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Research Article

## Analgesic, Antipyretic and Anti-inflammatory Effect of the Whole Plant Extract of *Desmostachya bipinnata* Stapf (Poaceae) in Albino Rats

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### ABSTRACT

Analgesic, Antipyretic and anti-inflammatory effect of petroleum ether, benzene chloroform, ethanol and aqueous extract of the whole parts of *Desmostachya bipinnata* Stapf (Poaceae) was investigated in albino rats. Animals were given a subcutaneous injection of 12% w/v suspension of yeast (1ml /100gm Body weight) suspended in 0.5% w/v methylcellulose solution which leads to pyrexia. Oral administration of petroleum ether, chloroform, ethanol and aqueous extract of the whole parts of *Desmostachya bipinnata* Stapf (Poaceae) at a dose 300 mg/kg body weight into six groups of animal for both the activities were shown significantly reduce the elevated body temperature of rat which was compared with standard paracetamol (marketed product) and diclofenac sodium respectively. The anti-inflammatory activity was evaluated by using Digital plethysmometer. The study was carried out using dose of 300 mg/kg orally. All the extracts produced statistically significant and dose dependent inhibition of edema induced by carrageenan at all doses when compared to the control groups.

**Keywords:** : *Desmostachya bipinnata* Stapf, Analgesic, Antipyretic and Anti-inflammatory, Albino Rat, Yeast, Diclofenac sodium, Paracetamol.

### INTRODUCTION

*Desmostachya bipinnata* Stapf (Poaceae) is an erect, tall, branched from the base perennial herb 30-90 cm height found in forest undergrowth, sandy areas almost throughout India. The plant used traditionally as analgesic, antipyretic, anti-inflammatory, asthma, thirst, jaundice, vaginal discharges, vesicle calculi, diseases of bladder, skin eruptions, vomiting, and sedative to pregnant uterus. In present study antipyretic & analgesic activity of petroleum ether, benzene, chloroform, ethanol and aqueous extract of the whole parts of *Desmostachya bipinnata* Stapf in albino rats were investigated. Pyrexia or fever is caused as a secondary impact of infection, malignancy or other diseased states [1]. It is the body's natural function to create an environment where infectious agents or damaged tissues cannot survive [1]. Normal body temperature is regulated by a centre in the hypothalamus that ensures a balance between heat loss and production. Fever occurs when there is a disturbance of this hypothalamic 'thermostat', which leads to the set-point of body tempera-

ture being raised. Once there has been a return to the normal set-point, the temperature regulating mechanisms (dilatation of superficial blood vessels, sweating etc.) then operate to reduce temperature [2]. Most of the antipyretic drugs inhibit COX-2 expression to reduce the elevated body temperature by inhibiting PgE2 biosynthesis [3]. Analgesia is the inability to feel pain while still conscious. From the Greek an-, without + algesis, sense of pain. Salicylates are the class of compounds that are widely valued for their analgesic, antipyretic and anti-inflammatory properties [4] [5]. The most commonly known and used salicylates are salicylic acid (also called 2-hydroxybenzoic acid), aspirin (acetylsalicylic acid -ASA) and sodium salicyclates. They are used extensively for the relief of headache, inflammation, arthritis pain, and some are employed in the treatment of heart attacks and strokes in the elderly [6]. Their mode of action is the inhibition of the synthesis of prostaglandin and its derivatives that cause inflammation, pain, rise in temperature and related diseases [4] [7].

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### MATERIAL AND METHODS:

#### Plant material:

The whole parts of the plant *Desmostachya bipinnata* Stapf (Poaceae) were collected in the month of October from different places of Sambalpur, Orissa. The plant was authenticated by The Joint Di-

rector, Botanical Survey of India, Shibpur, Howrah, India. A voucher specimen was deposited.

#### Preparation of extracts:

The whole parts of *Desmostachya bipinnata* Stapf (Poaceae) was shade dried and powdered. About 500 gm of dry powder was extracted in the petroleum ether (40-60) by continuous hot percolation using soxhlet apparatus. The extraction was continued for 72 hrs. The petroleum ether extract was filtered and concentrated to a dry mass by using vacuum distillation. Subsequently the dried powder was extracted with benzene, chloroform, ethanol and water (aqueous) by following successive extraction. The solvents were evaporated to dryness and then the residue of different extracts obtained was taken for the experiment.

#### Animals:

Healthy adult Wistar strain albino rats of both sex between 2-3 months of age and weighing 150- 240 g were used for this study. Animals were allowed to be acclimatized for a period of 2 weeks in our laboratory environment prior to the study. Rats were housed in polypropylene cages (3 animals per cage), maintained under standard laboratory conditions (*i.e.* 12:12 h light and dark sequence; at an ambient temperature of  $25 \pm 2^\circ\text{C}$ ; 35-60% humidity); the animals were fed with standard rat pellet diet (Hindustan Liver Ltd. Mumbai, India) and water *ad libitum*.

#### Study on normal body temperature:

Six groups of six animals were taken. The body temperature of each rat was measured rectally at 0, 1½, 2½, 3½ and 4½ hr after administration of distilled water (control), petroleum ether, chloroform, ethanol and aqueous extract at a dose of 300mg/kg body wt. orally.

#### TREATMENT PROTOCOL:

##### Analgesic activity:

Analgesic activity of different extract of whole parts of *Desmostachya bipinnata* Stapf (Poaceae) was investigated by Tail immersion method. In this method healthy albino rats weighing about 150-200gm were taken. They were divided into 6 groups having 6 each and numbered. They were then placed into individual restraining cages leaving the tail hanging out freely. The tail of the mice (about 5 cm long) was immersed into water bath of  $55 \pm 10^\circ\text{C}$ , the time (s) taken to withdraw the tail clearly out of the water bath was taken as the reaction time. The reaction time was recorded in 0.5 seconds by a stop watch. After each determination the tail was carefully dried. The reaction was determined before oral feeding of the drug and various extracts at a dose of 300mg/kg body weight, which was recorded as zero minutes reading. The control, standard and test substances were

given to the animals by feeding needle. After the drug administration the reaction time was recorded at an interval of ½, 1, 2, 3 and 4hrs. The mean reaction time was found out for each group and compared with the value of standard drug. Chloroform extract has shown the maximum analgesic activity.

##### Antipyretic activity:

Rats were divided into six groups of six rats each. Fever was induced in rats by subcutaneous injection of 12% w/v suspension of yeast (1ml/100gm Body weight) suspended in 0.5% w/v methylcellulose solution which leads to pyrexia. After 19 hrs of yeast injection, the elevated body temperature ensures induction of pyrexia, and then the petroleum ether, chloroform, ethanol and aqueous extract of leaf at the dose of 300 mg/kg orally were administered into the experimental animal. One group of animal was treated with distilled water and serve as control group. Another group of rats received the standard antipyretic drug Paracetamol at a dose of 150 mg/kg orally. Then the rectal temp was recorded of six groups at ½, 1, 2, 3 and 4hrs gradually.

##### Anti-Inflammatory Activity:

Inflammation in the hind paw of albino rat was induced as described by Winter et al. (1962) [8]. 0.1 ml of 1% carrageenan suspension was injected into sub-plantar surface of the right hind limb of each rat. The different extract of *Desmostachya bipinnata* was evaluated for anti-inflammatory activity by carrageenan-induced paw edema method in rats [9]. Male wistar rats (150-200 g) were randomly distributed into seven groups of six animals each. The first, second, third, fourth and fifth group were the test groups for different extract of whole parts of the plant respectively in the concentration of 300 mg/kg body weight, the sixth group was treated with standard anti-inflammatory agent (Diclofenac sodium 100 mg/ kg i.p.) and seventh group served as a control. After 1 h, 0.1 ml of 1% w/v suspension of carrageenan was injected in to sub plantar region of the right hind paw to all the four group of rats. The paw volumes were measured using plethysmometer. Mean increase in paw volumes were noted for every 2 hours till 4 hrs. Thus edema volumes in control ( $V_c$ ) and in groups treated with test compounds ( $V_t$ ) were calculated. Percentage inhibition was calculated by using the formula [10].

$$\% \text{ inhibition} = \frac{V_c - V_t \times 100}{V_c}$$

Where,  $V_c$  = edema volume of Control,  $V_t$  = edema volume of the test.

##### Statistical analysis:

Data were statistically calculated by utilizing one way ANOVA and expressed as mean  $\pm$  S.E.M. followed by Dunnett's *t*-test using computerized Graph Pad InStat version 3.05, Graph pad software, U.S.A.

**Table1. Analgesic effect of *Desmostachya bipinnata* Stapf (Poaceae) in rats.**

Sl. No.	Treatment	Reaction time (second) ± SEM					
		0 min	30 min	60 min	120 min	180 min	240 min
1.	Control	2.46 ± 0.18	2.26 ± 0.43	2.46 ± 0.38	2.30 ± 0.34	2.56 ± 0.28	2.56 ± 0.28
2.	Diclofenac sodium	2.40 ± 0.25	3.50 ± 0.28*	4.03 ± 0.23*	4.73 ± 0.42*	3.80 ± 0.25*	2.86 ± 0.17*
3.	Petroleum Ether	2.37 ± 0.13	6.00 ± 0.58*	3.93 ± 0.59*	3.03 ± 0.59*	2.70 ± 0.25	2.57 ± 0.23*
4.	Benzene Extract	2.06 ± 0.23	3.73 ± 0.37**	4.10 ± 0.85*	3.43 ± 0.47	2.93 ± 0.32*	2.60 ± 0.30
5.	Chloroform extract	2.67 ± 0.22	3.93 ± 0.78	4.30 ± 0.72*	3.43 ± 0.33	2.83 ± 0.86	2.70 ± 0.25
6.	Ethanol extract	2.30 ± 0.17	3.40 ± 0.55*	3.90 ± 0.75*	4.10 ± 0.95	3.60 ± 0.55	3.07 ± 0.18
7.	Aqueous extract	2.00 ± 0.06	2.70 ± 0.30	3.20 ± 0.16*	2.74 ± 0.07*	2.43 ± 0.17	2.17 ± 0.09*

Mean ± SEM, "\*" indicates  $p < 0.05$ , "\*\*"  $p < 0.01$

**Table2. Antipyretic effect of *Desmostachya bipinnata* Stapf (Poaceae) in rats.**

Sl. No.	Treatment	Reaction time (second) ± SEM					
		0 min	30 min	60 min	120 min	180 min	240 min
1.	Control	2.46 ± 0.18	2.26 ± 0.43	2.46 ± 0.38	2.30 ± 0.34	2.56 ± 0.28	2.56 ± 0.28
2.	Diclofenac sodium	2.40 ± 0.25	3.50 ± 0.28*	4.03 ± 0.23*	4.73 ± 0.42*	3.80 ± 0.25*	2.86 ± 0.17*
3.	Petroleum Ether	2.37 ± 0.13	3.48 ± 0.58*	3.93 ± 0.59*	3.03 ± 0.59*	2.70 ± 0.25	2.57 ± 0.23*
4.	Benzene Extract	2.06 ± 0.23	3.36 ± 0.37**	4.10 ± 0.85*	3.43 ± 0.47	2.93 ± 0.32*	2.60 ± 0.30
5.	Chloroform extract	2.37 ± 0.22	3.43 ± 0.78	4.30 ± 0.72*	3.43 ± 0.33	2.83 ± 0.86	2.70 ± 0.25
6.	Ethanol extract	2.30 ± 0.17	3.40 ± 0.55*	3.90 ± 0.75*	4.10 ± 0.95	3.60 ± 0.55	2.77 ± 0.18
7.	Aqueous extract	2.00 ± 0.06	2.70 ± 0.30	3.20 ± 0.16*	2.74 ± 0.07*	2.43 ± 0.17	2.17 ± 0.09*

Mean ± SEM, "\*"  $p < 0.05$ , "\*\*"  $p < 0.01$

**Table3. Anti-inflammatory effect of *Desmostachya bipinnata* Stapf (Poaceae) in rats.**

Group	Treatment & dose (mg/kg, i.p)	Initial Paw	Paw thickness	Percentage
		thickness (cm)	after 4h (cm)	Inhibition
1	Petroleum Ether (300mg/kg)	0.72 ± 0.019	0.34 ± 0.038*	47.69
2	Benzene (300mg/kg)	0.76 ± 0.042	0.37 ± 0.027	43.07
3	Chloroform (300mg/kg)	0.83 ± 0.046	0.35 ± 0.05	46.15
4	Ethanol (300mg/kg)	0.82 ± 0.041	0.30 ± 0.209*	53.84
5	Aqueous (300mg/kg)	0.83 ± 0.23	0.40 ± 0.036	38.46
6	Diclofenac sodium (100mg/kg)	0.89 ± 0.034	0.44 ± 0.021	32.30
7	Control	0.99 ± 0.029	0.65 ± 0.23	—

Mean ± SEM, "\*" indicates  $p < 0.05$

## RESULTS AND DISCUSSION:

By tail immersion method analgesic activity was investigated with petroleum ether, benzene, chloroform, ethanol and aqueous extract of the whole parts of *Desmostachya bipinnata* Stapf. Almost all the extracts possess a significant effect as the value of  $p < 0.05$  was considered statistically significant, which is shown in Table 1.

Paracetamol is a common antipyretic agent, which is safe in therapeutic doses. The resultant effects of *Desmostachya bipinnata* Stapf (Poaceae) whole parts of the plant extracts on yeast-induced pyrexia in rats are depicted in Table 1. Experimental results exhibited that petroleum ether, benzene, chloroform, ethanol and aqueous extract of the whole parts of *Desmostachya bipinnata* Stapf, possess a significant antipyretic effect in the maintaining of normal body temperature and reduce yeast induced elevated rectal temperature in rabbits and their effect are comparable to that of standard antipyretic drug, paracetamol. The result of the present study suggests that all the extracts of *Desmostachya bipinnata* Stapf significantly reduced

the temperature of pyretic rats as the value of  $p < 0.05$  was considered as statistically significant, shown in Table 2.

The different extracts of *Desmostachya bipinnata* Stapf (300 mg/kg, orally) gave significant ( $p < 0.05$ ) reduction of rat paw edema at all assessment times. The maximum inhibition was shown by the ethanol extract 53.84% whereas the standard drug showed 32.30% of inhibition. As per we can say ethanol extract significantly reduce inflammation in inflamed rat which is shown in Table 3.

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