Research Article

Antiinflammatory and Antipyretic Activities of *Drynaria quercifolia* Rhizome in Rats

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ABSTRACT

In the present study, the methanolic extract of *Drynaria quercifolia* rhizome was investigated for its anti inflammatory and anti pyretic activities on carrageenan-induced paw odema and brewer's yeast-induced pyrexia in rats. The results revealed that the extract at test doses of 100, 250 & 500 mg/kg b.w produced a remarkable anti inflammatory activity at 2 ½hr with an inhibition of paw oedema of 21%, 33% and 58% respectively, compared to the reference drug dexamethasone (200mg/kg b w) with an inhibition of 40%. Among the three concentrations, dose of 500 mg showed a maximum inhibition on carrageenan-induced rat paw oedema. Anti pyretic activity was also studied on Brewer's yeast – induced pyrexia rats. Fever was induced by injecting 10 ml/kg (s.c) of 20% aqueous suspension of Brewer's yeast in normal saline and rectal temperature was recorded by clinical thermometer before and after 12hrs of yeast administration. *Drynaria quercifolia at a* doses of 100, 250, 500 mg/ kg, showed significant anti-pyretic effect by decreasing the rectal temperature. Among the three concentrations, 500mg of plant extract exhibited remarkable antipyretic activity by decreasing the rectal temperature of rats in 1 hr (38.06^{o}C), 2hr (37.33^{o}C), 3hr (37.09^{o}C) after treatment which was higher than that of standard drug paracetamol (200 mg/kg) (37.24^{0}C). These findings demonstrated that *Drynaria quercifolia* have remarkable anti inflammatory and anti-pyretic activities when compared with positive control and thus have great potential as a source for natural health products.

Keywords: Anti inflammatory, Anti pyretic, *Drynaria quercifolia,* methanolic extract.

INTRODUCTION

Inflammation is the complex biological response of vascular tissues to harmful stimuli including pathogens, irritants, or damaged cells. It is a protective attempt by the organism to remove the injurious stimuli as well as initiate the healing process for the tissue[1]. The process of inflammation is necessary in healing of wounds. Inflammation however, if runs unchecked, lead to onset of diseases like vasomotor rhinnorhoea, rheumatoid arthritis and atherosclerosis[2].

Acute inflammation is characterised by classical signs-edema, erythrema, pain, heat, and above all, loss of function. The classical signs are triggered by the infiltration of the tissues by serum and white blood corpuscles (leucocytes). Chronic inflammation results in a progressive shift in type of cells, present at site of inflammation. It is characterized by simultaneous destruction and healing of the injured tissue from incidence of inflammation.

Fever or pyretic is defined as the elevation of core body temperature above normal; in normal adults, the average oral temperature is 36.98C (98.58F). In oncology practice, a single temperature of more than 38.3°C (101°F) or three readings (at least 1 hour apart) of more than 38°C (100.4° F) are considered significant. Lower temperature elevations in the very young or old and in patients receiving steroids or other immunosuppressant's are considered abnormal[3].

Medicinal plants are assuming greater importance in the primary health care of individuals and communities in many developing countries. There has been an increase of demand in international trade because of very effective, cheaply available, supposedly have no side effects and used as alternative to allopathic medicines. Medicinal plants are believed to be much safer and proved elixir in the treatment of various ailments[4]. In recent years, the natural antiiflammatory and antipyretics of plant origin are being appreciated due to possible toxicity of synthetic drugs. Keeping this view, *Drynaria quercifolia* was selected to investigate its anti inflammatory and antipyretic activities

Drynaria quercifolia (Family: Polypodiaceae) J. smith localy known as Gurar, is a parasitic fern [5,6] and it is widely distributed in Bangaladesh, India, South China, Malaisia, Australia and Thailand. It also found in low down the mountains on tree or rocks[6,7]. *Drynaria querfcifolia* usually grows in low fetile land with humid condition. This also grows in coastal areas of India including coastal Western Ghats of maharastra[7].

Rhizome and roots of this plants are used as tonic in typhoid fever and dyspepsia. Traditional use of this drug is in diarrhea, typhoid, jaundice, fever, headache, skin disease and syphilis. In another combination of drug, *Drynaria* is used for expelling rheumatism[8]. In the treatment of hyperthyroidism, *Drynaria* along with other drugs are used. The ethnomedicinal uses of the fern *Drynaria quercifolia* have been pharmacologically confirmed by several workers such as anthelmintic activity[9], antibacterial and antidermatophytic activity [10] .

MATERIALS AND METHODS

Animals

Male albino rats of wistar strain approximately weighing 160-180g were used in this study. They were healthy animals purchased from the Indian Institute of Science, Bangalore. The animals were housed in spacious polypropylene cages bedded with rice husk. The animal room was well ventilated and maintained under standard experimental conditions (Temperature 27 ± 2° C and 12 hour light/dark cycle) throughout the experimental period. All the animals were fed with standard pellet diet and water were provided *ad libitum*. The animal feed composition is crude protein (22.3%), crude oil (4.01%), crude fibre (4.02%), Ash (8.02%) and sand silical (1.02%).

Chemicals

Carrageenan was purchased from Sigma Chemical Company, Mumbai. All other chemicals and reagents used in this study were of analytical grade with high purity and were obtained from Glaxo laboratories and Sisco Research laboratories, Mumbai, India.

Collection of plant materials

The material used in the present study is the rhizome of *Drynaria quercifolia.* The rhizome was collected from Kollimalai, Namakkal district, Tamil Nadu, India. The rhizome is covered with small brown coloured hair like structures, they were removed using sterile scalpel and washed with sterile distilled water. They were cut into small pieces and dried in shade and made into fine powder, using blender. The powder was used for extraction.

Preparation of plant extract

The powder material of *Drynaria quercifolia* was macerated with 70% ethanol at room temperature for 3 days. After 3 days, the supernatant was transferred into china dish. The supernatant was completely removed by keeping the china dish over a boiling water bath at 45°C. A semi solid extract was obtained after complete elimination of alcohol. The obtained residue was kept in the refrigerator for further use. The extract was made up to a known volume in distilled water just before oral administration.

Anti inflammatory activity

Carrageenan induced rat paw oedema

Anti inflammatory activity of *Drynaria quercifolia* was evaluated using Carrageenan induced rat paw oedema. After 12hrs fast, rats were divided into five groups of six each. Each animal was marked for identification and regularly monitoring.

Experimental design

Group I served as control group received distilled water only, Group II, III & IV animals received 100, 250 & 500 mg/kg b.w of the methanalic extract of *Drynaria quercifolia* respectively and 0.1 ml of 1% carrageenan into sub plantar region of rat's paw, Group V animal received carrageenan (0.1 ml/kg b.w) and orally administered (200mg/kg) Dexamethasone as a standard drug.

Experimental procedure

Anti infalmmtory activity was evaluated using carrageenan induced rat paw oedema. An injection was made of 0.1 ml of 1 % carrageenan into the right hind foot of each rat. The test group of rats were treated orally with 100, 250, 500mg/kg b.w of methanolic extract of *Drynaria quercifolia* 1 hr before the carrageenan injection. Rreference group was given (200 mg/kg b.w) Dexamethasone. The paw was marked with in at the level of lateral malleous and immersed in mercury upto the mark and measured by mercury volume displacement methods. The paw volume was measured in right paw for 30 minutes interval up to 2 ½ hours. Finally the percentage of inhibition of oedema was calculated[11,12].

$$\% \text{ of inhibition rate} = \frac{V_c - V_t}{V_c} \times 100$$

Where V_c is the oedema value of the control group and V_t is the oedema value of treated groups.

Anti pyretic activity

Yeast-induced hyperpyrexia in rats

Anti pyretic activity of *Drynaria quercifolia* was evaluated using yeast induced pyrexia in rats. After 19 hrs fast, rats were divided into five groups of six each. Each animal was marked for identification and regularly monitoring.

Experimental design

Group I served as control received saline only; Group II, III & IV Animals received yeast (10 ml/kg b.w) and 100, 250 & 500 mg / kg of methanol extract of *Drynaria quercifolia* respectively orally; Group V Animal received yeast (10 ml/kg b.w) and orally administered (200mg/kg) paracetamol as a standard drug.

Experimental procedure

Antipyretic activity was measured by slightly modifying the method described by Adams *et al*.,(1968)[13]. The first group was given saline, the second, third and fourth group was given 100, 250 and 500 mg/kg of the extract, respectively, and the fifth group was given as standard Paracetamol (150mg/kg b.w.). Pyrexia was induced by subcutaneously injecting 20% w/v brewer's yeast suspension (10ml/kg) into the animal's dorsum region. 19h after the injection, the rectal temperature of each rat was measured using a digital thermometer (SK-1250 MC, Sato keiryoki Mfg.). Only rats that showed an increase in temperature of at least 0.7°C was used for experiments, the rectal temperature was measured at 1, 2,3 hrs after treatment.

RESULTS

The present study is carried out to evaluate the anti-inflammatory and antipyretic activity of *Drynaria quercifolia* rhizome in rats. The observations made on different groups of experimental and control animals were compared as follows.

Anti inflammatory activity

The effect of *Drynaria quercifolia* rhizome on carrageenan induced paw oedema is shown in the table 1. The rats foot paw become oedemateous after injection of carrageenan. The administration of extract at doses of 100,250,500 mg/kg b.w produced a significant anti-inflammatory activity at 2 ½ hours with paw oedema inhibition of 21%, 33 % and 58% respectively, while the reference drug Dexamethasone inhibited paw oedema of 40 %. Only the extract at the dose of 500 mg showed a maximum inhibition of carrageenan induced rat paw oedema when compared with standard drug.

Anti pyretic activity

Anti pyretic activity of *Drynaria quercifolia* rhizome was performed using brewer yeast induced pyrexia test (Table 2). Subcutaneous injection of yeast suspension markedly elevate the rectal temperature after 24 h of administration in experimental rats. Treatment with the *Drynaria quercifolia* extract at the doses of 100, 250 and 500 mg/kg decreased the rectal temperature at 3h were 37.74°C, 37.10°C and 37.09°C respectively. There was a dose dependent responses were observed in experimental rats. The antipyretic effect started as from the first hour and the effect was maintained for 3 hrs, after administration of the extract. The dose of 500 mg/kg of extract showed remarkable anti pyretic activity when compared with positive control paracetamol (37.24°C).

Table 1: Effect of *Drynaria quercifolia* on carrageenan induced paw oedema

Treatment Groups	Doses (mg/kgb.wt.)	Paw edema volume (ml)					Percentage (%) of inhibition				
		½ hr	1 hr	1½ hr	2 hr	2½ hr	½ hr	1 hr	1 ½ hr	2 hr	2 ½ hr
Group I (Control)	--	1.13±0.21	1.42±0.12	1.91±0.49	2.47±0.62	2.68±0.17	----	----	----	----	----
Group II	100	0.64. ±0.21	1.4. ±0.12	3.9±0.17	3.1±0.62	2.9±0.49	11.%	16 %	19%	20%	21%
Group III	250	2.7. ±0.18	2.6±0.08	5.4±0.41	7.3±0.22	7.1±0.12	20%	28%	24%	31%	33%
Group IV	500	2.2. ±0.12	7.6±0.16	7.4±0.17	7.6±0.20	7.9±0.13	45%	46%	50%	52%	58%
Group V	Standard (Dexomethasone) (200mg/kg)	2.8. ±0.16	1.07±0.15	5.8±0.14	2.2±0.22	5.7±0.27	25%	25%	32%	38%	40%

Values were expressed as mean ± SD six rats in each group.

Table 2: Effect of *Drynaria quercifolia* on Yeast-induced pyrexia in normal and experimental rats

Treatment Groups	Doses (mg/kg b. wt)	Rectal temperature (°C)				
		Before Yeast injection	Time After Treatment (hrs)			
			0	1	2	3
I	--	37.64±0.26	38.93±0.01	38.19±0.25	37.87±0.23	37.59±0.15
II	100	37.10±0.25	38.94±0.19	38.72±0.10	37.67±0.15	37.74±.03
III	250	37.07±0.21	38.66±1.0	38.41±0.26	37.61±0.22	37.10±0.9
IV	500	37.01±0.15	38.52±0.10	38.06±0.31	37.33±1.20	37.09±1.43
V	Paracetamol (200mg)	37.07±0.15	38.63±0.72	38.68±0.18	37.53±0.86	37.24±1.12

Values were expressed as mean ±SD, six rats in each group.

DISCUSSION

Anti-inflammatory activity of *Drynaria quercifolia* rhizome

The investigation is based on the need for newer anti-inflammatory agents from natural source with potent activity and lesser side effects as substitutes for chemical therapeutic. In Indian system of medicine, certain herbs are claimed to provide relief of pain and inflammation. So there is continuous search for indigenous drugs, which can provide relief on inflammation[14]. Carrageenan induced inflammation is a biphasic phenomenon and is a useful model to detect oral actions of anti-inflammatory agents[15]. The development of oedema in the paw of the rat after the injection of carrageenan is due to release of histamine, serotonin and prostaglandin like substances[11].

Histamine is one of the important inflammation mediators and it is a potent vasodilator substance and increases the vascular permeability[16,17]. This study showed that all the doses of *Drynaria quercifolia* effectively suppressed the oedema produced by histamine, so it may be suggested that its anti-inflammatory activity is possibly packed by its antihistaminic activity. The significant activity of the

standard drug was also observed. The *Drynaria quercifolia* also effectively suppressed the inflammation produced by serotonin induced by hind paw edema, which indicates that the *Drynaria quercifolia* may exhibit its anti-inflammatory action by means of either inhibiting the synthesis, release or action of inflammatory mediators viz. histamine, serotonin and prostaglandins that might be involved in inflammation. From the above results it was suggested that the anti-oedematogenic effects of *Drynaria quercifolia* on carrageenan mediators-induced paw oedema may be related to inhibition of inflammation mediator formation. The results indicate that methanolic extract of *Drynaria quercifolia* has potent anti-inflammatory activity than standard drug.

Yeast induced hyperpyrexia in rats

Fever may be a result of infection or one of the sequelae of tissue damage, inflammation, graft rejection, or other disease states. Antipyretic are drugs, which reduce the elevated body temperature. Regulation of body temperature requires a delicate balance between production and loss of heat, and the hypothalamus regulates the set point at which body temperature is maintained. In fever, this set point elevates and a drug like paracetamol does not influence body temperature when it is elevated by the factors such as exercise or increase in ambient temperature[18].

Yeast-induced fever is called pathogenic fever. Its etiology includes production of prostaglandins, which set the thermo-regulatory center at a lower temperature[19]. So inhibition of prostaglandin synthesis could be the possible mechanism of antipyretic action as that of acetylsalicylic acid [20]. Akio *et al.* (1988) suggested that there are several mediators or multi-processes underlining the pathogenesis of fever[21]. Inhibition of any of these mediators may bring about antipyretic. The present study reveals that the rhizome extract of *Drynaria quercifolia* causes a significant antipyretic effect in yeast-provoked elevation of body temperature as well as normal body temperature in rats. Among three concentrations of extracts, 250 & 500 mg of the extract caused a significant lowering of body temperature, with the effect being comparable to that of paracetamol. Thus, the present pharmacological evidence provides support for the folklore claim of *drynaria* as an anti-pyretic agent.

CONCLUSION

The above results confirmed that *Drynaria quercifolia* rhizome has better anti-inflammatory and antipyretic activity. The potential activity of the plant may be due to the presence of phytochemical constituents. Some of these compounds possess anti-inflammatory and anti pyretic activity. Further studies involving the purification of the chemical constituents of the plant and investigation in the biochemical pathway may results in the development of a potent anti-inflammatory and anti pyretic agent with low toxicity and better therapeutic index.

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