

Comparative Evaluation of Anti-inflammatory, Antipyretic and Analgesic Properties of *Ixora coccinea* and *Mussaenda frondosa* (Rubiaceae) Leaves

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ABSTRACT

The present study was an attempt to establish a comparative study of anti-inflammatory, analgesic and antipyretic properties of methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves (Rubiaceae). In anti-inflammatory, activity the formation of edema relies upon the generation and participation of various inflammatory factors e.g. kinins and peripheral blood mononuclear cells (PBMC). These include prostaglandins, chemokines, and cytokines (interleukins). Secondly, the analgesic activity has been carried out using Eddy's Hot plate method, Tail Flick Method and Acetic Acid induced Writhing Method in mice compared to the reference drug Diclofenac sodium. This is may be due to the stimulation of pain reduction by peripheral mechanism, achieved by inhibition of prostaglandin synthesis. For antipyretic method, pyrexia induced method was used using Brewer's yeast where Paracetamol was used as the standard drug. Antipyretic activity is observed may be due the inhibition of prostaglandin synthesis in the region of hypothalamus of brain (CNS). It has been concluded that the methanol extract of *Mussaenda frondosa* was more potent in comparison to *Ixora coccinea* as anti-inflammatory, antipyretic and analgesic drug at the dose of 500 mg/kg body weight.

Keywords: Anti-inflammatory, Antipyretic, Analgesic, *Mussaenda frondosa*, *Ixora coccinea*.

INTRODUCTION

Inflammation is the result of an immune reaction of our body in response to invading perilous allergens. Allergies, cancer, autoimmune diseases, metabolic syndromes and cardiovascular disorders are also associated with the untreated inflammatory response.¹An increase in body temperature beyond physiological range is termed pyrexia or fever. Various physiological stresses caused by excessive exercise, microbial infection, increased thyroid

hormone secretion and lesion to central nervous system predispose pyrexia in healthy individuals. Body's immune system gets stimulated in response to invading infectious agents, which leads to inhibition of those infectious agents by creating a pernicious environment. Infectious agents or damaged tissues stimulates the production of pro-inflammatory cytokines such as interleukin and TNF- α which in turn regulates the increased formation of prostaglandin E2 (PGE2) and the prostaglandin act on the hypothalamus to elevate the body temperature.² An obnoxious sensory and emotional attributes associated with actual or potential tissue damage is termed as pain.

The nociceptors are the sensory receptors of pain,

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present in almost all body tissues are mainly responsible for conduction of nerve impulse to the central nervous system, upon stimulation of by chemical, physical or thermal stimuli. In response to damage of any tissues, blood vessels, neutrophils, macrophages and mast cells release a wide variety of mediators, such as histamine, prostaglandins, bradykinin, leukotrienes, noradrenaline, cytokines, and glutamate.³⁻⁴ In response to inflammation, pain and pyrexia the mostly used drugs are the non-steroidal anti-inflammatory drugs (NSAIDs), but these agents lead to some gastrointestinal and cardiovascular complications.⁵ Hence search for other alternatives seems necessary and beneficial.

Herbs or medicinal plants contain several components which have numerous pharmacological activities. From ancient times these plants were used as a source of the treatment of human diseases. Herbs are considerably useful and economically essential. The active constituents of plants are now used to prevent as well as to ameliorate many diseases. These plants contain ecologically developed secondary metabolites, which are capable to ameliorate different ailments.⁶ *Ixora coccinea* is the evergreen perennial shrub through south East Asia belonging to family Rubiaceae. The genus *Ixora* contains more than 400 species. *Ixora coccinea* is commonly known as jungle of geranium and flame of the woods or

“Vetchi” in ayurveda. Leaves of this plant contain the chemical constituents like epicatechin, procyanidine A, flavonols, kaemferol, quercetin, phenolic acids, ferulicacids, mixture of hydrocarbons, sesquiterpens, and steroids. The methanol extracts of leaves have shown hypolipidaemic, hypoglycaemic, antimicrobial, antiulcer, chemoprotective and antioxidant activities.⁷ *Mussaenda frondosa* Linn. (Rubiaceae) is widely distributed throughout India and capable to ameliorate a wide range of diseases. This plant is known by several names in different languages as “Bedina” in Hindi, “Sriparnah” in Sanskrit, and “Nagavalli” in Telugu. Traditionally the methanol extract of whole plant is effective as an astringent, expectorant as well as used to ameliorate fever, jaundice, hyperacidity, cough, ulcers, leprosy, diuresis, wound, swelling and microbial growth. The same extract of the plant is also found to possess hypolipidemic effect and hepatoprotective activity. The leaves and flowers of *Mussaenda frondosa* contain the several chemical constituents including beta-sitosterol glucoside, anthocyanins, rutin, hyperin, ferulicacid, quercetin and sinapic acids.⁸ Both the plants belong to Rubiaceae family and used as ornamental plants. This study aims to compare the anti-inflammatory, analgesic and antipyretic activity of *Ixora coccinea* and *Mussaenda frondosa* leaves.

MATERIALS AND METHODS

Materials used for Experimental Study

Materials	Suppliers
Methanol(LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Tween 80 solution(LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Carrageenan	Sigma Aldrich Chemicals Pvt. Ltd.
Diclofenac sodium	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
1% acetic acid(LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
20% brewer's yeast	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Chloroform (LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Glacial acetic acid (LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Ferric chloride (LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.

Materials	Suppliers
Sulphuric acid (LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Acetic anhydride (LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Potassium hydroxide (LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Potassium iodide (LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Sodium thiosulphate (LR Grade)	TESTING INSTRUMENTS MFG. CO. PVT. LTD.
Other reagents for qualitative chemical tests	TESTING INSTRUMENTS MFG. CO. PVT. LTD.

Collection and preparation of plant materials

The fresh leaves of *Ixora coccinea* and *Mussaenda frondosa* were collected from Birbhum, West Bengal, India. The leaf samples of both plants were then subjected to botanical authentication by a taxonomist of Acharya Jagadish Chandra Bose Indian Botanic Garden, Shibpur, Howrah, West Bengal. The leaves were then processed by the following processes sorting, cleaning with tap water and finally rinsing with distilled water in pharmacognosy laboratory of NSHM Knowledge Campus, Kolkata – Group of Institutions. Followed by chopping of those cleaned leaves into small pieces and air drying, finally the dried leaves were converted into fine powder by using an electric mill.

Preparation of extracts

Alcoholic extracts were prepared by percolation using Soxhlet apparatus. The powdered form of *Ixora coccinea* and *Mussaenda frondosa* leaves were separately packed into a thimble, made up of cellulose filter paper. Methanol was used as the solvent for this extraction. After extraction the solvent was completely removed using rotary flash evaporator. Finally, a high concentrated methanol crude extract of *Ixora coccinea* and *Mussaenda frondosa* leaves were obtained and preserved.

Phytochemical screening

In order to determine the presence or absence of various constituents, phytochemical screening of plant extracts was performed using standard methods of analysis.⁹⁻¹⁰ The qualitative phytochemical tests that were

performed include alkaloids, terpenoids, saponins, flavonoids, phenolics, cardiac glycosides and steroids.

Experimental animals

Female Swiss albino mice aged between 2-3 months and weighing around 20-25 g were procured from Central Animal House, NSHM Knowledge Campus, Kolkata – Group of institution. All the animal experiments were conducted according to the protocols approved by the Institutional Animal Ethical Committee (Regd. No. 1458/PO/E/11/CPCSEA; Valid up to 11th May, 2019; Ref: NCPT/IAEC-08/2018). All animals were housed in cages in well-ventilated room with a 12 h light: 12 h dark cycle at 20±2°C. All animals were fed with standard rodent pellets and tap water *ad libitum*. Animals were kept for 7 days in the animal house for acclimation prior to start any experiment.

Acute toxicity study

Acute oral toxicity study was performed for the extracts in order to determine the therapeutic safe dose by the Organization of Economic Cooperation and Development (OECD) 423 guidelines. For this purpose, Swiss Albino mice were procured and each mouse was weighing around 20-25 g. The selected animals were fed with standard diet and drinking water and monitored on a regular basis. The animals were then randomly selected and grouped, each group having three animals. They were kept fasting 4 hrs prior to the treatment, and the extracts were orally administered in a single dose of 2000 mg/kg body weight (methanol extracts were suspended in Tween

80 solution) to all the groups. All mice were observed after dosing, once at the first 30 minutes of duration, then first 4 hrs were given special attention and thereafter for a total of 14 days. Body weight alterations and other signs of toxicities in mice like allergic reactions, abdominal cramps, tongue thickness, tightness in the throat, swelling of the lips, throat and eyes, itching all over the body, hives, and blockage of the breathing passages were evaluated by observing those mice for 3 days.⁸

Study of anti-inflammatory activity

After acclimatization period all mice were kept in overnight fasting condition and randomly divided into seven groups, each group containing six mice. The

treatment protocol is depicted in **Table 1**. Acute inflammation was induced by sub-plantar injection of 0.05 ml 1% carrageenan in normal saline (Sigma Aldrich Chemicals Pvt. Ltd.) 30 minutes after treatment by methanol extract (250 mg/kg of body weight [bw] and 500 mg/kg of body weight [bw]) of *Ixora coccinea* (MEIC) and methanol extract (250 mg/kg bw and 500 mg/kg of body weight [bw]) of *Mussaenda frondosa* (MEMF). All the doses were selected according to the previous reference paper of the similar work. A digital Vernier caliper was used to determine the altered paw diameter. The measurements were taken 30 minutes prior to carrageenan injection and at 1, 2, 3 and 4 hours after carrageenan injection.^{11-13, 31}

Table 1: Protocol for evaluation of anti-inflammatory activities of methanol extracts of *Ixora coccinea*(IC) and *Mussaenda frondosa*(MF) using Swiss albino mice

Group	Status	Treatment
I	Control	Tween 80
II	Positive control	Carrageenan(1%)+Tween 80
III	Inflammation+Diclofenac	Carrageenan(1%)+Tween 80+15 mg/kg bw diclofenac
IV	Inflammation+MEIC	Carrageenan(1%)+ Tween 80+250 mg/kg bw extract of IC
V	Inflammation+MEIC	Carrageenan(1%)+ Tween 80+500 mg/kg bw extract of IC
VI	Inflammation+MEMF	Carrageenan(1%)+ Tween 80+250 mg/kg bw extract of MF
VII	Inflammation+MEMF	Carrageenan(1%)+ Tween 80+500 mg/kg bw extract of MF

MEIC= Methanol extracts of *Ixora coccinea*. MEMF= Methanol extracts of *Mussaenda frondosa*.

Study of analgesic activity

Eddy's Hot Plate Method

After acclimatization period all mice were kept in overnight fasting condition and randomly segregated into six groups and each group contain six mice. The treatment protocol is depicted in **Table 2**. Before initiation of any treatment the animals were individually placed in Hot plate, regulated at a temperature of 45±0.5°C and their reaction time was recorded. After recording of the initial reaction time, the treatment of standard drug (Diclofenac sodium), MEIC (250 mg/kg bw, 500 mg/kg bw) and MEMF (250 mg/kg bw, 500 mg/kg bw) was given to each

mice. Then each mouse was kept in the Eddy's hot plate in order to record their response, hot-plate latency was recorded by licking of the forepaws or jump of the Hot plate surface. Mice exhibited baseline latencies less than 5s or more than 30s were excluded from the study. The basal reaction time was recorded by using a stop-watch and then the mice were subjected to oral administration of extracts and standard drug, followed by re-determination of reaction time after 0, 30, 60 and 90 min.^{14-16, 30, 32}

Tail Flick Method

Mice were segregated into six groups, each group

contain six mice in order to evaluate the analgesic activity of the extracts. The treatment protocol is depicted in **Table 2**. Evaluation of analgesic activity was done using tail flick method in mice. An analgesiometer was used to assess the analgesic activity by tail-flick method. Individually all mice were held on the analgesiometer, the tail was voluntarily protruding out of the holder. The middle part of tail was put on the radiant heat source i.e. heated nichrome wire to observe the response. 4 amps current strength, passing through the nichrome wire was constantly maintained. "Tail-flick response" accounted as the endpoint of the experiment, which was characterized by a sharp withdrawal of the tail in response to heat. The time gap between keeping the tail on the radiant heat source and the flick of the tail was noted as "reaction time". During this experiment each mice was observed 4 times maintaining a gap of 5 minutes between the two responses. Mean of all 4reaction time readings was accounted as "basal latency". In all six groups before extracts and standard drug (Diclofenac sodium) administration and at the end of 30, 60, 90 and 120 minutes

after extracts and standard drug administration tail flick test was performed in order to record the reaction time, followed by the reaction time at each time interval (test latency) was calculated.^{14,16}

Acetic Acid Induced Writhing Method

All mice were divided into six groups for analgesic test. Each group contained six mice. The treatment protocol is depicted in **Table 2**. Writhing test, induced by acetic acid was used to evaluate the analgesic activity of the extracts. This screening model articulates a chemical nociceptive test that basically relies upon the induced peritonitis like condition (the contraction of abdominal muscle together with the stretching of hind limbs) in animals by injecting irritant substances intra peritoneal (i.p) 1% acetic acid was administered intra-peritoneal after 30 min of oral administration of test samples. Diclofenac sodium was administered intra-peritoneal after 15 min. "Writhing" was observed for next 10 min as significant contraction of body.^{14, 17-19}

Table 2: Protocol for evaluation of analgesic activities of methanol extracts of *Ixora coccinea*(IC)and *Mussaenda frondosa*(MF) using Swiss albino mice.

Group	Status	Treatment
I	Control	Tween 80
II	Algesia+Diclofenac	Tween 80+15 mg/kg bw diclofenac
III	Algesia+MEIC	Tween 80+250 mg/kg bw extract of IC
IV	Algesia+MEIC	Tween 80+500 mg/kg bw extract of IC
V	Algesia+MEMF	Tween 80+250 mg/kg bw extract of MF
VI	Algesia+MEMF	Tween 80+500 mg/kg bw extract of MF

MEIC= Methanol extracts of *Ixora coccinea*. MEMF= Methanol extracts of *Mussaenda frondosa*.

Study of antipyretic activity

Pyrexia was induced in mice by a single subcutaneous injection of 20% brewer's yeast suspended in distilled water at a dose of 1 mL/100g b.w. The primary rectal temperatures of mice were recorded by digital

thermometer. The rectal temperature was again recorded upon elevation of body temperature at its peak (18 hours after yeast injection). Those experimental mice that showed an elevation in rectal temperature of at least 2°F were included in the study. The test animals were then

divided into seven groups (six mice each). The study protocol is described in **Table 3**. Extracts, standard drug i.e. paracetamol and control vehicle were orally

administered and for next 3 hrs at 1 hr interval the rectal temperature of animals was recorded.²⁰

Table 3: Protocol for evaluation of antipyretic activities of methanol extracts of *Ixora coccinea*(IC)and *Mussaenda frondosa*(MF) using Swiss albino mice

Group	Status	Treatment
I	Control	Distilled water
II	Positive control	Distilled water+ brewer's yeast1 mL/100g b.w
III	Hyperthermia+Paracetamol	Distilled water+ brewer's yeast1 mL/100g b.w+paracetamol 150 mg/kg b.w
IV	Hyperthermia+MEIC	Distilled water+ brewer's yeast1 mL/100g b.w+250 mg/kg bw extract of IC
V	Hyperthermia+MEIC	Distilled water+ brewer's yeast1 mL/100g b.w+500 mg/kg bw extract of IC
VI	Hyperthermia+MEMF	Distilled water+ brewer's yeast1 mL/100g b.w+250 mg/kg bw extract of MF
VII	Hyperthermia+MEMF	Distilled water+ brewer's yeast1 mL/100g b.w+500 mg/kg bw extract of MF

MEIC= Methanol extracts of *Ixora coccinea*. MEMF= Methanol extracts of *Mussaenda frondosa*.

Statistical analysis

The results are expressed as mean \pm SEM. Two-way analysis of variance (ANOVA) analysis followed by Dunnett's multiple comparisons test was used to compare group means. All statistical analyses were performed using the Graph Pad Prism 7.00 (Graph Pad Software, Inc., La Jolla, CA) statistical software. $p < 0.05$ was considered statistically significant.

RESULTS

Phytochemical screening

The qualitative phytochemical screening of methanol leaf extract of *Ixora coccinea* showed the presence of carbohydrates, alkaloids, flavonoids, triterpenoids, sterols and glycosides. However, the methanol leaf extract of *Mussaenda frondosa* demonstrated the presence of alkaloids, flavonoids, glycosides, starch, carbohydrates and triterpenoids. (**Table 4**)

Table 4: Phytoconstituents of methanol extracts of leaves of *Ixora coccinea* and *Mussaenda frondosa*.

Phytochemical	Leaf of <i>Ixora coccinea</i>	Leaf of <i>Mussaenda frondosa</i>
Carbohydrate	+	+
Alkaloids	+	+
Flavonoids	+	+
Triterpenoids	+	+
Tannins	-	-
Resin	-	-
Sterol	+	-
Glycoside	+	+
Saponins	-	-
Proteins/ amino acid	-	-
Starch	+	+

Present is denoted by (+) sign and absent is indicated by (-) sign

Acute toxicity study

No significant alteration in body weight as well as no sign of toxicity was observed before and after treatment with the extracts. Upon repetition of the experiment for 7 more days at the same dose i.e. 2000 mg/kg b.w. the extracts did not exhibit any signs of toxicity when observed for 14 days.

Anti-inflammatory activity

Methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves were used to treat the carrageenan induced inflammation at a dose of 250 mg/kg and 500 mg/kg body

weight. After administration of those two extracts at the first hour there is no significant alteration in hind paw diameter. But at the second, third and fourth hour after treatment the paw diameter significantly declined in cases of both extract. 500 mg/kg b.w. dose of methanol extract of *Mussaenda frondosa* (MEMF) significantly alleviated the paw diameter in comparison to the methanol extract of *Ixora coccinea* (MEIC) 500 mg/kg b.w. (**Figure 1**). Comparison of inflammatory activity of the two plants according to their dose is graphically represented in **Figure 2**. It can be observed that both of these plants significantly alleviate inflammation, but the activity of MEMF is slightly greater in comparison to the MEIC.

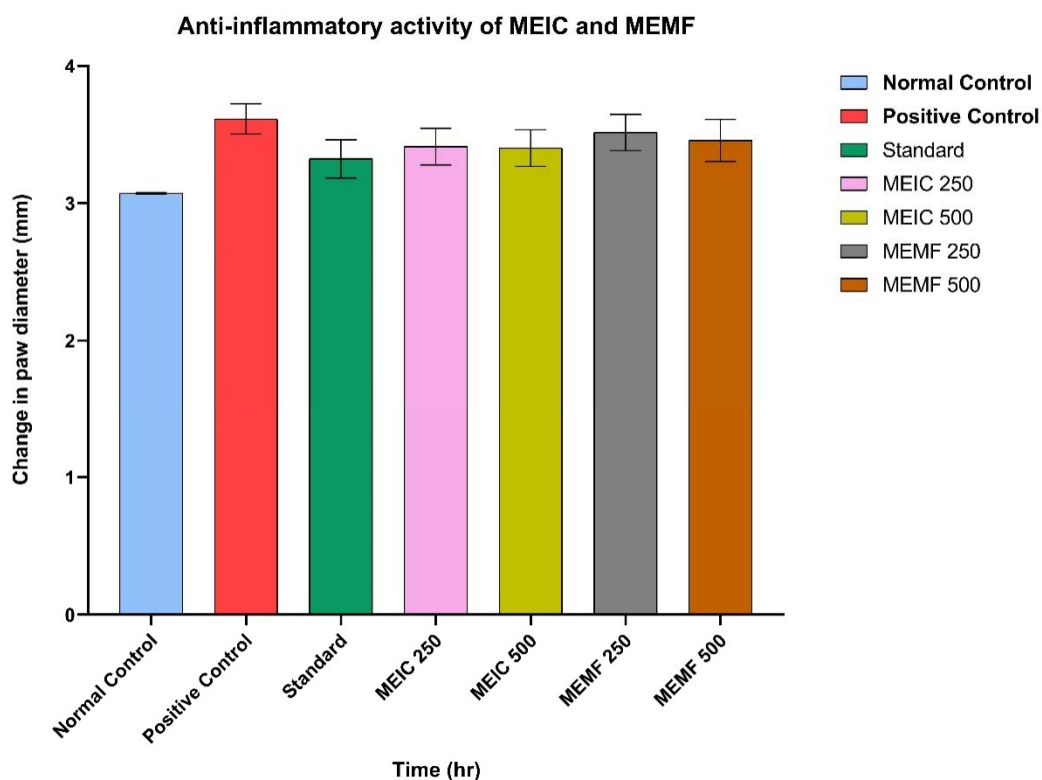


Figure 1: Graphical representation of anti-inflammatory property of methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves on carrageenan induced inflammation in mice.

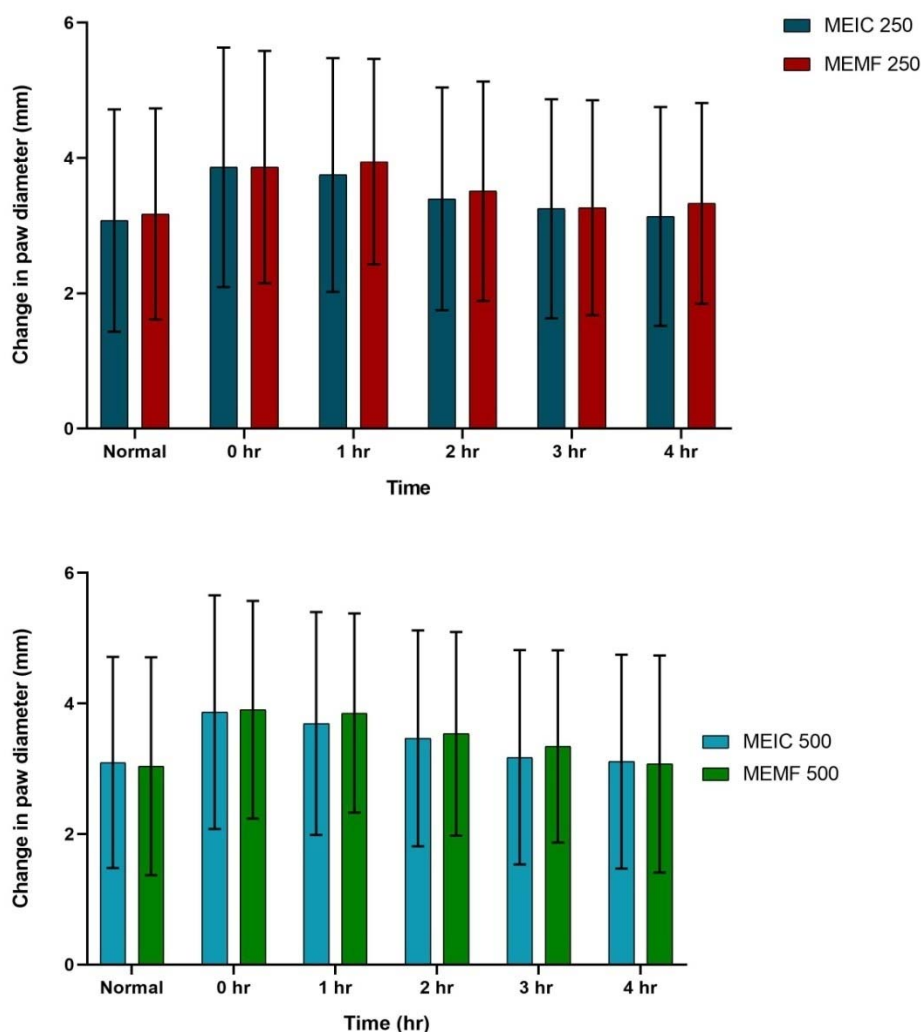


Figure 2: Comparison of reduction in paw diameter of methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves on carrageenan induced inflammation in mice.

Analgesic activity

Eddy's Hot Plate Method

The methanol leaf extracts of *Ixora coccinea* and *Mussaenda frondosa* showed potent analgesic activity in mice. The extracts were mostly active at the dose level of 500 mg/kg body weight in the 30 & 60 minutes of treatment.

Figure 3 represents the bar diagram of analgesic activities of *Ixora coccinea* and *Mussaenda frondosa*. The latency period of both the extract at the dose of 500 mg/kg b.w was

significantly ($P < 0.05$) higher than control at time period 30-90 minutes. At the 30&60 minutes of treatment by both of the plant extracts at the above said dose, significantly relieve the pain and thereby enhances the reaction time of mice.

Tail Flick Method

The methanol leaf extracts of *I. coccinea* and *M. frondosa* showed potent analgesic activity in mice through

tail flick method also. The analgesic activity of leaf extracts of both the plants was comparable to standard drug (Diclofenac sodium). Control group of mice did not show any significant difference in the reaction time on tail flick throughout the whole observation time. But, the MEIC and

MEMF revealed a significant and dose dependent increase in the latency time when compared to the control group. The most active dose level of these extracts was 500 mg/kg body weight in the 30-90 minutes of treatment (**Figure 4**).

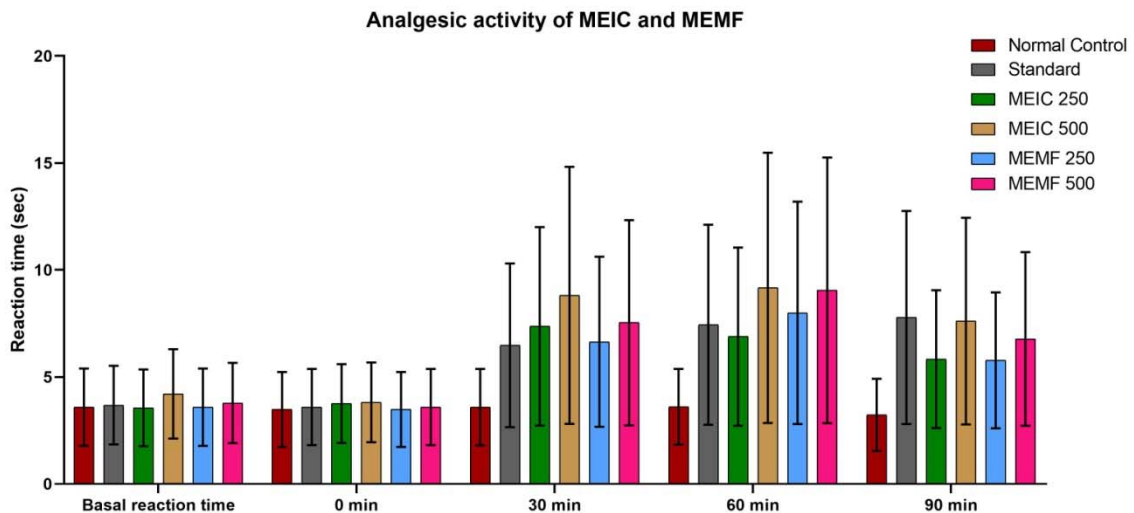


Figure 3: Analgesic property of methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves in mice by Eddy’s hot plate method.

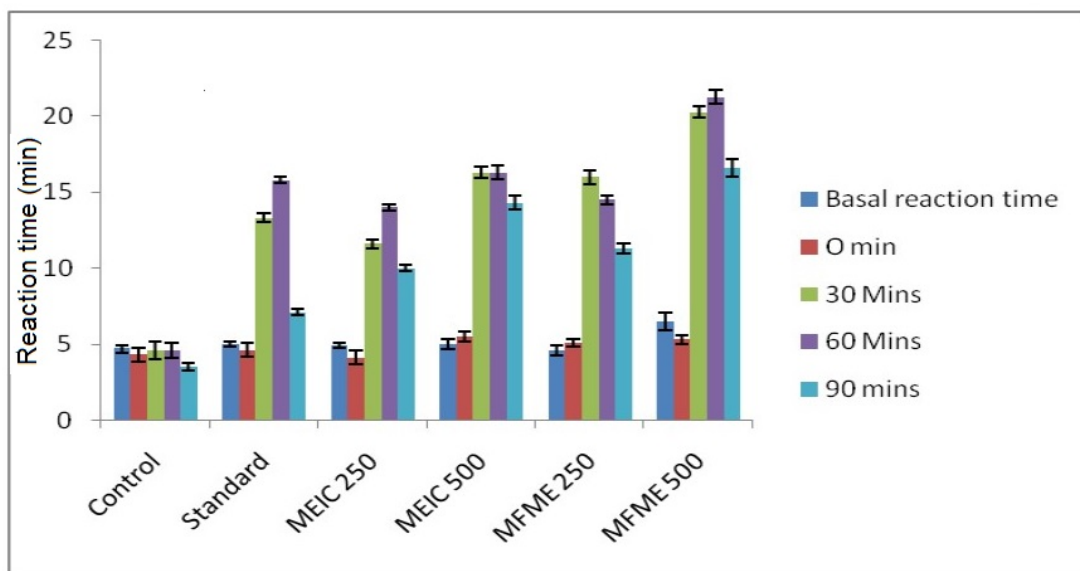


Figure 4: Analgesic property of methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves in mice by tail flick method.

Acetic Acid Induced Writhing Method

The MEIC and MEMF also showed potent analgesic activity in mice through acetic acid induced writhing method. The number of writhing inhibition has been observed for both the extracts (250 mg/kg b.w and 500

mg/kg b.w). In between those, the 500 mg/kg b.w dose of the methanol extracts of both the plants has been shown significant result. Both the extracts therefore, may be alternative bio-resource for generating analgesic agents (Figure 5).

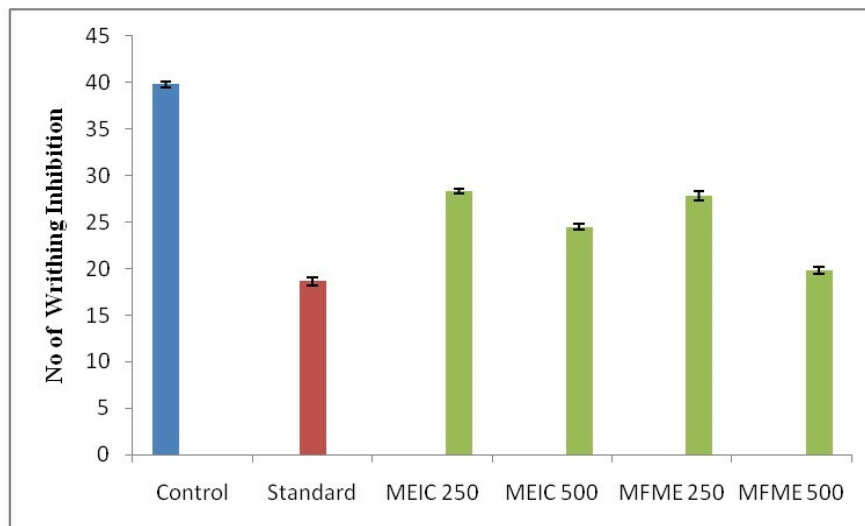


Figure 5: Analgesic effects of methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves in mice by acetic acid induced writhing method.

Antipyretic activity

The methanol leaf extracts of *Ixora coccinea* and *Mussaenda frondosa* showed potent antipyretic activity in mice. The extracts were mostly active at the dose level of

500 mg/kg body weight in the third hour of treatment. The methanol extract of *Mussaenda frondosa* was found to be more potent in comparison to *Ixora coccinea* to alleviate the enhanced body temperature (Figure 6).

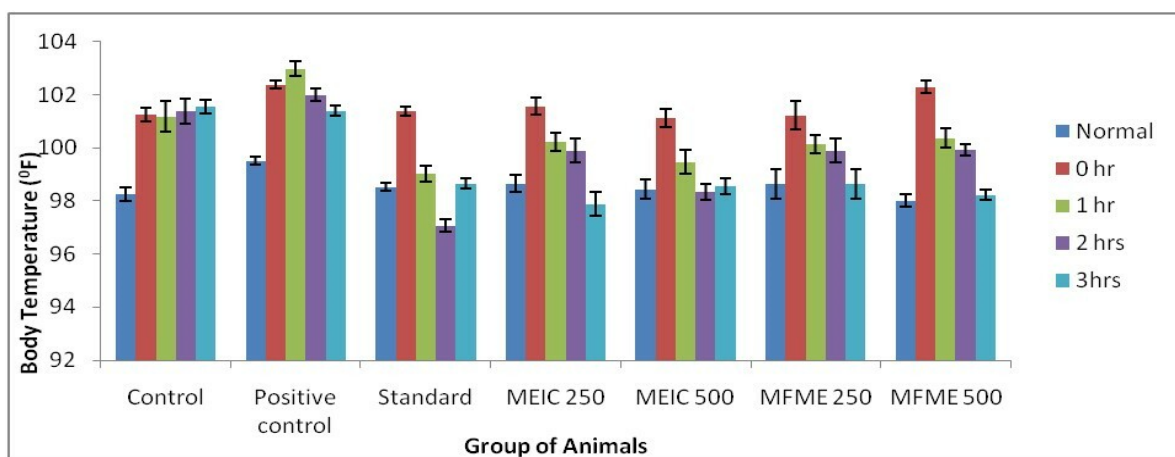


Figure 6: Antipyretic property of methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves in mice.

DISCUSSION

The result of the present study clearly demonstrates that the MEIC and MEMF possess anti-inflammatory, analgesic and antipyretic activities.

The most widely used *in vivo* screening model for assessing the anti-inflammatory activity of plant extracts and drugs is carrageenan induced paw edema test.²¹ The formation of edema relies upon the generation and participation of various inflammatory factors e.g. kinins and peripheral blood mononuclear cells (PBMC). These include prostaglandins, chemokines, and cytokines (interleukins). The decrease in the diameter of paw edema in comparison to the positive control group indicates the anti-inflammatory activity of *Ixora coccinea* and *Mussaenda frondosa*.

The methanol leaf extracts of the two plants possess potent analgesic activity as observed in the hot plate method, Tail Flick Method and Acetic Acid Induced Writhing Method in mice compared to the reference drug Diclofenac sodium. This may be due to the stimulation of pain reduction by peripheral mechanism, achieved by inhibition of prostaglandin synthesis. Results of the present study indicate that methanol leaf extracts of both *Ixora coccinea* and *Mussaenda frondosa* possess an antipyretic activity. The antipyretic activities of these extracts of the two plants certify the traditional uses of these plants in amelioration of common fever and cold. Antipyretic activity is observed may be due to the inhibition of prostaglandin synthesis in the region of hypothalamus of brain (CNS).²² To produce antipyretic activity, a drug must cross the blood-brain barrier (BBB) in order to act on temperature regulator centre of hypothalamus. But practically there are very few molecules that can cross the BBB and enter into the CNS. Result of the present study indicates that the extracts of *Ixora coccinea* and *Mussaenda frondosa* may cross the BBB and thus enter

the CNS, followed by producing the antipyretic activity.

The qualitative phytochemical analysis of these two plant extracts demonstrates the presence of flavonoids, triterpenes, alkaloids and glycosides. It has been reported that flavonoids²³ and triterpenes²⁴ attenuate inflammation; most of the compounds that exhibit anti-inflammatory activity must possess analgesic activity, thereby supporting our present findings. Flavonoids mainly hinder the activities of cyclooxygenase/ lipoxygenase that lead to the reduced level of prostaglandins, arachidonic acid and other metabolites.²⁵⁻²⁶ Several studies have already demonstrated that flavonoids exhibit antipyretic activity.²⁷⁻²⁸ Triterpenes down regulate the release of histamine from mast cells and possess anti-inflammatory activity.²⁹ Accordingly, findings of the present study are consistent and support the previous research findings.

CONCLUSION

The methanol extracts of *Ixora coccinea* and *Mussaenda frondosa* leaves were investigated in different animal (rodent) models such as carrageenan-induced paw edema, hot-plate, tail flick, acetic acid induced writhing method and brewer's yeast induced pyrexia to observe their anti-inflammatory, analgesic and antipyretic properties. Further investigations are needed to find the active components from both the extracts which are actually responsible for anti-inflammatory, analgesic and antipyretic activity and also to confirm their mechanism of action. The methanol extract of *Mussaenda frondosa* may be a possible source to bring a new lead either as potent anti-inflammatory or, analgesic or, antipyretic drug in future.

CONFLICT OF INTEREST

Authors have no conflict of interest.

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التقييم المقارن للخصائص المضادة للالتهابات، خافض للحرارة ومسكن ل *Ixora coccinea* و *Mussaenda frondosa* (Rubiaceae)

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ملخص

كانت هذه الدراسة محاولة لإنشاء دراسة مقارنة للخصائص المضادة للالتهابات، مسكن وخافض للحرارة من مقتطفات الميثانول من أوراق الشجرة الصفراء و *Mussaenda frondosa* (Rubiaceae) في النشاط المضاد للالتهابات، يعتمد تكوين الوذمة على توليد ومشاركة العوامل الالتهابية المختلفة، على سبيل المثال الأقرباء وخلايا الدم المحيطة أحادية النواة (PBMC) وتشمل هذه البروستاجلاندين، والكيماويات، والسيبتوكينات (الانترلوكينات). (ثانياً، تم تنفيذ النشاط المسكن باستخدام طريقة Eddy's Hot plate، Tail Flick Method، و Ethic Method in Writhing Method في الفئران مقارنة بالعقار المرجعي Diclofenac sodium. قد يكون هذا بسبب تحفيز الحد من الألم عن طريق الآلية الطرفية، التي تحققت عن طريق تثبيط تخليق البروستاجلاندين. لطريقة خافض للحرارة، تم استخدام الطريقة التي يسببها بيركسيا باستخدام خميرة بروير حيث تم استخدام الباراسيتامول كدواء قياسي. لوحظ نشاط خافض للحرارة قد يكون بسبب تثبيط تخليق البروستاجلاندين في منطقة ما تحت المهاد من المخ. (CNS) لقد خلص الباحثون إلى أن مستخلص الميثانول من موسيندا فروندوسا كان أكثر فعالية مقارنةً بإكسورا كوكسينا كعقار مضاد للالتهابات وخافض للحرارة ومسكن بجرعة 500 مغ / كغ من وزن الجسم.

الكلمات الدالة: مضاد للالتهابات، خافض للحرارة، مسكن، موسندافوندوسا، إكسوراكوكسينا.

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