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Research Article

EVALUATION OF ANTIDIABETIC AND ANTIPYRETIC ACTIVITY OF *BUTEA MONOSPERMA (LAM)* EXTRACTS ON RATS

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ABSTRACT

In the present investigation an indigenous medicinal plant species of the Western Ghats *Butea monosperma* were selected to explore its morphogenic potentialities under *in vitro* condition, to isolate active constituents from different plant part extracts and to evaluate pharmacological properties of the crude and isolated constituents for antipyretic, antidiabetic, disorders. The antipyretic potential of *B. monosperma* was evaluated using yeast induced pyrexia on Albino rats and petroleum ether extract exhibited significant antipyretic activity after 90 minutes (37.56±0.20) and 120 minutes (37.33± 0.14) as compared to standard group (37.38±0.18). In view of the alleged antidiabetic potential of *B. monsperma* plant and for the claim that their leaves and stem possesses more curative properties in general, among the different extracts of *B. monsperma,* significant antidiabetic activity was noticed in animal groups treated with ethanol extract of stem, it had exhibited highly significant antidiabetic activity after 3 hours of administration of extract (263.53±6.28).

Key Words: Petroleum ether extract, Ethanol extract, Albino rats, Pyrexia.

INTRODUCTION

Plants have formed the basis of sophisticated traditional medicine systems that have been in existence for thousands of years, so that today we possess many effective means of ensuring health care [1]. In spite of spectacular advances in synthetic drugs in recent years, some of the drugs of plant origin have still retained their importance. It is believed that herbal drugs are relatively safe and exhibit a remarkable efficacy in the treatment of chronic ailments. According to an estimate, for nearly quarter are being used for medicinal purpose [2]. About 80% of people in developing countries depend on traditional systems of medicine for primary health care [3]. Despite the vast availability of medicinal plant, *Butea monosperma* is the plant selected in our study and the case for the collection of material and its unique importance in this area. Plants have always been an exemplary source of drugs and many of the currently available drugs have been derived directly or indirectly from them.

Butea monosperma (Lam) Taub belongs to the family Fabaceae, it has many Indian names, depending on the geographical region or the language, for example mutthuga (kannada), dhak (hindi), palasha (sanskrit), palas (marati & bengali), moduga (telugu), parasa (tamil), plasu camata (Malayalam), khakra (gujarati) etc., In English it is commonly called as "Flame of the Forest" because in the summer months, when most of the other trees and shrubs are dry due to the scorching heat of the sun, *Butea monosperma* truly stands out like a flame in the forest with its clusters of orange colored flowers. It is a medium sized deciduous, erect tree very conspicuous when it flowers; it is about 12 – 15 m height with gum containing grey bark exfoliating in irregular pieces. Traditionally most of the plant parts are used therapeutically in treatment of various diseases. The plant is known to have hepatoprotective [4], anti-inflammatory [5], antidiabetic **[**6], antidiarrheal**,** aphrodisiac, diuretic, febrifuge, antiarthritic, antiestrogenic [7]. Many plant products have been described as anti-pyretics in ayurvedic literature and a few have been used traditionally used more often

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as food additives/vegetables. The leaves are used as appetizer, expectorant, astringent, anti-inflammatory, anodyne and aphrodisiac and are useful in pimples, boils, flatulence, colic worm infections, inflammations, arthralgia, haemorraoids and night blindness [8]. Roots are useful in filariasis, night blindness, helminthiasis, piles, ulcer and tumours). It is reported to possess antifertility, aphrodisiac and analgesic activities [9]. The bark is fibrous and ash coloured and reported to possess astringent bitter, pungent, alliterative, aphrodisiac and anthelmintic properties [10]. They possess a number of pharmacotherapeutic effects including antihepatotoxic, antifungal, estrogenic, anti-inflammatory, antistress and anticonceptive [11]. In view of its efficacy, free availability and having great potential of preventing various diseases.

The present study looking into scientific exploration of various extracts of *butea monosperma* as prospective antipyretic and antidiabetic agents.

MATERIALS AND METHODS

Plant material and preparation of the extract

The leaves stem bark, flowers and root of *Butea monosperma* were collected in and around the Kuvempu University campus. The plant was authenticated by comparing with the herbarium voucher specimen deposited at Kuvempu University herbaria. The plant materials were shade dried, powdered mechanically (sieve No. 10/44), 200g of powdered material was soaked in 100ml of petroleum ether and ethanol separately for 48 h. Simultaneously 1 kg of the powdered leaf, stem bark and roots of *B monosperma* were boiled in distilled water for 30 min, kept for 3 days with intermittent shaking and filtered to get the aqueous extract [12]. It was filtered by using Whatman no.1 filter paper. The solvent was distilled out completely from the filtrate under the reduction pressure in Rota vapour

Animal collection

Adult male Albino Wistar rats weighing 150 – 200g were acclimatized in a well ventilated animal house condition and were fed with commercial feed. There were no significant differences in the body weights of the treated rats when compared with control, either at the beginning or at the end of the study period. Institutional animal ethics committee (IAEC) approved the experimental protocol and care of the animals was taken as per guidelines of CPCSEA Department of animal welfare, Govt. of India.

1. Antipyretic activity

Yeast induced pyrexia [13]: For studying antipyretic activity of *B. monosperma,* albino rats weighing 150-200 gms were selected and divided into eleven groups containing six animals in each group (Table: 1) were used for yeast induced pyrexia models**.** Group I animals received 1 ml/kg body weight of normal saline orally and served as control group. Group II animals were treated with paracetamol by intraperitoneal injection in the dose of 100 mg/kg body weight and served as standard group. The animals of group 3, 4, 5, 6, 7, 8, 9, 10 and 11 received the petroleum ether, ethanol and aqueous extracts of the stem, leaf and root of *B. monosperma* orally (200mg/kg body weight) to the respective groups of animals.

In the beginning of the experiment normal rectal temperatures was noted by inserting 2cms of digital thermometer, lubricated with glycerine into the rectum. Pyrexia was induced by intraperitonial injection of 2ml/kg body weight of 15% brewer's yeast suspension in normal saline. The animals were then fasted for the duration of experiment (approximately 24 hours). After 18 hours of yeast injection, extracts (200 mg/kg body weight) are given to the respective test group animals then the basal temperatures were recorded for all the three groups of animals by inserting 2cms of digital thermometer, lubricated with glycerin into the rectum.

The rectal temperatures of all the animals were noted at 30 minutes of intervals till 3 hours.

1. Antidiabetic activity: The antidiabetic activity was carried out on albino rats as described by the method based on alloxan induced diabetes.

Animals were segregated into 12 groups of six each and diabetic control group animals, standard group animals and all the test group animals were rendered diabetic by injecting alloxan intraperitonially at a dose of 150mg/kg body weight. Alloxan was weighed according to the body weight of animals separately before starting the experiment. Each group of animals was housed separately, with a distinct identity for individual identity throughout the study. After 3 hours of administration of alloxan injection all the animals were injected 1ml of (100mg/ml) Glucose I.P. to combat ensuring severe hypoglycemia. After 72 hours of the alloxan injection, the animals were tested for the blood glucose only.

To the animals of test group the respective test extracts (250mg/kg body weight) and to the animals of standard group standard drug Glibenclamide 10mg/kg body weight were administered by dissolving in water. Group I animals received 1.0ml of normal saline orally, and served as nondiabetic control. Group II animals received 1.0ml of alloxan (150mg/ml), and served as diabetic control, Group III animals received 1.0ml of alloxan + Glibenclamide (10mg/kg body weight) served as standard. The animals of group 4, 5, 6, 7, 8, 9, 10, 11, and 12 received orally (200mg/kg body weight) the petroleum ether, ethanol and aqueous extracts of the leaf, stem and root extracts of *B. monosperma* respectively.

The blood sample were obtained through the tail vein puncturing with hypodermic needle, 0.2 ml of Blood was withdrawn from all the animals of all the groups at an interval of initial 0, 1st, 3rd, 5th and 7th hour of administration of single dose and blood glucose levels was measured using glucometer and the results were compared with standard glibenclamide group.

Histopathological studies

The animals were sacrificed and their pancreas was isolated. The isolated pancreas were cut into small pieces and preserved and fixed in 10% formalin for two days. After fixation was complete, tissue was processed and then embedded in paraffin and serial thin sections were cut using Microtome. Each section was stained with hematoxylin and eosin. The sections were examined under light microscope and photographs were taken.

Statistical analysis

All values are expressed as mean ± SEM, statistical significance was analysed using one way ANNOVA followed by Turkey-Krammer multiple comparison test**.** The data were considered significant at $P< 0.05$.

RESULTS

Antipyretic activity

Yeast induced pyrexia

In the present investigation we have adopted yeast induced pyrexia model for the assessment of anti pyretic activity of *B. monosperma.* Among the various extracts of *B. monsperma*, the animals treated with petroleum ether extract of leaf exhibited significant antipyretic activity after 90 minutes (37.56±0.20) and 120 minutes (37.33± 0.14) as compared to standard group (37.38±0.18) (Table: 2 and Fig 1)

2. **Antidiabetic activity**

During the experimental period many changes were observed in the physical appearance of all the animals in all the groups except normal and control groups. The observations in the physical appearance include changes in the fur, skin, eyes, mucous membranes respiratory, circulatory, and autonomic and central nervous systems, somatomotor activity and behavioral patterns. Tremors and convulsions were also observed in some of the rats.

Among the different extracts of *B. monsperma*, significant antidiabetic activity was noticed in animal groups treated with ethanol extract of stem, it had exhibited highly significant antidiabetic activity after 3 hours of administration of extract (263.53±6.28) and significant antidiabetic activity after 5 hours of administration of extract (201.43±9.12) and after 7 hours of administration of extract (136.18±7.70) this is when compared to the standard drug treated animals which exhibited highly significant antidiabetic activity after 3 hours of administration of glibenclamide (241.16±4.80), significant activity was noticed after 5 hours and 7 hours (Table 3 and Fig 2).

Table 1. Grouping of rats

Group	Type of Extract
Group1	Control
Group2	Paracetamol (standard, 100 mg/kg)
Group3	Pet. ether ext. of leaf(200mg/kg)
Group4	Ethanol ext. of leaf(200mg/kg)
Group5	Aqueous ext. of leaf(200mg/kg)
Group6	Pet. ether ext. of stem(200mg/kg)
Group7	Ethanol ext. of stem(200mg/kg)
Group8	Aqueous ext. of stem(200mg/kg)
Group9	Pet. ether ext. of root(200mg/kg)
Group10	Ethanol ext. of root(200mg/kg)
Group11	Aqueous ext. of root(200mg/kg)

Table 2. Effect of leaf, stem and root extracts of *B. monosperma* against yeast induced pyrexia in rats

Group (n)	Initial Body Temperature (^{0}C)	Basal Temperature (^{0}C)	30 min	60 min	90 min	120 min	180 min
Control	36.80±0.20	39.40±0.20	39.62±0.14	39.85±0.11	39.97±0.13	40.25±037	40.32±041
Paracetamol (standard)	37.10±0.18	39.93±0.30	38.36±0.24*	38.22±0.12**	37.44±0.15**	37.38±0.18*	37.31±0.22
Pet. ether ext. of leaf	37.17±0.12	38.60±0.11	38.82±0.15	39.95±0.13	37.56±0.20*	37.33±0.14*	37.16±0.14
Ethanol ext. of leaf	36.92±0.14	37.26±0.20	37.75±0.35	38.33±0.20	38.53±0.22	39.13±0.35	39.36±0.18
Aqueous ext. of leaf	37.14±0.20	37.36±0.10	37.97.±0.32	38.24±018.	38.80±0.21	39.20±0.38	39.54±0.20
Pet. ether ext. of stem	36.94±0.15	37.64±0.30	38.09±0.22	38.55±0.18	39.34±0.15	39.82±0.28	40.22±0.10
Ethanol ext. of stem	36.73±0.12	37.45±0.22	38.18±0.16	38.62±0.20	39.02±0.18	39.42±0.20	39.71±0.24
Aqueous ext. of stem	36.67±0.20	37.16±0.18	38.28±0.26	38.76±0.32	38.98±0.12	40.14±0.13	40.37±0.22
Pet. ether ext. of root	37.19±0.18	38.15±0.20	38.73±0.26	39.06±0.18	39.31±0.27	39.70±0.29	40.10±0.16
Ethanol ext. of root	36.70±0.20	37.82±0.26	38.16±0.32	38.66±0.14	38.99±0.16	40.13±0.14	40.43±0.12
Aqueous ext. of root	37.04±0.18	37.38±0.32	37.72±0.22	38.19±0.18	38.64±0.15	39.18±0.22	39.38±0.28

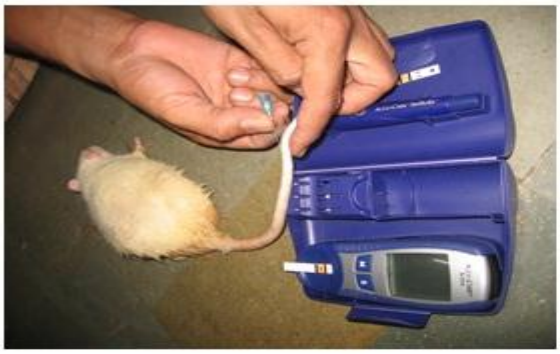
Non significant (P>0.05) *Significant (P<0.05), ** More significant (P<0.01), n=6 number of animals in each group.

Table 3. Effect of leaf, stem and root extracts of *B. monosperma* on antidiabetic activity by using alloxan induced diabetic rats

Group (n)	**Blood Glucose level mg/100dl (mean ±SEM)**				
	Initial	**1hr**	**3hr**	**5hr**	**7hr**
Normal control	106.16±3.27	107.50±4.42	107.00±4.42	106.50±2.66	103.60±3.27
Diabetic control	354.66±10.5	368.50±6.04	362.50±6.90	360.66±6.06	362.12±5.59
Glibenclamide (Standard)	382.16±12.0	361.00±7.81	241.16±4.80***	199.66±4.60**	128.00±4.42**
Pet. ether ext. of leaf	363.20±11.30	365.48±6.15	376.80±4.50	381.60±3.52	390.50±6.10
Ethanol ext. of leaf	350.28±10.34	357.10±8.72	363.60±7.48	370.83±8.55	381.70±4.78
Aqueous ext. of leaf	381.45±5.80	388.16±7.80	390.45±6.80	391.62±5.62	390.28±6.10
Pet. ether ext. of stem	376.16±10.69	382.50±6.04	387.52±6.80	384.61±5.60	385.10±5.80
Ethanol ext. of stem	378.92±8.62	357.24±6.70	263.53±6.28***	201.43±9.12**	136.18±7.70**
Aqueous ext. of stem	366.16±7.20	372.20±7.81	377.16±4.58	383.33±10.68	383.10±7.60
Pet. ether ext. of root	366.34±8.51	370.42±8.90	383.20±9.70	381.80±6.56	380.40±10.32
Ethanol ext. of root	393.50±6.80	402.10±10.20	405.11±7.82	401.38±4.48	403.68±8.10
Aqueous ext. of root	383.69±8.90	388.46±.4.46	391.56±8.24	387.58±8.16	387.3±86.50

Non significant (P>0.05) *Significant (P<0.05), ** More significant (P<0.01), n=6 number of animals in each group.

Figure 1: Antipyretic study by using yeast induced pyrexia



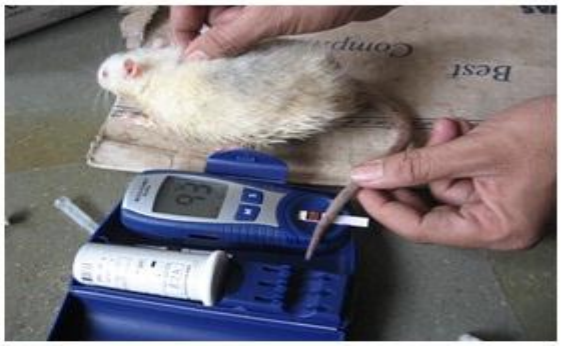
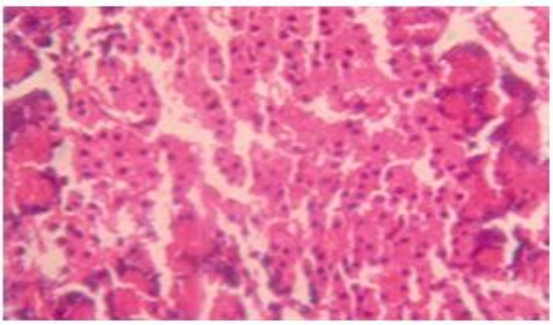
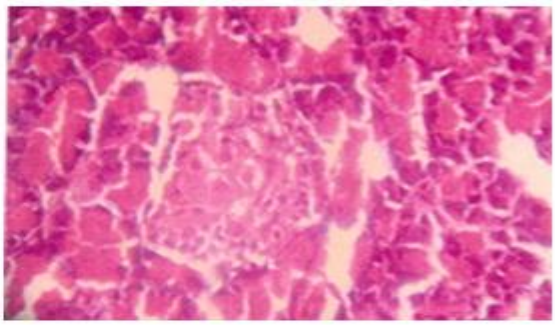


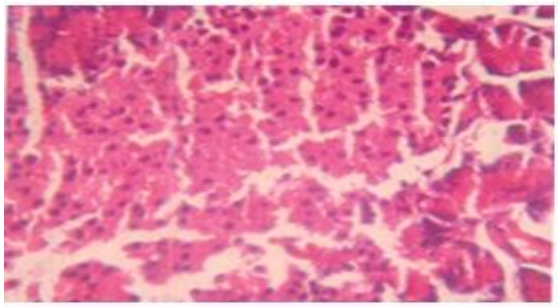
Figure 2: Antidiabetic study by alloxan induced diabetes



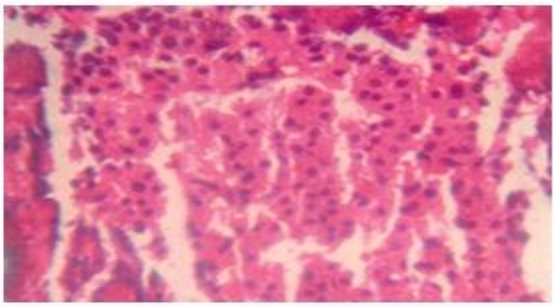
Normal control



Diabetic control



Glibenclamide treated



Ethanol extract of stem treated

DISCUSSION

Search for safe herbal remedies with potent antipyretic activity received momentum recently as the available antipyretic, such as paracetamol, aspirin, nimusulide etc. have toxic effect to the various organs of the body. The acute toxicity result reveals that *B. monosperma* plant might be considered as a broad non-toxic. The antipyretic activity exhibited that the petroleum ether extracts of leaf of *B. monosperma* possess significant antipyretic effect in maintaining normal body temperature and their effect are comparable to that of standard antipyretic drug aspirin. Such reduction of rectal temperature of tested animals appears to be due to the presence of a single bioactive principles or mixture of compounds in them. The present study, therefore, supports the claims of traditional medicine practitioners as an antipyretic remedy. However, to know the exact mechanism of action of these extracts in reducing the body temperature further study with purified fractions/ bioactive compounds are warranted.

Diabetes mellitus is a group of syndromes characterized by hyperglycemia; altered metabolism of lipids, carbohydrates and proteins; and an increased risk of complications from vascular disease [14]. Diabetes mellitus has been shown to be associated with atherosclerotic and cardiovascular diseases. Insulin deficiency leads to various metabolic aberrations in the animals viz. increased blood glucose, decreased protein content and increased cholesterol **[**15]. In histopathological study of pancreas, there was a reduction in number of islets, damage to the islets, ethanol extract of stem of *B. monosperma* treated as well as standard drug treated groups have shown a restoration of number of islets towards the normal population, also improvement in damaged islets and hyperplasia. Phytomicrographical data in our studies reinforce healing of pancreas, by ethanol extract of stem of *B. monosperma*, as a possible mechanism of their antidiabetic activity.

CONCLUSION

In conclusion, by carefully examining the antidiabetic and antipyretic activity of *B. monosperma*, the petroleum ether extract of *B. monosperma* exhibited significant antipyretic potentials. The present work provides evidence that the petroleum ether extract of *B. monosperma* exhibited significant antipyretic potentials. Among the different extracts of *B. monosperma* significant antidiabetic activity was noticed in animal groups treated with ethanol extract of stem, it had exhibited highly significant antidiabetic activity after 3 hours, 5 hours and after 7 hours of administration of extract, compared to the standard drug treated glibenclamide treated animals. Hence further investigations using more experimental paradigms are warranted for further confirmation of the treatment of various ailments, diseases and disorders.

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