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Research Article

Anti inflammatory activity of *Parkinsonia acculeata* on carrageenan and formalin induced rat paw edema in rats

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ABSTRACT

The anti-inflammatory effect of the Pet ether and aqueous leaf extract of *Parkinsonia acculeata* was evaluated using the carrageenan and formalin induced rat paw edema. The extract administered orally at 500 mg/kg b. w produced a significant inhibition. The results obtained suggest that the Pet ether and aqueous leaf extract of *Parkinsonia acculeata* is endowed with effective anti-inflammatory activity mediated via either inhibition of cyclo-oxygenase pathways, inhibiting the synthesis of inflammatory mediators and scavenging free oxygen radicals. These findings seem to justify that the plant can be used as an anti-inflammatory agent.

Keywords: *Parkinsonia acculeata;* Carrageenan; formalin; anti-inflammatory

INTRODUCTION

The inflammatory process is the response to an injurious stimulus. It can be evoked by a wide variety of noxious agents (*e. g.,* infections, antibodies, or physical injuries). The ability to mount an inflammatory response is essential for survival in the face of environmental pathogens and injury; in some situations and diseases, the inflammatory response may be exaggerated and sustained without apparent benefit and even with severe adverse consequences. No matter what the initiating stimulus, the classic inflammatory response includes calor (warmth), dolor (pain), rubor (redness), and tumor (swelling). Inflammatory responses occur in three distinct temporal phases, each apparently mediated by different mechanisms: (1) an acute phase characterized by transient local vasodilation and increased capillary permeability; (2) a delayed, sub acute phase characterized by infiltration of leukocytes and phagocytic cells; and (3) a chronic proliferative phase, in which tissue degeneration and fibrosis occur. (Goodman & Gillman's 2006) Many mechanisms are involved in the promotion and resolution of the inflammatory process. Although earlier studies emphasized the promotion of migration of cells out of the microvasculature, recent work has focused on adhesive interactions, including the E, P, and L selectins, intercellular adhesion molecule-1 (ICAM-1), vascular cell adhesion molecule-1 (VCAM-1), and leukocyte integrins, in the adhesion of leukocytes and platelets to endothelium at sites of inflammation (Meager, 1999).

Flavonoids are a class of secondary metabolites widely distributed over the plant kingdom. (Middleton E. J, 1998) A fairly large number of plants known to contain flavonoids are used in folk medicine, in some cases as anti-inflammatory agents. Biological assays using isolated compounds revealed that flavonoids exhibit a wide range of effects on biological systems. They have been shown to exert antimicrobial, antiviral (Kaul TN *et al.,* 1985) antiulcerogenic, cytotoxic, antineoplastic (Loft S *et al.,* 1996), mutagenic, antioxidant, antihepatotoxic, antihypertensive, hypolipidemic, antiplatelet, anti- allergic and anti-inflammatory activities. Also, it was found that they decrease capillary permeability and exert an inhibitory effect on protein exudation and leukocyte migration. Biochemical investigations of the flavonoid mechanism of action have shown that these compounds inhibit a wide variety of enzymatic systems. The ability of certain flavonoids to inhibit both cyclooxigenase and 5 lipoxigenase pathways of the arachidonate metabolism may contribute to the anti-inflammatory properties (Akçahan Gepdiremen *et al.,* 2004). On the other hand, flavonoids are known to display many antioxidant properties including scavenging free radicals and preventing lipid peroxidation. These activities seem to be directly related to the number (Lilian Eugenia Pelzar *et al.,* 1998).

Ethics committee approval

Experimental protocols were reviewed and approved by I E C of Y. B. Chavan College of Pharmacy Aurangabad.

MATERIALS AND METHODS

Plant material and Preparation of extracts

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Table 1: The effects of extracts of *Parkinsonia acculeata* and indomethacin in carrageenan-induced acute paw edema

Dose mg/kg	Drug	Right Paw volume (ml) (mean ± S.E.M) (% inhibition)				
		1h	2h	3h	4h	% inhibition
	Normal	0.18±0.029	0.19±0.030	0.19±0.034	0.18±0.036	33.33
0.2 ml (1% W/V)	Carrageenan	0.185±0.0034	0..2±0.040	0.25 ±0.041	0.27±0.047	-----
500 mg	Indomethacin	0..20 ±0.0040	0.19±0.030	0..2±0.033	0..21 ±0.041	22.22
500 mg	*P A* Pet ether extract	0.19 ±0.030	0..22 ±0.022	0.21±0.030	0.20±0.031	25.92
500 mg	*P A* Aqueous extract	0..17 ±0.0025	0.21±0.039	0.22±0.035	0.225±0.029	16.66

n=6, Values are ± S.E.M., P<0.005 extremely significant as compared to control.

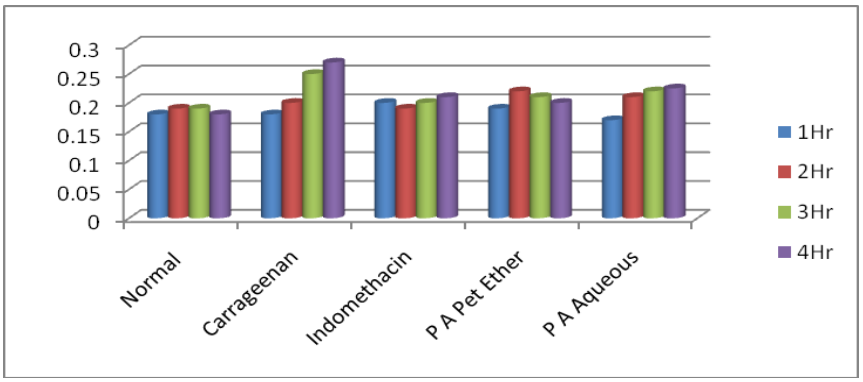

Figure 1: The effects of extracts of *Parkinsonia acculeata* and indomethacin in carrageenan-induced acute paw edema

The leaves of *Parkinsonia Acculeata* were collected from Sholapur district and were authenticated by Department of Botany, Maulana Azad College of Arts, Science and Commerce Aurangabad. A voucher specimen has been deposited in the herbarium of the Department of Botany, Maulana Azad College of Arts, Science and Commerce Aurangabad. Leaves were shade dried and ground into powder form. The powdered leaves were extracted in Soxhlet extractor using petroleum ether and concentrated with vacuum evaporator. The aqueous extract was prepared by maceration of leaves with water for 48h.

Phytochemical screening

The extracts of leaves were subjected to preliminary phytochemical screening to identify the presence of various phytoconstituents present. It showed the presence of Alkaloids, glycosides, saponins, flavanoids, etc (Singh P *et al.,* 2011.)

Acute Toxicity Studies

The preliminary pharmacological study was conducted to assess LD_{50} of the crude extract. The acute toxicity study was carried out in adult wister rats by the 'up and down' method. The animals were fasted overnight and next-day extracts of the herb *P. Acculeata* was administered orally suspended in Tween 40 at a different dose level. Then the animals were observed continuously for three hours for general behavioural, neurological and autonomic profiles and then every 30 minutes for next three hour and finally death after 24 hours. (K. Jaijoy *et al.,* 2011).

Drugs and chemicals

Parkinsonia acculeata extract, carrageenan, formalin and standard drugs. All other chemicals were of analytical grade.

Animals

In this study, adult male Wistar rats, weighing 180 – 200 gm were used.

Anti-inflammatory studies

Carrageenan induced oedema in rats

In this test, oedema was induced in rats by injecting 0. 2 ml of carrageenan (1% w/v) solution in distilled water into the sub plantar region of the right hind paw. The volume of the paw was measured as follows: Immediately, after injection, four times with periods of 1 h and once in 24 h until the inflammation disappeared. (Winter *et al.,* 1962). The % inhibition of Paw oedema was calculated by the formula, (A. Aminur Rehman et al 2010).

$$(\%)\ \text{Inhibition} = \frac{(Vc - Vt)}{Vc} \times 100$$

Experimental Design

Wistar rats (150-250 gm. Each) of either sex kept under standard environmental conditions (25±2°C under 12 h

Table 2: The effects of extracts of indomethacin in formalin-induced acute paw edema

Dose mg/kg	Drug	Right Paw volume (ml) (mean ± S.E.M) (% inhibition)				
		1h	2h	3h	4h	% inhibition
	Normal	0.19±0.022	0.2±0.034	0.21±0.029	0.21±0.027	25
0.2 ml (1% W/V)	Formalin	0.22±0.023	0.28±0.030	0.29±0.028	0.28 ±0.040	----
500 mg	Indomethacin	0.23 ±0.027	0.22 ±0.035	0.23 ±0.039	0.22 ±0.040	21.42
500 mg	*P A* Pet ether extract	0.24 ±0.030	0.25 ±0.030	0.25 ±0.022	0.24 ±0.022	14.28
500 mg	*P A* Aqueous extract	0.25 ±0.027	0.24 ±0.038	0.254 ±0.008	0.25 ±0.0122	10.71

n=6, Values are ± S.E.M., P<0.005, extremely significant as compared to control.

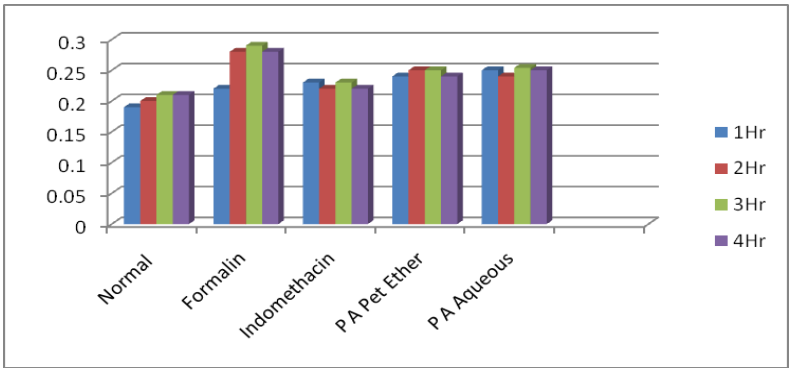

Figure 2: The effects of extracts of indomethacin in formalin-induced acute paw edema

light & 12 h dark cycles) in polypropylene cages. Standard pelleted feed & drinking water were provided *ad libitum* throughout the experimental period. The animals were acclimated to laboratory conditions one week prior to the initiation of experimental work. Animals were divided into five groups. Group I was treated as normal control, Group II was treated with Carrageenan, Group III was treated with Indomethacin, Group IV was treated with P A pet ether extracts, Group V treated with *P Acculeata* aqueous ether extracts. Extract was suspended in Tween 40 and given orally in a dose of 500mg/kg. (Y. M. Bahuguna *et al.,* 2010).

Formaldehyde induced oedema in rats

Oedema in rats was induced by injecting 0. 2 ml of formaldehyde (1% w/v) in the right hind paw. The volume of the paw was measured as followed immediately after injection; once on the third, sixth, and twenty-fourth hours and once in 24 h until inflammation disappeared (Ozdemir *et al.,* 1996). The % inhibition of Paw oedema was calculated by the formula, (A. Aminur Rehman et al 2010).

$$(\%)\ \text{Inhibition} = \frac{(Vc - Vt)}{Vc} \times 100$$

Statistical Analysis

The values are expressed as mean ± S. E. M. Statistical Analysis was performed using ANOVA (one way) followed by Post hock Tukey test, p < 0. 005 was considered to be significant, or we can say that the values are significantly different from the control or normal group at P < 0. 005.

DISCUSSION

Inflammatory diseases are currently treated with steroidal and nonsteroidal antiinflammatory drugs (NSAIDs). NSAIDs exert their effects by inhibiting the metabolism of arachidonic acid, by both cyclo-oxygenase and lipoxygenase enzyme pathways (Insel, 1996). Despite their widespread use, NSAIDs are often associated with severe adverse effects; the most common being gastrointestinal bleeding (Fung and Kirschenbaum, 1999). For this reason, safer compounds with fewer side effects are needed (Akçahan Gepdiremen, 2004). *Parkinsonia acculeata* has shown the presence of flavonoids during the phytochemical screening. In this study, it was found that *Parkinsonia acculeata extracts* showed that (1) 25. 92 % inhibitory effect with *P A* Pet ether extract and 16. 66 % inhibitory effect in Carragenan induces acute paw edema. (2) 14. 28% inhibitory effect with *P A* Pet ether extract and 10. 71 % inhibitory effect in Formalin induces acute paw edema. From the present study, it is revealed that *Parkinsonia acculeata* exerted its anti-inflammatory effect through multiple mechanisms. By the virtue of flavanoids it exerts free radical scavenging mechanism, inhibiting a wide variety of enzymatic systems, by inhibiting both cyclooxygenase and 5 lipoxygenase pathways of the arachidonate metabolism may contribute to the anti-inflammatory properties (Akçahan Gepdiremen *et al.,* 2004). Analytical studies have revealed the presence of

steroidal ring, which may be responsible for inhibiting the synthesis of inflammatory mediators.

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