

Evaluation of anti-inflammatory activity of aqueous extract of *Mangifera indica* leaves in albino rats

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ABSTRACT

Background: *Mangifera indica* (MI) commonly known as mango belongs to the family *anacardiaceae*, distributed in rural and semi urban parts of India. According to Ayurveda, various medical properties are attributed to different parts of the mango tree. The purpose of the study was to evaluate anti-inflammatory activity of aqueous extract of *Mangifera indica* leaves.

Methods: Aqueous extract of *Mangifera indica* leaves was prepared and tested for anti-inflammatory activity in albino rats weighing 200-250 gm. The in vivo anti-inflammatory activity was evaluated by using Acute (carrageenan induced paw edema) and chronic (Formalin induced paw edema) animal models. Rats were divided into 4 groups, 6 rats in each group. Group I (control) received 0.1 ml 4% gum acacia suspension. Group II and Group III received *Mangifera indica* extract at doses of 200 mg/kg and 400 mg/kg body weight. Group IV (standard) received diclofenac 10 mg/kg body weight. All the drugs were administered orally. Anti-inflammatory activity was expressed as percentage inhibition of paw edema.

Results: The percentage inhibition in carrageenan induced paw edema with 200 mg/kg and 400 mg/kg *Mangifera indica* extract was 44.8% and 53% and in formalin induced paw edema was 47.5% and 64.4% respectively. The two doses of *Mangifera indica* extract showed significant anti-inflammatory action ($p < 0.001$) in both models.

Conclusions: Aqueous extract of *Mangifera indica* leaves showed significant dose dependent anti-inflammatory activity.

Key words: Anti-inflammatory activity, Carrageenan, Edema, Formalin, *Mangifera indica*

INTRODUCTION

Inflammation is considered as a primary physiologic defense mechanism that helps body to protect itself against infections, burns, toxic chemicals, allergens or other noxious stimuli. An uncontrolled and persistent inflammation may act as etiological factor for many chronic illnesses.¹ Non-steroidal anti-inflammatory drugs (NSAIDs) are widely used in the treatment of pain and inflammation. Currently available NSAIDs are associated with unwanted side effects and have their own limitations. About 34-46% of the users of NSAIDs usually sustain some gastrointestinal damage due to inhibition of the protective cyclooxygenase enzyme in gastric mucosa.² Hence there is a need for anti-inflammatory drugs with fewer side effects.

Mangifera indica (*anacardiaceae*) is a large evergreen tree that grows to a height of 10-45 m, dome shaped with dense foliage, typically heavy branches from a stout trunk.³

There are many traditional uses for different parts of *Mangifera indica* throughout the globe. *Mangifera indica* is used to treat asthma, cough, dysentery, diarrhea, pain, leucorrhoea and malaria.⁴ Pharmacological studies have demonstrated that *Mangifera indica* exhibits a wide range of properties like analgesic, anti-inflammatory, antidiabetic, antiulcer, antioxidant and immunomodulatory.⁶⁻⁹ The studies evaluating the anti-inflammatory activity of *Mangifera indica* leaves are

limited. The main purpose of the study was to evaluate anti-inflammatory activity of *Mangifera indica* leaves.

METHODS

Mangifera indica leaves available locally were identified and used for the study.

Preparation of extracts

The fresh leaves of *Mangifera indica* were shade dried for 2 weeks and grinded into a fine powder and passed through a sieve to made fine free flowing powder. The powder was soaked in equal amount of water and stirred intermittently and was left overnight. The macerated pulp was dried at reduced temperature. This dry mass served as aqueous extract of leaves of *Mangifera indica* for experimentation.

Drugs and chemicals

Diclofenac (win medicare), carrageenan (sigma), formalin and all other chemicals were analytical grade.

Animals

Adult albino rats of either sex, weighing between 200-250 gm were used in this study. Animals were obtained from National Institute of Nutrition, Hyderabad, India. The animals were stabilized for one week at temperature 25±1°C and 60±5% relative humidity and 12 hrs dark light cycles. They have been given a standard pellet diet and water ad libitum. All the experiments were conducted as per norms approved by institutional animal ethics committee.

Experimental procedure

The rats were randomly allocated into 4 groups (n=6) and treated as follows.

Group I: Control received vehicle only (0.1 ml 4% gum acacia suspension)

Group II: Test rats received aqueous extract of leaves of *Mangifera indica* 200 mg/kg.

Group III: Test rats received aqueous extract of leaves of *Mangifera indica* 400 mg/kg.

Group IV: Standard received diclofenac 10mg/kg.

All the drugs were administered orally.

Carrageenan induced rat paw edema model

In this method, the rats were pre-treated with drugs, orally 1 hr before the experiment. 0.1ml of 1% carrageenan solution was injected into sub plantar region of the right hind paw of each rat.

The rat paw volume up to the ankle joint was measured at 0, 1, 2, 3 and 4 hours after the injection of carrageenan using plethysmometer. Increase in the paw edema volume was considered as the difference between initial at 0 hr and of 1hr, 2hr, 3hr or 4 hr. Percentage inhibition of paw volume treated and control groups were calculated as follows.¹⁰

$$\text{Percent inhibition} = \frac{V_c - V_t}{V_c} \times 100$$

Where Vc and Vt represent the mean increase in paw volume in control and treated groups respectively.

Formalin induced rat paw edema model

0.1 ml of 2% formalin was injected in the sub plantar area of right hind paw of rat. All the drugs were administered orally 1 hr prior to formalin injection and subsequently for 9 consecutive days. The second injection of formalin was given on third day.¹¹ The paw volume was measured by plethysmometer on day 1 and day 9. The difference in the paw volume on day 1 and day 9 was considered as inflammatory edema. Volume changes in standard and test groups were compared with that of control and percentage inhibition was calculated.

Statistics

Results were expressed as mean±SD. Statistical analysis was performed by using one way analysis of variance (ANOVA) followed by Dunnet’s test. P<0.05 was considered statistically significant.

RESULTS

Anti-inflammatory effect of *Mangifera indica* extract against carrageenan induced paw edema is shown in Table 1.

Table 1: Anti-inflammatory effect of aqueous extract of *Mangifera indica* in carrageenan induced paw edema.

Treatment group	Increase in paw volume in ml (% inhibition of paw edema)			
	1 hour	2 hour	3 hour	4 hour
Control	0.2811±0.0129	0.3542±0.0130	0.4343±0.0128	0.3812±0.0254
MI 200 mg/kg	0.1782±0.0145* (36.88)	0.2018±0.0120* (43.22)	0.2310±0.0112* (46.77)	0.2102±0.0122* (44.88)
MI 400 mg/kg	0.1932±0.0104* (31.56)	0.2098±0.0109* (40.96)	0.2172±0.0157* (50)	0.1798±0.0170* (53.01)
Diclofenac (10 mg/kg)	0.1372±0.01048* (51.41)	0.1747±0.0140* (50.84)	0.1555±0.009* (64.28)	0.1100±0.01361* (71.12)

Results expressed as mean±SD. p<0.001* compared to control. Figures in parenthesis indicate percentage inhibition.

The two doses of *Mangifera indica* extract (200 mg/kg and 400 mg/kg) showed statistically significant ($p < 0.001$) inhibitory effect on "mean increase in paw volume" at all-time intervals (1, 2, 3 and 4 hours). Maximum percentage inhibition was observed at the end of four hours. The extract test doses 200 mg/kg and 400 mg/kg body weight reduced the edema induced by carrageenan by 44.8% and 53% respectively. The standard drug showed 71.1% of inhibition compared to control.

Table 2: Anti-inflammatory effect of aqueous extract of *Mangifera indica* in formalin induced edema.

Treatment group	Increase in paw volume in ml	Percentage inhibition of paw edema
Control	0.515±0.0920	-
MI 200 mg/kg	0.270±0.7127*	47.57%
MI 400 mg/kg	0.183±0.0454*	64.46%
Diclofenac (10 mg/kg)	0.126±0.0350*	75.53%

Results expressed as mean ± SD. $p < 0.001$ compared to control.

Table 2 shows the anti-inflammatory effect of *Mangifera indica* extract in formalin induced paw edema. The percentage inhibition of edema at the end of nine days was 47.5% and 64.4% at the doses of 200 mg/kg and 400 mg/kg respectively. The standard drug showed 75.5% of inhibition when compared to control. *Mangifera indica* extract (200 mg/kg and 400 mg/kg) showed statistically significant ($p < 0.001$) inhibitory effect in formalin induced edema.

DISCUSSION

Carrageenan induced hind paw edema is the standard experimental model of acute inflammation. Carrageenan is phlogistic agent of choice for testing anti-inflammatory drugs as it is devoid of apparent systemic effects and more over the experimental model exhibits a high degree of reproducibility.¹² Carrageenan induced paw edema is characterized by biphasic event with involvement of different inflammatory mediators.¹³ Histamine and serotonin plays important role in the first phase (during the first 2 hours after carrageenan injection) while in the second phase (3-4hours after carrageenan injection) kinins and prostaglandins are involved.¹⁴ Our results revealed that administration of *Mangifera indica* extract inhibit edema starting from the first hour and all phases of inflammation, which is probably due to inhibition of release of different chemical mediators of inflammation.

Formalin induced paw edema is the most suitable experimental model to screen antiarthritic and anti-inflammatory agents as it closely resembles human arthritis.¹⁵ The nociceptive effect of formalin is biphasic, an early neurogenic component followed by a later tissue mediated response. Formalin induced paw edema in rats represents the proliferative phase of inflammation.¹⁶ *Mangifera indica* extract showed significant activity in

this model. Therefore, it appears to act by inhibiting proliferative phase of inflammation.

The phyto chemical screening of *Mangifera indica* extract revealed the presence of polyphenolics, flavonoids, triterpenoids and tannins.^{17,18} These phyto constituents could be responsible for anti-inflammatory action.

Studies have demonstrated that crude leaf extract of *Mangifera indica* showed antibacterial activity.¹⁹ Therefore the additional property of antimicrobial along with anti-inflammatory activity of *Mangifera indica* leaves may have synergistic effects on the inflammation.

CONCLUSION

Aqueous extract of *Mangifera indica* leaves showed significant anti-inflammatory action in acute and chronic experimental models and the activity was dose dependent.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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