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Anti-Inflammatory Activity of Ethanol Extract of Crateva Nurvala Stem Bark on Carrageenan Induced Paw Edema in Rats

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Abstract
Natural medicines, which are abundant in various vitamins and flavonoids, have been increasingly popular in recent years for the treatment of inflammation. When compared to standard allopathic medications, these natural therapies are predicted to be both safe and cost effective. With the goal of approximating its traditional and pharmaceutical usage against pain and inflammation disorders, this research examined the anti-inflammatory action of ethanol extract of stem bark of crateva nurvala.The anti-inflammatory effects of crateva nurvala (varun), an ethanol extract of crateva nurvala stem bark, were studied using in-vivo models. This research set out to determine if crateva nurvala ethanol extract had anti-inflammatory effects when used against carrageenan-induced paw edema in rats at two distinct doses (200 and 400 mg/kg body weight). In rat models of carrageenan-induced edema, the extract demonstrated considerable anti-inflammatory efficacy at a dose of 400 mg/kg body weight, with a reduction in paw volume of 41.61% at 4 hours comparable (P< 0.05) to that caused by the standard medication indomethacin 74.49%.Phytochemical constituents in the ethanol extract of crateva nurvala stem bark, such as alkaloid, flavonoids, saponins, and tannins, work together to suppress inflammation. These compounds inhibit arachidonic acid metabolism, neutrophil degranulation, and enzyme systems that promote cell proliferation and regulate the complement system. Although these results are promising, further preclinical and clinical testing is required to confirm them.

1. Introduction

An inflammatory reaction is a normal aspect of the body's defense mechanism against harmful stimuli including pathogens, damaged cells, or irritants that enter the bloodstream. The stem bark of the *crateva nurvala* tree is used in traditional medicine in Asia. Plant extracts that have been purified can provide a fresh starting point for the development of next-generation anti-inflammatory medications that are safer and more effective than their predecessors.[1]

This is the body's way of protecting itself from further harm by ending the source of the injury and setting the stage for the healing of the affected area. Opioids and nonsteroidal anti-inflammatory drugs (NSAIDs) are two examples of currently accessible medications that are widely held to be ineffective for treating inflammatory illnesses due to their high risk of unwanted side effects and limited effectiveness. [2,3]. The purpose of this research was to determine whether or whether an ethanol extract of *crateva nurvala* might reduce inflammation in response to carrageenan-induced paw edema in rats.

Nurvala crataeva (C. nurvala) Varuna, or Buch-

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Ham, is a tree native to India. It belongs to the family Capparidaceae and is evergreen. It is a medium-sized deciduous plant that grows wild or is cultivated along the riverbanks of southern India and other tropical and subtropical nations throughout the world [4].

Alkaloids, saponins, triterpenes, tannins, flavonoids, and phytosterol abound in the plant. The bark can be used as a digestive aid, stomachic, diuretic, or laxative due to its high temperature, initially bitter, then sweet, biting flavour. worm medicines with fever reducers [5].

2. Plant Material

Dr. V. B. Awale, an accredited botanist from the department of botany at Dr. patangrao Kadam Mahavidyalaya in Sangli, identified and authenticated the stem bark of a *crateva nurvala* (Family: Capparidaceae) that was gathered in the area. The specimen voucher number is (LNCT /Bhopal/ 102). Extraction from crateva nurvala steam bark was performed using a Soxhlet equipment and methanol as a solvent between 60 and 70 degrees Celsius. The ethanolic extract was dried, then kept at 4 degrees Celsius. To facilitate its use in in vivo studies, the methanolic extract was fully solubilized in a 1% w/v Cellulose Methylcellulose solution.

Members of IAEC on the research board approved animal testing in accordance with NIH and NACLAR guidelines [6,7].

Biocyte Institute of Research and Development Sangli. M.S. (Reg. No. 2114/PO/RE/S/20/CPCSEA) conducted all animal experiments in accordance with the guidelines set forth by the institution's Ethics Committee on Research in Animals (Approval number IAEC/Sangli/2020-21/09). The plastic pens used for housing the animals were kept at a constant temperature of around 25 degrees Celsius and humidity levels of between 50 and 60 percent on a rotating twelve-hour basis. Each mouse had unrestricted access to its regular food and water supply. About one hour before the trials began; the rats were brought to the lab. The rats' overall health was evaluated by seeing that they didn't move, have any swelling, diarrhoea, or ulcers during the 7-day acclimation period in a laboratory setting before the dose was given.

Grounding of drugs

Merck was the source for both carrageenan and gum tragacanth. From a reputable pharmacy, Indomethacin was obtained. Merck's 2% tragacanth gum (in powder form) was utilized to make two suspensions (200 and 400 mg/kg) for the study's control group. Subjects in the placebo group were given tragacanth gum (10 mL/kg PO). New suspensions were made for dosing each time.

Carrageenan-Induced Rat Paw Edema Model: Acute inflammation was created using an edema experiment on rats that were randomly assigned to one of four groups of six (one control, one standard, and two test groups). After inducing edema in the rat's hind paw with carageenan, the anti-inflammatory effect of Ethanol extract of stem bark of *crateva nurvala* (200 and 400 mg/kg) can be evaluated using this well-validated approach. Phlogistic agents, like carrageenan, are used to cause inflammation and swelling [8].

The extract's anti-inflammatory properties were tested. Acute inflammation was induced in the right hind paw of rats 1 h after subplantar injection of 0.1 ml of 1% Carrageenan in normal saline. Digital callipers were used to measure the paw diameter at 1, 3, and 5 hours after the Carrageenan injection. The standard medication was Indomethacin (10 mg/kg orally) [9].

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Control Group: 1% Carrageenan solution (5 ml/kg b.w)

Standard Group: Carrageenan + Indomethacin (10 mg/kg b.w)

Test Group 1: Carrageenan + Ethanol extract of stem bark of *crateva nurvala* (200 mg/kg b.w)

Test Group 2: Carrageenan + Ethanol extract of stem bark of *crateva nurvala* (400 mg/kg b.w)

The anti-inflammatory activity was calculated as percentage inhibition of Carrageenan induced paw edema using the following formula.

$$\text{Percent inhibition} = 1 - dt \times 100 / dc$$

Where: dt = paw diameter in treated; dc = paw diameter in control

Statistical Analysis: The data was summarized using a mean standard error of the mean (SEM), and then differences between groups were analyzed using Dunnett's t-test. For this study, a p-value of 0.05 or lower was considered statistically significant.

3. Results

Ethanol extract of *crateva nurvala* stem bark inhibits carrageenan-induced paw edema in rats: A substantial increase in paw edema ($p < 0.05$) was seen in control rats given carrageenan at a dose of 0.1 ml (1.0 w/v). Paw edema was dramatically reduced with indomethacin, the conventional treatment. It was revealed that at the 4-hour mark, there was a 74.49% inhibition rate. Paw edema in rats treated with 200 or 400 mg/kg of ethanol extract of *crateva nurvala* stem bark was significantly ($p<0.05$) reduced in comparison to control rats at 4 hours post-treatment. We measured 36.92% and 41.61% inhibition rates. To minimize paw edema size, the highest dose was determined to be most effective.

TABLE 1: Anti-Inflammatory Activity of Crateva Nurvala Steam and Bark Ethanoic Extract on Carrageenan Induced Paw Edema in Rats

Sr. no.	Treatment	Dose	Paw edema at different time points (ml)			
			1h	2h	3h	4h
1	Vehicle	5ml/kg	0.71 ±0.14	0.97 ±0.12	1.21 ±0.08	1.49 ±0.13
2	Indomethacin	10ml/kg	0.31 ±0.16	0.52 ±0.16	0.49 ±0.09	0.38 ±0.14*
3	Ethanol extract of stem bark of *crateva nurvala*	200mg/ml	0.58 ±0.17	0.79 ±0.12	0.86 ±0.12	0.94 ±0.18*
4	Ethanol extract of stem bark of *crateva nurvala*	400mg/ml	0.49 ±0.09	0.68 ±0.07	0.73 ±0.17	0.87 ±0.19*

Results are mean ± SEM (n=6) *p<0.05

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Sr. no.	Treatment	Dose	Percent inhibition of paw edema (ml)			
			1h	2h	3h	4h
1	Vehicle	5ml/kg	0	0	0	0
2	Indomethacin	10ml/kg	56.33	46.39	59.50	74.49
3	Ethanol extract of stem bark of *crateva nurvala*	200mg/ml	18.30	18.55	28.92	36.92
4	Ethanol extract of stem bark of *crateva nurvala*	400mg/ml	29.89	29.89	39.66	41.61

4. Discussion

Experimental results from the current investigation confirm that an ethanol extract of *crateva nurvala* has anti-inflammatory properties. Injecting carrageenan into the rats' paw causes them to develop paw edema, which can be used to test the anti-inflammatory effects of various plant extracts. Mast cell serotonin and histamine release initiates the first phase (1 h after carrageenan challenge), kinins supply the second phase (3 h), and prostaglandins, cyclooxygenase products, and lipoxygenase products mediate the third phase (5 h) of the reaction. It's possible that alkaloids are to blame for the current activity [10,11]. Lymphocyte proliferation, natural killer cell cytotoxicity, mast cell histamine release, and human monocyte IL-1 production are all potentially inhibited by alkaloids due to their potential mechanism of action [12, 13]

5. Conclusion

Similar anti-inflammatory effects to those of nonsteroidal anti-inflammatory medicines like Indomethacin were reported with the use of *Crateva nurvala*. It has been hypothesized that *crateva nurvala* may work by blocking the production of certain neurotransmitters, including histamine, serotonin, and prostaglandins. However, more research is required to identify the chemical components of ethanol extracts of the plant that have anti-inflammatory effects.

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