ORIGINAL ARTICLE

Comparative analysis of *Bauhinia tomentosa* L. and *Kalanchoe pinnata* Lam extracts with regard to their antinociceptive and antipyretic potentials in experimental animal models

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Context: In the present study, different parts (stem and roots) of *Bauhinia tomentosa* and *Kalanchoe pinnata* have been screened for antipyretic and analgesic activity. **Materials and Methods:** Eddy's hot plate method and acetic acid-induced writhing test have been performed to elucidate the mechanism of action of analgesic potential whereas antipyretic potential have been evaluated by the yeast induced hyperthermia model. **Results and Conclusions:** *B. tomentosa* root extracts at both the doses (200, 400 mg/kg) and stem extracts at high doses (250, 500 mg/kg) were found to possess statistically significant analgesic as well as antipyretic activity when compared to that of control. *K pinnata* root and stem extracts at both the doses (200, 400 mg/kg) were found to possess statistically significant analgesic and antipyretic activity when compared with that of control. *K. pinnata* root extracts were found to possess significantly increases in mean latency time whereas failed to inhibit number of writhings in acetic acid-induced writhing models suggesting its central nervous system action whereas stem extract significantly inhibited number of writhings in acetic acid-induced writhing methods whereas fail to increase mean latency time at both doses respectively suggesting its peripheral nervous system action. Present study reveals that *B. tomentosa* (root and stem) possesses significant antipyretic and analgesic effect suggests that the plant may have therapeutic value in hyperthermia associated with pain.

Key words: Antinociceptive, acetic acid-induced writhings, eddy's hot plate method, flavonoids, yeast induced hyperthermia model

INTRODUCTION

Bauhinia tomentosa and *Kalanchoe pinnata* are the miracle medicinal plants widely used in folk medicine and in Ayurveda as analgesic, carminative, in diarrhea, inflammation, snake bite and scorpion sting, etc.[1-3] Plants are reported to possess a number of activities like antidiabetic, antiproliferative, antimicrobial, etc.[4,5] Despite the very encouraging traditional medicinal applications of some species of *Bauhinia* and *Kalanchoe* different extract (root and stem), prior investigations with respect to analgesic and antipyretic potential to validate the traditional medicinal applications have not been done till now. Hence, an attempt has been taken to explore the analgesic, and antipyretic potential of above said plants and their comparative analysis.

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MATERIALS AND METHODS

Drugs and Chemicals

Chemicals were procured from Merk, Loba Chem and Central Drug House (P) Ltd., India of laboratory grade from the store of Devsthali Vidyapeeth College of Pharmacy, Lalpur, Rudrapur (Uttarakhand). The gift samples of drugs (indomethacin and diclofenac sodium) were procured from Combitic Global Caplet Pvt. Ltd., India.

Plant Material and its Extraction

Stem and root of *B. tomentosa* and *K. pinnata* were collected from the local area of Rudrapur, India in September 2012 and authenticated by National Botanical Research Institute Lucknow. The herbarium of the plant was prepared and deposited in the museum of Devsthali Vidyapeeth College of Pharmacy with a voucher number (varsha no. 10, 11). The stems and roots were dried at room temperature in the shade and away from direct sunlight for 5 days and in hot air oven for 2 days. The shade dried stem and root powder (100 g) was extracted separately exhaustively with 70% v/v methanol in a soxhlet apparatus by continuous heat extraction. The extract was concentrated to small volume and then

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evaporated to dryness. The ethanol extract for experimental purpose was prepared in distilled water containing 2% v/v tween 80 (suspending agent). The same procedure was followed for ethanol extract preparation. Aqueous extract was prepared by maceration with chloroform water, followed by filtration and concentrating the extract to small volume and then evaporated to dryness. The aqueous extract for experimental purpose was prepared in distilled water containing 2% v/v tween 80 (as suspending agent).

Phyto-Chemical Screening

The freshly prepared crude extract was qualitatively tested for the presence of phyto-constituents.[6]

Animals

For the experiment, Swiss albino mice of either sex, 3–4 weeks of age, weighing between 20 and 25 g and wistar rats of either sex, weighing between 150 and 175 g were collected from the animal research branch of the IVRI Bareilly, Uttar Pradesh, India. Animals were maintained under standard environmental conditions (temperature: [24.0°C ± 1.0°C], relative humidity: 55–65% and 12 h light/12 h dark cycle) and had free access to feed and water *ad libitum*. The animals were acclimatized to laboratory condition for 1-week prior to experiments. All protocols for the animal experiment were approved by the Institutional Animal Ethical Committee (CPCSEA/IAEC/2010–11/06).

Acute Toxicity Studies

Acute toxicity studies were conducted to study the toxic effects and to determine the safest dose (ED) of the drug extracts. Swiss albino mice of either sex weighing between 20 and 25 g fasted overnight were used for the study. The extracts were administered orally, at the doses of 30, 100, 300, 1000, 3000 mg/kg. Further, the doses of 2000 and 2500 mg/kg were also assessed to determine the safest dose (ED). Subsequent to administration of drug extracts, animals were observed closely for the first 3 h, for any toxic manifestation (increased motor activity, sedation, acute convulsion, coma, and death). Thereafter, the observations were made at regular intervals for 24 h. The animals were under further observation for 1-week.[7,8]

Anti Nociceptive Activity

Experimental Protocol

Group 1: Vehicle (1% tween 80 in water, 10 ml/kg)
Group 2: Diclofenac sodium (50 mg/kg)
Group 3: Aqueous extract (200 mg/kg body weight) p.o
Group 4: Aqueous extract (400 mg/kg body weight) p.o
Group 5: Alcohol extracts (200 mg/kg body weight) p.o
Group 6: Alcohol extracts (400 mg/kg body weight) p.o.

Eddy's Hot Plate Method

The animals were placed on Eddy's hot plate kept at a temperature of 55°C ± 0.5°C. A cut off period of 15 s was observed to avoid damage to the paw. Reaction time was recorded when animals licked their fore or hind paws, or jumped prior to and 0, 30, 60, 90 and 120 min after oral administration of the samples.[9,10] The animals were divided into six groups with six mice in each group.

Acetic Acid-Induced Writhing Methods

The analgesic activity of the samples was also studied using acetic acid-induced writhing model in mice. Extracts, vehicle, and standard drug were administered orally 30 min before intraperitoneal administration of 0.6% v/v acetic acid. After an interval of 5 min, the mice were observed for specific contraction of the body referred to as 'writhing' for the next 10 min. In the study, Indomethacin was used as the standard drug. Control animals received an equal volume of vehicle.[11]

$$\% \text{ inhibition} = \{(Wc - Wt) \times 100\} / Wc$$

Where,
Wc = No. of writhings in control group,
Wt = No. of writhings in test group

Antipyretic Activity

Yeast Induced Hyperthermia Model

For induction of fever in rats, 20% w/v of brewer's yeast in distilled water was administered by subcutaneous injection. All animals were induced pyrexia by injection of 10 ml/kg of brewer's yeast solution under the skin in between the shoulder blades. The site of injection was massaged in order to spread the suspension beneath the skin. Basal rectal temperature was measured before the injection of yeast, by inserting digital clinical thermometer to a depth of 2 cm into the rectum. The rise in rectal temperature was recorded 19 h. after the yeast injection. The febrile rats were divided into six groups, each containing 6 animals. Thereafter, treatment was carried out as follows:

Group 1: Vehicle control (distilled water containing 2% Tween 80) p.o
Group 2: Standard group (paracetamol 150 mg/kg body weight) p.o
Group 3: Aqueous extract (200 mg/kg body weight) p.o
Group 4: Aqueous extract (400 mg/kg body weight) p.o
Group 5: Alcohol extract (200 mg/kg body weight) p.o
Group 6: Alcohol extract (400 mg/kg body weight) p.o.

The different groups of febrile rats were orally administered with the respective drugs, and rectal temperature was recorded at 30, 60,120, 180 and 300 min posttreatment. Decrease in rectal temperature posttreatment indicated antipyretic effect. The difference in body temperature was recorded.[12]

Statistical Analysis

Statistical analysis for the animal experiment was carried out using one-way analysis of variance followed by Tukey–

Kramer multiple comparison test. The results obtained were compared with the vehicle control group. P <0.05 was considered as statistically significant.

RESULTS

Phyto-Chemical Screening

Phyto-chemical analysis of the extracts revealed the presence of flavonoid, steroid, alkaloid, tannin, gum and saponins as shown in Table 1.

Acute Toxicity Studies

Stem and root extracts of *K. pinnata* and *B. tomentosa* were administered at the doses of 30–3000 mg/kg to swiss albino mice. All the extracts were found to be safe up to the dose of 3000 mg/kg when administered orally. Extracts showed no toxic symptoms even at the high doses.

Analgesic Screening

Hot Plate Method

Bauhinia tomentosa root extracts at both the doses (200 and 400 mg/kg) were found to possess a statistically significant (P < 0.05–0.001) dose-dependent increase in latency time when compared with the control. When compared among the extracts, alcohol extract at both the doses was found to be more significant than the aqueous extract [Table 2 and Figure 1].

Kalanchoe pinnata root extracts (200, 400 mg/kg) were found to possess a significant dose-dependent increase in latency time when compared with the control. The results were found to be statistically significant (P < 0.05–0.001) as shown in Table 2 and Figure 2. When compared among the extracts, alcohol and aqueous extracts at high dose (400 mg/kg) were found to possess more potent than the lower doses and results were comparable to the standard drug.

K. pinnata stem extracts (alcohol and aqueous) of plant at the doses 200,400 mg/kg in significantly inhibited increase in mean latency time and the results were found to be statistically insignificant (P > 0.05–0.001) at both doses as shown in Table 2.

Table 1: Preliminary phytochemical analysis of *B. tomentosa* and *K. pinnata* extracts

Test for	BTRALE	BTRAQE	KPRALE	KPRAQE	KPSALE	KPSAQE
Alkaloids	-	-	++	+	+	+
Carbohydrates and glycosides	+	+	+	+	+	+
Phytosterols	++	-	+	-	+	-
Fixed oils and Fats	+	-	+	-	+	-
Phenolic compounds and tannins	++	+	+	+	+	+
Saponins	-	++	-	-	-	+
Flavonoids	++	+	+	+	+	+
Gums mucilage	-	+	-	+	-	+

+ – Present, - – Absent, †BTRALE – *B. tomentosa* root alcohol extract, BTRAQE – *B. tomentosa* root aqueous extract, KPRALE – *K. pinnata* root alcohol extract, KPRAQE – *K.pinnata* root aqueous extract, KPSALE – *K. pinnata* stem alcohol extract, KPSAQE – *K. pinnata* stem aqueous extract, *B. tomentosa* – *Bauhinia tomentosa*, *K. pinnata* – *Kalanchoe pinnata*

Table 2: Effect of extracts on latency to hot plate test in mice

Treatments	Dose (mg/kg b.w.)	Mean latency (s) before and after drug administration (s)				
		0 min	30 min	60 min	90 min	120 min
Control	-	2.28±0.219	2.45±0.228	2.16±0.187	2.58±0.241	2.26±0.223
Diclofenac sodium	10	2.32±0.098	5.64±0.678**	8.46±0.647***	11.04±1.007***	13.47±0.796***
BTRALE	200	2.34±0.695	3.86±2.20	7.18±1.10**	9.86±4.12**	11.33±5.16**
	400	2.42±1.65	4.50±4.79*	7.68±5.35**	10.35±4.71***	12.35±4.90***
BTRAQE	200	2.32±1.01	2.41±2.39	5.83±1.39	8.08±2.32**	9.92±1.32**
	400	2.430±5.34	3.89±3.86	6.65±7.92*	9.86±2.15**	10.3 5±3.43**
KPRALE	200	2.44±0.695	2.98±1.02	5.78±0.105	7.66±0.152	9.53±0.162*
	400	2.35±0.545	4.55±0.479*	6.68±0.350*	8.24±0.147	11.24±0.190**
KPRAQE	200	2.28±1.031	3.64±0.439	4.78±1.190	6.78±0.327	8.59±1.31
	400	2.40±0.534	4.98±0.846*	7.23±0.079*	9.56±0.265*	10.65±0.431**
KPSALE	200	2.44±0.695	2.98±1.02	3.78±0.245	5.26±1.09	4.79±0.112
	400	2.35±0.545	2.25±0.469	3.48±0.550	4.87±0.197	5.24±0.090
KPSAQE	200	2.28±1.031	3. 34±0.435	2.78±1.090	9.78±0.627	4.69±1.37
	400	2.40±0.534	2.92±0.847	3.17±0.479	3.56±0.262	4.94±0.314

Values are expressed as mean±SEM. *P<0.05, **P<0.001, ***P<0.0001 significant from normal control group. †BTRALE – *B. tomentosa* root alcohol extract, BTRAQE – *B. tomentosa* root aqueous extract, KPRALE – *K. pinnata* root alcohol extract, KPRAQE – *K. pinnata* root aqueous extract, KPSALE – *K. pinnata* stem alcohol extract, KPSAQE – *K. pinnata* stem aqueous extract, SEM – Standard error of the mean, *B. tomentosa* – *Bauhinia tomentosa*, *K. pinnata* – *Kalanchoe pinnata*

Acetic Acid-Induced Writhing Test

Bauhinia tomentosa root extracts at both the doses were found to possess very significantly ($P < 0.05$–0.001) inhibited writhing response induced by acetic acid in a dose-dependent manner when compared to the control as shown in Table 3. Analgesic activity of *B. tomentosa* stem extracts writhing test by hot plate as well as acetic acid-induced writhing test has been done.[13] The oral administration of *Kalanchoe pinnata* root extracts insignificantly ($P < 0.001$) inhibited writhing response induced by acetic acid at both doses when compared to the control. *K. pinnata* stem extracts significantly ($P < 0.001$) inhibited writhing response induced by acetic acid when compared to the control suggesting its peripheral nervous system (PNS) action.

When compared among the extracts aqueous extracts, *K. pinnata* stem at low dose (200 mg/kg) found to inhibit writhing response in more potent way than the high dose. When compared among the extracts aqueous and alcohol extract of *B. tomentosa* root were found to be more significant than the *K. pinnata* extracts as shown in Table 3 and Figure 2.

Antipyretic Screening

Antipyretic effect of *B. tomentosa* root extracts was found to possess a statistically significant antipyretic effect ($P > 0.05$–0.001) after 60 min of oral administration of extracts. Alcohol extract showed significant antipyretic effect after 60 min at low dose whereas aqueous extract at both the dose showed significant antipyretic effect after120 min of oral administration of extracts [Table 4 and Figure 3].

Table 3: Effect of *B. tomentosa* and *K. pinnata* extracts on acetic acid induced writhing in mice

Treatment	Dose (mg/kg)	Number of writhing	Inhibition %
Control	-	39.4±1.58	-
Standard	10	8.4±1.11***	79.26
BTRALE	200	17.2±1.396**	56.30
	400	7.4±1.24***	81.21
BTRAQE	200	9.3±1.16***	76.14
	400	8.2±1.01***	79.18
KPRALE	200	24.8±1.56	38.76
	400	25.2±1.03	37.77
KPRAQE	200	29.3±1.31	27.65
	400	32.2±0.750	20.5
KPSALE	200	27.33±1.29*	30.7
	400	21.45±0.912*	45.4
KPSAQE	200	22.80±1.27*	42.13
	400	20.6±0.846*	47.7

Values are expressed as mean±SEM. *P<0.05, **P<0.001, ***P<0.0001 significant from normal control group. †BTRALE – *B. tomentosa* root alcohol extract, BTRAQE – *B. tomentosa* root aqueous extract, KPRALE – *Kalanchoe pinnata* root alcohol extract, KPRAQE – *Kalanchoe pinnata* root aqueous extract, KPSALE – *Kalanchoe pinnata* stem alcohol extract, KPSAQE – *Kalanchoe pinnata* stem aqueous extract, SEM – Standard error of the mean, *B. tomentosa* – *Bauhinia tomentosa, K. pinnata* – *Kalanchoe pinnata*

Bauhinia tomentosa stem extracts on febrile rats are shown in Table 5. Both (alcohol, aqueous) extracts at 250 and 500 mg/kg found to possess statistically significant antipyretic effect at 120, 180 and 300 min. after oral administration of the extracts when compared to the control. Whereas standard drug paracetamol was found to possess statistically significant antipyretic effect at all the minutes starting from the 30 min of oral administration of the extracts [Table 5 and Figure 4].

Kalanchoe pinnata root extracts at both the dose (200, 400 mg/kg) were found to possess significant antipyretic when studied through yeast induced pyrexia model. Higher doses of *K. pinnata* root extracts were found

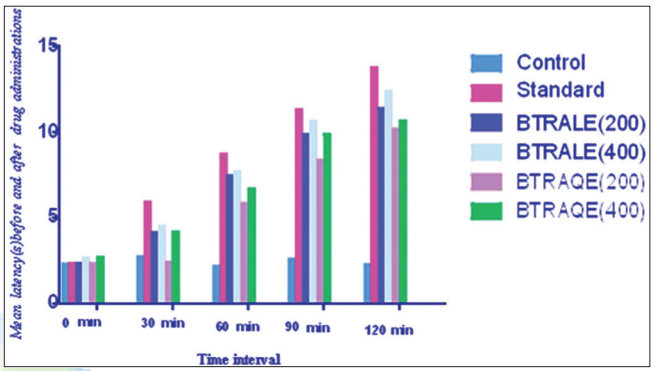

Figure 1: Effect of *Bauhinia tomentosa* extracts on mean latency in mice

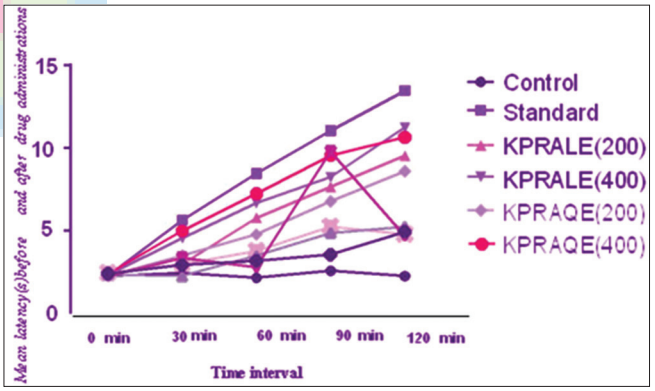

Figure 2: Effect of *Kalanchoe pinnata* extracts on mean latency in mice

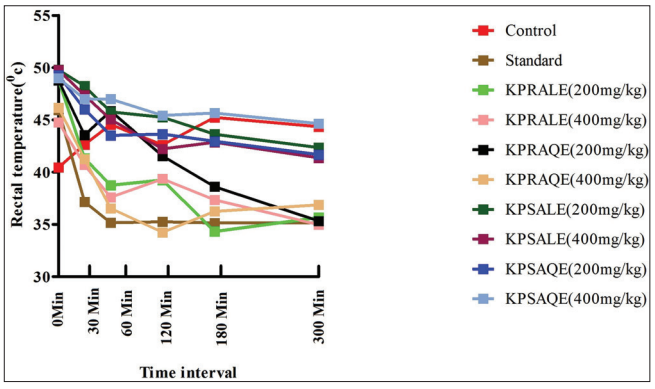

Figure 3: Antipyretic analysis of *Kalanchoe pinnata* stem and root extracts

to possess significant antipyretic activity after 60 min of oral administration whereas low dose (200 mg/kg) was found to possess the statistically significant activity after 120 and 180 min of oral administration of the extracts.

The stem extracts were found to possess antipyretic potential at high dose but found to be statistically insignificant ($P > 0.05$) at low doses when compared with that of control. Hence *K. pinnata* root aqueous extract at high dose (400 mg/kg) and root alcohol extract at both the doses (200, 400 mg/kg) were found to possess more potent antinociceptive as well as antipyretic activity respectively. When compared among the extracts, alcohol and aqueous extracts of *B. tomentosa* root at both the doses were found to possess more significant antipyretic and analgesic activity than the *K. pinnata* extracts [Figure 5].

DISCUSSION

Results of the present study showed that the extracts were found to possess marked antipyretic, analgesic effects

Table 4: Effect of extracts on yeast induced hyperthermia

Treatments	Dose (mg/kg)	Rectal temperature (°C)						
		Basal	0 min	30 min	60 min	120 min	180 min	300 min
Control	-	34.83±0.119	40.46±0.218	42.65±2.239	44.54±0.210	42.62±0.202	45.23±0.302	44.35±1.20
Standard	150	35.14±0.213	45.93±0.206	37.16**±0.153	35.15***±0.264	35.25***±0.381	35.14***±0.328	35.14***±0.507
KPRALE	200	34.99±0.242	48.75±0.253	41.32±0.302	38.75±0.315	39.25*±0.107	34.32**±0.117	35.65**±0.331
	400	36.44±0.212	44.75±0.713	40.69±0.127	37.60*±0.304	39.35*±1.99	37.35*±0.11	34.96**±0.185
KPRAQE	200	35.45±0.25	48.75±1.025	43.53±0.237	45.85±0.316	41.54±0.130	38.61±0.338	35.33**±0.069
	400	34.63±0.307	46.15±2.27	41.28±0.99	36.54**±02.11	34.24**±1.08	36.24**±0.109	36.86**±0.335
KPSALE	200	35.79±1.22	49.78±0.55	48.23±0.230	45.75±0.105	45.25±0.207	43.62±01.23	42.36±0.023
	400	36.25±0.26	49.75±0.66	47.36±0.22	45.02±2.13	42.23±0.35	42.86±0.667	41.38±1.15
KPSAQE	200	34.26±0.55	49.26±2.52	46.03±0.334	43.52±0.16	43.65±0.236	42.96±0.031	41.69±1.13
	400	36.25±0.703	48.98±0.710	47.08±0.534	46.98±0.209	45.42±0.115	45.65±4.23	44.63±3.831
BTRALE	200	35.69±1.12	42.63±0.543	41.26±0.285	38.56*±1.28	35.84**±2.34	35.65**±5.41	35.87**±0.851
	400	33.98±1.47	46.56±0.744	44.35±0.845	36.46*±2.25	35.52**±0.653	34.87**±0.135	34.21**±0.341
BTRAQE	200	35.62±2.48	45.38±0.667	44.26±0.884	40.74±0.254	37.84*±0.541	36.58**±2.25	35.74**±0.984
	400	34.86±3.24	43.84±0.872	41.54±0.564	40.25±0.228	38.51*±4.54	36.69**±1.24	35.34**±0.887

Values are expressed as mean±SEM. *P<0.05, **P<0.001, ***P<0.0001 significant from normal control group. †BTRALE – *B. tomentosa* root alcohol extract, BTRAQE – *B. tomentosa* root aqueous extract, KPRALE – *Kalanchoe pinnata* root alcohol extract, KPRAQE – *Kalanchoe pinnata* root aqueous extract, KPSALE – *Kalanchoe pinnata* stem alcohol extract, KPSAQE – *Kalanchoe pinnata* stem aqueous extract, *B. tomentosa* – *Bauhinia tomentosa, K. pinnata* – *Kalanchoe pinnata*

Table 5: Effect of *B. tomentosa* stem extracts on febrile rats

Rectal temperature (°C)	Control	Standard paracetamol (150 mg/kg)	Alcohol (250 mg/kg)	Alcohol (500 mg/kg)	Aqueous (250 mg/kg)	Aqueous (500 mg/kg)
Basal	34.83±0.119	35.14±0.213	35.09±0.232	36.44±0.012	36.05±0.202	34.13±0.107
After 19 h	40.46±0.218	45.93±0.206	46.75±0.253	44.35±0.253	48.53±1.025	47.15±3.27
After 30 min	42.65±2.239	37.16**±0.153	45.32±3.32	45.69±0.197	47.35±0.327	44.28±0.382
After 60 min	44.54±0.210	35.15**±0.264	43.75±0.315	42.36±0.204	45.85±0.316	40.54±1.13
After 120 min	42.62±0.202	35.25**±0.381	39.25±0.107	37.35*±1.99	43.54±1.31	38.24*±1.08
After 180 min	45.23±0.302	35.14**±3.28	37.32*±0.917	37.35*±0.11	38.61±3.38	38.24*±0.109
After 300 min	44.35±1.20	35.14**±0.507	37.65*±1.331	35.96**±0.385	37.33*±0.369	36.86*±0.325

Values are expressed as mean±SEM. *P<0.05; **P<0.001; ***P<0.0001 significant from normal control group. SEM – Standard error of the mean, *B. tomentosa* – *Bauhinia tomentosa*

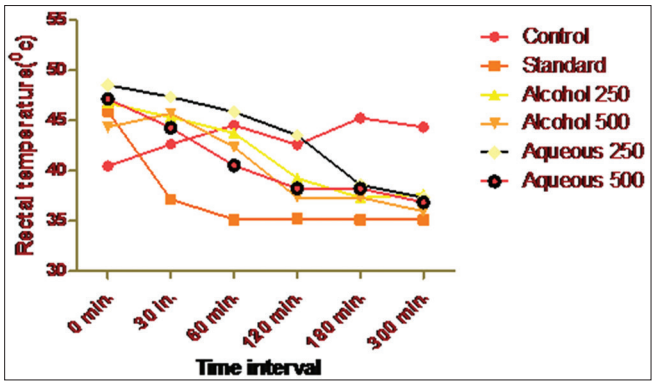

Figure 4: Antipyretic potential of *Bauhinia tomentosa* stem extracts

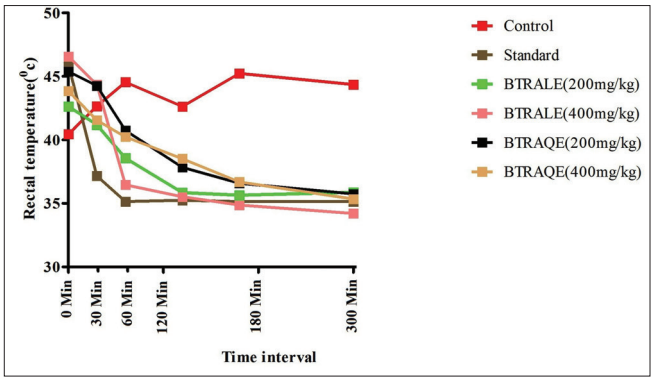

Figure 5: Antipyretic potential of *Bauhinia tomentosa* root extracts

with a reasonable safety profile. Subcutaneous injection of Brewer's yeast induces pyrexia by increasing the synthesis of prostaglandin. It is considered as a useful test for the screening of plants materials as well as synthetic drugs for their antipyretic effect.[14,15] Yeast induced pyrexia is called pathogenic fever, and its etiology could be the production of prostaglandins.[16] The inhibition of prostaglandin synthesis could be the possible mechanism of antipyretic action as that of paracetamol, and the inhibition of prostaglandin can be achieved by blocking the cyclo-oxygenase enzyme activity. The oral administration of extracts significantly attenuated rectal temperature of yeast induced febrile rats.

Acetic acid-induced writhing is a well-recommended protocol for evaluating medicinal agents for their analgesic property. This pain paradigm is widely used for the assessment of peripheral analgesic activity due to its sensitivity and response to the compounds at a dose that is not effective in other methods. The substance inhibiting the writhings will have an analgesic effect preferably by inhibition of prostaglandin synthesis, a peripheral mechanism of pain inhibition.[17,18]

Bauhinia tomentosa root was found to possess significant effect by both the models, that is, acetic acid-induced writhing and hot plate method suggesting its central nervous system (CNS) and PNS and their mechanisms of action may be mediated through inhibition of local peritoneal receptors which may be the involvement of cyclo-oxygenase inhibition potential. *K. pinnata* root extracts were found to possess significant antinociceptive effect but failed to inhibit a number of writhings in acetic acid-induced writhing models suggesting its CNS action. *K. pinnata* stem extract significant inhibited number of writhings in acetic acid-induced writhing methods whereas fail to increase mean latency time at both doses respectively suggesting its PNS action. Antipyretic effect of alcohol and aqueous extracts at high dose, that is, 500 mg/kg found to possess statistically significant antipyretic effect at 120, 180 and 300 min. after oral administration of the extracts when compared to the control. When compared among the extracts tested *B. tomentosa* root extracts found to possess statistically significant ($P < 0.01$) analgesic and antipyretic activity at both (low and high) doses whereas *K. pinnta* stem and root extracts showed statistically significant ($P < 0.01$) analgesic and antipyretic activity at higher doses.

Preliminary phytochemical screening of root extract gave positive test for the tannins, phenolic compounds, amino acids, carbohydrate, phytosterols, triterpenoids, and alkaloids. The presence of tannins, phytosterols, alkaloids, triterpenoids present in the extracts may be responsible for the antipyretic and analgesic activity.[19-23]

Based on the results of the present study, we conclude that *B. tomentosa* and *K. pinnta* extracts possess significant analgesic and antipyretic potential. *B. tomentosa* root extracts at low doses were found to possess significant analgesic and antipyretic potential. Further research is going to identify the phyto-constituents responsible for the above said activities.

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