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Pharmacological Study

Evaluation of antinociceptive and antirheumatic activity of *Grangea maderaspatana* (L.) Poir. using experimental models

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Abstract

Introduction: *Grangea maderaspatana* (L.) Poir. (Asteraceae), a popular Indian medicinal plant is traditionally used for rheumatism in the knee joint and pain in the muscles. **Aim:** To investigate antinociceptive and antirheumatic activity of *G. maderaspatana* (L.) Poir. using experimental models. **Materials and Methods:** Antinociceptive activity of methanolic extract of *G. maderaspatana* (L.) Poir. (GMME) (500 mg/kg, 1000 mg/kg, p.o.) was evaluated in rats using tail flick test. Anti-inflammatory and anti-arthritic activity of GMME (1000 mg/kg, p.o.) was evaluated using carrageenan-induced rat paw edema and complete Freund's adjuvant (CFA)- induced arthritis models. The degree of arthritis was evaluated by hind paw swelling, body weight changes, arthritic index, erythrocyte sedimentation rate (ESR), rheumatoid factor (RF), and C-reactive protein (CRP) supported by histopathology of ankle joints. **Results:** GMME treatment showed a significant increase in the latency for tail flick and provided significant protection against carrageenan-induced rat paw edema. 21 days treatment of GMME significantly inhibited paw edema found to be induced by arthritis by CFA in rats. Further, GMME treatment also reversed arthritic index and loss of body weight and reduced CFA-induced rise of ESR, RF, and CRP significantly in rats. Histopathological study of ankle joint revealed that GMME inhibited edema formation and cellular infiltration induced by CFA. **Conclusions:** GMME possesses antinociceptive, anti-inflammatory, and antirheumatic activities.

Key words: Antinociceptive, antirheumatic, carrageenan, Freund's adjuvant, *Grangea maderasptana*

Introduction

Rheumatoid arthritis (RA) is a systemic and autoimmune disease that is characterized by pain, swelling, and destruction of cartilage and bone, with a resultant disability.[1,2] Strategies for treatment of patients with RA have changed over the past decades, from traditional nonsteroidal anti-inflammatory drugs or disease-modifying antirheumatic drugs to novel biological agents, such as tumor necrosis factor (TNF) monoclonal antibody.[2] Despite these progress made in the treatment of RA, the best ways to prevent long-term joint damage and functional decline is still unknown.[3] Besides, considering the side effects and the high costs of the current drugs, it is necessary to develop an efficient, minimum side effect yet low-cost treatment for RA. The main characteristics of RA are joint dysfunction caused by inflammation and serious pain. That is to say, inflammation and pain should be controlled in the therapy of RA.[4] Thus, agents with the activity of anti-inflammation and analgesia may meet the requirement.

Herbal medicines have been used by the mankind since time immemorial. *Ayurveda*, the oldest traditional system of India, reveals that ancient Indians had a rich knowledge

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of medicinal value of different plants. With the advent in science, many of the crude drugs used in traditional system have been investigated scientifically. *Grangea maderaspatana* (L.) Poir. is a medicinal plant widely used in Indian traditional system of medicine for curing various ailments.[5] *G. maderaspatana* (family: Asteraceae) is a common weed usually growing in sandy land and waste places in tropical and subtropical Asia and Africa.[6] The herb is traditionally used as antipyretic and good for pain in the eyes and ears. The root is an appetizer; astringent to the bowel, diuretic, anthelmintic, emmengogue, galactogogue, and stimulant; useful in griping, in troubles of chest and lungs, headache, paralysis, rheumatism in knee joint, piles, pain in the muscles, diseases of the spleen and liver, troubles of the ear, the mouth, and the nose; lessens perspiration.[5] This plant is pharmacologically studied for estrogenicity, antifertility, cytotoxic, antioxidant, hepatoprotective, diuretic, and antimicrobial activities.[7-12] There is no scientific evidence regarding antirheumatic action of this plant. Based on this, aim of the present study was to evaluate analgesic, anti-inflammatory, and antirheumatic activity of *G. maderaspatana* using animal models.

Materials and Methods

Preparation of extract

Fresh plant material of *G. maderaspatana* was collected from the region near Saputara, Dang. The plant was authenticated by Dr. N. Sasidharan, Department of Botany, at Bansilal Amrutlal College of Agriculture, Anand and herbarium was deposited to A. R. College of Pharmacy, Vallabh Vidyanagar (Herbarium no: RPR/GM-1/12/ARGH-11-13). The whole plant material was dried in shade and was ground to get a coarse powder. The powdered plant material of *G. maderaspatana* was extracted with methanol using soxhlet apparatus. The crude extract was filtered, concentrated, and dried (yield 10.2% w/w). Freshly prepared aqueous solution of dried methanolic extract of *G. maderaspatana* (GMME) was used in the experimental study. Doses of GMME were selected based on acute toxicity study, available review literature, and a pilot study in tail flick test.

Preliminary phytochemical screening

The qualitative chemical investigation of GMME was carried out to check the presence of various phytoconstituents.[13]

Drugs and chemicals

Pentazocine (Fortwin®, Ranbaxy Laboratories Ltd., Ahmedabad) was used as a standard for tail flick method. Dexamethasone (Biodexone®, Biochem Pharmaceutical Industries Ltd., Mumbai) was used as a standard for complete Freund's adjuvant (CFA)-induced arthritis model. Indomethacin (Westcoast, Ahmedabad) used as a standard for carrageenan-induced paw edema model. Carrageenan (S.D. Fine Chem Ltd., Mumbai) was used for inducing inflammation in carrageenan paw edema model. CFA (Sigma Aldrich Cooperation, Bangalore) was used for inducing arthritis. All other chemicals and reagents used for the study were of analytical grade.

Animals

All the experiments were carried out using Wistar albino rats of either sex weighing between 150 and 250 g. The animals were housed under standard conditions, were maintained on a 12 h light/dark cycle and having free access to food and water up to the time of experimentation. The animals were acclimatized to the laboratory environment 1 h before the experiments. Animals were randomly distributed into groups of 6 animals each. All experiments were conducted during the light period (08.00–16.00 h). All the protocols were approved by the Institutional Animal Ethical Committee (IAEC) (Protocol no: CPCSEA/IAEC/ARCP/12-13/09) and was conducted according to the guidelines of Committee for the Purpose of Control and Supervision of Experiment on Animals (CPCSEA).

Acute toxicity test

Wistar rats were treated with graded dose up to 2000 mg/kg by per oral (p.o) route and were observed for mortality up to 24 h.[14]

Analgesic activity -tail flick test

Wistar rats (150–250 g) of either sex were divided into four groups (n = 6). Group 1 served as a control received distilled water (1 ml/kg, p.o.). Group 2 received reference standard (pentazocine 5 mg/kg, i.p.). Group 3 and 4 received GMME in the dose of 500 mg/kg and 1000 mg/kg per oral, respectively. The tail flick latency of rats was assessed by the analgesiometer.[15] Animals were placed into individual restraining cages leaving the tail hanging out freely. The tail was kept on the bridge of analgesiometer called jacket with an electrically heated nichrome wire (55°C) underneath. The time taken for withdrawal of the tail was taken as the tail flick latency, an index of nociception. The pretreatment latency of tail flick response (initial reaction time) was noted down for each rat and cut-off time of 15 s was fixed. Tail flick latency was measured to 15, 30, 60, and 90 min after treatments. The antinociception response for each was calculated by the following formula.

$$\text{Percent antinociception} = \left(\frac{[\text{Tr} - \text{Tc}]}{[\text{cut off} - \text{Tc}]}\right) \times 100$$

Where T_c is control reaction time (s) and T_r is reaction time (s) after drug treatment.

Anti-inflammatory activity-carrageenan-induced rat paw edema

Groups and drug regimen is same as above except reference standard Indomethacin (5 mg/kg, p.o) was used. Inflammation in rats was produced by carrageenan according to the method described by Winter *et al.*[16] After 1 h of sample treatments, acute inflammation was produced by a subplanter injection of 0.05 ml of 1% solution of carrageenan in normal saline in the right hind paw of rat. The paw was marked with ink at the level of the lateral malleolus and paw volume was measured up to this mark. The paw volume was measured plethysmographically immediately after injection, again after 1 h, 2 h, 3 h, 6 h, and eventually 24 h after carrageenan injection. Data were shown as an increase in paw volume and percentage inhibition (PI) of paw edema produced by treated groups. PI of paw edema was calculated at1 h, 2 h, 3 h, 6 h, and 24 h using the formula:

$$PI = (1 - [(Vd - Vp)/(Vc - Vp)]) \times 100$$

Where, Vd–Vp = Difference in paw volume after carrageenan and initial paw volume for drug treated animals. Vc–Vp = Difference in paw volume after carrageenan and initial paw volume for control animals.

Antirheumatic activity-complete Freund's adjuvant induced arthritis in rats

Wistar rats (150–250 g) of either sex were divided into three groups (n = 6). Group 1 served as a control received distilled water (1 ml/kg, p.o). Group 2 served as arthritic control received CFA (CFA containing 10 mg of heat killed mycobacterium tuberculosis in 1 ml paraffin oil [0.1 ml]) only. Group 3 received GMME (1000 mg/kg, p.o.). Group 4 received reference standard (dexamethasone 100 μg/kg, i.p.). Adjuvant arthritis was induced in all animals by injection into the subplantar region of the left hind paw with 0.1 ml of CFA.[17] Drug treatment (standard/GMME) was started from initial day, that is, from the day of adjuvant injection (0 day), 30 min before adjuvant injection and continued until 21st day. Paw volume was measured on 0, 3rd, 7th, 14th, and 21st day using digital plethysmometer (INCO, Ambala). The mean changes in injected paw edema with respect to initial paw volume, was calculated on respective days and PI of paw edema with respect to the untreated group (control) was calculated. The animals were weighed, using digital weighing balance on 1st and 21st day from the day of adjuvant injection. At the end of the experiment, on the 21st day all animals were anesthetized and blood was withdrawn by a retro-orbital puncture and collected in plain and ethylenediaminetetraacetic acid containing tubes, respectively for serum separation. Biochemical and hematological parameters such as serum C-reactive proteins (CRPs), serum rheumatoid factor (RF), and erythrocyte sedimentation rate (ESR) were measured as an indicative of inflammation. On day 21, rats were sacrificed and ankle joints were subjected to histopathological studies.

PI of paw edema = (1 – [mean change in paw volume of treated rat/mean change in paw volume of untreated rat]) × 100.

Arthritic index is the mean of the score/grade given to the severity of inflammation on the ears, nose, tail, fore paw, and hind paw.[18] All the animals were closely observed and scored. An arthritic index for each animal was calculated as the sum of these scores and compared with respective control groups.

ESR was measured by Westergren's method.[19] Serum RF estimation and CRP were measured by turbidimetry.[19]

Histopathology of synovial joint

Rats were sacrificed on the 21st day; ankle joints of the left hind paws were removed and fixed in 10% buffered formalin. They were decalcified in 5% formic acid, processed for paraffin embedding, sectioned at 5 μm thicknesses, and subsequently stained with hematoxylin-eosin for examination under a light microscope with ×100 magnifications. Sections were examined for the presence of hyperplasia of the synovium, pannus formation, and destruction of the joint space.[19]

Statistical analysis

Results were expressed as a mean ± standard error of mean. The statistical significance of the difference between groups for the various treatments was determined by one-way analysis of variance followed by Dunnett's multiple range test. $P < 0.01$ was considered statistically significant as compared to control.

Results

Preliminary phytochemical screening

Phytochemical screening revealed the presence of carbohydrate, flavonoids, steroids, polyphenols, and tannins in the GMME.

Acute toxicity test

The GMME did not show any mortality in rats up to the dose of 2000 mg/kg. One-fourth and one-half of this dose were selected for pharmacological models.

Effect of methanolic extract of *Grangea maderaspatana* on tail flick method in rats

As shown in Table 1, GMME (500 and 1000 mg/kg) significantly increased the tail flick latency of rats at 60 min, 90 min, and 120 min, toward the thermal source in a dose dependent manner. GMME in the dose of 500 mg/kg showed significant activity in animals as percentage antinociception at 60 min (28.86%), 90 min (37.45%), and 120 min (27.74%) were observed. Furthermore, 1000 mg/kg dose of GMME showed significant ($P < 0.01$) activity as percentage antinociception at 60 min (43.67%), 90 min (54.42%), and 120 min (45%) of drug administration. Thus, significant ($P < 0.01$) analgesic effect of GMME was observed in tail flick test, which started at 60 min and attained the peak effect at 90 min of the time interval. Pentazocine (5 mg/kg) as positive control significantly increased the tail flick latency of rats at all observed time intervals.

Effect of methanolic extract of *Grangea maderaspatana* on carrageenan-induced rat paw edema model

The result of the anti-inflammatory activity of GMME is shown in Table 2. GMME at the dose of 1000 mg/kg produced significant inhibition of rat paw edema after 3 h (53.09%),

Table 1: Effect of GMME on tail flick test in rats

Time interval in min	Control	GMME (500 mg/kg, p.o.)		GMME (1000 mg/kg, p.o.)		Pentazocine (5 mg/kg, i.p.)	
	Tail flick latency (s)	Tail flick latency (s)	PA	Tail flick latency (s)	PA	Tail flick latency (s)	PA
0	2±0.26	1.83±0.31	-	2±0.37	-	2.17±0.31	-
15	1.83±0.30	2.31±0.21	3.59	2.88±0.40	7.97	11.33±0.49*	72.15
30	2.16±0.40	3.58±0.35	11.01	4.43±0.45	17.66	13.67±0.61*	89.61
60	1.84±0.30	5.63±0.45*	28.86	7.58±0.61*	43.67	10.16±0.31*	63.29
90	2.17±0.40	6.97±0.29*	37.45	9.15±0.29*	54.42	5.83±0.31*	28.57
120	2±0.26	5.61±0.45*	27.74	7.85±0.32*	45	3.5±0.56	11.54

Values are expressed as mean±SEM (n=6). One-way ANOVA followed by Dunnett's test, *P<0.01 when compared with control group. PA: Percentage antinociception, SEM: Standard error of mean, GMME: Methanolic extract of *Grangea maderaspatana*, ANOVA: Analysis of variance

6 h (58.72%), and 24 h (78.08%) of carrageenan injection. Indomethacin (5 mg/kg) as a reference standard significantly inhibited the edema formation due to carrageenan to an extent of 58.33%, 63.53%, and 81.61% at 3 h, 6 h, and 24 h, respectively. Thus, results showed that indomethacin and GMME were significantly effective at the phase of inflammation which was produced at 3 h of carrageenan injection.

Effect of methanolic extract of *Grangea maderaspatana* on rat paw edema in complete Freund's adjuvant-induced arthritis model

CFA challenge produced an increase in the paw volume by inducing acute inflammation in all the animals. There was significant ($P < 0.01$) rise in the paw volume in the arthritic control group as compared to normal control group. The treatment with GMME (1000 mg/kg, p.o.) inhibited the rat paw edema by 78.84% which was comparable to dexamethasone treated group that showed 85.54% inhibition of rat paw edema after 21 days [Table 3].

No significant changes in body weight were observed in all experimental groups. Arthritic index was significantly ($P < 0.01$) decreased in groups treated with GMME (1000 mg/kg) and dexamethasone (100 µg/kg) as compared to arthritic control group [Table 4].

As shown in Table 5, there were significant changes in biochemical parameters such as ESR, RF, and CRP in changes which were observed with CFA challenge. Significant ($P < 0.01$) rise in ESR value in arthritic control group (17.33 ± 0.954) was observed as compared to normal control group (6.67 ± 0.494). The treatment with GMME (1000 mg/kg) and dexamethasone (100 µg/kg) produced significant ($P < 0.01$) reduction in ESR values; 11.67 ± 0.667 and 9.33 ± 0.494, respectively, as compared to arthritic control group. There was a significant increase in RF value in arthritic control group (14.03 ± 0.419) as compared to normal control group (3.62 ± 0.251). The treatment with GMME (1000 mg/kg) and dexamethasone (100 µg/kg) produced significant reduction in RF values; 9.08 ± 0.548 and 6.58 ± 0.456, respectively, as compared to arthritic control group. There was an increase in CRP value in arthritic control group (18.25 ± 0.519) as compared to normal control group (3.28 ± 0.247). The treatments with GMME

Table 2: Effect of GMME on carrageenan-induced rat paw edema model

Carrageenan-induced paw edema measured at time intervals	Control	GMME (1000 mg/kg, p.o.)		Indomethacin (5 mg/kg, p.o.)	
	Increase in paw volume (ml)	Increase in paw volume (ml)	PI	Increase in paw volume (ml)	PI
1 h	0.469±0.014	0.358±0.014	23.70	0.311±0.032	33.74
2 h	0.561±0.019	0.401±0.015	28.53	0.354±0.023	36.99
3 h	0.954±0.024	0.447±0.012*	53.09	0.397±0.019*	58.33
6 h	0.939±0.024	0.387±0.010*	58.72	0.342±0.015*	63.53
24 h	0.621±0.016	0.136±0.024*	78.08	0.114±0.028*	81.61

Values are expressed as mean±SEM (n=6). One-way ANOVA followed by Dunnett's test, *P<0.01 when compared with control group. PI: Percentage inhibition, GMME: Methanolic extract of *Grangea maderaspatana*, SEM: Standard error of mean, ANOVA: Analysis of variance

Table 3: Effect of GMME on rat paw edema in CFA-induced arthritis model

CFA-induced paw edema measured at time intervals	Normal control	Arthritic control	GMME (1000 mg/kg, p.o.)		Dexamethasone (100 µg/kg, i.p.)	
	Increase in paw volume (ml)	Increase in paw volume (ml)	Increase in paw volume (ml)	PI	Increase in paw volume (ml)	PI
0 day	0.753±0.027	0.778±0.011	0.792±0.019	-	0.752±0.024	-
3rd day	0.756±0.022	1.542±0.034#	1.368±0.025*	24.62	1.266±0.033*	32.70
7th day	0.752±0.023	1.682±0.050#	1.311±0.025*	42.52	1.205±0.024*	49.93
14th day	0.759±0.022	1.952±0.034#	1.223±0.034*	63.25	1.127±0.015*	68.07
21st day	0.754±0.023	1.877±0.026#	1.024±0.022*	78.44	0.911±0.028*	85.54

n=6. Expressed as mean±SEM. #P<0.01 as compared to normal control group, *P<0.01 as compared to arthritic control group by one-way ANOVA followed by Dunnett's test. PI: Percentage inhibition, CFA: Complete Freund's adjuvant, GMME: Methanolic extract of *Grangea maderaspatana*, SEM: Standard error of mean, ANOVA: Analysis of variance

Table 4: Effect of GMME on physical parameters in CFA-induced arthritis model

Treatment	Physical parameters			Arthritic score
	Body weight (g)			
	Before treatment	On day 21	Difference	
Normal control	203.33±2.78	225.00±6.19	21.67	-
Arthritic control	210.00±5.77	196.67±3.07	–13.3	3.67±0.33
GMME (1000 mg/kg, p.o.)	208.33±4.94	220.00±3.80	11.67	2.50±0.22**
Dexamethasone (100 µg/kg, i.p.)	199.17±3.27	195.83±2.39	–3.34	1.5±0.22*

n=6. Expressed as mean±SEM.*P<0.01 as compared to arthritic control group by one-way ANOVA followed by Dunnett's test, **P<0.05. GMME: Methanolic extract of *Grangea maderaspatana*, CFA: Complete Freund's adjuvant, SEM: Standard error of mean, ANOVA: Analysis of variance

Table 5: Effect of GMME on biochemical parameters in CFA-induced arthritis model

Treatment	Biochemical parameters		
	ESR (mm/h)	RF factor (IU/ml)	C-reactive proteinCRP (mg/l)
Normal control	6.67±0.494	3.62±0.251	3.28±0.247
Arthritic control	17.33±0.954#	14.03±0.419#	18.25±0.519#
GMME (1000 mg/kg, p.o.)	11.67±0.667*	9.08±0.548*	11.26±0.348*
Dexamethasone (100 µg/kg, i.p.)	9.33±0.494*	6.58±0.456*	6.93±0.427*

n=6. Expressed as mean±SEM. #*P*<0.01 as compared to normal control group, **P*<0.01 as compared to arthritic control group by one-way ANOVA followed by Dunnett's test. GMME: Methanolic extract of *Grangea maderaspatana*, CFA: Complete Freund's adjuvant, ESR: Erythrocyte sedimentation rate, RF: Rheumatoid factor, SEM: Standard error of mean, ANOVA: Analysis of variance

(1000 mg/kg) and dexamethasone (100 µg/kg) reduced CRP values; 11.26 ± 0.348 and 6.93 ± 0.427, respectively, as compared to arthritic control group.

The observed histopathological changes of ankle joints of the experimental groups are shown in Figure 1. Control group showed the normal architecture of ankle joint. Arthritic control joint showed prominent abnormalities such as edema formation, degeneration with the partial erosion of the cartilage, and extensive infiltration of inflammatory exudates in the articular surface. Standard drug, dexamethasone (100 µg/kg) treatment showed less cellular infiltrates and less edema formation. GMME treatment for 21 days revealed a reduction in pannus formation with reduced neutrophil infiltration, that is, comparable to that of the standard.

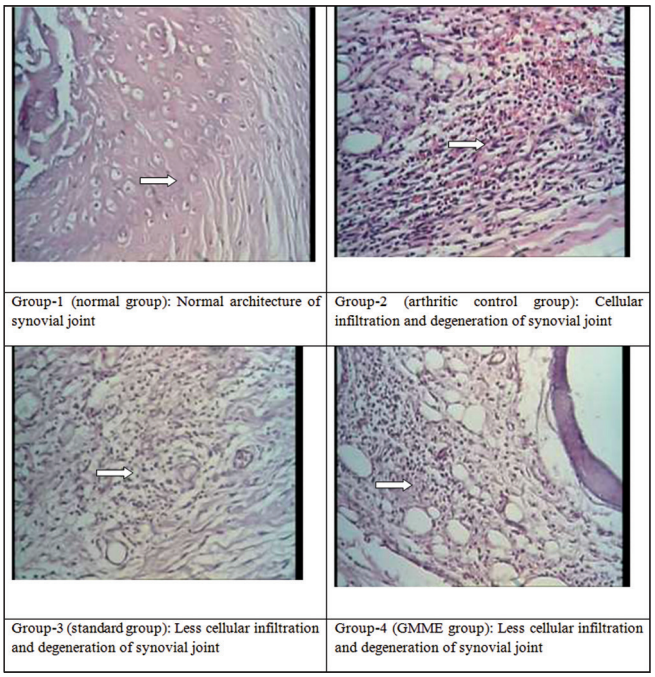

Figure 1: Histopathology of synovial joints in rats. Microscopic ×100. Stained with hematoxylin and eosin for general evaluation and with toluidine blue for specific evaluation of cartilage changes

Discussion

RA, a chronic autoimmune disease, is characterized by cartilage loss, synovial hyperplasia, and joint damage, mainly in the ankles.[20] The treatment goals for RA are long-term relief of pain, prevention of joint inflammation and suppression of pannus formation and morphological changes. Opioid analgesics could reduce the pain of RA, but they are associated with severe adverse effects.[21] The results of tail flick test indicated that GMME produced antinociceptive activity via central action without any side effects. Furthermore, reported analgesic activity of this plant against acetic-induced writhing in mice indicates its action through a peripheral action by inhibition of prostaglandins also.[22] Acute toxicity test, as well as the chronic administration of GMME, did not produce any pathological changes in the tested animals, thus demonstrating its safety on long-term administration.

Edema represents the early phase of inflammation in carrageenan-induced paw edema and is the simplest and most widely used acute inflammatory model for studying anti-inflammatory agents. Anti-inflammatory activity of GMME (1000 mg/kg) against carrageenan-inflammation during the late phase (3 h after carrageenan injection) of inflammation might be attributed to the inhibition of release of prostaglandins.[23]

The similarities in joint pathology between CFA-induced arthritis and RA could be used for screening of new drugs for this disease.[24] Decreased paw volume in both acute and chronic phase in CFA-induced arthritis may be due to the suppression of inflammatory mediator released due to immunological events by Freund's adjuvant.[25] CFA-induced polyarthritis is indicated by arthritic index includes the combined index of inflammation, the formation of nodules, and extent of spread of the disease to other organs. This gives the full picture of the disease.[26] Inflammation and/or nodules are observed on ears, nose, tail, fore paws, and hind paws. Arthritic index is the average of the score given to severity of the lesions in these places. GMME treated animals showed significant reduction of arthritic index indicating its action through the inhibition of release of immune-mediated inflammatory mediators.[27]

Adjuvant arthritis is characterized by reduced body weight associated with increased production of pro-inflammatory cytokines such as TNF-α and interleukin 1.[28,29] In the present study, arthritic animals showed nonsignificant weight loss while the body weight was recovered during the treatment of GMME may be due to reduction in the distress caused by the severity of the arthritis.

CRP can activate the complement system and can bind to phagocytic cells, an observation suggesting that it can initiate the elimination of targeted cells by its interaction with both humeral and cellular effector system of inflammation. CRP prevents the adhesion of neutrophils to endothelial cells by decreasing the surface expression of L-selectin to inhibit the generation of superoxide by neutrophils.[30] Similarly, an increase in the ESR is attributed to the accelerated formation of endogenous proteins such as fibrinogen and globulin,

and such a rise in the ESR indicates an active but obscure disease process.[31] An increment in ESR and CRP levels was observed in the arthritic animals. The restoration of these biochemical markers on GMME treatment shows the effective antiarthritic effect.

RF is an autoantibody directed against the Fc portion of IgG that is positive in 80% of patients with RA. This response to the nonself-immunoglobulin results in the presence of immune complexes, these in turn bind to the complement and may eventually lead to the destruction of synovium, cartilage, and bone. Higher the levels of serum RF, higher the development of inflammation.[32] GMME treatment showed a significant reduction in RF value when compared to CFA control indicating its anti-inflammatory activity. Histopathological changes in arthritis and GMME treated animals further support and confirm its antiarthritic effect. Phytochemical screening of GMME revealed the presence of various phytoconstituents. Efficacy of most herbal remedies is attributed to various active principles in combination. Therefore, it is probable that the components that are present in abundance in the extract might contribute in part for the observed effects.

Conclusion

GMME possess favorable analgesic, anti-inflammatory, and antiarthritic activities in experimental models which may be mediated by inhibition of inflammatory mediators or immunological parameters. The present results confirm the traditional uses of *G. maderaspatana* in the treatment of painful arthritis and other inflammatory conditions.

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Conflicts of interest
There are no conflicts of interest.

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हिन्दी सारांश

ग्रेन्गीया मेडारस्पाटाना का पीड़ानाशक एवं सूजनहर प्रभाव का प्रायोगिक अध्ययन

रक्षित बी. रांछ, वर्षा जे. गलानी

ग्रेन्ग्रीया मेडरस्परानाा पादप वनस्पति का भारत में पुरातनकाल से मांसपेशीशूल एवं संधिशूल में चिकित्सीय प्रयोग होता है। प्रस्तुत अध्ययन में ग्रेन्गीया मेडारस्पाटाना का पीड़ानाशक एवं सूजनहर प्रभाव का प्रायोगिक अध्ययन किया गया है। इस मूल्यांकन हेतु ग्रेन्ग्रीया मेडास्पटाना के मेथेनोल धुलितसार की (जी.एम.एम.ई.) (५०० एम.जी./के.जी., १०० एम.जी./के.जी.) मात्रा २१ दिन तक मुखद्वारा एण्टीनोसेबेप्टिव क्रिया का अध्ययन। टेइल फ्लिक टेस्ट, केराजिनान द्वारा सूजन एवं फ्रुण्ड एडेजुवेन्ट द्वारा पीड़ा उत्पन्न किये चूहों पर किया गया है। २१ दिन के प्रयोग के बाद ग्रेन्ग्रीया मेडरस्परानाा अर्थराटिक इन्डेक्स एवं शारीरिक भार में कमी तथा इ.एस.आर.; आर.एफ. तथा सी.आर.पी. में सार्थक रुप से वृद्धि किया। गुल्फ संधि के हिस्टोपेथोलॉजी अध्ययन में जी.एम.एम.ई. ने सूजन प्रक्रिया को कम किया तथा कोशिका में जल का अंतः सरण प्रक्रिया का सी.एफ.ए. द्वारा कम किया। प्राप्त परिणाम के अनुसार यह निष्कर्ष पाया गया कि इस वनस्पति में पीड़ानाशक और सूजन को हरने की क्षमता जैसे महत्वपूर्ण गुण है।