Pharmacognosy Magazine
ISSN: 0973-1296

PHCOG MAG.
An official Publication of Phcog.Net

PHCOG MAG.: Research Article
Evaluation of hypoglycemic and antidiabetic activity of bark of *Butea monosperma*

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ABSTRACT

Plants and plants extracts have been used for many years as folklore medicine. Therefore the objective of present study was to screen different extracts of *Butea monosperma* for antidiabetic activity and to rationalize the folk claim. In light of the traditional claim of *Butea monosperma* in the treatment of diabetes, investigations were carried out to evaluate the effects of extract from the bark of *Butea monosperma* on normal and alloxan induced diabetic mice. Glucose tolerance test was also performed. The studies indicate that the crude aqueous extract exhibited statistically significant hypoglycaemic ($P < 0.01$) and anti-hyperglycemic ($P < 0.001$) activities in normal and alloxan-induced diabetic albino rats respectively.

KEY WORDS: Anti-diabetic activity, *Butea monosperma,* Glucose tolerance test, hypoglycemic study,

INTRODUCTION

Butea monosperma; family- Fabaceae Synonym: *Butea frondosa* Varnacular name: English-Flame of the forest Hindi- Dhak, Palas and Found throughout India.(1) The methanol extract of Butea monosperma seeds, tested in vitro, showed significant anthelmintic activity.(2,3) Anticonvulsive (4) and hepatoprotective (8) activity of Butea monosperma flowers was evaluated the latter being attributed to Isobutrin and butrin (8). Estrogenic/antiestrogenic potential and antifertility activity of *B monosperma* seeds was evaluated (6). Anti-diarrhoeal (5) activity and antifungal constituent from the stem bark of *Butea monosperma* was reported (7).

Isolation and in vitro antimicrobial efficiency of *Butea monosperma* seed oil was also observed (9, 10). 'Pippali Rasayana the mixture of Palash (*Butea monosperma*) and Pippali (Piper longum) was found useful in Giardiasis(11). Butea monosperma has been also evaluated for antistress (13) antifertility (14) activity. The effect of oral administration of the aqueous and alcoholic extracts of the leaves was assessed on stress, cognitive function, and anxiety in albino rats (15, 16). Ethyl acetate, butanol and aqueous fractions derived from total methanol extract of *Butea monosperma* flowers were evaluated for free radical scavenging activities using different *in vitro* models (17). Alcoholic bark extract of Butea *monosperma* was found useful in healing of cutaneous wound in rats (18). A potential antiviral flavone glycoside from the seeds of *Butea monosperma* was also identified and isolated. Three glucosides have been identified as coreopsin, isocoreopsin and sulphurein from the seeds of *Butea monosperma*(19). Flavone glycosides have been isolated from butea monosperma (20). An imide from the pods of *Butea monosperma*(palasonin-N-phenyl imide) was isolated and identified.[21] Use of Bacto-arga--a binding matrix for purification of a lectin from *Butea monosperma* seeds was also done(22, 23). Recently antidiabetic activity of flowers was evaluated (12) Diabetes mellitus is a common metabolic disorder with multiple etiologies and is associated with variety of irreversible complications. The modern management of diabetes, in spite of newer developments, remains unsatisfactory. Thus there is continuous need to develop antidiabetic drug in view of alarming rise in diabetic patients worldwide. The search for natural sources still leads to drug discovery and drug design has established with unexpectedly fast developing biotechnology and biomedical fields.

Literature survey revealed that the bark of the plant *Butea monosperma (fabaceae*) is traditionally used in Indian system of medicine for treatment of diabetes (1) However this is not evaluated experimentally or scientifically, hence we evaluated the hypoglycemic and antidiabetic activities of the extracts from the bark of *Butea monosperma* .

MATERIALS AND METHODS

Plant material and Preparation of the extracts: As anti-diabetic activity of *Butea monosperma* barks isn't

reported in literatures so *Butea monosperma* barks was selected for evaluation. Material was collected From Amravati university campus In month of July 2005 and Authenticated by Dr. Prabha Bhogaokar, Head, Botany Department, Vidharbha institute of Humanities And science, Amravati, [MS].

The powdered bark material was extracted using methanol in a soxhelet apparatus and water extract was prepared by hot maceration. The solvent was completely removed by using rotary flash evaporator and yield obtained were 5.2 gm and 17.5 gm respectively. Preliminary chemical evaluation was performed and discussed in results.

Animals

Albino Wister mice of either sex weighing (20-30g) were maintained in the animal house of Anuradha College of pharmacy, Chikhali, Dist. Buldhana [MS]. The mice were breed in institutional animal house. All animals were housed in standard polypropylene cages (48x35x22 cm) at room temperature (20±2°C) with artificial light from 7.00 am to 7.00pm, and provided with pelleted food (Standard laboratory diet) and water ad libitum. Ambient relative humidity was 55-60%. Prior to each study, the animals were subjected to fasting for 18 h. The protocol for the study was approved by The Animal Ethical Committee of Animal Breeding and Research, Anuradha college of Pharmacy, Chikhali.

Preparation of Extracts

The suspensions of methanol and aqueous extracts were prepared by using 0.5 % w/v CMC (SD Fine Chemicals, Mumbai, India) in normal saline solution.

a) Standard Drug and selection of Dose

Metformin tablet (500 mg/tab.) manufactured by USV Limited was used as a standard drug. The dose (75 mg/kg B.W.) of Metformin was selected on the basis of adult human effective dose.

Acute and short-term Toxicity Study

The methanolic and aqueous extracts were tested for its acute and short- term toxicity in mice (24). To determine acute toxicity of different doses of the drug (1.0, 3.0 and 5.0 g/kg) were administrated to different groups of mice (2 mice were used for each group; control mice received 0.5% CMC). Mortality and general behavior of the animals were observed periodically for 48 h. The animals were observed continuously for the initial 4 hr and intermittently for the next 6 h and then again at 24 h and 48 h following drug administration. The parameters observed were grooming, hyperactivity, sedation, loss of righting reflex, respiratory rate and convulsion.

To study short- term toxicity, 3 groups of mice 3 male mice (20-25 g, body weight) each were used. Group I was kept as control and group II and III received 500 mg/kg methanolic and aqueous extracts respectively in 0.5% CMC. The drug was administrated daily for 7 days (p.o.). Control group received 0.5% CMC in an identical manner. The behavior of the animals was observed daily for 1h in the forenoon (10 to 11 A.M.) for 7 days.

Induction of Experimental Diabetes

Mice were fasted for 18 hrs and experimental diabetes was then induced by administration of three doses of alloxan monohydrate (150 mg/kg) each i.p. at intervals of 48 hrs. Seven days after the last administration, the animals were fasted for 18 hrs and blood glucose levels were determined. Animals with fasting blood glucose levels ranging from 200-300 mg/dl (mild diabetic mice) were used for the study (25).

Determination of Blood Glucose Level

For glucose determination, blood was obtained by snipping tail with the help of sharp razor. Blood glucose level was monitored by using Hypoguard Advance Blood Glucose Meter, imported and marketed in India by Nicholas Piramal Ltd. Each time the tail of the mice was sterilized with spirit (26, 27).

1. Hypoglycemic study in normal fasted mice: (28)

Animals were fasted overnight and were divided in to four groups of five each as follows

Group1- Received 3% CMC suspension as control group

Group2- Received Metformin (75mg/ kg) body weight as Std. group

Group3- Received aqueous extract (500mg/ kg) body weight

Group4- Received Methanol extract (500mg/ kg) body weight

Blood Samples were collected after 120 min of drug administration.

Results are elaborated in table 1 and figure 1

2. Hypoglycemic study in alloxan induced Diabetic mice: (28)

Alloxan in a dose of 150Mg/kg body weight was given i.p. And 25% mortality was observed. Mice having blood glucose level above 200mg/dl were selected for experimentation. Animals were divided in to four groups of six animals each as follows

Group 1- Received 3% CMC suspension as control group.

Group 2- Received Metformin (75mg/ kg) body weight as Std. group.

Group 3- Received Aqueous extract (500mg/ kg) body weight.

Group 4- Received Methanol extract (500mg/ kg) body weight.

Blood samples were collected at the interval of 0, 1, 2, 3, 5 And 24 hours for estimation of blood glucose levels. Results are elaborated in table 2 and figure 2.

3. Effect on Glucose loaded mice (Glucose tolerance test)

Only aqueous extract significantly decreases blood glucose level as compared to the control group. Methanolic extracts failed to show the activity in diabetic mice. So in study of effect on glucose loaded mice only Aqueous extract was selected. Animals were fasted overnight and divided in to three groups of five each

Group1:- 3% CMC suspension as control group.

Group2:- Metformin (75mg/kg) body weight as standard group.

Group3:- Aqueous extract (500mg/kg) body weight.

The mice of all the groups were loaded with 2.5% glucose 30 min after drug administration. Blood glucose levels were determined at 0, 30, 90 and 120 min after drug administration. Results are elaborated in table 3 and figure 3.

Statistical Analysis

Results are expressed as mean fasting blood glucose level (FBGL) ± Standard Deviation and were analylised using Instat software by one way ANOVA, followed by Dunnett's multiple square test.

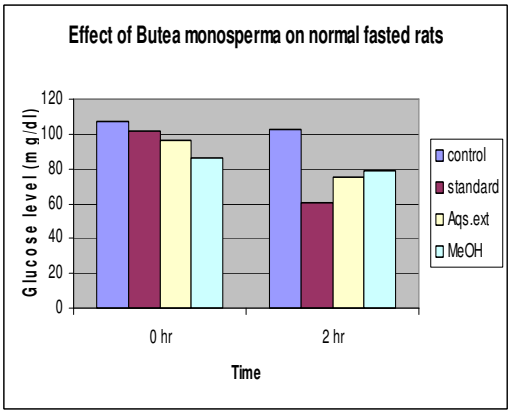

Figure 1. Hypoglycemic activity in normal fasted mice

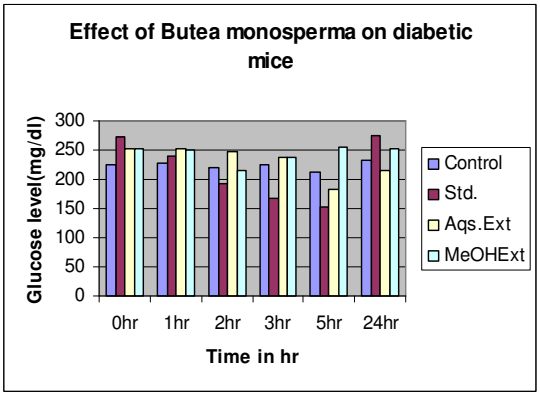

Figure 2. Results alloxan induced diabetic mice

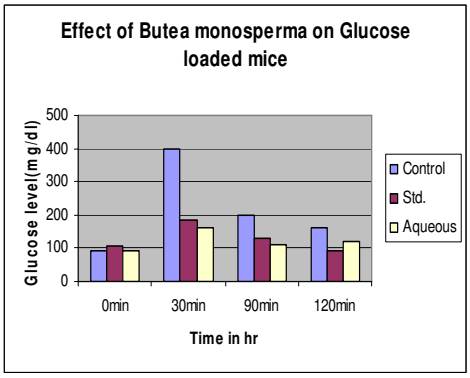

Figure 3. Effect of Aqueous extract of bark of Butea monosperma on Glucose loaded mice

Table 1. Hypoglycemic activity in normal fasted mice

Sr.no.	Groups	Blood glucose level(mg/dl)	
		0 hr	2hr
1	Control	107.00±11.6	102±11.5
2	Std.	102.20±7.9	60.4±7.7***
3	Aqueous	96.00±13.7	75.00±13.4**
4	Methanol	86.00±10.7	79.00±5.9*

*Values are mean ±SD; n=5, **p<0.01, ***p<0.001, *p<0.05 ; as compared to control group at 2 hr.*

Table 2.Results alloxan induced diabetic mice

Sr.no.	Groups	Blood glucose level (mg/dl)					
		0hr	1hr	2hr	3hr	5hr	24hr
1	Control	225.67±19.6	227.33±16.8	220.33±13.2	224.50±11.9	213.00±14.7	233.5o±23.3
2	Std.	271.33±22.5	240.00±19.0	192.83±19.7	167.00±17.3*	152.00±21.0**	274.00±26.6
3	Aqueous	252.50±38.1	251.83±34.2	248.17±31.7	238.17±31.0	183.00±41.2***	214.00±47.7
4	Methanol	251.67±31.0	249.17±22.0	215.17±40.3	237.67±37.5	253.83±46.4	252.83±33.8

*Values are mean+SD; n=5, **p<0.01, ***p<0.001, *p<0.05 as compared to control group.*

Table 3. Effect of aqueous extract of bark of Butea monosperma on Glucose loaded mice

Sr. no.	Groups	Blood glucose level (mg/dl)			
		0min	30min	90min	120min
1.	Control	93.00±16.4	399.80±15.1	200.20±30.2	161.20±34.9
2.	Std.	105.40±19.0	185.60±30.4***	127.40±31.4***	93.00±31.6***
3.	Aqueous	93.60±16.9	163.80±21.3***	111.40±14.3***	121.80±21.8***

*Values are mean ±SD; n=5, **p<0.01, ***p<0.001, *p<0.05 as compared to control group*

RESULTS

Preliminary phytochemical screening reveals presence of saponin glycosides, tannins and proteins. During preliminary toxicity study, no adverse effect or mortality was observed in albino mice with oral administration of methanol and aqueous extracts up to a high dose of 5 gm/kg body weight observed for 24 h. Hence a high dose of 500 mg/kg body weight was selected as a test dose.

In normal fasting mice aqueous extract (500mg/kg body weight) showed 21.87% reduction in blood glucose level at 2 h interval while metformin treatment resulted in 40.78% reduction in blood glucose level.

In alloxan induced diabetic mice aqueous extract (500mg/kg body weight) showed reduction in blood glucose level after 2 h, and maximum reduction (27.52%) was observed at 5 h. While metformin (75mg/kg body weight) showed maximum reduction of 43.97% at 5 h post administration.

In glucose loaded mice aqueous extract significantly reduces the blood glucose level at 90 min and the decrease in peak blood glucose level was similar to that observed with metformin. However, unlike aqueous extract, metformin showed sustained hypoglycemic effect even at 120 min.

DISCUSSION

Aqueous extract significantly decreases blood glucose level both in normal ($p<0.01$) and alloxan induced diabetic ($p<0.001$) mice at 2 and 5 hr respectively. However, the hypoglycemic effect is peaked at 90min and is not sustained as observed for the standard drug metformin. The study reports for the first time the hypoglycemic activity of bark of *Butea monosperma* in mice. The aqueous extract of this bark is an attractive material for the development of the good phytomedicine for the diabetes. However the drug cannot be substituted to present allopathic drugs but can at least act as an adjuvant in antidiabetic therapy.

REFERENCES

1. The wealth of India, A dictionary Of Indian Raw Material and Industrial product, First supplement series (Raw Material), A-Ci, NISCAIR, **1**:176-177.
2. Prashanth, D, Asha, M K, Amit A, Padmaja R. Anthelmintic activity of Butea monosperma, *Fitoterapia.* **72**(4): 421-2,(2001).
3. Danaratna et al. Use of *Butea monosperma* (Lam.) Kuntz. And Mallotus philippinensis Muell.-Arg. in treatment of helminthiasis, *Journal of the Nepal Pharmaceutical Associatio*n. **7**, 73-75, (1979).
4. Kasture VS, Kasture SB, Chopde CT. Anticonvulsive activity of Butea monosperma flowers in laboratory animals, *Pharmacol Biochem Behav*. **72(4)** : 965-72,(2002)
5. Gunakkunru A, Padmanaban K, Thirumal P, Pritila J, Parimala G, Vengatesan N, Gnanasekar N, Perianayagam JB, Sharma SK, Pillai KK. Anti-diarrhoeal activity of *Butea monosperma* in experimental animals. *J Ethnopharmacol*. **98(3):**241-4, (2005)
6. Johri RK, Pahwa GS, Sharma SC, Zutshi U. Determination of Estrogenic/ antiestrogenic potential of antifertility substances using rat uterine peroxidase assay.*Contraception.* **44(5):**549-5, (1991)
7. Bandara BM, Kumar NS, Samaranayake KM, An antifungal constituent from the stem bark of *Butea monosperma*. J Ethnopharmacol. **25(1)**:73-5,(1989)
8. Wagner H, Geyer B, Fiebig M, Kiso Y, Hikino H. Isobutrin and butrin, the antihepatotoxic principles of Butea monosperma flowers, *Planta Med.* **4 (2)**:77-9.(1986)
9. Rani P, Khullar N. Antimicrobial evaluation of some medicinal plants for their anti-enteric potential against multi-drug resistant Salmonella typhi., *Phytother Res.***18(8)**:670-3. Aug(2004)
10. M. C. Redo, J. L. Rios, A. Villar, A review of some antimicrobial compounds isolated from medicinal plants

reported in the literature, *Phytotherapy Research,* **3(4)**, 117 – 125. (1978-1988)

11. A. K. Agarwal, M. Singh, N. Gupta, R. Saxena, A. Puri, A. K. Verma, R. P. Saxena, C. B. Dubey and K. C. Saxena Management of giardiasis by an immuno-modulatory herbal drug Pippali rasayana *Journal of Ethnopharmacology,* **44(3)**, 143-146. December (1994)
12. Somani R., Kasture S., Singhai A., "Antidiabetic potential of *Butea monosperma* in rats", *Fitoterapia,* **77**: 86-90. (2006)
13. Bhatwadekar AD, Chintawar SD, Logade NA, Somani RS, Veena Kasture S, Kasture SB Antistress activity of Butea monosperma flowers, *Ind. J. of pharmacology,* **31 (2)**: 153-155. (1999)
14. Garg, S.K., S.B. Vohora and R.R. Chaudhury Antifertility screening of plants, part VI: investigations on Butea monosperma (Lam.) Kuntze, *IJMR,* 1969, **57**(10), 1946-1949.
15. Gawale, N.S., S.C. Pal, V.S. Kasture and S.B. Kasture, Effect of Butea monosperma on memory and behaviour mediated via monoamine neurotransmitters in laboratory animals, *Journal of Natural Remedies,* **1**, 1.(2001)
16. I. Soman, S. A. Mengi and S. B. Kasture , Effect of leaves of *Butea frondosa* on stress, anxiety, and cognition in rats, *Pharmacology Biochemistry and Behavior*, **79(1)** : 11-16. (2004)
17. Manish S Lavhale & S H Mishra, Evaluation of free radical scavenging activity of *Butea monosperma* Lam. *Indian Journal of Experimental Biology* , **45**: 376-384. April
18. Panchatcharam Manikandan, Miriyala Sumitra, Lochin Sugunam, Efficacy of *Butea monosperma* on dermal wound healing in rats .*International Journal of Biochemistry & Cell Biology,* **37 (3)**: 566-573. (2005)
19. Yadava RN, Tiwari L. A potential antiviral flavone glycoside from the seeds of *Butea monosperma* .O. Kuntze, *J Asian Nat Prod Res.***7(2)**:185-8, Apr (2005)
20. S. R. Gupta, B. Ravindranath and T. R. Seshadri, The glucosides of *Butea monosperma*, *Phytochemistry,* **9(10)**: 2231-2235.(1970)
21. Guha, P.K.Poi, R.: Bhattacharyya, A., An imide from the pods of Butea monosperma. *Phytochemistry (United Kingdom*). **29(6)** : p. 2017.(1990)
22. Sopit wongkham, Chaisiri wongkham, Chusri trisonthi, patcharee boonsiri, sontaya simasathiophon ; kanit atisook ; isolation and properties of a lectin from the seeds of *Butea Monosperma*, *plant sci.,* **103** : 121-126 (19 ref.) (1994)
23. Ghosh B, Dasgupta B, Sircar PK.Bacto-arga--a binding matrix for purification of a lectin from *Butea monosperma* (Lam) Kuntze. *Indian J Biochem Biophys*. **18(2)**:166-9. (1981)
24. Badole S., Patel N., Bodhankar S., Jain B., Bhardwaj S., Antihyperglycemic activity of aqueous extract of *Cocculus hirsutus* (L.) Diels in alloxan-induced diabetic mice. *Indian J. Pharmacol*., 38 **(1)**:48-53. (2006)
25. Babu V., Gangadevi T., Subramoniam A., Antidiabetic activity of ethanol extract of *Cassia kleinii* leaf in streptozotocin-induced diabetic rats and isolation of an active fraction and toxicity evaluation of the extract. *Indian Journal of Pharmacology.* **35**, 290-296. (2003).
26. Vogel H. Gerhard, Drug discovery and Evaluation-pharmacological Assays, Springer-Verlag Berlin Heidelberg, New York, 947-1051. (2002).
27. Williamson Elizabeth M., Okpako David T., Evans Fred J. Selection, preparation, and pharmacological evaluation of plant material: pharmacological methods in phytotherapy research. 1: 155-167.
28. Hanefi Ozbek, Ebubekir Ceylan, Mehmet Kara, Fevzi Ozgokce, Mehmet Koyuncu. Hypoglycemic effect of *Rheum ribes* roots in alloxan induced diabetic and normal mice. Scand. *J. Lab. Anim. Sci.,* **31**:133-115. (2004).