ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Analgesic and anti-inflammatory activities of *Buchanania lanzan* Spreg. Roots

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ABSTRACT

Buchanania lanzan Spreng plant is well known for its medicinal and therapeutic values in Indian folk medicine. However, to be clinically useful, more scientific data are needed. Therefore, in the present study, we investigated the effects of root of *Buchanania lanzan* Spreng. methanolic extract (MBL) on pain and acute inflammation. To assess the analgesic activity of varied concentrations of the MBL (200 and 400 mg/kg orally) acetic acid-induced writhing model in mice and hot plate reaction time model in rats was used. Anti-inflammatory activity was tested in carrageenan-induced rat paw oedema model. The writhes in experimental rats were reduced significantly as compared to that of control, and hot plate test showed significant licking effect in rats. Paw volumes was significantly reduced in treated animals. Results clearly indicate that the *Buchanania lanzan* Spreng could be a potential source for using as anti-inflammatory and analgesic agent.

Keywords: Buchanania lanzan, analgesic, anti-inflammatory, roots

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ISSN: 0975-8585

INTRODUCTION

Medicinal herbs have been used as a form of therapy for the relief of pain throughout history. Natural products in general and medicinal plants in particular, are believed to be an important source of new chemical substances with potential therapeutic efficacy. Taking into account the most important analgesic prototypes (e.g. salicylic acid and morphine) were originally derived from the plant sources, the study of plant species traditionally used as pain killers should still be seen as a fruitful research strategy in the search of new analgesic and anti-inflammatory drugs [1].

Inflammation is considered as a primary physiologic defense mechanism that helps body to protect itself against infection, burn, toxic chemicals, allergens or other noxious stimuli. An uncontrolled and persistent inflammation may act as an etiologic factor for many of these chronic illnesses. Although it is a defense mechanism, the complex events and mediators involved the inflammatory reaction can induce, maintain or aggravate many diseases. Currently used anti-inflammatory drugs are associated with some severe side effects. Therefore, the development of potent anti-inflammatory drugs with fewer side effects is necessary [2].

India is a rich source of medicinal plants and a number of plant derived oils and extracts are used against diseases in various systems of medicine such as Ayurveda, Unani and Siddha. Only a few of them have been scientifically explored. Plant derived natural products such as flavonoids, terpenes and alkaloids [3] have received considerable attention in recent years due to their diverse pharmacological properties including inflammatory, antipyretic and analgesic activities.

Buchanania lanzan Spreng. (family: Anacardiaceae) commonly known as Char in hindi is Subdeciduous tree, 13-17m high and upto 1.3m in girth, dark grey bark, Leaves alternate, petiolate, very coriaceous or hard sessile Flowers, greenish white in colour and stone hard bi-valved, kernel has a pleasant sweetish acidic flavor; found throughout the hot dried parts of India [4].Tribal people of Jharkhand and Chhattisgarh are using *Buchanania lanzan* Spreng. Mainly for wound healing, anti-diarrhoeal, analgesic and antiulcer activity apart from in other conditions, but no scientific study has been carried out regarding its pharmacological activities. Therefore present study designed to evaluate the Analgesic and anti-inflammatory activity of *Buchanania lanzan* Spreng.

MATERIALS AND METHODS

Plant material identification and extraction

Buchanania lanzan Spreng roots were collected in September 2008 from B.I.T. Mesra, Ranchi India. Further taxonomic identification was done Dr. S. Jha, Associate Professor, Dept. of Pharmacognosy, BIT, Mesra, Ranchi. The roots were dried in shade for 15 days and to ensure complete dryness plant roots were kept in hot air oven at 45˚C for 10 minutes. Then roots were subjected to size reduction to make coarse powder and passed through 40-mesh sieve and

stored in an airtight container for further use. The dried and powdered roots were subjected to hot extraction in Soxhlet apparatus with methanol.

Animals

Swiss albino mice weighing 25–30gm of either sex were used in the study. Animals were procured from Laboratory Animal House of Birla Institute of Technology, Mesra (Reg. no.: 621/02/ac/CPCSEA). All animal experiments strictly complied with the approval of institutional animal ethical committee. The animals were kept in polyacrylic cages and maintained under standard housing conditions of temperature (24-27°C) and humidity (60-65%) with 12:12 light: dark cycles. They were acclimatized for seven days. Food was provided in the form of dry pellets and water *ad libitum.*

Acute toxicity assay

Acute toxicity assay was performed in mice according to OECD guidelines. Animals were divided into different groups of six each. After an overnight fast, the test drug was administered orally in graded dose (100–2000 mg/kg). In further, they were observed continuously for the first 2 h for toxic symptoms and up to 24 h for mortality. There was no lethality in any of the groups after treatment [5].

Analgesic activity

Acetic acid-induced writhing test in mice

For the analgesic activity assay, acetic acid solution (15 mg/ml) at the dose of 300 mg/kg body weight was injected (i.p.) and the number of writhes during the following 15 minute period was observed [6]. A significant reduction in the number of writhes by drug treatment (MBL 200 and 400 mg/kg, p.o.) as compared to vehicle treated animals was considered as a positive analgesic response. The percentage inhibition of writhing was then calculated. Aspirin (100 mg/kg, p.o.) was used as standard drug.

Hot plate reaction time in rats

Rats were screened by placing them on a hot plate maintained at 55 ± 1ºC and the reaction time in seconds for hind paw licking or jumping were recorded [6]. The rats were orally administered the test drug (MBL 200 and 400 mg/kg, p.o.). Only rat which reacted within 15s and which did not show large variation when tested on four separated occasions, each 15 min apart, were used in this study. Pentazocine (10 mg/kg body weight, p.o.) was used as standard. The time for hind paw licking or jumping on the heated plate of analgesiometer was taken as the reaction time.

ISSN: 0975-8585

Anti-inflammatory activity

Carrageenan-induced paw oedema in rats

Carrageenan-induced paw edema was examined in female rats according to the method of Winter et al. (1962) [7]. Acute inflammation was produced by injecting 0.1 ml of (1%) carrageenan into plantar surface of rat hind paw. The test samples of MBL (200 and 400 mg/kg, orally), and Aspirin (300 mg/kg, orally) as reference agent were administered 60 min before carrageenan injection. The paw volume was measured at 1and 3 h, using a thread to determine the diameter of oedema formation size. Before oral administration of drugs, the average volume of the right hind paw of each animal was measured two times (Vo) by a digital plethysmometer. The volume of right hind paw was determined again at 1 and 3 h after carrageenan treatment (Vt). The percent inhibition in increase of edema volume for each animal group was calculated by the following formula,

$$\% \text{ inhibition of edema} = \frac{[(Vt-Vo)control-(Vt-Vo)treated]}{(Vt-Vo)control} \times 100$$

RESULTS

Analgesic Activity

MBL indicated significant and dose dependent analgesic activity against both thermally and chemically induced pain. In acetic acid induced writhing method MBL (200 and 400 mg/kg, p.o.) and standard (Aspirin 100 mg/kg, p.o.) treated animals showed significantly reduced number of writhing in 15 min at the rate of 13.96%, 39.29% and 60%, respectively, when compared with control group. Analgesia produced by MBL 400 mg/kg was more significant ($p < 0.01$) when compared to that of MBL 200 mg/kg.

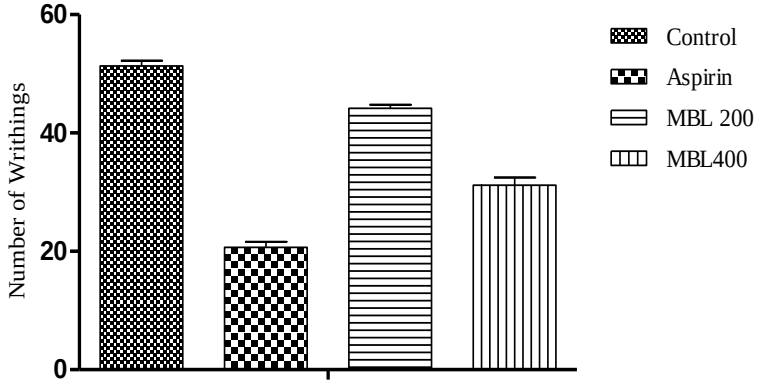

Figure 1: Effect of the methanolic extract of *Buchanania lanzan* roots on acetic acid induced writhing

ISSN: 0975-8585

Table 1: Effects of the methanolic extract of *Buchanania lanzan* roots on hot plate test in mice.

Treatment	Dose(mg/kg)	Mean reaction time (sec)			
		0	30	60	90
Control	--	3.48±0.08	3.66±0.06	3.62±0.12	3.52±0.10
Pentazocine	100	3.84±0.04	5.98±0.20**	6.94±0.13**	7.82±0.88**
Methanol extract	200	3.38±0.05	3.74±0.10	3.82±0.8	3.56±0.16
	400	3.78±0.07	3.88±0.08	4.04±0.15	4.17±0.17

Each value is the mean ± S.E.M. of six mice.
**p < 0.01 vs. control, One way ANOVA followed by Dunnet's t-test

Anti-inflammatory activity

The results of the anti-inflammatory effect of MBL on carrageenan-induced oedema in right hind paws of the experimental rats are presented in Table 1. There was a gradual increase in oedema paw volume of rats in the control (carrageenan treated group). However, in the test groups, the MBL at dose 200 mg/kg didn't significantly reduced the edema formation of rat paw at 1 and 3 h after carrageenin injection. But MBL at dose 400 mg/kg significantly reduced the edema formation of rat paw at 1 and 3 h after carrageenin injection ($p< 0.05$ and $p< 0.01$ respectively). On the other hand, Aspirin at the dose of 300 mg/kg significantly ($p < 0.01$) reduced the paw edema.

Table 2: Effect of the methanol extract of *Buchanania lanzan* and aspirin on carrageenin-induced hind paw edema in rats

Group	Dose mg/kg	Time after carrageenan injection				
		0 hr	1 hr		3 hr	
		EV	EV(ml)	EI(%)	EV(ml)	EI(%)
Control	-	-	0.82 ± 0.03	-	0.80 ± 0.03	-
Aspirin	300	-	0.45 ±0.03**	45.12	0.41 ± 0.03**	48.75
Methanol Extract	200	-	0.78 ±0.03	4.8	0.74 ± 0.02	7.5
	400	-	0.74 ±0.02*	9.7	0.62 ± 0.03**	22.5

Each value is the mean ± S.E.M. of six mice
**p < 0.01 vs. control, One way ANOVA followed by Dunnet's t-test

DISCUSSION

A number of drugs are available in market for relieving pain but they are accompanied with serious side effect. Still there was use of plant medicine in folk culture which is safer than these medicines. Tribal people of Jharkhand and Chhattisgarh are using *Buchanania lanzan* Spreng. For its anti-inflamatory and analgesic activities. In this study we made a effort to rationalaze the use of *Buchanania lanzan* Spreng. as anti-inflamatory and analgesic agent.

The acetic acid-induced writhing response used to screen for both peripheral and centrally acting analgesic. The abdominal constriction is related to the sensitization of nociceptive receptors to prostaglandins. Acetic acid is supposed to release prostaglandin E_2 and $F_{2\alpha}$ in peritoneal cavity that excites pain nerve endings [8]. Therefore, it is possible that MBL produced analgesic effect probably due to the inhibition of synthesis or action of prostaglandins. Hot plate method has been found to be suitable for the evaluation of centrally but not of peripherally acting analgesics. The hot plate method measures the complex response to non-inflammatory, acute nociceptive input. The opioid agent exert their analgesic effects via supra spinal and spinal receptor [9]. In the hot plate test MBL did not showed significant analgesic activity. Findings of present study indicate that MBL act as peripheral analgesic by inhibition of release of autacoids.

Carrageenan induces an acute inflammation which is useful for the detection of anti-inflammatory agents. The ability of MBL to significantly protect against carrageenan paw edema in rats indicates that it can effectively decrease acute inflammation. The edema which develops on carrageenan injection is a biphasic event [10]. The initial phase seen at+1 h are attributed to the release of histamine and serotonin. The edema maintained between the first and second phase is due to kinin-like substances. The second phase (1-3 h) is said to be promoted by prostaglandin-like substances. It has been reported that the second phase edema is sensitive to most clinically effective steroidal and non-steroidal anti-inflammatory agents [11], The fact that inhibition of the carrageenan-induced edema is mediated by MBL both in the first and third hours indicates the possibility of MBL being clinically useful and, like the reference drug aspirin, has an effect on both phases of carrageenan-induced inflammation.

CONCLUSION

Findings of the study indicate that MBL exerts significant analgesic activity probably mediated through peripheral inhibition of autacoids along with significant anti-inflammatory activity.

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