cyperus rotundus* Linn. Der Pharmacia Lettre. 2011; 3 (3): 427-431.
 36. Soleimani Asl S, Mousavizadeh K, Pourheydar B, Soleimani M, Rahbar E, Mehdizadeh M. Protective effects of N-acetylcysteine on 3, 4-methylenedioxymethamphetamine-induced neurotoxicity in male Sprague–Dawley rats. Metabolic Brain Disease. 2013; 28 (4): 677-686. Available:<https://doi.org/10.1007/s11011-013-9423-1>.
 37. Kumar S, Tiwari R, Alam N. Anti-inflammatory activity of methanolic extract of *Cyperus rotundus* Rhizome on Carrageenan-induced paw edema in rats. International Journal of Pharmaceutical Sciences and Research. 2012;3 (12): 5097-5100.
 38. Uddin SJ, Mondal K, Shilpi JA, Rahman MT. Anti-diarrhoeal activity of *Cyperus rotundus*. Fitoterapia. 2006; 77 (2): 134-136. doi:10.1016/j.fitote.2004.11.011.
 39. Daswani PG, Brijesh S, Tetali P, Birdi TJ. Studies on the activity of *Cyperus rotundus* Linn. tubers against infectious diarrhea.

- Indian Journal of Pharmacology. 2011; 43 (3): 340-344. <https://doi.org/10.4103/0253-7613.81502>.
40. Imam MZ, Sumi CD. Evaluation of antinociceptive activity of hydro-methanol extract of *Cyperus rotundus* in mice. BMC Complementary and alternative medicine. 2014; 14 (1): 1-5. Available:<https://doi.org/10.1186/1472-6882-14-83>
41. Singh P, Khosa RL, Mishra G, Jha KK. Antidiabetic activity of ethanolic extract of *Cyperus rotundus* rhizomes in streptozotocin-induced diabetic mice. Journal of Pharmacy & Bioallied Sciences. 2015; 7 (4): 289-292. Available:<https://doi.org/10.4103/0975-7406.168028>.
42. Seo EJ, Lee DU, Kwak JH, Lee SM, Kim YS, Jung YS. Antiplatelet effects of *Cyperus rotundus* and its component (+)-nootkatone. Journal of Ethnopharmacology. 2011; 135 (1): 48-54. Available:<https://doi.org/10.1016/j.jep.2011.02.025>
43. Gangwar AK, Ghosh AK. Antiulcer activity of chloroform extract of *Cyperus rotundus*. International Journal of Pharmacognosy and Phytochemical Research. 2017;9 (6): 780-782. Available:<https://doi.org/10.25258/phyto.v9i6.8178>
44. Shivakumar SI, Shivakumar B, Suresh HM, Hallikeri CS, Hatapakki BC, Handiganur JS, Sankh K. Anticonvulsant effect of *Cyperus rotundus* Linn. rhizomes in rats. Journal of Natural Remedies. 2009; 9 (2): 192-196. DOI: 10.18311/jnr/2009/239.
45. Ounjaijean S, Lektip C, Somsak V. *In vivo* antimalarial activity of *Cyperus rotundus* and its combination with dihydro artemisinin against Plasmodium berghei. In Research Square. 2023: 1-21. <https://doi.org/10.21203/rs.3.rs-3329573/v1>
46. Kempraj V, Bhat SK. Ovicidal and larvicidal activities of *Cyperus giganteus* Vahl and *Cyperus rotundus* Linn. essential oils against *Aedes albopictus* (Skuse). Natural Products Radiance. 2008; 7(5): 416-419.

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