

SHORT COMMUNICATION

ANTIDIABETIC ACTIVITY OF METHANOL EXTRACT OF RHIZOMES
OF *CYPERUS TEGETUM* ROXB. (CYPERACEAE)NITAI CHAND CHAULYA^{1*}, PALLAB KANTI HALDAR² and ARUP MUKHERJEE³¹Gupta College of Technological Sciences, Ashram More, GT Road, Asansol-713301, West Bengal, India²Department of Pharmaceutical Technology, Jadavpur University, Kolkata-700032, India³University Colleges of Science and Technology, Calcutta University, 92 APC Rd., Kolkata-700009, India**Keywords:** diabetes mellitus, *Cyperus tegetum*, antidiabetic activity, alloxan monohydrate

Diabetes mellitus, often simply referred to as diabetes, is a group of metabolic diseases in which a person has high blood sugar, either because the body does not produce enough insulin, or because cells do not respond to the insulin that is produced. This high blood sugar produces the classical symptoms of polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger) (1). Diabetes mellitus type 2 formerly non-insulin-dependent diabetes mellitus (NIDDM) is a metabolic disorder that is characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency (2). In NIDDM, insulin resistance is a major pathophysiologic factor influencing glucose homeostasis. NIDDM accounts for over 85% of diabetes worldwide and is associated with morbidity and mortality, resulting from its microvascular, macrovascular and neuropathic complications (3). The treatment of hyperglycemia in patients with NIDDM is directed towards achieving euglycemia and eliminating or minimizing the chronic complications. Unfortunately, none of the oral hypoglycemic agents have been successful in maintaining euglycemia, and in addition have a number of side effects (4). In recent years, substantial efforts have been made to identify efficient antidiabetic agents, as synthetic hypoglycemic agents are associated with many disorders and their effectiveness is limited and prone to a variety of side effects (5). Despite considerable progress in the management of diabetes mellitus by conventional synthetic drugs, research work on natural agents has greatly increased all over the world. It has become quite clear that the use of herbal products

to treat type 2 diabetes mellitus has greatly increased during the past decades (6, 7). Plants used in folk medicine to treat diabetes mellitus represent a viable alternative for the control of this disease (8). The plant, *Cyperus tegetum* Roxb. (Family Cyperaceae) is glabrous and robust perineal sedge found throughout India up to an altitude of 1800 m (9). The plant is commonly known as mat stick, madurkathi (Bengali). It is cultivated as an economic crops in Paschim Midinipur district of West Bengal and traditionally used by the tribal people for the treatment of cachexia, atrophy, snake bite and antidiabetic (10). Going through the literature survey it was found that although activities like anticonvulsant (11), sedative (12), antimalarial (13), antiarrhoeal (14), antidiabetic (15) etc., have been reported by several research workers on other plants belonging to Cyperaceae family, there is no scientific report on the plant *Cyperus tegetum* Roxb. of the same family. The present investigation was carried out to evaluate antidiabetic activity of methanol extract of rhizomes of this plant and find how it correlates with its phytoconstituents.

MATERIALS AND METHODS

Plant material

The plant *Cyperus tegetum* Roxb. (Family: Cyperaceae) was collected from the cultivated land of Paschim Medinipur, West Bengal in the months of June-July. Botanical Survey of India taxonomically identified the plant. A voucher specimen (CNH/I-I (198)/2007/ Tech.II/162) has been pre-

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served in our laboratory for further references. The rhizomes were washed, dried at room temperature under shed and then grounded in a mill to a coarse powder.

Extraction of plant material

The powdered rhizomes were subjected to successive Soxhlet extraction using a series of solvents of increasing polarity starting from petroleum ether, chloroform, and methanol, respectively. The extracts were vacuum dried and the percentage yields of the extracts were 2.1%, 3.0%, and 5.4%, respectively.

Preliminary phytochemical analysis

The phytochemical tests were performed using various reagents as described in Table 1 (16–18). The methanol extract was tested for the presence or absence of alkaloids, glycosides, tannins, steroids,

reducing sugars, proteins and amino acids, phenolic compounds and flavonoids (Tab. 1)

Acute toxicity study

The acute toxicity of methanol extract of *Cyperus tegetum* Roxb. was studied on Swiss albino mice (20–25 g) following Karber's method. The Institutional Animal Ethical Committee permitted the use of the animals for this purpose. After fasting condition for overnight, the animals divided into six groups (four in each group), were administered a dose of 100, 200, 400, 800, 1600 and 3000 mg/kg b.w. intraperitoneally (*i.p.*). No animals were found died but sedation of the test animals was observed.

Antihyperglycemic studies

Animals

Healthy adult Wistar strain albino rats (180–200 g) were screened for the study. The rats

Table 1. Qualitative phytochemical evaluation of the *Cyperus tegetum* Roxb. extracts

Phytoconstituents	Test performed/reagents used	Presence (+) or absence (–)
Alkaloids	Mayer's test	+
	Dragendorff's test	+
	Hager's test	+
Steroids	Liebermann-Burchard test	–
Flavonoids	Shinoda test	+
Tannins	Ferric chloride	+
	Lead acetate	+
Saponins	Test for stable foam	+
Glycosides	Borntager test	–
Proteins and amino acids	Ninhydrin test	+
Reducing sugars	Fehling's test	+
	Benedict test	+

Table 2. Effect of methanol extract of *C tegetum* rhizome (MECT) on blood glucose levels of alloxan-induced diabetic rats.

Treatment	Blood glucose level (mg/100 mL) at different time					
	0 h	1 h	2 h	3 h	4 h	7 th day
Control	81.62 ± 7.41	80.23 ± 5.23	78.16 ± 10.25	80.11 ± 4.61	81.02 ± 6.58	78.06 ± 7.48
Diabetic untreated	215.21 ± 5.35*	210.02 ± 8.15*	215.08 ± 7.04*	213.74 ± 2.01*	212.15 ± 8.19*	213.73 ± 4.69*
Diabetic treated with metformin	268.52 ± 8.15*	260.52 ± 6.31*	230.35 ± 6.29*	205.38 ± 3.52*	180.68 ± 2.05*	150.25 ± 5.12*
Diabetic treated with MECT 250 mg/kg	250.24 ± 6.27*	240.16 ± 5.72*	228.69 ± 8.02*	220.16 ± 6.12*	215.17 ± 6.57*	197.58 ± 3.64*
Diabetic treated with MECT 500 mg/kg	304.36 ± 7.24*	300.25 ± 9.12*	260.71 ± 4.86*	215.81 ± 13.09*	167.16 ± 3.16*	124.52 ± 1.05*

Values are the mean ± SD, (n = 6). * p < 0.05 as compared to vehicle control on corresponding time

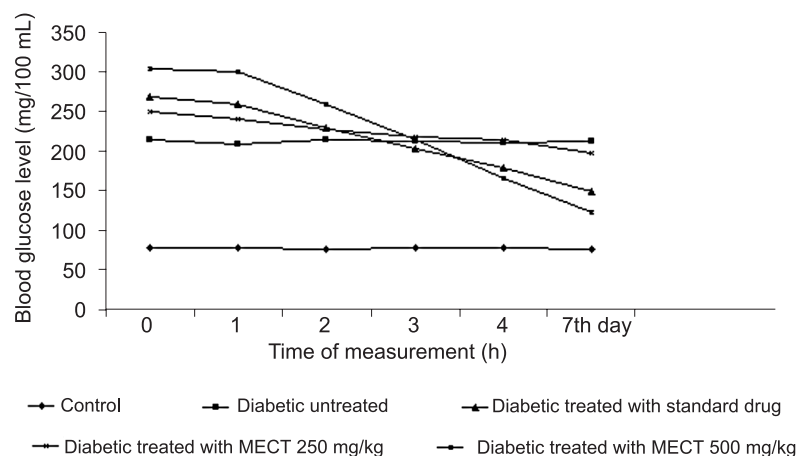


Figure 1. Effect of methanol extract of *C. tegetum* rhizome on alloxan-induced diabetes in rats

were housed in standard polypropylene cages maintained under standard laboratory conditions at an ambient temperature of $25 \pm 2^\circ\text{C}$ and 45–55% relative humidity with 12 h light-dark cycle. The animals had free access to standard pellet diet (Hindustan Lever Ltd.) and water *ad libitum*. Institutional Animal Ethics Committee (Reg. No.955/a/06/CPCSEA), constituted under the guidelines of CPCSEA, Ministry of Environment, Govt. of India, New Delhi, approved all the animal experimental protocols.

Induction of diabetes

Hyperglycemia was induced in overnight fasted Wistar strain rats (180–200 g) by a single *i.p.* injection of freshly prepared alloxan monohydrate in normal saline (150 mg/kg b.w.).

Evaluation of antidiabetic activity of methanol extract

Diabetes was induced in Wistar strain rats (weighing 180–200 g) by *i.p.* administration of ice-cold aqueous alloxan monohydrate (150 mg/kg b.w.) (19). The blood samples were collected from tail vein on 15th day and blood glucose levels were estimated. Rats having blood glucose levels above 200 mg/dL were selected for further experiments. The rats were divided in five groups of six rats each: group I (normal rats), group II (diabetic untreated rats), group III (diabetic rats treated with 150 mg/kg of metformin), group IV (diabetic rats treated with MECT 250 mg/kg) and group V (diabetic rats treated with MECT 500 mg/kg). All groups were treated orally once a day for 7 days. Rats in group I and II were treated with vehicle. The blood glucose levels were evaluated at regular time intervals at 1, 2, 3

and 4 h after the first treatment (acute treatment) and on the seventh day, 1 h after the last treatment (chronic treatment).

RESULTS AND DISCUSSION

Alloxan, a β -cytotoxin, causes a massive destruction of β -cells of the islets of Langerhans resulting in reduced synthesis and release of insulin (20). It results in elevation of blood glucose level. Expression of elevated blood glucose level confirmed the induction of diabetes in alloxan-induced experimental rats. In the present study, hyperglycemia produced by alloxan monohydrate was significantly (*t*-test) lowered by administration of methanol extract of rhizomes of *C. tegetum* in a dose of 250 and 500 mg/kg b.w. after 4 h of treatment (Tab. 2 and Fig. 1), but the extract could not produce any hypoglycemic effect in normal rats. This reduction of blood glucose levels could be due to the possibility that some β -cells are still surviving to act upon by *C. tegetum* extract to exert its insulin releasing effect. Hence, the methanol extracts may be considered to have good antihyperglycemic active principles without causing any hypoglycemic effect unlike insulin and other synthetic drugs. The phytochemical screening of methanol extract revealed the presence of flavonoids, phenolic compounds, tannins, saponins and reducing sugars. Flavonoids, sterols, triterpenoids, alkaloids and phenolics are known to be bioactive antidiabetic principles (21, 22). Flavonoids are known to regenerate the damaged β cells in the alloxan diabetic rats (23). Phenolics are found to be effective antihyperglycemic agents (24). It was reported that *C. tegetum* rhizome has free radical, hydroxyl radical scavenging property and an inhibitory effect on the production of NO. (25).

It is well known that oxygen free radicals are involved in the diabetogenic action of alloxan (26) and antioxidants have been shown to be effective in diabetes (27). The injection of hydroxyl radical scavengers into animals protected them against the diabetogenic action of alloxan (28). Flavonoids and phenolic compounds are potential sources of antioxidants, which have been shown to be effective in diabetes. The present investigation suggests that the antihyperglycemic activity of *C. tegetum* rhizome may be due to its free radical scavenging activity against alloxan-induced free radicals.

CONCLUSION

Methanol extract of rhizomes of *C tegetum* exhibited significant anti hyperglycemic activities in alloxan-induced diabetic rats. Further studies will be focused on determination of the mechanism(s) of action, as well as on the isolation of bioactive principles.

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