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ANTI-INFLAMMATORY ACTIVITY OF ETHANOL EXTRACT OF LEAF AND BARK OF *FERONIA ELEPHANTUM* CORREA

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ABSTRACT

Ethanol extract of *Feronia elephantum* leaf and bark were investigated for its anti-inflammatory activity in animal models. The anti-inflammatory activity was estimated volumetrically by measuring the mean increase in hind paw volume of rat with the help of plethysmometer. Indomethacin in the dose of 10 mg/Kg is used as standard drug. The plant extracts were given in the doses of 200 and 400 mg/Kg body weight. Control group received 0.5% NaCl (saline) solution. All the doses were administered orally. Results showed that, ethanol extract of leaf had potent and significant anti-inflammatory activity.

Key words: *Feronia elephantum*, Ethanol extract, Carrageenan induced oedema, Anti-inflammatory.

INTRODUCTION

Despite the progress made in medical research for the past decades, the treatment of many serious diseases is still problematic. Chronic inflammatory diseases remain one of the world's major health problems[1-3]. Inflammation is the response of living tissues to injury. It involves a complex array of enzyme activation, mediator release, extravasations of fluid, cell migration, tissue breakdown and repair[4-5]. Inflammation had become the focus of global scientific research because of its implications in virtually all human and animal diseases. As a result of adverse effects such as gastric lesions caused by non-steroidal anti-inflammatory agents have not been successful in all cases[6-7]. Therefore, new anti-inflammatory drugs lacking these side effects are being researched as alternatives to NSAID and Opiates[8]. Attention is being focused on the investigation of the efficacy of plant-based drugs used in the traditional medicine because, they are cheap, have little side effects and according to WHO, about 80% of the world population still rely mainly on herbal remedies.

Feronia elephantum is one of the medicinally important plants belonging to Rutaceae, commonly known as wood apple. Various parts of wood–apple have been used against various ailments in ethnomedicine. Juice of young leaves is mixed with milk and sugar candy given as remedy for biliousness and intensive troubles of children. A powdered gum mixed with honey, is given to overcome dysentery and diarrhea in children. The leaves are used traditionally in Ayurveda as antiemetic, aromatic, expectorant, purgative, useful in anorexia, bronchitis, calculus, cardiac debility, cough, gastropathy, hiccup and in vitiated conditions of vayu[9]. The bark is occasionally prescribed for biliousness and useful in liver diseases[10.]

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Since the conventional drugs used are either too expensive or toxic and not commonly available to the rural folks that constitute the major populace of the world, this present study was therefore undertaken to evaluate the effect of anti-inflammatory activity of *Feronia elephantum* leaf and bark on carrageenan induced rat paw oedema, so as to establish a scientific basis for the synthesis of new generation anti-inflammatory drugs.

EXPERIMENTAL

Materials and methods

Plant material

The leaf and bark of *Feronia elephantum* were collected in the month of Feb. and March-2011 from the Agasthiarmalai Biosphere Reserve, Western Ghats, Tirunelveli. The plant was identified with the help of local Flora and voucher specimen, preserved in Ethnopharmacology Unit, Research Department of Botany, V. O. Chidambaram College, Tuticorin - 628 008, Tamil Nadu, India.

Animals

Adult Wistar albino rats of either sex (150-200 g) were used for present investigation. Animals were housed under standard environmental conditions at temperature (25 ± 2^{o}C) and light and dark (12 : 12 h). Rats were feed standard pellet diet (Goldmohur Brand, M/s Hindustan Lever Ltd., Mumbai, India) and water *ad libitum.*

EXPERIMENTAL

Acute toxicity study

For toxicity studies, six Albino rats of either sex were administered orally with the test substance in the range of doses 200-2000 mg/Kg and the mortality rates were observed after 72 h. The ethanol extract of leaf and bark of *Feronia elephantum* has shown no mortality at 2000 mg/Kg. Therefore 2000 mg/Kg dose was considered as LD_{50} cut off dose (safe dose). So 1/10 and 1/5 of that were selected (200 and 400 mg/Kg) for the experiment as sub maximal and maximal dose.

Anti-inflammatory activity

Carrageenan-induced hind paw oedema

Albino rats of either sex weighing 150-200 g were divided into four groups of six animals each. The dosage of the drugs administered to the different groups was as follows, **Group I** - Control (normal saline 0.5 mL/Kg), **Group II** – Leaf extract of *Feronia elephantum* (200 mg/Kg and 400 mg/Kg, p.o.), **Group III** – bark extract of *Feronia elephantum* (200 mg/Kg and 400 mg/Kg, p.o.) and **Group IV**- Indomethacin (10 mg/Kg). All the drugs were administered orally.

After one hour of the administration of the drugs, 0.1 mL of 1% w/v carageenan solution in normal saline was injected into the subplantar tissue of the left hind paw and the right hind paw of the rat was served as the control. The paw volume of the rats were measured in the digital plethysmograph (Ugo basile, Italy), at the end of 0 min., 60 min., 120 min., 180 min. The percentage increase in paw oedema of the treated groups was compared with that of the control and the inhibitory effect of the drugs were studied. The relative potency of the drugs under investigations was calculated based upon the percentage inhibition of the inflammation.

The percentage inhibition of the inflammation was calculated from the formula:

Percentage Inhibition = D_o-D_t / D_o × 100,

where D_o was the average inflammation (hind paw oedema) of the control group of rats at a given time; and D_t was the average inflammation of the drug treated (i.e extracts or reference indomethacin) rats at the same time[11-13].

RESULTS AND DISCUSSION

In the present study, the anti-inflammatory activity of ethanol extract of leaf and bark of *F. elephantum* were assayed in Albino rats using carrageenan-induced rat paw oedema method. Table 1 shows the anti-inflammatory activity of *F. elephantum* significantly inhibited the rat paw oedema at 3rd hour post carrageenan were 24.53% and 63.15% for 200 and 400 mg/Kg of leaf extract and 21.30% and 37.33% for 200 and 400 mg/Kg of barks extract, respectively. The results were compared with indomethacin 10 mg/Kg show percentage paw reduction of 65.94%.

Table 1: Anti-inflammatory activity of ethanol extract of *F. elephantum* leaf and bark against carrageenan-induced paw oedema in albino rats

Treatment	Dose mg/Kg	Oedema volume (mL)				%inhibition after 180 min.
		0 min	60 min.	120 min.	180 min.	
Control (Group-1)	Normal saline	29.45 ± 1.21	68.39 ± 1.22	98.23 ± 2.32	118.54 ± 3.37	-
FEL extract (Group-II)	200	31.22 ± 1.71	58.13 ± 1.38	68.34 ± 1.33*	89.46 ± 2.18*	24.53
	400	23.26 ± 1.56	31.53 ± 1.88*	52.33 ± 1.28	43.68 ± 1.97**	63.15
FEB extract (Group-III)	200	25.59 ± 1.23	61.34 ± 1.21	89.28 ± 2.66	93.28 ± 2.56	21.30
	400	22.34 ± 1.08	54.67 ± 1.69	61.58 ± 1.37*	74.28 ± 2.03*	37.33
Indomethacin (Group-IV)	10	26.51 ± 1.34	69.76 ± 1.46	53.55 ± 1.62**	40.37 ± 1.93**	65.94

Each Value is SEM ± 5 individual observations *$p < 0.05$; **$p < 0.01$

Carrageenan oedema is a multimediated phenomenon that liberates diversity of mediators. It is believed to be biphasic; The first phase (1 h) involves the release of serotonin and histamine while the second phase (over 1 h) is mediated by prostaglandins, the cyclooxygenase products, and the continuity between the two phases is provided by kinins[14,15]. Development of oedema induced by carrageenan is commonly correlated with early exudative stage of inflammation.[16] The ethanol extract of *F. elephantum* produced dose-dependent and significant inhibition of carrageenan induced paw oedema of the studied plant parts, leaf of *F. elephantum* showed more potent anti- inflammatory acitivity at the dose of 400 mg/Kg when compared with standard drug indomethacin.

Phenol, 4[2(dimethylamino)ethyl], 2, 3Dimethylquinolin4(1H)one(Alkaloid), Ethylisoallocholate (Steroid) and Phenol, 4-(3-hydroxy-1-propenyl)-2-methoxy-,3-2-N-Acety l-N-methylaminoethyl) indol (Steroid), Cholesta-8,24-dien-3-ol,4-methyl-, (3a'4a')-(Steroid) were reported in the ethanol extract of *F. elephantum* leaf and bark by GC-MS analysis[17]. These compounds may have the role in anti-inflammatory. Anti-inflammatory activity of many plants has been attributed to their high sterol/triterpene[18] or flavonoid[19] contents. It has been shown that, these pharmacological substances could exhibit anti-inflammatory activity through inhibition of cyclooxygenase lipooxygenase pathways[20].

Since carrageenan-induced inflammation model is a significant predictive test for anti-inflammatory agents acting by the mediators of acute inflammation[21], the results of this study are an indication that, *F. elephantum* leaf can be effective in acute inflammatory disorders.

CONCLUSION

In conclusion, the results of the present study support the traditional use of *F. elephantum* leaf extract, possessing significant anti-inflammatory activity. This may be due to the presence of triterpenoids, saponins and tannins, which deserves further studies to establish its therapeutic value as well as its mechanism of action.

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