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Pharmacological Investigations of *Cyperus rotundus* Tuber Extract in Monosodium Glutamate Induced Experimental Animal

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ABSTRACT

Nowadays obesity is the major health problem due to food habit and life style of people. Nature and natural compounds possess lots of health benefits. To explore the therapeutic benefit of *Cyperus rotundus* in this work, we have evaluated the anti-obesity potential on Monosodium glutamate (MSG) induced obese rats. Methanolic extract of tubers of *Cyperus rotundus* was administered at the dose of 250 and 500 mg/kg/oral after 45 d of treatment and a significant improvement in body weight, organs and lipid profile was observed as compared with MSG induced obese rats. Nowadays obesity is a common metabolic disorder in developed and developing countries. It was observed that *Cyperus rotundus* tuber possesses anti-obesity potential and protective action on heart and liver.

Keywords: *Cyperus rotundus*, obesity, Monosodium glutamate, Lipid profile, Orlistat

1. INTRODUCTION

Plants drugs are always play a major role for treatment of human ailments. Nowadays researchers are focusing more on natural and herbal drugs for treatment of different ailment human and animals all over the world.[1] *Cyperus rotundus* (figure 1) widely used in traditional medicine around the world for the treatment of various ailments like diabetes, diarrhoea, fever, enhancement of memory, anthelminthic, anti-fungal, anti-parasitic, anti-rheumatic, antispasmodic, aphrodisiac and astringent. It also possess protective actions on liver, spleen, and pancreas.[2]

Cyperus rotundus is commonly known as Nagarmotha belonging to (family-*Cyperaceae*). major chemical constituent in the rhizomes extract of *Cyperus rotundus* consist of terpenoids, flavonoids, sitosterol and glycosides α-rotunol, β-cyperone, β-selinene, camphene, cyperene, cyperenon, cyperol, cyperolonselinene, cyperotundone, D-copadiene, linolenic acid, oleic acid, rotundene, rotundenol, rotundone, polyphenols, pectin, stearic acid, camphene, sugeonol, sugetrio.[3]

Obesity increases the risk of medical illness and premature death and thus imposes an enormous economic burden on the health care system. Obesity is one of the most prevalent health problems in the western world and developing countries. The clinical manifestations in these conditions may include increased insulin resistance, hyperglycemia, dyslipidemia, endocrine disruptions, and fatty liver disease.[4]The administration of monosodium glutamate to new born rats causes the destruction of the ventromedial hypothalamic and arcuate nuclei, leading the rats to develop obesity due to the lack of control between absorption and energy expenditure.[5] The main objective of present study is to evaluate the pharmacological potential of methanolic extract of *C. rotundus* tubers and establish its pharmacological potential in MSG induced obese rat model.

Fig. 1a: Tuber of *Cyperus rotundus*

Fig. 1b: Whole plant of *C. rotundus*

2. MATERIALS AND METHODS

2.1 Drugs and chemicals

All chemicals reagents used in this study are pharmaceutical grade. Orlistat capsule was purchased from local dealer Afeslim60 capsule (Systoniclife sciences).

2.2 Plant material

Tubers of *C. rotundus* were collected from local region of Moradabad, Uttar Pradesh, India in the month of January-February. Tubers were washed under running tap water followed by rinsed with distilled water for five minutes. Leaves of *C. rotundus* were identified and authenticated by Prof. Ashok Kumar, head department of Botany, IFTM University, specimen no. MKPH: 2017

2.3 Animals

Studies were carried out using Wistar albino rats of both sexes (15-100 g). They were housed in standard cages at room temperature 25±2 °C and 50±5% relative humidity, under a light/dark cycle of 12/12 h, for 1 w before the experiment for acclimatization. Animals were provided with standard rodent pellet diet (Amrut, India), and water *ad libitum*. Experiments were performed after the approval of institutional Animal Ethical Committee IFTM University (IAEC approval no: 2016/837ac/MPh/17).

2.4 Extraction

Tubers were washed and shades dried and were pulverized by an electrical blender. The coarse powder was passed through sieve No.20. Methanolic extraction was carried out by mixing the powdered (500 g) powder with methanol for 2days. The resulted extract was filtered and concentrated by rotary evaporator under reduced pressure and low temperature.

2.5 Induction of obesity

40 d old rats were selected for the Experiment and obesity was induced by giving monosodium glutamate (MSG) mixed with rat food.

2.6 Sample collection

At the end of 40 d the animals were deprived of food overnight and sacrificed by high dose of anesthesia. Plasma was separated for the estimation of lipid profile; liver functions test and liver were dissected out.

2.7 Biochemical measurements

Determination of lipid profile Total Cholesterol, Triglyceride content in plasma was estimated by using a reagent kit, (Span Diagnostic Ltd. Surat India).

2.8 Statistical analysis

Results were analyzed using the EXCEL and SPSS statistical software and $P \leq 0.05$was considered as statistically significant. The results were expressed as mean ± Standard Error Mean.

3. RESULTS

3.1 Preliminary phytochemical screening

The phytochemical screening of ethanol extract of *Cyperus rotundus* rhizomes has revealed presence of Carbohydrates, Alkaloids, Amino acid, Tannins and Phenolic compounds, Flavonoids, Saponnins. The result obtained were presented in the table 1

Table 1: Preliminary phytochemical screening

S. No.	Phytochemical	EEAA
1	**Test for carbohydrate**	
	Molisch test	+
2	**Reducing sugar test**	
	a-Fehling's test	+
	b-Benedict's test	+
3	**Test for Alkaloids**	
	a-Dragendroff's test	-
	b-Wager's test	-
	c-Hager's test	+
4	**Test for amino acid**	
	Ninhydrin's test	-
	Tyrosine test	-
5	**Test for flavonoids**	
	Alkaline reagent test	+
6	**Test for tannins and phenolic compound**	
	5% $FeCl_3$solution test	+
	Lead acetate	+
	Potassium dichromate solution test	+
	Dilute iodine test	+
7	**Test for saponnins**	
	Foam test	+
8	**Test for proteins**	
	Biuret test	-
	Millon's test	+
9	**Cardiac glycosides**	**-**
10	**Triterpinoids**	**-**

(+) Sign indicates presence and (-) Sign indicates absence.

3.2 Pharmacological potential

Table 2: Effect of *Cyprus rotundus* tuber extracts in triglyceride level of MSG induced obesity

S. No.	Treatment group	TG level	% change in TG level
		AVG±SEM	AVG±SEM
1	Normal control	155.7±0.5**	
2	Negative control (MSG)	215.2±1.4	38.2±0.9
3	Standard Orlistat 21.67 mg/kg	152.7±0.6**	-29.0±0.3
4	MSG+MECR (250 mg/kg)	162.7±0.8**	-24.4±0.4
5	MSG+MECR (500 mg/kg)	157.2±2.1**	-27.0±1.0

** indicates significant difference from the Negative control at $p<0.05$. All data were analysed by one-way ANOVA followed by Dunnett's t-test.

Table 3: Effect of *Cyprus rotundus* tuber extracts in cholesterol level of MSG induced obesity

S. No.	Treatment group	CHOL level	% change in CHOL level
		AVG±SEM	AVG±SEM
1	Normal control	37.7±0.4**	
2	Negative control (MSG)	60.3±0.7	60.2±1.9
3	Standard Orlistat 21.67 mg/kg	41.2±0.5**	-31.8±0.8
4	MSG+MECR (250 mg/kg)	44.3±0.8**	-26.5±1.3
5	MSG+MECR (500 mg/kg)	42.2±1.0**	-30.1±1.7

** indicates significant difference from the Negative control at $p<0.05$ All data were analysed by one way ANOVA followed by Dunnett's t-test.

Table 4: Effect of *Cyprus rotundus* tuber extracts in SGOT level of MSG induced obesity

S. No.	Treatment group	SGOT level	% change in SGOT level
		AVG±SEM	AVG±SEM
1	Normal control	115.0±0.9**	
2	Negative control (MSG)	153.5±1.0	33.5±0.9
3	Standard Orlistat 21.67 mg/kg	124.3±0.9**	-19.0±0.6
4	MSG+MECR (250 mg/kg)	129.8±1.2**	-15.4±0.8
5	MSG+MECR (500 mg/kg)	127.3±0.4**	-17.0±0.3

** indicates significant difference from the Negative control at $p<0.05$. All data were analysed by one-way ANOVA followed by Dunnett's t-test.

Table 5: Effect of *Cyprus rotundus* tuber extracts in SGPT level of MSG induced obesity

S. No.	Treatment group	SGPT level	% change in SGPT level
		AVG±SEM	AVG±SEM
1	Normal control	25.2±0.6**	
2	Negative control (MSG)	59.7±0.4	137.1±1.7
3	Standard Orlistat 21.67 mg/kg	27.8±0.4**	-53.4±0.7
4	MSG+MECR (250 mg/kg)	32.0±1.0**	-46.4±1.6
5	MSG+MECR (500 mg/kg)	30.5±0.6**	-48.9±0.9

** indicates significant difference from the Negative control at $p<0.05$. All data were analysed by one way ANOVA followed by Dunnett's t-test.

3.3 Histopathological assessment of heart

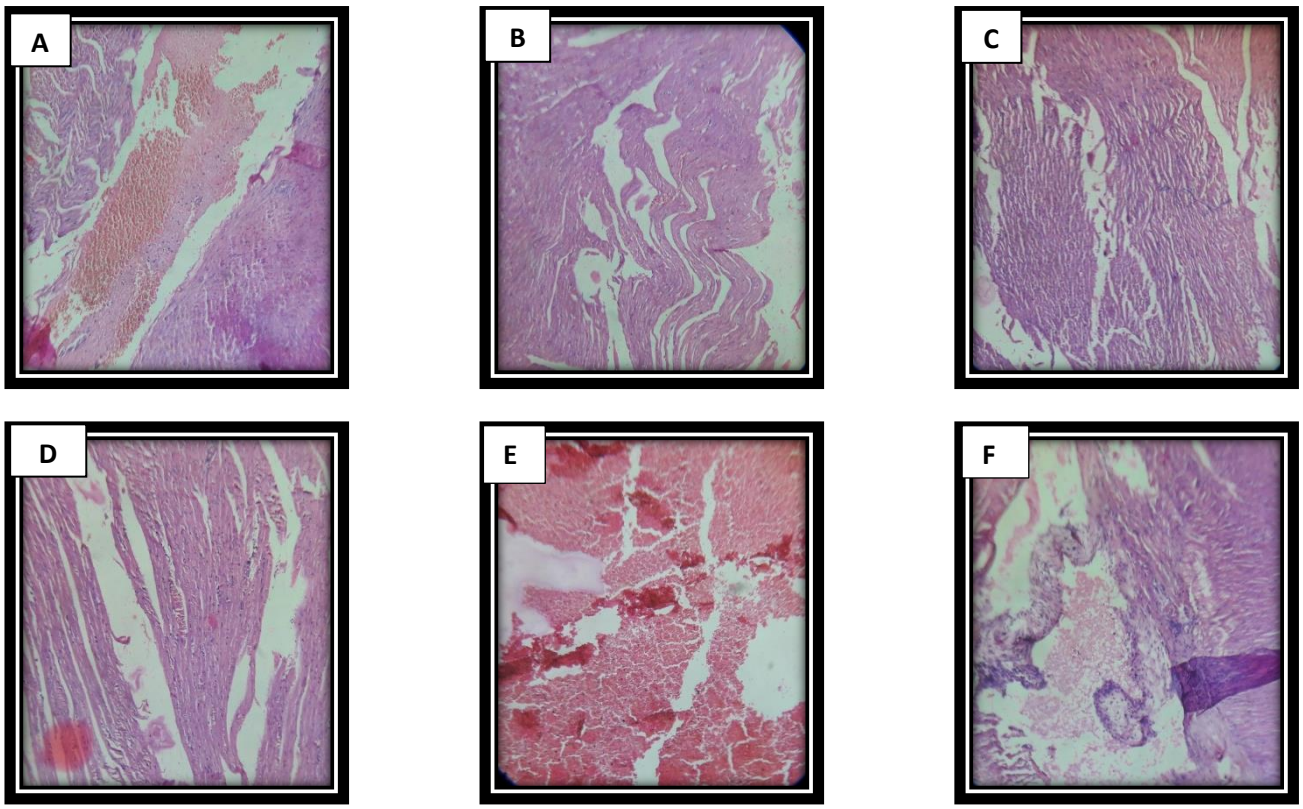

Fig. 2: Histopathological assessment of Heart (A) section of heart treated with 1%CMC,(B) section of heart treated with normal diet, (C) section of heart treated with MECR (250 mg/kg)+MSG (D) section of heart treated with MECR (500 mg/kg)+MSG, (E) section of heart treated with MSG, (F) section of heart treated with Orlistat (21.67 mg/kg) and MSG

3.4 Histopathological assessment of liver

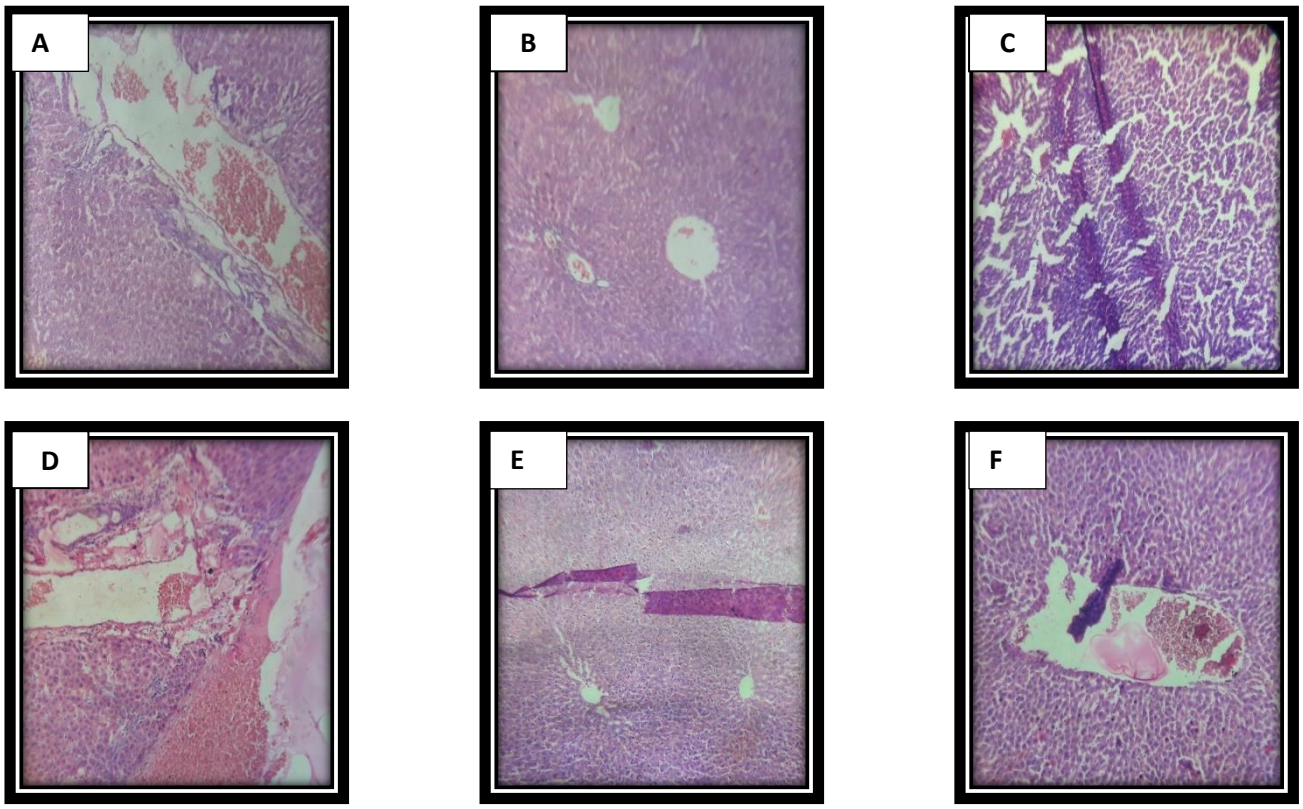

Fig. 3: Histopathological assessment of Liver (A) section of liver treated with 1%CMC,(B)) section of liver treated with 1%CMC, (C) section of liver treated with MECR(250 mg/kg)+MSG (D) section of liver treated with MECR (500 mg/kg)+MSG,(E) section of liver treated with MSG, (F) section of liver treated with Orlistat (21.67 mg/kg)+MSG

3.5 Histopathology

Heart histology is represented in figure 2 while Figure 3 represents histopathology of liver. The liver histopathology of MSG treated rats figure: 4E shows both micro-and macro-vesicular steatosis of moderate to severe degree in most of the hepatic lobules. Additionally, some of the animals showed focal areas of necrosis with sinusoidal congestion. Liver steatosis was absent in the normal rats (i.e. figure 3A and 3B) but present in negative control (3E). It is also observe that the rats treated with MSG more fats deposited on the hepatocytes (3E) while it is decreases in rats treated with standard drug Orlistat and test drugs 500 mg/kg (figure 3D and 3F). Histopathological study of heart indicates deposition fat on MSG treated heart cells(figure 2E. It is decreases or absent in normal cells and standard and test drugs treated heart cells (fig. 2A, 2B, 2D, 2F.

4. DISCUSSION

In the developing country obesity is a major health problem. Obesity and overweight have increased at an alarming rate in the world during the last three decades. Obesity is a crucial factor in the development of metabolic abnormalities, including glucose intolerance, insulin resistance, metabolic syndrome, low-grade inflammation and oxidative stress.[6]

In order to find effective anti-obesity treatments, different animal models of obesity have been used. Rat models with MSG-induced obesity, considered useful for evaluation of the anti-obesity effect of drugs. The supplementation of MSG in their diet is an imperative factor which leads to the development of obesity. The current study was conducted by using MSG induced obesity model in rats. MSG in diets has been previously reported to increase oxidative stress and cause obesity in humans as well as animal. [7, 8]

Despite of large number a drug available in market for management of obesity synthetic anti-obesity drugs possess more side effects. Drug related side effects are major problem for treatment of obesity.[4]As stated; earlier plant and herbs are the foundation of the traditional system. Plants have shown considerable improvement in parameters of obesity devoid of any visible adverse effects. Hence, they are being widely used in treating obesity.[9]

In this study result of Table 1 indicate that *C rotundus* contains flavonoid, tannin, and steroid/triterpenoid. Similar to other herbs, natural medicines contain an abundance of

constituents that may have certain pharmacological effects. It was observed that drugs use for treatment of obesity causes destruction of liver cells. In this study, we observed that in Table: 2 to 5 indicate that *C. rotundus* possess both anti-hyperlipidemic and hepatoprotective action so that it can be better alternative for treatment of obesity due to hyperlipidemic conditions. In histopathology (Figure 2 A-E and 3A-E) indicates that deposition of fatty plaque is more in untreated group in comparison with test and standard drug treated group.

5. CONCLUSION

In this study it was observed that *C rotundus* improved lipid profile and liver functions parameters. In histopathological study it was also confirmed that it possess protective action on heart and liver. *C rotundus also* possess anti-obesity potential and prevent weight gain. There are several contributed ways of *C rotundus* as anti-obesity agent, including: inhibiting lipid absorption, having diuretic properties, and suppressing appetite. In future, this work can be extended by including more obesity models and establishing its mechanism to confirm the anti-obesity potential of *C rotundus.*

CONFLICT OF INTERESTS

The authors declare that there is no any conflict of interest in this study.

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