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Ethno-Pharmaco-therapeutic Activities of CyperusRotundus

Ankita Sharma*, Dr.Nimali Singh and Dr.Roopraj Bharadwaj*****

**Research Scholar, University of Rajasthan, Jaipur*
***Associate Professor, Department of Home Science, University of Rajasthan, Jaipur*
****Medical Officer University of Rajasthan, Jaipur*

ABSTRACT

CyperusRotundus is a medicinal plant belonging to cyperaceae family and commonly known as mustak or motha or nutsedge. Rhizomes of the plant are the most useful part. It contains essential oils, flavonoids, b-sitosterol and terpenes especially cyperenes which is an active ingredient, working as hypotensive agent, anti-inflammatory, diuretic and hypolipemiant. It improves the altered regulation of digestive system functions as well as constipation, dysentery, neurogenic gastralgia, irregular menstruation, painful menstruation, inflammation, skin infections, fever. The aim of this review is to provide comprised information related to chemical constituents, pharmaceutical properties and multi-faceted benefits of the plant.

Keywords: - *CyperusRotundus, Anti- Microbial, Anti-obesity, Anti-Inflammatory, Cyperene, Chemical Constituent.*

INTRODUCTION

Cyperusrotunduslinn., commonly known as motha (Hindi), Mustak (Sanskrit) and nutgrass or purple nutsedge (English) belongs to cyperaceae family. It is an erect, glabrous, grass like herb with fibrous roots which is grown typically from 7-40cm tall and reproduces extensively by rhizomes and tubers(Himaja *et al*., 2014).The rhizomes of Cyperusrotundus has been widely used in traditional medicine. It has a wide range of biological activities and pharmaceutical properties such as antidiabetic, anti- inflammatory, antioxidant, antimicrobial, cyto-protective, analgesic activities.(Imam *et al*., 2016; Samraj *et al*, 2014; Zhou and Yin, 2012)

MEDICINAL USES

Although it's all parts contain medicinal properties but rhizome is the most useful part. It is used as an estrogenic and anti-inflammatory agent used in the treatment of gastro-intestinal disorders, menstrual disorders("Jiangsu New Medical College," 1971 and Kim *et al*., 2013), dyspepsia, diarrhoea, dysentery, fever, intestinal parasites, bronchitis, vesical calculi, urinary tenesmus, amenorrhoea, deficient lactation, cervical cancer, loss of memory(Bhattarai, 1993; Sivapalan andJeyadevan, 2012; Uddin *et al*., 2006; Umerie and Ezeuzo, 2000)

Besides this it is used as a component in herbal formulations in treatment of various disease, some of them are shown in table no 1.

S.no.	Herbal Formulation	Studied on Disease	Age group	Duration of intervention	Reference
1.	Dadimghrita	Sickle cell disease	<16yrs children of either sex	3months	(Kameshwar *et al*., 2011)
2.	Lekhaniyamahakashaya (in decoction and extract form)	Hyperlipidaemia	16-60yrs either sex	month	(Naresh, 2012)
3.	Devadarvyadivati	Gastro-intestinal Disorder	3-12yrs of either sex	4 weeks	(Patel*et al*., 2011)
4.	Agnimanthadi	obesity	16-60 yrs either sex	7 weeks	(Goyal*et al*., 2011)
5.	Amrita ghrita	rheumatism	11-50 either sex	45 days	(Lekurwale *et al*., 2010)
6.	Haritakyadiyoga	hypertriglyceridemia	10-80 yrs	2 months	(Deepti*et al*., 2015)
7.	Aviraikudineer	Diabetes	-	-	(Rajalakshmi*et al*., 2015)

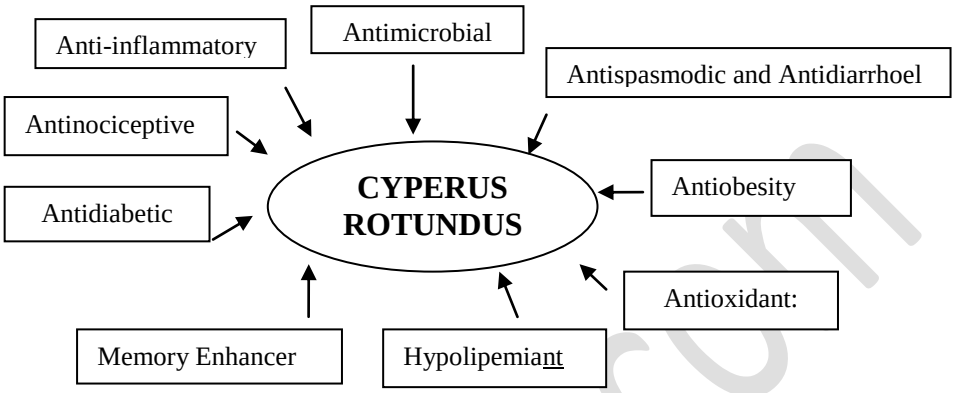
Table no 1. Shows herbal formulations of Cyperusrotundus

CHEMICAL CONSTITUENT

The major chemical components present in the extract of essential oil and rhizomes ofCyperusrotundus are terpenoids, flavonoids, essential oils, sesquiterpenes(Ohira*et al*., 1998), monoterpenes, sitosterol and glycosides(Kilani *et al*., 2005a),alpha- rotunol, beta-cyperone, beta-selinene, camphene, calcium, cyperene, cyperenone(Kakarla*et al*., 2014), cyperol, cyperolonecyperotundone D- copadiene, linolenic acid, linoleic acid, linolenic acid, oleic acid, rotundene, rotundenol, rotundone, polyphenols, pectin, stearic acid, camphene, sugeonol, sugetriol(Singh*et al*., 1970; Singh *et al*., 2012; Sivapalan and Jeyadevan, 2012 andSoman*et al*., 2013).

PHARMACOLOGICAL ACTIVITIES

CyperusRotundus exhibits a large number of medicinal properties which are describes as under



1. **Anti-inflammatory**:- Mehta*et al*., 2013have investigated the antimicrobial activity of ethanolic extract of Cyprus rotundus against streptococcus pyogenes which is mainly responsible for throat infection.In this study 16 tonsillectomy samples were collected in order to study organisms responsible for tonsillitis.

   Gelatinzymography is used to check the reduction level of inflammation by analysing the activity of MMP (Matrix Metalloprotease). Results revealed that the levels of MM-2 and MM-9 expression have been differing in 16 samples.After that, about 20% to 90% of reductions in MMP levels have been seen in all samples which show its broad range of antimicrobial action.

   Another study was done on two models (i.e.,carraagenein induced oedema and formaldehyde induce arthritis in rats). Researchers have found that the relative effect of anti- inflammatory action of cyrprusrotundus wassignificant ($P<0.001$) than that of hydrocortisone (75.9% versus 47.3% in carageenin induced oedema model: 55.1% versus 35.6% in formaldehyde induced induced arthritis model)(Singh and Gilca, 2010).

   "Triterpenoid" is the active compound found in chromatographic separation due to which its anti-inflammatory action is 8 times greater than that of hydrocortisone(Singh*et al*., 2012).

   Nitric oxide (NO) and superoxide (o_2^-) are important mediators in the pathogenesis of inflammatory disease. Seo*et al*. (2001) have found that the methanol (MeOH) extract of rhizomes of C. rotunduscould modulate NO and CO_2^- productions by murine macrophage cell line, Raw 264.7 which results, inhibition of NO^- production due to suppression of iNOSprotein, as well as iNOS mRNA expression(Seo*et al*., 2001).

2. **Antimicrobial activity**:-Sharma *et al*. investigate that the ethanolic extract of Cyperusrotundus is the most effective extract pertaining to the antimicrobial activity

against some microorganism such as S. epidermis, B. cereus, P. aeruginosa, E. coli, A. niger and C. albicans.

They suggested that this activity is due to the presence of tannins, flavonoids and steroidal alkaloids although the degree of susceptibility could differ between different organisms (Sharma and Singh, 2011). They found that a most susceptible gram positive bacterium was B. Cereus followed by S. Epidermis whereas the resistant gram negative bacteria were E. coli against all extract.

3. **Antispasmodic and Anti-diarrhoeal:-**Shamkumar*et al*. have studied that the aqueous extract of tubers of Cyperusrotundus (ACR) shows significant anti-diarrhoeal activity at the doses of 125, 250 and 500 mg/kg. The results revealed inhibition of diarrhoea was 30.36%, 37.90%, 45.45% as well as standard drug has been used as laperamide 2mg/kg which showed 92.45% of inhibition.

   Inhibition of intestinal transit has been seen in ACR at doses 125, 250, 500mg/kg and atropine sulphate at 2mg/kg dose produced 24.35%, 31.48%, 36.75% and 55.94% inhibition of intestinal transit respectively (Shamkuwar*et al*., 2012).

4. **Anti-obesity: -** A pilot study has been carried out in which administration of powdered tubers of CR on 30 obese people for 90 days showed significant reduction in weight and decrease in serum cholesterol and triglycerides as well (Karnick, 1992).

   Another study has been conducted by Athesh*et al.*, they have divided albino rats into six comprising of 6 rats each, group I served with normal fed with pellet chow group II served with high fat cafeteria diet while group III, IV, V received ATECR (aqueous tuber extract of Cyperusrotundus) at a dose level of 100, 200 and 300 mg/kg body weight along with HFCD for 40 days and VI group served with control drug (orlistat at 50 mg/kg body weight along with HFCD).

   Results revealed that ATECR treated samples showed significant reduction in the body weight gain, organ weight of the liver, kidney, spleen, and weight of fat pads and the levels of serum triglycerides, total cholesterol, LDL cholesterol, VLDL cholesterol, glucose and increase in HDL cholesterol. Along with these liver markers such as aspartate transminase (AST); alanine transaminase (ALT) and alkaline phosphatase (ALP) resumed to normal. Besides this ATECR consumption reduced stress by enhancing the levels of glutathione (GSH), glutathione peroxidises (GPx), superoxide dismutase (SOD) and catalyse in the hepatic tissue of rats with HFCD induced obesity(Athesh*et al*., 2014).

   Lemaure*et al*. found the effect of tubers extract of Cyperusrotundus on obese zuker rats. It was demonstrated that administration of 45 or 220mg/kg/day of its tubers hexane extract for 60 days in zuker rats induced a significant reduction in weight gain without affecting food consumption or inducing toxicity. In vitro, this extract was able to stimulate lipolysis in 3T3- F442 adipocytes suggesting that this medicinal plant contains activators of β-adrenoreceptors (AR). The binding assay performed on the rat β 3- AR isoform, known to induce thermogenesis, demonstrated that tubers extract can consistently and effectively bind to these receptors. These data suggest that the effect on weight gain exerted by tubers extract may be mediated, at least partially through the activation of β 3- AR (Lemaure *et al*., 2007).

5. **Antioxidant:-**A different extraction methods were used to evaluate antioxidant activity by using different in-vitro antioxidant assays. The result revealed that the total flavonoids contents in methanol extracts of Cyprus rotundus were (8.15-18.25mg CE/g of dry matter) higher as compared to ethanol extract (6.44-13.77 mg CE/0 of dry matter). Phenolic content were also higher (27.40-37.85mg GAE/g of dry matter) as compared to ethanol extract (25.21-30.23mg GAE/g of dry matter). Similarly percent inhibition of linoleic acid system, DPPH free radical scavenging capacity and reducing power all were reported higher in methanolic extract as compared to ethanolic extract(Bashir *et al*., 2012).

   One study has been carried out in Shahad University of Tehran, Iran. In this study Khalili*et al*. divided 60 male mice into six groups, 1. Control, 2.Pentylentetrazole (PTZ) - Kindled mice 3. Received valporate (100mg/kg) as anticonvulsant drug 4 to 6 which received Cyperusrotundus rhizome extract at three doses of 100, 200 and 400 mg/kg;ip). Except control group all groups were kindled by 11 injections of 48h. Except control group, in the 12^{th} injection all groups were tested for PTZ challenge dose (75mg/kg)(Khalili*et al*., 2011).

   The exhibited phase of seizure (0-6) were observed and noted for 30 min after PTZ infection. The intensity and duration of seizure could be reduced due to the hydro alcoholic extract of Cyprus rotundus. All brains were removed and the level of **MDA** (malondialdehyde; index of lipid peroxidation) were determined which is significantly reduced afterwards while **SOD** (superoxide dismutase; it is an intracellular antioxidant enzyme that catalyses converting of peroxidise to hydrogen peroxide (H_2O_2) to protect the cell from superoxide radical and oxidative stress) and **NO** (nitric oxide ; neurotransmitter in brain that is responsible for paradoxical role in the seizure modulation, as an inhibitor (Buisson *et al*., 1993) or promoter (Osonoe*et al*., 1993)in different cases, were increased in mice brain. This concluded that the extract of Cyperusrotundus exhibit antioxidant properties and could have exerted a potent antiepileptic effect(Khalili *et al*., 2011).

6. **Hypo- lipidemic**: - One intervention study has been carried out by Chandratre*et al*., 2011, they took Wister rats in 7 groups comprising of 6 rats in each group. Group 1 was fed with normal pellet diet and 0.1% sodium CMC solution and served as vehicle control and remaining 6 were fed with high fat diet enriched with high calorie and 1% cholesterol. After 10 days group 2 served as high fat diet control and left untreated while rest received treatment for 15 days. Fenofibrate (20mg/kg/day) and Simvastatin (5mg/kg/day) standard drug were given to group 3 and 4 respectively.Group 5, 6 and 7 treated with alcoholic extract of Cyperusrotundus at the dose level of 70mg/kg/day, 140 mg/kg/day, 280mg/kg/day respectively.A statistically significant reduction was observed ($p<0.05$) in serum total cholesterol, LDL, Triglyceride, HDL levels at the end of 15 days of intervention(Chandrate *et al*., 2011)

7. **Memory Enhancer**: -Soman*et al*. 2013 have studied the cognitive enhancer activity of Cyperusrotundus on midazolam induced swiss albino mice. Mice were divided into 3 groups, control group received saline, in diseased control group received 2mg/kg of midazolam and I treatment group received 100mg/kg of ethanolic extract of Cyperusrotundus after 30 min. II treatment group received 200mg/kg of ethanolic extract and midazolam. Extract has been given orally while midazolam was given intraperitonial.

The experiment has been performed by elevated plus maze apparatus for mice, the transfer latency was measured at the time of acquisition, consolidation and retrieval in mice in arranged groups. It was found significant decrease in transfer latency in elevated plus more for mice which measures the increase in memory in at the time of retrieval. This whole study would be beneficialto provide an alternative medicine for short and long term memory or semantic memory due to its neurological activities(Soman *et al*., 2013).

8. **Anti-diabetic: -**Raut and Gaikwad, 2012 conducted a study on male Sprague- dawley rats and saw anti-diabetic effect of hydro-ethanol extract of Cyperusrotundus on alloxan monohydrate induced rats. The duration of extract given once in each for 7 successive days. A dose of 300mg/kg in acetone fraction and residual left after successive fraction have found most significant ($P<0.001$) result which reduces hyperglycaemic conditions(Raut and Gaikwad, 2012).
9. **Analgesic activity:** - Imam and Sumi, 2014 have investigated the anti-nociceptive activity of hydro-methanol extract of Cyperusrotundus in mice. At the tested doses of 50, 100 and 200mg/kg, the hot plate and tail immersion test HMCR significantly increased the latency period to the thermal stimuli. A dose of 200 mg/kg showed the maximum inhibition percentage of licking in early (61.60%) and late phase (87.41%).
10. **Anti-arthritic activity:-**Singh et al., 1986 has conducted a double blind trial on 200 patients suffering from rheumatoid arthritis. Each group consist of 50 patients including placebo group. A crude powder of cyperusrotundus, withaniasomnifera and their combination (1:1) has been given in the form of capsule of 500mg three times a day for 3 months. Biweekly assessment has done on the bases of global criteria (duration of morning stiffness, articulate index, erythrocyte sedimentation rate, x-ray findings, rheumatoid factor titre, and grip strength). Results revealed that cyperusrotundus is more effective than withaniasomnifera and the response was better seen when both drugs combined (1:1) as compared to single drug.(Gupta *et al*., 1971;Singh, *et al*., 1986).

Toxicological studies :-Ahmad*et al*. 2012, conducted a toxicological study. A dose of 10, 100 and 1000mg/kg in ethanolic extract form has given for 14 days to Sprague- dawley rats. The results revealed that there has been the absence of any sign of toxicity at these doses. However dose at 1000mg/kg shows slight decrease in motor activity. Different biochemical parameters and other liver enzymes are found normal and statistically non significant while there is no significant increase in serum bilirubin, gamma- GT and SGPT was observed. Haematological and histo-pathological examinations on different organs of rats also show safe and non toxic.

CONCLUSION:-

All above evidence from the literature suggest that Cyperusrotundus has a great potential against diarrhoeal pathogens, inflammations, infections, menstruationproblems, obesity etc. They have shown remarkable actions on varying degrees of anti-diabetic, antioxidant, hypolipidemic, memory enhancer, arthritis and other gastro-intestinal disorders. The aim of this review is to attract the attention of researchers to make new herbal formulations from Cyperusrotundus and carryout collaborative research and clinical trials to overcome the challenges of inflammations, infections and lifestyle disorders.

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