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Original Article

Anti-inflammatory Activity of Ethanol Leaves Extract of *Cymbopogon jwarancusa* on Carrageenan Induced Paw edema in Rats

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ABSTRACT

Inflammatory conditions are the root cause for various diseases like atherosclerosis coronary artery disease's, metabolic disorders, Alzheimer's disease and cancers. Inflammation may be acute or chronic inflammation. Chronic inflammatory conditions if not properly control will lead to development of various morbidities. *Cymbopogon jwarancusa* is an aromatic perennial grass that grows widely in tropical and sub-tropical regions of Pakistan. Essential oil of Cymbopogon species used in perfumes, soaps, detergents, cosmetics, flavoring and pharmaceutical industry. The objective of investigation was to observethe anti-inflammatory activity of ethanol leaves extract of *Cymbopogon jwarancusa* in rats at different doses using Carrageenan induced paw edema model. These findings showed that *Cymbopogon jwarancusa* had significant dose dependent reduction in paw edema at 4th hour and highly significant reduction at 5th hour. The % inhibition of edema was 38.16%, 43.46% and 44.35 respectively at the 5th hour at 150, 300 and 500mg/kg of*Cymbopogon jwarancusa*as compared to control. We can conclude from the outcome of the present work that *Cymbopogon jwarancus a* extract exert an excellent anti-inflammatory effect in the rats.

KEYWORDS: Anti-inflammatory, Plethysmometer, Ibuprofen, Carrageenan, *Cymbopogon jwarancusa.*

1. INTRODUCTION

Inflammatory conditions are the root cause for various diseases like atherosclerosis coronary artery disease's, metabolic disorders, Alzheimer's disease and cancers [7]. Inflammation is common pathology that effects more than

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half population in the world. The prevalence of this disease is significantly increasing in all countries regardless of socioeconomic status. Inflammation is the body's defensive mechanism occurs in response to physical or chemical injury or bacterial invasion evident by 5 basic signs (redness, heat, edema, pain and loss of function). Inflammation may be acute or chronic inflammation [4]. Chronic inflammatory conditions if not properly control will lead to development of various morbidities [6].

Many synthetic drugs were used either alone or in combination for management of pain and inflammation such as opioids, NSAIDs and corticosteroids. NSAIDs are the most widely used anti-inflammatory drugs but side effects associated with these drugs limits its use. NSAIDs block COX 1 and COX 2 enzymes responsible for prostaglandin, thromboxane and prostacyclin production which are involved in management of pain, inflammation, platelet aggregation etc. Major side effects of NSAIDs are bleeding, peptic ulcers, gastrointestinal toxicity and renal function failure. Selective COX 2 blockers have advantage over conventional NSAIDs as it possess less side effects and responsible for beneficial effects of NSAIDs [11]. Medicinal plants are used by majority of populations to cure various illness and have high impact on the world's economy. *Cymbopogonj warancusa*is an aromatic perennial grass that grows widely in tropical and sub-tropical regions of Pakistan. Essential oil of Cymbopogon species used in perfumes, soaps, detergents, cosmetics, flavoring and pharmaceutical industry. Literature survey showed that *C. jwarancusa* possess anti-microbial, anti-convulsant, anti-oxidant, anti-pyretic, anti-fungal and cytotoxic properties which attributed towards the presence of phytochemicals.

Winter *et al* was the first who described the method for measuring the edema. Carrageenan induced paw swelling in rats in very convenient in vivo method for analyzing the anti-inflammatory activity of marketed and trial anti-inflammatory drugs.

2. MATERIALS AND METHODS

Fresh leaves of *Cymbopogon jwarancusa* were collected from University of Karachi. Identified and submitted in herbarium of botany department, University of Karachi with voucher number 93325. Fried leaves were washed and dried under shady places for 2 weeks. Dried leaves were cut, chopped and soaked in ethanol for 15-20 days. Final residual form of extract was obtained by freeze drying. Albino wistar rats of either sex weighing between 180-250gm. were used for examining anti-inflammatory activity. Animals were kept under controlled temperature (25±2 ^{o}C) and humidity (50 - 60%) conditions and were fed with standard laboratory diet with water ad libitum throughout the experiment.

Carrageenan induced paw edema model

Anti-inflammatory activity was evaluated using carrageenan induced acute inflammatory model in rats [12]. 0.1 ml of freshly prepared Carrageenan solution (1 % w/v of carrageenan in normal saline) was used as phlogistic agent for inducing edema in all rats by sub plantar injection in left hind paw of rats. Carrageenan injected 30 min before administering vehicle, standard drug and herbal extract respectively.

Animals were divided into five groups, each containing six rats. One group was control received only 10% DMSO. Second group served as standard received ibuprofen while animals of remaining three groups received 150, 300 and 500 mg/ kg of *Cymbopogon jwarancusa* and served as treated groups.

Plethysmometer was used for measuring paw thickness initially at 0 hour just before the carrageenan injection and represented as "Vi" and then measured at 1, 2 3, 4 and 5 hour after administering vehicle, standard drug and herbal extract and represented as "Vt".

Anti-inflammatory activity was evaluated by calculating mean increase in paw volume and % inhibition of edema by following formulas.

Mean increase in paw volume = Vt - Vi

Vi = Initial paw volume

Vt = Increase in paw volume at different time intervals

% inhibition of edema = Vc – Vt / Vc * 100 (Palanichamy and Nagarajan 1990).

Vc = Mean increase in paw volume of control group

Vt = Mean increase in paw volume of treated group

Statistical Analysis

The value for paw edema was expressed as mean increase in paw volume ± S.E.M in (ml). Level of significance was measured by applying one way ANOVA, followed by Dunnett's t-test to compare the groups. Values were taken as significant and highly significant if $p<0.05$ and $p<0.001$respectively. All statistical procedures were performed by SPSS (20). Graphical representation were done by Microsoft excel.

3. RESULT

Anti-inflammatory activity

Table 1 and figure 1 showed comparison between different groups receiving 10% DMSO, ibuprofen and *C. jwarancusa* extract.

Animals received DMSO had showed increase in paw volume up to 5th hour. At 0 hour thickness was 3 ± 0.07 mm which increased to 5.21 ± 0.21 mm at 5th hour. The paw thickness of group received standard drug showed mild increased up to 3rd hour that is 2 ±0.09 mm, and then significantly decrease at 4th and 5th hour respectively (1.92 ± 0.07 mm ; 1.2 ± 0.27 mm). Groups treated with different doses of *C. jwarancusa* extract showed increment in paw edema up to 3rd hour 4.44 ± 0.51 mm, 4.36 ± 0.33 mm, 500 mg/kg 4.3 ± 0.23 mm) followed by significant dose-dependent decreased in inflammation at 4th hour (150 mg/kg 3.64 ±0.51 mm, 300 mg/kg 3.46 ± 0.27 mm, 500 mg/kg a3.5 ± 0.29 mm) and highly significant decreased at 5th hour (150 mg/kg 3.22 ± 0.53 mm, 300 mg/kg 2.94 ± 0.25 mm, 500

mg/kg 2.9 ±0.27 mm).

Table 1: Effect of *C. jwarancusa*, ibuprofen and DMSO on inflammation by carrageenan induced paw edema in rats

Groups	**Mean paw volume (ml) ± S.E.M**						**Mean increase in paw volume (ml) ± S.E.M**					**% inhibition of edema ± S.E.M**				
	Before Carrageenan	1hr	2hr	3hr	4hr	5hr	1hr	2hr	3hr	4hr	5hr	**1hr**	**2hr**	**3hr**	**4hr**	**5hr**
Control (10% DMSO)	3.1 ± 0.09	6 ± 0.04	7.82 ± 0.25	8.13 ± 0.25	8.33 ± 0.2	8.3 ± 0.2	3 ± 0.07	4.72 ± 0.29	4.82 ± 0.24	5.15 ± 0.21	5.21 ± 0.21	-	-	-	-	-
Ibuprofen 20mg/kg	3.29 ± 0.05	4.73 ± 0.06*	4.87 ± 0.04**	5.3 ± 0.1	5.21 ± 0.05**	4.49 ± 0.27**	1.44 ± 0.04*	1.58 ± 0.05**	2 ± 0.09**	1.92 ± 0.07**	1.2 ± 0.27**	51.88 ± 1.49	66.52± 1.24	59.73± 1.81	62.71± 1.53	76.96± 5.21
C. jwarancusa 150mg/kg	3.3 ± 0.08	6 ± 0.46	7.45 ± 0.56	7.74 ± 0.5	6.94 ± 0.5*	6.52 ± 0.53*	2.74 ± 0.48	4.15 ± 0.57	4.44 ± 0.51	3.64 ± 0.51*	3.22 ± 0.53**	8.66 ± 16.03	12.07± 12.19	11.63± 10.15	29.25± 10.03	38.16± 10.31
C. jwarancusa 300mg/kg	3.26 ± 0.12	5.9 ± 0.39	7.37 ± 0.45	7.62 ± 0.4	6.72 ± 0.32*	6.2± 0.3**	2.64 ± 0.3	4.1 ± 0.35	4.36 ± 0.33	3.46 ± 0.27*	2.94 ± 0.25**	11.89± 10.1	12.81± 7.51	13.21± 6.56	32.78± 5.42	43.46± 4.89
C. jwarancusa 500mg/kg	3.1 ± 0.09	5.83 ± 0.37	7.34 ± 0.51	7.45 ± 0.29**	6.64 ± 0.34*	6.± 0.29**	2.7 ± 0.35	4.2 ± 0.52	4.3 ± 0.23	3.5 ± 0.29*	2.9 ± 0.27**	9.94± 11.92	10.8± 11.10	11.92± 6.01	31.84± 5.74	44.35± 5.25

n =6
Values are expressed as mean ± S.E.M
Significant anti-inflammatory if *p value < 0.05 as compared to control
Highly significant anti-inflammatory if **p values < 0.001 as compared to control

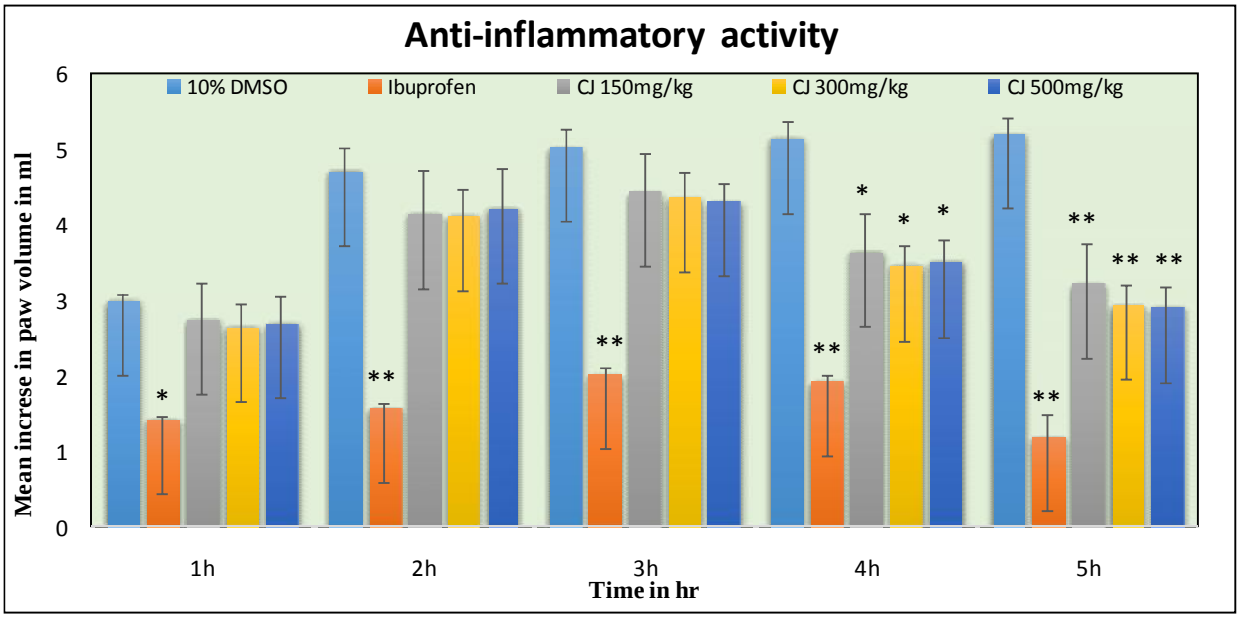

Fig 1: Changes in paw thickness of rats at different time interval after treatment with *C. jwarancusa* and ibuprofen
Each value represents the mean ± SEM (n=6)
Significant anti-inflammatory if *p value < 0.05 as compared to control
Highly significant anti-inflammatory if **p values < 0.001 as compared to control, CJ= *Cymbopogon jwarancusa*

4. DISCUSSION

The global burden has continued to shift away from communicable to non-communicable diseases. The raising burden from inflammatory disorders will impose new challenges on global health systems. Carrageenan induced paw edema model is most continent and suitable method for evaluating acute inflammatory conditions. The inflammation induced by carrageenan is bi-phasic. First phase starts with the release of histamine, serotonin, and kinins while the second phase is correlated with the release of prostaglandins like substances [2]. It has been found that mostly anti-inflammatory and steroidal drugs produced anti-inflammatory action in to 2nd phase of carrageenan induced inflammation.

Present study demonstrates significant anti-inflammatory potential of *C. jwarancusa* extract at all three doses in carrageenan induced paw edema model at 4thhr and highly significant anti-inflammatory activity at 5th hr. The *C.*

jwarancusa extracts exhibited 38.15%, 43.46% and 44.35% inhibition of edema as compare to ibuprofen which showed 76.96% inhibition at 5th hour. It may be expected that anti-inflammatory mechanism of *C. jwarancusa* would be due to inhibition of prostaglandin synthesis, mainly responsible for inflammation.

Moreover phytochemicals and trace elements present in *C. jwarancusa* e.g. phenols, terpenoids, zinc, manganese and copper etc. may accounts for anti-inflammatory activity. Phenols reported to prevent formation of NO and NF-kB pathway activation [5]. Elemol reserved the production of IL-6, IL-1β, and TNF-α [13]. Geraniol stopped neutrophil migration to injured site [1]. Terpenoids constitute highest composition in *C. jwarancusa* extract and are used to treat various inflammatory conditions and cancers [9].Copper reduces the expression of iNOS and production of cytokines (e.g. IL-4 and INF-α) [10] .Manganese is also used to treat inflammation, sprains and rheumatoid arthritis [3].

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