

# Diuretic Effect of *Cymbopogon jwarancusa* after Single and Multiple Doses in Rats

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## Abstract

Diuretics are efficaciously used in management of various clinical emergencies like hypertension, heart failure, cirrhosis, hypercalciuria, hematuria and nephrotic syndrome. *Cymbopogon jwarancusa* is an aromatic perennial grass used in both traditional and Unani system of medicine to eradicate diseases like colds, seasonal fever, asthma, tuberculosis, rheumatic pain, back pain, toothache and nervous disorders. *C. jwarancusa* essential oils are used in perfumery, soap, detergents, medicines and pharmaceutical industry. Monoterpenes and sesquiterpenes constitute the highest composition in essential oil of *C. jwarancusa*. The present was designed to compare the diuretic activity of *C. jwarancusa* after single and multi-doses. Furosemide (20 mg/kg) was used as reference drug and 10% DMSO was used as vehicle. Diuretic activity was noticed by measuring urine volume and calculating diuretic and Lipchitz values. Maximum diuretic response was observed at 500 mg/kg of extract after both single and multi-dose administration. On basis of results it may be concluded that *C. jwarancusa* may be used as diuretic agent.

## Keywords

*Cymbopogon jwarancusa*, Diuretic, Dimethyl Sulfoxide, Lipchitz Value, Furosemide

## 1. Introduction

Maintenance of homeostasis is very important for a normal healthy life, since existence of life becomes difficult if any change disturbs this balance. Diuretics preserve this balance by maintain blood volume as well as concentration of excess ions in the body. These properties enable diuretics to treat various pathologies e.g. hypertension, congestive heart failure, hypercalciuria, edema, nephritic syndrome, cirrhosis and renal dysfunctions [1] [2]. Hypertension is a

worldwide problem and its management gains priority each day. Survey of 2000 in adult population showed that around 972 million people had hypertension. This number is predicted to increase up of 1.56 billion by 2025 [3].

Diuretics mainly alters the excretion of electrolytes and water by acting on renal tubules. Various classes of diuretics include carbonic anhydrase inhibitors, thiazide, loop, potassium sparing and osmotic diuretics [4]. However loop diuretics are most effective as causes excretion of 20% - 25% of sodium and water while thiazide diuretics are moderate in action causing excretion of 5% - 8% sodium whereas potassium sparing diuretics are least effective since excrete only 2% - 3% of sodium.

Most common undesired effects of diuretics are hypomagnesaemia, hyponatremia, hyperglycemia, hypercholesterolemia, hyperuricemia, hypokalemia while less common side effects are weakness, impotence and fatigue [5].

In modern era herbal remedies are preferred over traditional medicines in eradicating numerous diseases, but are slow in action however thought to produce less side effects. *C. jwarancusa* is an aromatic perennial grass (Rush grass, khavi grass) belonging to family Poaceae, used in both traditional and Unani system of medicine for treatment of various ailment e.g. vomiting, fever, inflammatory condition, blood impurities and skin problems [6]. Monoterpenes and sesquiterpenes constitute the highest composition in essential oil extracted from *C. jwarancusa*. The Species name of plant is a combination of two Sanskrit words jwar and khusha means fever breaker [7]. In literature *C. jwarancusa* have been used as anti-pyretic [8], anti-fungal [9], antibacterial [10], anti-oxidant and cytotoxic agent [11]. However there is lack of documented evidence regarding diuretic activity of *C. jwarancusa*. Thus current study is designed to explore the diuretic potential of *C. jwarancusa* leaves extract at different doses after single and multiple doses.

## 2. Materials and Methods

### 2.1. Collection of Plant and Extraction

Aerial parts of *C. jwarancusa* were collected from University of Karachi and identified by herbarium, Department of Botany. A voucher specimen No. 93325 was then deposited in the herbarium. The parts of the plant were washed to remove impurities, dried, chopped and soaked in ethanol for 20 days. The filtered extract was then evaporated by rotary evaporator, freeze dried and kept in refrigerator for further examination.

### 2.2. Selection of Animals and Handling

The study was conducted on albino *Wister* rats of both sex (140 - 200 gm.) obtained from the animals house of ICCBS, University of Karachi. All the animals were kept at the animal house of Department of Pharmacology, University of Karachi, in plastic cages with 12-h light/dark cycle at 22°C ± 2°C and 50% - 60% humidity for a period of one week before the start of experiment. Animals were

fed standard diet and water regularly and were handled according to the guidelines of National Institute of Health for care and use of animals [12]. All doses of *C. jwarancusa* 150, 300 and 500 mg/kg and standard drug, furosemide 20 mg/kg were prepared in 10% DMSO and administered by oral intubation tube.

### 2.3. Design of Study

Diuretic activity was examined using Lipschitz method. Animals were randomly divided into five groups designated as negative control, positive control and three treated groups each comprising of 6 animals. Animals were deprived of food and water for 15 hours then given normal saline by mouth in a dose of 25 ml/kg before administration of vehicle, standard drug and herbal extract, to enforce water balance and salt load. After administration of standard and treated drugs all animals were separately placed in especially designed metabolic cages for collection of urine. Animals were given food and water ad libitum during the total period of experiment.

#### 2.3.1. Single Dose Response

Single dose response of the vehicle, standard drug and herbal extract at three doses was examined in animal groups pre-treated with normal saline. Negative control group received only 10% DMSO. Positive control group was given furosemide (20 mg/kg) and treated groups received 150, 300 and 500 mg/kg of *C. jwarancusa* extract. Drugs and vehicle were given in the equivalent volume to all animals once a day. Urine volume was measured continuously every hour up to five hours and then after 24 hours.

#### 2.3.2. Multiple-Dose Response

Protocol for multiple-dose was same as that for single dose, except that test and standard drugs were administered daily in the same dose for five days. Urine volume was measured daily for 5 days at an interval of 24 hours. However readings on 5th day demonstrated cumulative result of urine volume from day 1 to 5.

#### 2.3.3. Estimation of Diuretic Parameters

Diuretic index and Lipschitz value were determined by following formulas [13].

$$\text{Diuretic index} = UV_t/UV_c$$

$$\text{Lipschitz value} = UV_r/UV_c$$

where,  $UV_t$  is mean urine volume of test group.  $UV_r$  is mean urine volume of reference group.  $UV_c$  is mean urine volume of control group.

### 2.4. Statistics

All statistical calculation were performed by SPSS version 20 and values are expressed as mean  $\pm$  S.E.M. For comparison studies one way ANOVA was used, followed by post hoc (Dunnett's test). Values of  $p < 0.05$  were considered as significant diuretic and values of  $p < 0.001$  as highly significant diuretic. All graph-

ical data interpreted by Microsoft excel.

### 3. Results

#### Diuretic Activity

##### 1) Effect on urine volume

**Table 1** and **Figure 1** show urinary output after single and multiple-dose of test and standard drugs. Result shows that groups received single and multiple-doses of furosemide have highly significant increase in urine output *i.e.*  $15.51 \pm 0.48$  ml and  $37.56 \pm 3.36$  ml as compared to control group *i.e.*  $6.40 \pm 0.94$  ml and  $22.31 \pm 1.55$  respectively. However, animals received 500 mg/kg of *C. jwarancusa* extract displayed significant increase in urine output as compared to control both after single and multiple-doses *i.e.*  $9.51 \pm 1.3$  ml and  $34 \pm 3.14$  ml. Animals received 300 mg/kg of extract exhibited significant urinary output only at 3rd and 4th day on as compared to control group.

##### 2) Effect on diuretic index and Lipschitz value

**Table 2** shows comparative effect of diuretic index and Lipschitz values after single and multiple-doses of test and standard drugs. Diuretic index values after single dose of furosemide and 150, 300 and 500 mg/kg of *C. jwarancusa* extract were 2.42, 1, 1.36 and 1.48 respectively whereas in animals received multiple-doses of furosemide and 150, 300 and 500 mg/kg of *C. jwarancusa* extract showed diuretic values of 1.68, 1.22, 1.35 and 1.52 respectively.

Lipschitz values of *C. jwarancusa* extract at 150, 300 and 500 mg/kg were 41%, 56% and 61% after single dose and 72%, 80% and 90% after multiple doses as compared to furosemide.

### 4. Discussion

Plants play very beneficial role in human life; not only provides nutritional benefits but also has medicinal value. In recent time's medicinal plant has been targeted to be used as drug for eradicating variety of diseases. According to WHO

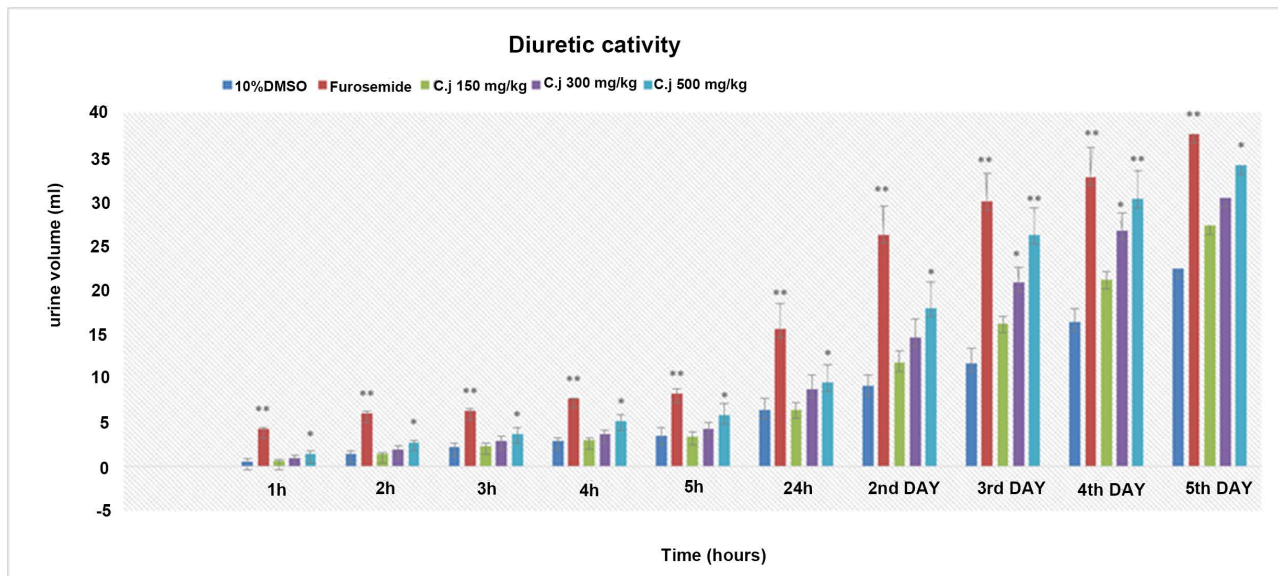
**Table 1.** Effect of *C. jwarancusa*, furosemide and DMSO on urine volume in rats.

Treatment	Urine volume (ml)									
	1 hr	2 hr	3 hr	4 hr	5 hr	24 hr	2nd day	3rd day	4th day	5th day
10% DMSO	$0.56 \pm 0.15$	$1.41 \pm 0.27$	$2.20 \pm 0.37$	$2.85 \pm 0.41$	$3.45 \pm 0.37$	$6.40 \pm 0.94$	$9.08 \pm 1.33$	$11.68 \pm 1.24$	$16.30 \pm 1.63$	$22.31 \pm 1.55$
Furosemide 20 mg/kg	$4.25 \pm 0.28^{**}$	$5.96 \pm 0.16^{**}$	$6.28 \pm 0.24^{**}$	$7.61 \pm 0.23^{**}$	$8.25 \pm 0.12^{**}$	$15.51 \pm 0.48^{**}$	$26.18 \pm 2.94^{**}$	$29.93 \pm 3.28^{**}$	$32.71 \pm 3.16^{**}$	$37.56 \pm 3.36^{**}$
<i>C. jwarancusa</i> 150 mg/kg	$0.62 \pm 0.14$	$1.40 \pm 0.20$	$2.33 \pm 0.16$	$2.95 \pm 0.26$	$3.40 \pm 0.26$	$6.41 \pm 0.46$	$11.73 \pm 0.84$	$16.08 \pm 1.33$	$21.08 \pm 0.88$	$27.23 \pm 0.94$
<i>C. jwarancusa</i> 300 mg/kg	$0.95 \pm 0.15$	$1.88 \pm 0.35$	$2.85 \pm 0.47$	$3.6 \pm 0.51$	$4.23 \pm 0.49$	$8.75 \pm 0.77$	$14.55 \pm 1.57$	$20.75 \pm 2.08^*$	$26.66 \pm 1.72^*$	$30.33 \pm 1.94$
<i>C. jwarancusa</i> 500 mg/kg	$1.36 \pm 0.2^*$	$2.71 \pm 0.37^*$	$3.66 \pm 0.20^*$	$5.13 \pm 0.75^*$	$5.75 \pm 0.72^*$	$9.51 \pm 1.31^*$	$17.91 \pm 1.99^*$	$26.16 \pm 2.95^*$	$30.25 \pm 3.09^*$	$34.0 \pm 3.14^*$

n = 6; Values are mean  $\pm$  S.E.M; Significant diuretic if  $p < *0.05$ ; Highly significant diuretic if  $p < **0.001$ .

**Table 2.** Effect of *C. jwarancusa* on diuretic index and Lipschitz value.

Groups	Dose mg/kg	Diuretic Index		Lipschitz Value	
		Single Dose	Multiple Dose	Single Dose	Multiple Dose
10% DMSO	-	-	-	-	-
Furosemide	20	2.42	1.68	-	-
<i>C. jwarancusa</i> 1	150	1	1.22	0.41	0.72
<i>C. jwarancusa</i> 2	300	1.36	1.35	0.56	0.80
<i>C. jwarancusa</i> 3	500	1.48	1.52	0.61	0.90



**Figure 1.** Comparison of urinary output after single and multiple-doses of various drugs.  $n = 6$ ; Values are mean  $\pm$  S.E.M; Significant diuretic if  $*p < 0.05$  as compared to control; Highly significant diuretic if  $**p < 0.001$  as compared to control; CJ = *Cymbopogon jwarancusa*.

almost one million people are dependent on herbal medicines for primary treatment of ailments and 21,000 herbal plants from all over the world have listed for possessing the medicinal properties [14]. In Unani Medicinal system the ethno pharmacological studies on *C. jwarancusa* illustrate its use as diuretic, but literature review reveals that no study have been performed to evaluate its diuretic action.

In this study different strengths of ethanol extract of *C. jwarancusa* were used to investigate diuretic activity, while furosemide was used as reference drug to compare the response of test drug. *C. jwarancusa* at 500 mg/kg showed significant diuretic effect after single and multiple doses, while 300 mg/kg extract displayed significant diuretic response only on 3rd and 4th day as compared to control, on basis of these findings it may be concluded that *C. jwarancusa* extract has dose-dependent diuretic response.

Terpenoids present in *C. jwarancusa* have been reported to have diuretic activity. Terpenoids prevent the actions of aldosterone by binding to A1 receptor,

thus causing diuresis [15]. Terpenoids constitute approximately 65% - 70% of the total composition in *C. jwarancusa*. Hence the diuretic activity of *C. jwarancusa* may be due to high composition of terpenoids. In future, studies could be carried out to isolate active pharmacological constituents and determine their actual mechanism of action.

Previously other species of *Cymbopogon* were also reported to have a diuretic response. *C. citratus* leaf decoction showed mild diuretic effects in rats at 10% and 20% [16]. *C. schoenanthus* extract also showed significant urine output values in combination with glycolic acid [17].

Patel [18] has categorized diuretics as good, moderate and poor on the basis of diuretic index, hence it may be concluded that according to diuretic index *C. jwarancusa* falls in the category of moderate diuretic at all doses and may be used safely.

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