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Screening of Analgesic and Antipyretic Activity of Dried Stem Bark of *Ficus bengalensis* Linn

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ABSTRACT

Tribal people in Satpuda ranges are using extract of stem bark of *Ficus bengalensis* Linn for treating and for reducing the body temperature and for analgesic activity. In view of these, different extracts of the stem bark are investigated for mechanism of antipyretic and analgesic activity on albino rats which were fevered by brewer's yeast suspensions. Evaluation of stem bark extracts of *Ficus bengalensis* Linn on fevered induced albino rats was evaluated using standard analytical methods like Yeast Induced Pyrexia Method, Hot Plate Method & Tail Immersion Method. The results shows significant ($p<0.001$) antipyretic and analgesic activity of ethanolic extract, in yeast induced fevered rats (10mg/kg body weight), compared to analgesia and pyrexia in control group (100mg/kg body weight). The inhibitory effect of the extracts was time dependent and comparable to that of reference analgesic and antipyretic drug, aspirin (100mg/kg body weight). Statistical data indicate that the ethanolic extract of stem bark of *Ficus bengalensis* Linn possesses remarkable analgesic and antipyretic activity on yeast induced fevered albino rats and therefore, justifies the traditional use of stem bark by tribal peoples for analgesic and antipyretic activity.

1. INTRODUCTION

Throughout human history, people have relied on natural products plants in particular, to promote and maintain good health and to fight sickness, pain and diseases. While modern (allopathic) medicine in many part of the world, has replaced traditional medical practices to the benefit of public health. In spite, we are increasingly aware of its limitation i.e. its ineffectiveness in dealing with a large number of conditions and diseases, the often unforeseen negative side effects of synthetic drugs, and the ever rising cost of medical treatment including pharmaceuticals. As a result, health specialists throughout the world are taking a second look at alternative or complementary medicine and traditional plant based drugs. [1] Ayurveda an ancient system of Indian medicine has recommended number of drugs from indigenous plant/animal sources for the treatment of several diseases or disorders.[1,2]

According to World Health Organization, herbal medicine is defined as a plant derived material or preparation, which contains raw or processed ingredients from one or more plants with therapeutic values. Use of plant products, as medicine is inherent in Ayurveda and in the ancient Indian system of Indian health care.[2] Thus plant drug research appears to be complementary to the ongoing synthetic research. World health organization had given its technical report on promotion of development of traditional medicine. [3,4]

Ficus bengalensis Linn (Moraceace) is medicinal plant which is used extensively in Satpuda region of India. It is also known as Banyan tree. Throughout the plains and forest tracts of India, planted in avenues for shade. Epiphytic when young and develops from seeds dropped by birds on old walls or on other trees. [5, 6, 7] A very large tree up to 30m in height with widely spreading branches bearing many aerial roots functioning as a prop root., bark are greenish white, leaves simple, alternate, often in clusters at ends of branches, stipulate, 10-20cm long and 5-12.5cm broad, broadly elliptic to ovate; the fruit receptacles are axillary, sessile, in pairs, globose, brick red when ripe, enclosing male, female, and gall flowers.[8,9,10,11]

Stem bark mainly contains β-sitosterol, a-D-glucose, meso-inositol, β-sitosterol-α-D-glucose, and three ketones viz…20-tetratriacontene-2-one, 6-heptatriacontene-10-one, and pentatriacontan-5-one. Bark also contains leucoanthocyanin and two other flavonoids

compounds. The three main and important flavonoids isolated from stem bark of *Ficus bengalensis* Linn are leucodelphinidin, leucopelargonin, and leucocyanidin. [12, 13]

The crushed seeds and the milky juice exuded from the cut stems, branches and twigs are applied externally to relieve pains, sore, ulcers, and bruises, and as an anodyne for treating rheumatism and lumbago. It is considered a valuable application for relieving and healing cracked and burning soles and is also used as a remedy for toothache. [14, 15]

The crushed dried fruit is taken with honey as a treatment for spermatorrhoea among the tribal inhabitants of central Orissa; in this region the latex of plant is taken with banana in the treatment of gonorrhoea. The seeds are considered cooling and tonic.

A paste of the leaves, or heated leaves, is applied as poultice to promote healing of abscesses. The bark is astringent; its infusion is considered a powerful tonic and useful for treating diabetes, dysentery and diarrhoea, leucorrhoea, menorrhagia and nervous disorders. In south Orissa, the juice of the aerial roots of *Ficus bengalensis* Linn is given to children suffering from dysentery. The latex and the aerial roots of *Ficus bengalensis* Linn along with flowers of *Hibiscus rosa-sinensis* Linn are used to treat spermatorrhoea, and the aerial roots are used as diuretic in diabetes.[16, 17]

This study was aimed to investigate the effect of stem bark extracts of *Ficus bengalensis* Linn on fever induced Wistar albino rats.

MATERIALS AND METHODS

Plant:

For the present study, bark of *Ficus bengalensis* Linn was procured from the local market of Faizpur. Bark and different plant parts were authenticated at the **Botanical Survey of India, Pune**. The authentication number was: **BSI/WC/TECH./2008/356.**

Animals:

Wistar strain albino rats (150-200g) were used for antipyretic model. Rats were kept in polypropylene cages and led on standard laboratory diet i.e. oil extracted groundnut feed was

given. The animals were exposed to 12 h. cycle of darkness and light. Bedding materials of cages were changed everyday. Rats were divided into six groups. Each group contained six animals.

Groups of Rats: (each group is having six numbers of animals)

Group I - Control (100mg/kg)

Group II- Standard (Aspirin) (100mg/kg)

Group III- Petroleum ether extract. (100mg/kg)

Group IV- Chloroform extract. (100mg/kg)

Group V- Ethanol extract. (100mg/kg)

Group VI- Water extract. (100mg/kg)

Acute toxicity studies:

The acute toxicity study of extracts of the *Ficus bengalensis* Linn was showed 50% of mortality at dose of 1000mg/kg. Hence, $1/10^{th}$ of the same dose for all these extracts was taken as therapeutic dose i.e. 100mg/kg.[18]

Chemicals and reagents:

The chemicals used in this study were of analytical grade and procured from reputed scientific shops at Jalgaon. They included: Petroleum ether, Chloroform, 80% ethanol, aspirin {standard drug (Binni lab. Ambad, Nasik. B.No.C0030035)}, 2% w/v gum acacia suspension and distilled water.

Preparation of extracts:

Bark of *Ficus bengalensis* Linn was dried in shade under normal environmental conditions and then subjected to size reduction to coarse powder. The coarse powder material was charged into the soxhlet extractor and hot continuous successive extraction was carried out using different solvents, on basis of their increasing order of polarity:

a) Petroleum ether ($60\text{-}80^0$)

b) Chloroform

c) Ethanol

d) Water

Each time before extracting with the next solvent, the powdered material was air-dried and each extract was concentrated by distilling off the solvent to obtain the crude extractive. The drug was extracted with each solvent till completion of extraction (approx. 40 cycles).[19,20]

Antipyretic Activity: Yeast Induced Pyrexia Method:

Working Principle:

The subcutaneous injection of Brewer's yeast suspension is known to produce fever in rats. A decrease in temperature can be achieved by administration of compounds with antipyretic activity. [19]

Procedure:

A suspension of Brewer's yeast (15%) in saline (0.9%) was prepared. Six groups each containing 6 rats of either sex were taken. The thermocouple was inserted 2cm deep into the rectum and the rectal temperatures were recorded. The animals were fevered by injection of brewer's yeast suspension (10mg/kg) subcutaneously in the back below the nape of the neck. The site of injection was massaged in order to spread the suspension beneath the skin. The room temperature was kept at 22-24^{0}C. Immediately after yeast administration, food was withdrawn, and then the rise in rectal temperature was recorded. The measurement was repeated after 30 minutes. The dose of the test compound and standard drug was given orally. The rectal temperature was recorded again after 30, 60, 120 and 180 minutes.

Aspirin (100mg/kg) was selected as a standard drug. The various extracts were dissolved in saline with the help of Gum acacia (2% w/v). [19,20,21,22]

Analgesic activity:

i) Hot Plate Method:

Working Principle:

The paws of mice and rats are very sensitive to heat and temperatures which are not damaging the skin. The responses are jumping, withdrawal of paws and licking of paws. The times until these responses occur is prolonged after administration of centrally acting analgesics, whereas

peripheral analgesics of the acetylsalicylic acid or phenyl acetic acid type do not generally affect these responses.[19,20,21,22,23]

Procedure:

In this Hot Plate Method, animals from the each group was placed on the hot plate, which is commercially available, consists of an electrically heated surface. Temperature of this hot plate is maintained at 55-56^{o}C and observation is done up to the time until either paw licking or jumping was noted. Then the average basal reaction time was noted before and after 30, 60, 90, and 120minutes following oral administration of the drugs and test compounds. [20,21,22]

ii) Tail Immersion Method:

Working Principle:

The method has been developed to be selective for morphine-like compounds. The procedure is based on the observation that morphine-like drugs are selectively capable of prolonging the reaction time of the typical tail withdrawal reflex in rats induced by immersing the end of the tail in warm water of 55°C. [21,22,23]

Procedure:

Rats of Wistar strain were randomly divided into six groups having six animals in each and they were fasted overnight but during the experiment had free access to water. All the extracts were administered orally (100mg/kg) 60 minutes prior to the commencement of the estimation of reaction time. The temperature of the water in the organ bath was set at 55 ± 0.5^{o}C with the help of thermostat. The reaction time was determined by immersing the tail in hot water and the time taken by the rat to withdraw its tail clearly out of water was noted. Observations were repeated at an interval of 30 minutes up to 120 minutes.[21,22,23]

Statistical Analysis:

The data obtained from the laboratory were subjected to one way analysis of Variance (ANOVA). Significant differences were observed at $p<0.05$, $p<0.01$, $p<0.001$. The resulted values are expressed as mean ± standard deviation (where, n=6) in each group.

RESULTS AND DISCUSSION

Evaluation of antipyretic activity of stem bark extracts of *Ficus bengalensis* Linn using hyper-pyrexia method:

Ethanolic extract showed significant decrease in elevated body temperature, while petroleum ether extract, chloroform extract and water extract did not show a significant decrease in elevated body temperature as compared to standard drug.

Results are given in Table-I and graph for the same is represented in figure-I.

Table-I Evaluation of antipyretic activity of *Ficus bengalensis* Linn. by Yeast Induced Hyper- Pyrexia Method:

Group		Rectal Temp °C		Time after administration		
	Initial	18 hr after Yeast injection	30 Min	60 Min	90 Min	120 Min
Control	37.97 ± 0.67	39.87 ± 0.09	39.47 ± 0.02	39.57 ± 0.05	39.55 ± 0.09	39.55 ± 0.07
Aspirin	38.02 ± 0.05	40.01 ± 0.03	39.02 ± 0.02*	38.96 ± 0.04***	38.00 ± 0.03***	38.02 ± 0.49***
Ethanol	38.52 ± 0.22	39.90 ± 0.04	39.45 ± 0.06	38.45 ± 0.06***	38.40 ± 0.06***	38.35 ± 0.10***
Chloroform	38.27 ± 0.06	40.11 ± 0.01	39.11 ± 0.02	39.10 ± 0.02**	39.10 ± 0.02*	39.08 ± 0.02***
Water	38.20 ± 0.39	40.05 ± 0.06	39.04 ± 0.06*	39.45 ± 0.70	39.55 ± 0.04	39.40 ± 0.01
Pet. Ether	38.65 ± 0.15	40.55 ± 0.14	40.45 ± 0.09***	40.02 ± 0.05*	40.03 ± 0.03**	39.80 ± 0.08

Values expressed in table are mean ± standard deviation (n=6) in each group, *p<0.05, **p<0.01, and ***p<0.001; when compared with control group.

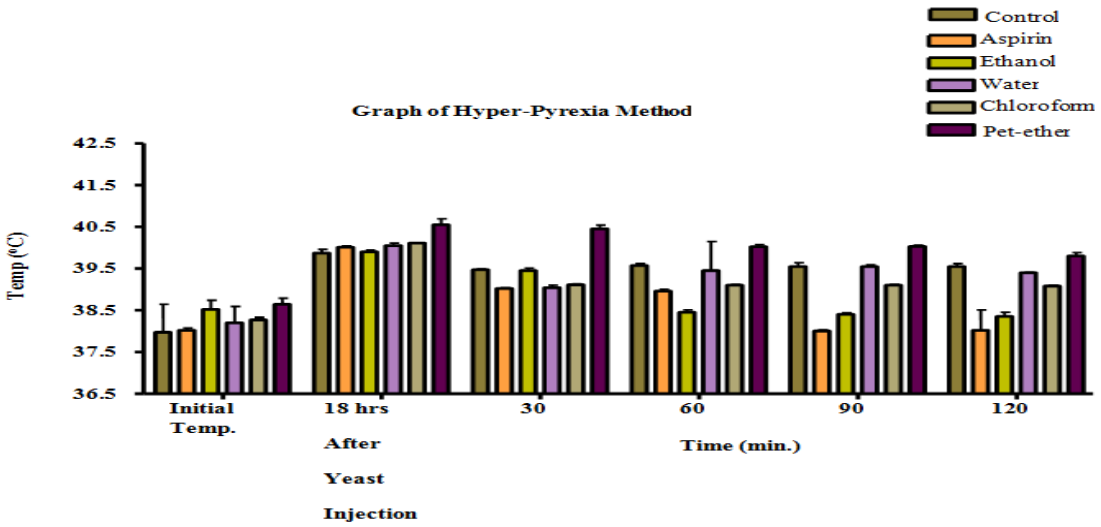

Fig. I: - Result of Yeast Induced Pyrexia Method

Evaluation of analgesic activity of stem bark extracts of *Ficus bengalensis* Linn using hot plate method:

Ethanolic extract of bark of *Ficus bengalensis* shows more significant activity, while pet-ether extract, chloroform extract and water extract does not show significant analgesic activity as compared to standard drug.

Results are given in Table-II and graph for the same is represented in figure-II.

Table-II Effect of *Ficus bengalensis* Linn bark extracts using Hot Plate Method.

Time (min.)	Control (100mg/kg)	Aspirin (100mg/kg)	Ethanol (100mg/kg)	Water Extract (100mg/kg)	Chloroform Extract (100mg/kg)	Pet-Ether Extract (100mg/kg)
0	12.45± 1.74	32.68 ± 2.31***	35.14 ± 1.49***	12.47 ± 0.42	8.20 ± 2.19*	12.27 ± 2.69
30	19.78 ± 1.88	23.45 ± 24.54	28.61 ± 1.82***	14.75 ± 3.31*	13.35 ± 3.64***	19.20 ± 0.98
60	10.24 ± 2.29	13.46 ± 2.49	36.58 ± 2.42***	14.14 ± 2.10	9.34 ± 1.97	9.05 ± 0.75
90	11.82 ± 2.39	16.86 ± 1.50**	29.82 ± 2.04***	9.20 ± 1.28	10.91 ± 2.70	11.37± 1.47
120	12.48 ± 2.48	22.93 ± 2.03***	13.00 ± 2.96	16.37 ± 1.92	11.78 ± 0.80	13.17± 4.17

Values expressed in table are mean ± standard deviation (n=6) in each group, *p<0.05, **p<0.01, and ***p<0.001; when compared with control group.

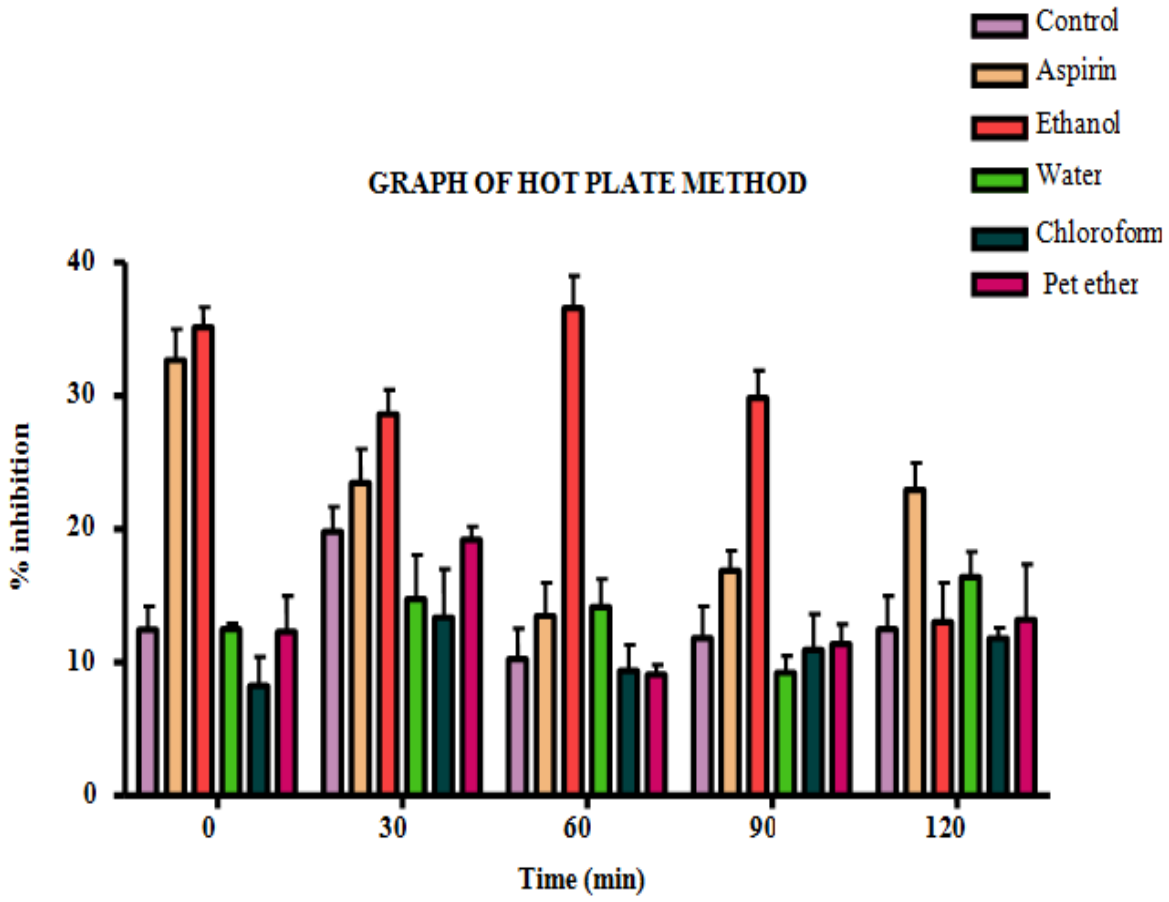

Fig. II: - Result of Hot Plate Method:

Evaluation of analgesic activity of stem bark extracts of *Ficus bengalensis* Linn using Tail Immersion Method:

Ethanolic extract of bark of the *Ficus bengalensis* shows more significant activity, while pet-ether extract, chloroform extract and water extract does not show significant analgesic activity as compared to standard drug.

Results are given in Table-III and graph for the same is represented in figure-III.

Table-III Effect of *Ficus bengalensis* Linn bark extracts using Tail Immersion Method:

Time (min.)	Control (100mg/kg)	Aspirin (100mg/kg)	Ethanol Extract (100mg/kg)	Water Extract (100mg/kg)	Chloroform Extract. (100mg/kg)	Pet Ether Extract (100mg/kg)
0	6.1 ± 0.08	6.1 ± 0.11	7.5 ± 0.63**	5.92 ± 0.52	5.0 ± 0.39*	6.0 ± 0.18
30	5.3 ± 0.26	8.2 ± 0.18***	8.3 ± 0.18***	5.58 ± 0.11	5.8 ± 0.76	5.4 ± 0.18
60	6.2 ± 0.29	9.2 ± 0.29***	10 ± 0.73***	6.92 ± 0.78	6.8 ± 0.54	7.52 ± 1.04**
90	7.1 ± 0.40	13.3 ± 1.00**	12.3 ± 0.33***	8.11 ± 0.27	9.5 ± 1.08***	6.29 ± 0.56
120	6.5 ± 0.40	20.2 ± 0.45***	18.7 ± 0.55***	7.92 ± 0.41**	15.3 ± 1.04***	5.92 ± 0.71

Values expressed in table are mean ± standard deviation (n=6) in each group, *p<0.05, **p<0.01, and ***p<0.001; when compared with control group.

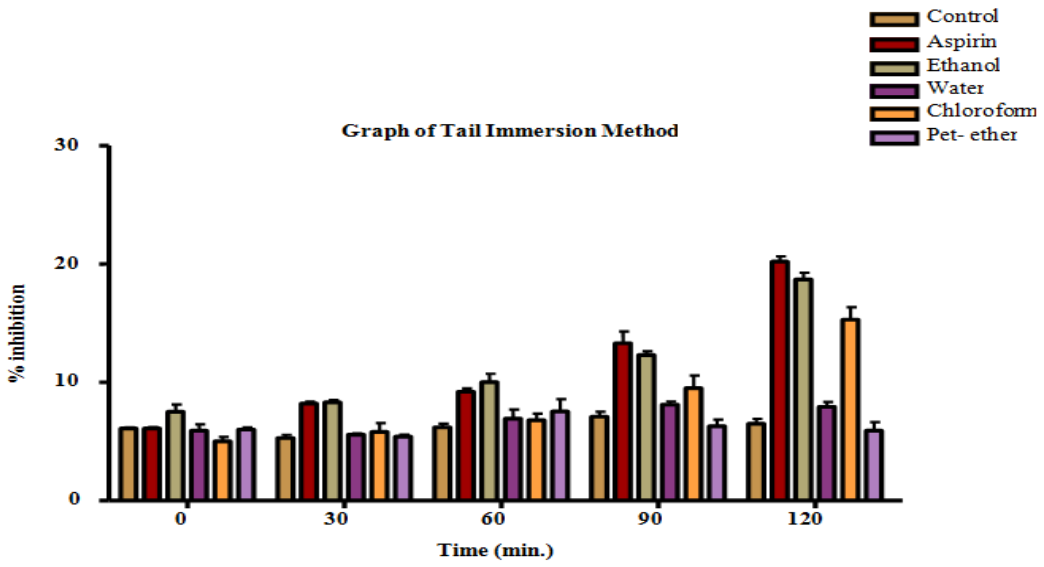

Fig. III: - Result of Tail Immersion Method:

DISCUSSION

Bark of *Ficus bengalensis* Linn is reported to possess antidiabetic, hepatoprotective, anthelmintic, antioxidant, immunomodulatory and anti-diarrhoeal activity, while antipyretic and analgesic activity of bark is still not scientifically investigated.

In the present work, attempts were made to study detail phytochemical investigation and pharmacological action, particularly antipyretic and analgesic activity of bark of *Ficus bengalensis* Linn belonging to family of Moraceae.

Extracts after preliminary phytochemical investigation was shown the presence of following active principles.

Petroleum Ether:	Fats, oils, sterols, triterpenoids.
Chloroform:	Sterols, triterpenoids.
Ethanol:	Sterols, flavonoids, triterpenoids, tannins, carbohydrates, saponins.
Water:	Sterols, flavonoids, triterpenoids, tannins, carbohydrates, saponins.

The acute toxicity study of extracts of the *Ficus bengalensis* Linn was showed 50% of mortality at dose of 1000mg/kg. Hence, $1/10^{th}$ of the same dose for all these extracts was taken as therapeutic dose i.e. 100mg/kg.

The animals were fevered by injection of Brewer's yeast suspension (10mg/kg) subcutaneously in back below the nape of neck. The petroleum ether, chloroform, ethanol, and aqueous extract were fed to fevered rats. Ethanolic extract showed significantly decrease in elevated body temperature, while petroleum ether extract, chloroform extract, and aqueous extract did not show a significantly decreased in elevated body temperature.

Similarly, in case of analgesic activity, the rats were kept on fasting for 24 hours. Then all these extracts were administered orally (100mg/kg) 60 minutes prior to the commencement of the estimation of reaction time. And finally, the animal models were subjected to hot plate and tail immersion analgesic activity. However, the ethanolic extract showed more significant analgesic activity as compared to any other extracts.

CONCLUSION

The results obtained in this study demonstrated that the stem bark extracts of *Ficus bengalensis* Linn have a significant analgesic and antipyretic activity supporting its traditional use for the treatment of pyrexia and analgesia.

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