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# EVALUATION OF DIURETIC AND NEPHROPROTECTIVE ACTIVITY OF *DESMOSTACHYA BIPINNATA IN* ALBINO RATS

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## ABSTRACT

Diuretic activity and nephroprotective activity of different extracts of *Desmostachya bipinnata* in rat was studied. The study suggested that the extracts have good diuretic property. Diuretic study was carried out as per Lipschitz method. Where successive aquoeus, ethonolic and petroleum extracts were studied for diuretic activity. The 6 hrs acute study of successive aqueous, ethonolic extracts showed increase in urine volume and $K^+$ ion excretion as compared to control. However advanced toxicological studies remain to be performed in rodents. Extracts have shown moderate nephroprotective effect against gentamicin induced nephrotoxicity.

**KEY WORDS:** *Desmostachya bipinnata*, nephroprotectective action, lipschitz method.

## INTRODUCTION

Drugs that induce a state of increased urine flow are called diuretics. These are most often in congestion of heart, hypertension, oedematous problems. *Desmostachya bipinnata* is a widely growing plant has been reported to possess number of medicinal properties. In the traditional system of medicine the plant is said to be possess anti diuretic, diuretic and liver tonic property. The present study is to investigate the diuretic activity of different extracts of the *Desmostachya* bipinnata.[1] It belongs to the family *Poaceae* is commonly called as **Halfa**

**grass**, **big cordgrass**, and **salt reed-grass**, is an old world perennial grass, long known and used in human history. In India it is known by many names, including: *daabh*, *darbha*, *kusha*, etc. The following study was undertaken for evaluation of diuretic and nephroprotective activity in normal healthy rats.

## MATERIALS AND METHODS

### Plant material

*Desmostachya bipinnata* were collected from locally during January and taxonomical identification and authentication was done through Department of pharmacognosy. The aerial parts were washed and cleaned with water to remove dirt, chopped shade dried and pulverized.[2-3]

### Preparation of extracts

Pulverized plant material were extracted in soxhlet apparatus with petroleum ether, alcohol. Aqueous extract is prepared by decoction. The extracts are filtered and the filtrates obtained were evaporated to dryness by vacuum evaporator.

### Animals

The male Wister albino rats weighing 160gm-200gm were used to study the diuretic activity. Animals were housed in standard environmental conditions and fed with standard diet and water *ad libitum*. Protocol is approved by institutional animal ethical committee.[4] All Chemicals & other reagents were analytical grade.

### Acute toxicity studies

The male Wister albino rats weighing 160gm-200gm were used divided into different groups comprising of five animals each. The control group received normal saline 25ml/kg i.p. The other groups received 100, 200, 400, 600, 800, 1000, 2000, 4000 mg/kg of test extracts. The animals were observed continuously for the behavioral changes for the first 5 hours and then observed for mortality if any for 24 hours. The acute oral toxicity study was carried out as per the guidelines set by Organization for Economic Co-operation and Development[5] (OECD), revised draft guide lines no.423, received from Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA).

**Evaluation of Diuretic activity**

Diuretic activity determined by Lipschitz method.[6,7] In brief, animals were divided in five groups containing 6 in each group. The control group received normal saline. Group two received urea (100 mg/kg). The other groups received petroleum ether, alcohol and aqueous extracts respectively. All extracts were administered by oral route. Animals were kept fasting for overnight before testing.[8] After the dosing animals were placed in metabolic cages and urine was collected in regular intervals of time. Room temperature was maintained up to $25^0$C. The urine volume during 24 hrs and urine electrolyte estimation was carried out for sodium, potassium, using flame photometer and chloride was estimated by titrations.

**Evaluation of Nephroprotective activity[9]**

Animals were divided in 5 groups containing six in each group. Control group received normal saline. The second group received only gentamicin 40 mg/kg twice a day for 10 days. Other groups received petroleum ether, alcohol, aqueous extracts along with gentamicin 40 mg/kg in the dose of 200 mg/kg twice a day for 10 days. gentamicin is administered through i.p. after the period all the animals were sacrificed by over dosing of anesthetic ether and blood was collected by cervical decapitation. Serum was separated from the blood and the level of urea and creatinine was estimated. Elevation of urea and creatinine level in the serum was taken as the index of nephrotoxicity.[10]

**Statistical analysis**

All results are expressed as mean ± standard error. The data was analyzed statistically using ANOVA followed by student 't' test.[11]

**RESULTS**

The results of the preliminary phytochemical screening of petroleum ether, alcoholic and aqueous extracts revealed the presence of carbohydrates, saponins, triterpenoids, and steroids. In acute toxicity study, it was found that the extracts of petroleum ether, alcoholic and aqueous extracts showed no morbidity even at 4000 mg/kg. In the evaluation of diuretic activity, Urea treated rats showed a significant increase in volume of urine and urinary excretion of sodium, potassium, chloride ($P<0.01$) as compared to control. Comparatively the petroleum ether extract not showed significant change urine excretion but effective in increasing the sodium ions and much less effect as diuresis. Whereas alcohol and aqueous extracts showed significant change (Table 1).

**Table: 1 Diuretic activity of different extracts of *Desmostachya bipinnata***

| Treatment | Dose(mg/kg) | Volume of urine (ml /100 gm) | | | | |
|---|---|---|---|---|---|---|
| | | After 5 hr | After 10 hr | After 15 hr | After 20 hr | After 24 hr |
| vehicle | - | 2.17±0.05 | 3.12±0.08 | 3.77±0.04 | 4.97±0.05 | 4.98±0.05 |
| Urea | 1000 | 3.98±0.09 | 4.39±0.05 | 4.68±0.08 | 5.44±0.08* | 5.98±0.10 |
| Pet. Ether | 400 | 2.56±0.06 | 4.07±0.04* | 4.43±0.06 | 5.12±0.06 | 5.29±0.12 |
| alcohol | 400 | 3.91±0.04 | 4.22±0.03 | 4.59±0.03 | 5.64±0.04 | 6.08±0.04* |
| aqueous | 400 | 4.14±0.06 | 4.45±0.06 | 4.88±0.05 | 5.72±0.07 | 6.17±0.06* |

**All values are mean ±SEM (n=6); *p< 0.01 when compared to control.**

Aqueous and alcoholic extracts showed significant Lipschitz values (Table 2). Rats showed a significant increase in volume of urine and urinary excretion of $Na^+$, $K^+$ and $Cl^-$ as compared to control (Table 3).

**Table: 2 Lipschitz value of different extracts of *Desmostachya bipinnata***

| Treatment | Dose(mg/kg) | Lipschitz value T/U value | | | | |
|---|---|---|---|---|---|---|
| | | After 5 hr | After 10 hr | After 15 hr | After 20 hr | After 24 hr |
| Pet. Ether | 400 | 0.64 | 0.93 | 0.95 | 0.94 | 0.89 |
| alcohol | 400 | 0.98 | 0.96 | 0.98 | 1.04 | 1.02 |
| aqueous | 400 | 1.04 | 1.01 | 1.04 | 1.05 | 1.03 |

**All values are mean ±SEM (n=6); *p< 0.01 when compared to control.**

**Table: 3 Parameters of diuretic activity of different extracts of *Desmostachya bipinnata***

| Treatment | Dose(mg/kg) | Concentration of ions (meq./L) at 24 h | | | |
|---|---|---|---|---|---|
| | | $Na^+$ | $K^+$ | $Cl^-$ | $Na^+/K^+$ |
| vehicle | - | 66.23±0.09 | 61.23±0.08 | 63.78±0.08 | 1.06 |
| Urea | 1000 | 95.47±0.07 | 86.49±0.07 | 91.63±0.07 | 1.10 |
| Pet. Ether | 400 | 74.48±0.08 | 68.11±0.06 | 72.42±0.08 | 1.09 |
| alcohol | 400 | 82.44±0.05 | 79.55±0.06 | 75.30±0.06 | 1.03* |
| aqueous | 400 | 88.05±0.07 | 84.05±0.08 | 81.89±0.08 | 1.04* |

**All values are mean ±SEM (n=6); *p< 0.1 when compared to control.**

In the evaluation of nephroprotective activity the alcoholic and aqueous extracts were found to produce moderate significant nephroprotective effect against gentamicin induced nephrotoxicity. Aqueous, alcohol and petroleum extracts were showed considerable low nephrotoxicity and serum urea and creatinine levels were found to be significantly low (Table 4).

**Table: 4 Nephroprotective action of different extracts of *Desmostachya bipinnata***

| Treatment | Dose(mg/kg) | Body weight(gm) | Serum urea | Serum creatinine |
|---|---|---|---|---|
| Control | - | 125.0±4.0 | 51.00±1.5 | 0.68±0.06 |
| Gentamicin | 40 | 125.0±4.0 | 97.46±2.4 | 1.98±0.08 |
| Gentamicin + Petroleum Ether | 400 | 120.0±3.0 | 83.4±1.9 | 1.52±0.82 |
| Gentamicin + Alcohol | 400 | 115.0±2.5* | 81.2±2.0 | 1.53±0.01 |
| Gentamicin + Aqueous | 400 | 115.5±2.5* | 74.5±2.0 | 1.06±0.03 |

**All values are mean ±SEM (n=6); *p< 0.1 when compared to control.**

## DISCUSSION

Diuretic agents are useful in reducing the syndrome of volume overload, pulmonary congestion including orthopnea and paroxysmal nocturnal dysponea. They decrease plasma volume and venous return facilitating in decrease cardiac overload, oxygen demand and plasma volume, resulting decreased blood pressure. In present study we can demonstrate that aqueous, alcohol and petroleum extracts may produce diuretic effect by increasing the excretion of $Na^+$, $K^+$ and $Cl^-$.The elevation of serum Urea and serum creatinine levels have been considered important parameter in gentamicin induced nephrotoxicity. But, concomitant administration with extracts did not produce considerable nephrotoxicity. Thus the study indicated that the alcoholic and aqueous extracts of *Desmostachya bipinnata* protect the kidney from the toxic effect of gentamicin. Both extracts have shown an increase in total urine production over a period of 5hrs. They also increased the excretion of $Na^+$, $K^+$ and $Cl^-$ significantly.

## CONCLUSION

On the basis of the results, it could be concluded that *Desmostachya bipinnata* used as a diuretic agent. Acute toxicity studies showed that no mortality was observed even at 2000mg/kg. However advanced toxicological studies remain to be performed in rodents. Plant extracts have shown moderate nephroprotective effect against gentamicin induced nephrotoxicity.

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## CONFLICT OF INTEREST STATEMENT

There is no conflict of interest associated with the authors of this paper.

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