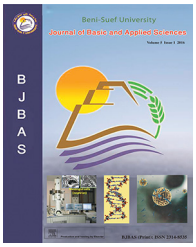
HOSTED BY

ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/bjbas



Full Length Article

Comparative analysis of analgesic and anti-inflammatory activity of bark and leaves of *Acacia ferruginea* DC.

Samriti Faujdar [a,*], *Swapnil Sharma* [a], *Bhawna Sati* [a], *A.K. Pathak* [b], *Sarvesh Kumar Paliwal* [a]

[a] *Department of Pharmacy, Banasthali University, Rajasthan 304022, India*
[b] *Department of Pharmacy, Barkatullah University, Bhopal, Madhya Pradesh 462001, India*

ARTICLE INFO

Article history:
Received 10 November 2015
Received in revised form 5 February 2016
Accepted 10 February 2016
Available online 19 February 2016

Keywords:
Acacia ferruginea
Analgesic activity
Carrageenan
Acetic acid-induced writhings
Flavonoids

ABSTRACT

The aim of the present study was to investigate and compare the analgesic and anti-inflammatory activities of hydroalcoholic extracts of bark and leaves of *Acacia ferruginea* DC. Hydroalcoholic extracts of bark and leaves were evaluated for analgesic activity using hot plate method and acetic acid-induced writhing test, whereas the anti-inflammatory activity was evaluated by carrageenan-induced paw oedema method. Hydroalcoholic extract of the bark at the dose of 50 mg/kg (6.10 ± 0.30) and leaves at a dose of 100 mg/kg (5.72 ± 0.39) after 45 min exhibited significant ($P < 0.001$) analgesic activity in hot plate test, which was comparable to Tramadol (6.11 ± 0.31) at a dose of 10 mg/kg. However, in acetic acid-induced writhing test, hydroalcoholic extract of both bark (90%) and leaves (90.91%) showed maximum protection from acetic acid at the dose of 100 mg/kg as compared to standard drug (50.91%) at a dose of 5 mg/kg. In the evaluation of anti-inflammatory activity, hydroalcoholic extract of leaves at a dose of 400 mg/kg had significantly (74.68%) inhibited the inflammation as comparable to indomethacin (82.8%) after 3 h of induction of carrageenan. It is concluded that hydroalcoholic extracts of bark and leaves have central analgesic and peripheral analgesic effects, respectively. Both hydroalcoholic extracts of the bark and leaves significantly reduced the paw oedema at a dose of 400 mg/kg and exhibited anti-inflammatory activity.

* *Corresponding author.* Department of Pharmacy, Banasthali University, Tonk, Rajasthan 304022, India. Tel.: +91 9887636909; fax: 01438 228365.
E-mail address: faujdar.samriti@rediffmail.com (S. Faujdar).
http://dx.doi.org/10.1016/j.bjbas.2016.02.002

1. Introduction

In spite of the progress made in medical research during the past decade, the treatment of some serious diseases remains problematic due to the side effect and high cost associated with it. Inflammation is a local response of animals towards injury. Basically, it is a body defence system to inhibit the spread of infection. It is characterized by formation of oedema, leucocytes infiltration and granuloma formation, tissue injury and repair (Bairagi et al., 2012). Inflammation causes triggers in inflammatory mediators such as TNF-α, interleukins and prostaglandins. Anti-inflammatory agents are capable of inhibiting the cyclooxygenase COX-1 and COX-2 pathway of arachidonic acid metabolism, which produces prostaglandins (Tasleem et al., 2014). Although a large number of remedies are available in the market, like immunosuppressants, NSAIDs, corticosteroids and histamines, side effects associated with them limit their use. Osteoporosis, gastric lesions, high blood pressure and allergy are the common side effects associated with them. Therefore, attention is being focused on the efficacy of plant based medicines with lesser side effects. According to WHO, 80% of the world population rely on plant based medicine for primary healthcare. It is estimated that in 1997, the world market for over the counter phytopharmaceuticals was US$ 10 billion with an annual growth of 6.5%. WHO includes phytotherapy in its health programmes and gives special emphasis on the validation of drugs from plant origins in developing countries (Ullah et al., 2014). Pain is frequently associated with inflammation (Bihani et al., 2014).

Pain is an unpleasant and emotional experience associated with tissue damage. Analgesics are the drugs used to relieve pain. Classical analgesics of natural origin include opiates and non-steroidal anti-inflammatory drugs but they are associated with side effects such as gastric lesions and tolerance and dependence (Ezeja et al., 2011). So, there is a need to explore natural available alternative sources to NSAIDs and opiates.

Secondary metabolites of plants such as steroids, flavonoids, alkaloids, terpenoids and glycosides have gained importance due to their diverse pharmacological activities such as anti-inflammatory, analgesic and antipyretic, etc. *Acacia* is a large genus containing 1300 species belonging to the family Mimosoideae. Different species of this genus have been reported to have anti-malarial, antifungal, antibacterial, anti-diarrhoeal, anti-oxidant, antiviral, hepatoprotective and antispasmodic activities. From ancient times, different species of *Acacia* have been used by the tribal community in Rajasthan to treat different ailments such as syphilis, dental pain, urinary tract bleeding and hypertension. A species of *Acacia*, i.e. *Acacia ferruginea*, is one of the important drugs of Ayurveda. *A. ferruginea* DC., a drought resistant, deciduous tree belonging to the family *Mimosoideae*, is native to Peninsular India from Gujrat to Gunjam in the east (Orwa et al., 2009). The bark of the plant is bitter and traditionally used as astringent and cure for itching, leucoderma, ulcers, stomatitis and diseases of the blood. Traditionally, the leaf extract has been in use as astringent and as a treatment for dysentery, gonorrhoea, urinary tract disorders, and useful in the diseases of the eye and liver. Bark decoction of *A. ferruginea* is one of the active ingredients of a gargle preparation. Ethanolic extract of *A. ferruginea* leaves is reported to have hepatoprotective (Akare et al., 2009), larvicidal (Vahitha et al., 2002), antiulcer (Sowndhararajan and Kang, 2013), and anti-tumour (Sakthivel and Guruvayoorappan, 2013) activities. Chemical constituents of *A. ferruginea* include flavonoids, phenols, alkaloids, terpenoids, anthraquinones and tannins. Glycosides and saponins were also present in trace amounts (Sakthivel and Guruvayoorappan, 2013). Earlier phytochemical studies indicated that this species acts as a rich source of tannins (catechin, epigallocatechin), terpenoids, polyphenolics (gallic acid) and saponins. It is noticeable that the aforementioned chemical constituents have been reported to possess analgesic and anti-inflammatory properties. Since no scientific data are available just yet to justify the anti-inflammatory and analgesic activities of this plant, the present study was designed to compare the anti-inflammatory and analgesic activities of hydroalcoholic extracts of the bark and leaves of *A. ferruginea*.

2. Materials and methods

2.1. Plant material

Bark and leaves of *A. ferruginea* plant were collected from Raholi village of the district of Tonk, Rajasthan, India in the month of August 2012 and were authenticated at the Department of Botany (Ref. RUBL21147), University of Rajasthan, Rajasthan, India. A specimen was submitted to the Department of Botany, Rajasthan University, for further reference. The bark and leaves were shade dried, coarsely powdered and stored in an air tight container for further use.

2.2. Preparation of extract

The coarsely powdered leaves and bark were extracted with 70% methanol using soxhlation. The solutions were filtered and concentrated under vacuum using rotary evaporator (Heidolph, Schwabach, Germany). Yields of extracts were calculated on the basis of percentage w/w. Hydroalcoholic extracts of leaves and bark were used in comparing the analgesic and anti-inflammatory activities of *A. ferruginea*.

2.3. Phytochemical screening

Hydroalcoholic extracts of bark and leaves were observed for the presence of alkaloids, carbohydrates, flavonoids, gum and mucilages, tannins, terpenoids, steroids and saponins (Harborne, 1998).

2.4. Experimental animals

Wistar albino rats (180–220 g, Male) and Swiss albino mice (25–40 g) were kept in polypropylene cages (3 in each cage) at an ambient temperature of 25 ± 2 °C and 55–65% relative humidity. A 12 h light/dark cycle was maintained in the animal house. The rats and mice had free access to water and feeds *ad libitum*. The approved protocol (BU/BT/627/14–15) of animal study was carried out as per the guidelines of IAEC and CPCSEA.