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Overview evaluation of Therapeutic actions of Cyperus rotundus Linn. (Musta)

Dr. Tripti Tyagi[1] Dr. Sakshi Sharma[2] Dr. Rajesh Sharma[3]

1. PG Scholar (Ayu), Dravyaguna Department, Ayurvedic and Unani Tibbia College and Hospital Karol Bagh, New Delhi

2. Senior Research Officer (Ayu), Ayurveda Central Research Institute West Punjabi Bagh, New Delhi

3. Associate Professor (Ayu), H.O.D, Dravyaguna Department, Ayurvedic and Unani Tibbia College and Hospital, Karol Bagh, New Delhi

Abstract

Background: *Cyperus rotundus* often known as *Musta*, is also referred to as java grass, nutgrass, and coco grass, a member of the *Cyperaceae* family. *Musta* is a herb that can reach a height of 4.5 feet and bear tuber-like roots which resemble nuts. The tubers are primarily found in Africa, South Asia, and Central Europe and are typically used medicinally. **Material and Method**: Ayurvedic textual and pharmacological experimental research has been thoroughly investigated. **Result:** *Cyperus rotundus* is well known to treat obesity, increase milk production in breastfeeding women, soothes the burning pain associated with cystitis and urinary tract infections, and reduce thirst *(trushnahara)*, body temperature associated with fever *(jwarahara)*. IBS (irritable bowel syndrome), herpes, diarrhea, and dyspepsia can all be treated with nut grass. Traditional folk remedies for the treatment of the stomach use the rhizomes of *Cyperus rotundus*. *Charakacharya* explained this herb is best utilized for IBS, diarrhea, and dysentery because it has the Grahi (absorbent) quality to aid IBS sufferers and diarrhea patients. Additionally, it aids in enhancing digestive power (*Agni*), so as supporting digestion (pachana), and easing ama condition digestion. Essential oils, terpenes, flavonoids, b-sitosterol, and ascorbic acid are present in *Cyperus rotundus*. Cyperenes, which contain sesquiterpene hydrocarbons, make up the majority of the terpenes *in Cyperus rotundus*. **Discussion:** The information regarding the pharmacological activity of *Cyperus rotundus* mentioned in the Ancient text is supported by shreds of evidence which has been explained in the current paper and proven medicinal authentication of *Cyperus rotundus* and having a variety of ethnobotanical purposes.

Keywords: Musta, Nutgrass, Jwarahara, Pachana, Cyperene

Introduction

The *Cyperaceae* Family has about 90 genera and 4000 species; widely distributed herbs. Main Genera from 90 genera mainly include *Cyperus* (550 spp.), *Scirpus* (300 spp.) and *Carex* (150–200 spp.), although numbers vary greatly due to the different taxonomic concepts of individual researchers. *Cyperus rotundus* commonly known as *Nagarmotha* is found throughout India. It belongs to the family *Cyperaceae*[1]. The genus name *Cyperus* is derived from *Cypeiros,* which was the ancient Greek name for the genus, *rotundus* is the Latin word for round and refers to the tuber[2]. *Cyperus rotundus classically known as Musta, Mustaka, Varida, Varidanamaka, and Kuruvinda* is a perennial herb 10-75 cm high; stolons 10-20 cm long, bearing hard, black, fragrant tubers. Leaves 10-18 cm long, narrowly linear. The inflorescence is a compound umbel. Spikelet's 0.8-1.0 x 0.1 cm, linear, brown. Nuts 15 mm long, broadly obovoid, greenish-black. It is a plentiful species occurring throughout the plains of India, especially in South India, and commonly found in India up to an elevation of 1800 m, from Kashmir to Simla, Garhwal, and Khasia hills and ascending mountains of Central table-land from Mount Abu and Pune to the Nilghiri hills[3]. The tubers are acrid, bitter, astringent anti-inflammatory, galactagogue carminative, stomachic, anthelminthic, emmenagogue, antidiabetic, cytoprotective, antimutagenic, antioxidant, antipyretic, and analgesic activities and useful in hyperdipsia, anorexia, flatulence, colic, vomiting, excessive thirst, intestinal worms, diarrhea, dysentery, inflammations, intermittent and malarial fevers[4-16]. Various phytochemical studies on *C.rotundus* revealed the presence of alkaloids, flavonoids, tannins, starch, glycosides, furochromones, and many novel sesquiterpenoids[17-21]. The tuber is rich in copper, iron, magnesium, nickel, and beta-sitosterol and exhibits significant anti-inflammatory activity. The alcoholic and aqueous extracts of tubers exhibit lipolytic

action and reduce obesity by releasing enhanced concentrations of biogenic amines from nerve terminals of the brain which suppress the appetite center. Eudalne group of sesquiterpene compounds of sesquiterpene alcohol, isocyperol have an important role in lipid metabolism[22].

Material /Methods

Cyperus rotundus occurring throughout India up to an elevation of 1800m has been utilized for a significant stretch in Ayurveda. Synonyms, activities, restorative purposes, and compound medications having *Cyperus rotundus* are explored. The administration methodology of the drug has been recalled from *Samhita and Nighantu*. On the side of its literary and ethnomedicinal benefits, a sharp and important inquiry from PUBMED and Scopus research doors has been gathered.

Taxonomy[23-25]

Kingdom: Plantae

Subkingdom: Tracheobionta

Super division: Spermatophyta

Division: Magnoliophyta

Class: Liliopsida

Subclass: Commelinidae

Order: Poales (Cyperales)

Genus: Cyperus

Species: rotundus

Classical categorization

Charaka[26]: *Truptighana, Trusnanigrahana , Lekhaniya, Kandughna, Stanyasodhana , Mutravirechaniya , Madhura skandhas, Tikta sangdha*

Sushruta[27]: *Mustadi, Vachadi*

Astanga Hridya[28]: *Mustadi, Vachadi, Rodharadi, Eladi*

Bhavprakash Nighantu[29]*: Karpuradi*

Dhanvantari Nighantu[30]*: Guduchyadi*

Kaiyadev Nighantu[31]*: Ausadha varga*

Madanpal Nighantu[32]*: Abhyadi*

Priya Nighantu[33]*: Shatpushpadi*

Raj Nighnatu[34]: *Pippalyadi*

Nighantu aadarsh[35]*: Karpuradi*

Sodhala Nighantu[36]*:Guduchyadi*

Synonyms[37-38]

Gangayi/Varid as Musta commonly grows near water resources, *Kachutha* because it grows in marshy areas. *Granthila* as Musta tubers is nodular. *Prachya* because commonly found in the northeastern region of India. *Sugandhi* because of its agreeable odor.

Types of Musta

Three main varieties of Musta are mentioned in Ayurvedic texts[39-44]

1. Nagarmusta
2. Bhardramusta
3. Kaivarta or Kshudramusta

Amarkosha	Bhavprakash	Raj Nighantu	Saligram Nighantu	Bhaisajya Ratnavali	Indian Medicinal Plants
Kuruvinda	Nagarmusta	Nagarmusta	Nagarmusta	Anupadesha-Marshy land - best	Nagarmusta-Cyperus scarious Br.
Bhadramusta	Musta	Musta	Bhadramusta	Mishrit Deshjanya-mixed type land	Bhadramusta-Cyperus rotundus Linn.
Chudala	Kaivartamusta		Kaivartamusta	Jangal-dry land	Kshudramusta-Cyperus esculents Linn.

Vernacular Name

English: Nut grass

Hindi: Nagarmotha, Motha

Bengali: Motha, Musta

Gujarati: Motha

Kannnada: Tungegadde, Tungahulli, Badramusti, Bhadramusti

Malyalam: Muttanna

Marathi: Bimbal, Motha

Tamil: Korai, Kora

Telgu: Tunga Musta, Bhadramuste, Gandala, Kaivartakamuste, Mustakamu, Shakhatungaveru, Tungamuste

Mundari: Batha-bijir

Santhal: Tandi sura

Rasa Panchaka or Pharmacodynamic of *Cyperus rotundus*

Rasa (Taste) - *Tikta, Katu, Kashaya*

Guna (Main Quality) - *Laghu, Ruksha*

Veerya (Potency) - *Sheeta*

Vipaka (Biotransformation) - *Katu*

Doshaghnata- Kaphapittashamaka

Chemical constituents

B- sitosterol, 4-alpha, 5-alpha oxidoeudesm- 11-en-3 alpha-ol from (rhizomes); pinene, cineol, alcohol- isocyperol (essential oil from the tubers); linolenic, linolic, oleic, myristic, and stearic acids and glycerol (fatty oil); sesquiterpene ketone-*Mustakone* and copaene, cyperotundone, sesquiterpenes(+) – copadiene, (+)- epoxyguaine, (-)- rotundone and cyperolone; cyperenone designated as isopatchoul-4(5)-en-3-one and aureusidin(essential oil); two sesquiterpene keto alcohols, alpha-rotunol, B- rotunol, kobusone, and isokobusone; oleanolic acid and its glycoside, oleanolic acid- 3-0- neohesperidoside along with sitosterol, sesquiterpenes- alpha-cyperone, cyperene, B- selinine and cyperenone(tubers); luteolin and aureusidin (leaves)

Part used – Tuber or bulbous root

Dose: Powder 3-6 gm, Decoction 50ml-100 ml

Toxicology

The LD_{50} of petroleum ether extract of the root was 50 mg/kg and ED_{50} was 1.6 mg/kg, intraperitoneally showing toxic effects.

Substitutes and Adulterants

Cyperus scariosus R. Br and *Cyperus arundinaceous* Baker are used as substitutes for *Cyperus rotundus*

Formulations

Mustakadi kvatha, Mustakarishta, Mustadi churna, Mustadi leha, Shadangapaniya, Ardrakakhandawaleha, Kutajashtaka kvatha, Darvyadi kvatha, Dhanyapanchaka kvatha, Vatsakadi churna, Stanyashodhanakashaya[45].

Therapeutic action in Ayurveda

Musta act as *Pitta Kaphasamaka*. *Pitta samaka* due to its *Sita virya* and *Tikta, Kasaya rasa*. *Kapha samaka* because of *Katu vipaka* and *Tikta Kasaya, Katu rasa*. *Cyperus rotundus* act as *Jwarghna (*anti-pyretic*), Trsnahara* (thirst reliever), *Rocaka* (enhance the taste), *Krimighna* (anti-helminthic), *Atisaraghna* (anti-diarrhea), *Pacaka* (digestion power), *Dipana* (aids digestion). In *Charaka Samhita Musta Agrya Karma* is mentioned as *Sangrahika* (astringent), *dipneeya* (appetizer), and *Pachniya* (digestant). It is therapeutically indicated in *atisara, jwara, aruchi, daha, trshna, and krimi*.[46]

Therapeutic administration

1. Decoction of *Musta (Cyperus rotundus)* root is prepared and then taken with honey will check all kinds of *Atisara (diarrhea)*[47]
2. Administration of decoction or cold infusion prepared from *Musta (Cyperus rotundus)* and *Parpata (Fumaria parviflora)* is beneficial in *Jwara (Fever)*[487]
3. *Ayasa churn* (Iron powder) mixed with *Musta churn* (Cyperus rotundus) taken with *Kasaya* (decoction) of *Khadira (Acacia catechu)* will relieve *Halimaka (type of Jaundice)*[49]
4. Continuous usage of decoction prepared from *Musta (Cyperus rotundus), Amalaki (Emblica officinalis),* and *Nisa (Curcuma longa)* taken with honey will cure *Vatarakta* associated with *Kapha dosa* (gouty arthritis)[50]
5. Decoction prepared from *Musta* is very beneficial in all kinds of *Madatyaya* (alcoholism).[51]

Evidence-based Pharmacological actions

Anti-inflammatory Activity and Analgesic Activity

The anti-inflammatory activity in adult albino Wistar rats', *C. rotundus* extract of the tuber part was tested. The test group was treated with ether, ethanol, and distilled water extract of three equal portions of the powder. The extract showed significant anti-inflammatory activity against carrageenan induces rat paw edema by the application of tuber extract of *C. rotundus*. The ethanolic extract showed good anti-inflammatory effect than other solvent systems[52].

Antioxidant Activity

The polyphenol and flavonoid content of both ethanolic and aqueous extracts are evaluated. The results showed that *Cyperus rotundus*, when extracted with alcohol, obtained higher polyphenol content, while the aqueous extract resulted in higher flavonoid content. Two different assays results showed that *Cyperus rotundus* had good antioxidant activity.[53]

Anti-diarrheal Activity

The methanol extract of Cyperus *rotundus* rhizome, given orally at doses of 250 and 500 mg/kg, showed significant antidiarrheal activity in castor oil-induced diarrhea 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.[54]

Antiulcer Activity

The antiulcer activity of *C. rotundus* tuber powder extract was studied in two different animal models. The first one was a histamine-induced ulcer in guinea pigs, and another one was aspirin-induced gastric mucosal damage in rats. In both cases, the plant extract showed a maximum reduction of ulcers which was comparable to ranitidine. The significant increase in the antiulcer activity of *Cyperus rotundus* extract could be attributed to the presence of flavonoids, terpenoids alkaloids, and

saponin glycoside. Flavonoids are among the cytoprotective materials for which antiulcerogenic efficacy has been extensively confirmed. The results of the present study suggest that the chloroform extract of *Cyperus rotundus* may be beneficial in the treatment of gastric lesions.[55]

Hepatoprotective Activity

Rhizomes of *Cyperus rotundus* Ethyl acetate extract, solvent ether, and ethyl acetate,), were evaluated for hepatoprotective activity in rats by inducing liver damage by carbon tetrachloride. The ethyl acetate extract at an oral dose of 100 mg/kg exhibited a significant protective effect by lowering serum levels of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase, and total bilirubin. These biochemical observations were supplemented by histopathological examination of liver sections.[56]

Cardio Protective and Anti-hyperlipidemic Activity

Methanolic extract of the rhizomes of *C. rotundus* exerts cardioprotective, as well as hypolipidemic action. Isoproterenol was used to induce myocardial infarction in rabbits, and the level of serum cardiac marker enzymes (creatine kinase-MB, lactate dehydrogenase, aspartate transaminase, and alanine transaminase), serum lipids (cholesterol, triglycerides, low-density lipoprotein, high-density lipoprotein) and antioxidant enzymes in heart tissues (superoxide dismutase, catalase, and peroxidase) were evaluated. *C. rotundus* extract showed a significant reduction in an isoproterenol-induced elevated level of lipids and cardiac enzymes. The reduced level of antioxidants was also restored to normalization.[57]

Anti-allergic Activity

Sesquiterpenes isolated from the ethanolic extract of the rhizomes of *C. rotundus* were found to possess antiallergic activity, these sesquiterpenes are valencene, nootkatone, caryophyllene α-oxide, β-pinene, limonene, 4-cymene, and 1, 8-cineole. Sesquiterpenes inhibited the 5-lipoxygenase-catalyzed leukotrienes production and also inhibited β-hexosaminidase release, as well as its degranulation. The delayed-type hypersensitivity reaction was also delayed by valencene and nootkatone present in the CRE.[58]

Antidiabetic Activity

Hydroalcoholic extract of *C. rotundus* rhizomes was performed on Sprague-Dawley rats to show the anti-diabetic action. Alloxan monohydrate was administered intraperitoneally to induce diabetes which shows a significant rise in the blood glucose level. On the 15th day, after administration of the plant extract the blood glucose level reduced as compared to the metformin. Thus aqueous ethanolic extract of *C. rotundus* rhizomes has significant hypoglycemic activity.[59]

Wound Healing Activity

Tuber parts of *C.rotundus* were examined in alcoholic extract for wound healing activity in the form of ointment in three types of wound models on rats: the excision, the incision, and the dead space wound model. The extract ointments showed significant variation in response in all wound models taken as compared to those of a standard drug nitrofurazone in terms of wound contracting ability, wound closure time, and tensile strength.[60]

Anti-obesity activity

C. rotundus preparations (powder in fine suspension, aqueous and alcoholic extracts) exhibited a lipolytic action and mobilized fat from the adipose tissues in rats, thus helping to reduce obesity. A pilot study carried out on 30 obese people who were administered the powdered tuber of *C. rotundus* for 90 days, showed a reduction in weight along with a decrease in serum cholesterol and triglycerides.[61-62]

Cytoprotective effects

The rhizome of *C. rotundus* was assessed for its cytoprotective effects against ethanol-induced gastric damage. Decoctions of the drug were given orally in different doses The decoction showed an ulcer-inhibitory effect in a dose-dependent manner. The activity was also observed when the decoction was given subcutaneously suggesting that the herb possessed systemic effects on protecting the stomach.[63]

Discussion

Cyperus rotundus is a folk medicine with several actions such as anti-inflammatory, analgesic, antioxidant, etc. It is widely used in many parts of the world. Herbal plants and *Ayurvedic* formulations are being extensively investigated worldwide because of their extensive pharmacological potential but there is a need for further research exploration to attain greater clarity on the mechanism of action. In folk medicines, as well as in *Ayurveda* *Cyperus rotundus* is one of the best and has a beneficial function on the majority of our organic systems. These medicinal activities include anti-emetic, anti-arthritic,

hypotensive, cytoprotective, cardioprotective, anti-hyperlipidaemic, anti-malarial, anti-allergic, hepatoprotective, gastroprotective, anti-helminthic, anti-ulcer, anti-obesity, anti-hyperglycaemic, anti-diarrheal, antipyretic, wound healing, anti-oxidant. All these pharmacological activities support the actions of *Cyperus rotundus* mentioned in our Ayurvedic text as in *lekhniya mahakshaya* (anti-obesity/antihyperlipidaemic), *jawarghana* (anti-pyretic), *pachana, deepan* (gastroprotective/cytoprotective), *sangrahika* in *atisara* (anti-diarrhoeal), *halimaka* (hepatoprotective) *vatarakta* (as anti-inflammatory and analgesic)

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