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Original Research Article

Evaluation of Anti-Inflammatory Activity of Parthenium Hysterophorus [Congress Grass]: An Experimental Study in Rat Models. (Carrageenan-Induced Paw Oedema Model)

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Abstract

Background: Parthenium hysterophorus is an aggressive ubiquitous annual herbaceous weed with medicinal properties used by some tribes as a remedy for inflammation, eczema, skin rashes, rheumatic pain, and gynaecological ailments and found to be pharmacologically active as an analgesic in muscular rheumatism, therapeutic for neuralgia and as a vermifuge. The decoction of P. Hysterophorus has been used in traditional medicine to treat fever, diarrhea, neurologic disorders, urinary tract infections, dysentery, malaria and as an emmenagogue.

Methods: The powdered aerial part of the plant was macerated with 70% v/v ethanol and hydroalcoholic extracts were obtained by percolation. A fresh solution was prepared by dissolving the extract in distilled water before the experiment. Carrageenan-Induced Paw Oedema Model used for evaluating anti-inflammatory activity. The albino Wistar rats of either sex were divided into 5 groups with six animals in each group and received either PH extract p.o. (200, 400,800 mg/kg), Aspirin (630 mg/kg) or control (1ml distilled water p.o.). 1% carrageenan solution was prepared and injected in the left hind paw (planter aspect) after 60 minutes of oral administration of standard and test drugs. Right hind paw kept as control.

Results: Parthenium Hysterophorus extract showed significant inhibition of oedema at the dose of 400, 800 mg/kg at the end of 4 and 24 hours.

Conclusion: Parthenium Hysterophorus extract exhibited significant anti-inflammatory activity in experimental analysis in Rats.

Keywords: Parthenium hysterophorus, Carrageenan-Induced Paw Oedema, inflammation

Introduction

"Herb" is a plant valued for its medicinal, aromatic or savory qualities. Herbs contain a variety of natural medicinal substances that has important pharmacological actions. Plant extracts are potentially curative. Some of these extracts can boost the humoral and cell-mediated immunity against viruses, bacteria, fungi, protozoa and cancer and produced the potential cure [1]. Also at the time of Charaka and Sushruta, many herbal medicines in different oral and topical formulations have been recommended for the treatment of various human diseases [2]. *Parthenium hysterophorus* [PH] is an aggressive ubiquitous annual herbaceous weed with medicinal properties of the plant but no economic importance. *Parthenium hysterophorus* is a weed of Asteraceae family. Recently many innovative uses of this hitherto notorious plant have been discovered. The decoction of P. hysterophorus has been used in traditional medicine to treat fever, diarrhoea, neurologic disorders, urinary tract infections, dysentery, malaria and as an emmenagogue. [3] It is used by some tribes as a remedy for inflammation, eczema, skin rashes, herpes, rheumatic pain, cold, heart trouble and gynaecological ailments. *Parthenium hysterophorus* has been found to be pharmacologically active as an analgesic in muscular rheumatism, therapeutic for neuralgia and as vermifuge [4]. This weed is also reported as a promising remedy against hepatic amoebiasis. Parthenin, the major constituent of the plant, exhibits significant medicinal attributes including anticancer property [5]. The flowers showed significant anti-tumour activity and parthenin exhibited cytotoxic properties against T cell leukaemia, HL-60 and Hela cancer cell lines [6]. They are easily available locally. Till now very less work has been done due to the lack of scientific data with respect to the pharmacological properties of the *Parthenium hysterophorus,* especially regarding the anti-inflammatory activity of *Parthenium hysterophorus*. Hence this study will be conducted to evaluate these unexplored properties of *Parthenium hysterophorus.*

Materials and methods:

A. Plant materials: Collection of the Plant Materials: Fresh *Parthenium hysterophorus* will be collected from the nearby area and will be authenticated by a local botanist of Science College. Aerial parts will be shade dried and powdered in the department of pharmacology.

Preparation of extract- The powders (Aerial parts) were macerated for 24 hours in 70 % v/v ethanol. The hydro-alcoholic extracts were obtained by percolation using 70 % v/v ethanol as a solvent. The percolated solution was again shade dried and the extract was obtained. A fresh solution was prepared by dissolving the extract in distilled water before each experiment.

Preparation of drug formulation- For oral administration, *Parthenium hysterophorus* extract was used which was prepared by dissolving the extract in distilled water before each experiment.

B) Drugs, Chemicals and Instruments: Tablet Ecosprin 75 mg was obtained from USV limited Mumbai India and Carrageenan was purchased from Sigma Chemicals. Percolator made of Borosil and Mercury Plethysmometer was purchased from Alka Scientific Co. Nagpur, India.

[C] Method for evaluating anti-inflammatory activity: Carrageenan-Induced Paw Edema Model [7] was used for evaluating anti-inflammatory activity in rats. The study was approved by IAEC and animals were maintained according to the CPCSEA guidelines. Animals were kept on 12 hour Light and dark schedule. The food and water were arranged ad-libitum. The albino Wistar rats of either sex weighing 150- 250 gm were divided into 5

groups and each group had 6 animals (total 30). Group I as Control received 1 ml dw p.o, Group II to IV received PH extract p.o. 200, 400,800 mg/kg, respectively and Group V received Asprin (630 mg/kg) p.o [8] as standard anti-inflammatory drug. 1% carrageenan solution was prepared and injected in the left hind paw (planter aspect) after 60 minutes of oral administration of standard and test drugs. The right hind paw was kept as the control in each animal. Both hind paws were marked at tibio-talar junction. Each paw was dipped in Mercury Plethysmometer up to the mark. Readings were taken at the end of 1, 2, 3, and 4 hours. The inhibitory percentage of inflammatory reaction was determined for each animal by comparing it with control and calculated by the formula [9] % Inhibition = (1-Vt/Vc) x 100 [10]

Statistical analysis: All results are expressed in Mean ± SD. The differences between experimental groups were compared by one-way analysis of variance (ANOVA). The results were considered statistically significant if *p<0.05, very significant when ** p<0.01, and highly significant if ***p < 0.001 compare to control.

Results:

In our study, we found that the Parthenium Hysterophorus extract at a dose of 400, 800 mg/kg showed 20%, and 40% inhibition of edema respectively which was statistically significant ($p < 0.05$, $p < 0.01$) respectively as compared to control and aspirin (54% inhibition of edema, $p < 0.001$) at the end of 4 hours.

PH extract in doses of 200, 400 and 800 mg/kg showed 25.71%, 34.28% and 48.57% inhibition in paw edema which was statistically significant ($p <0.05$, $p <0.01$) respectively as compared to control at the end of 24 hrs, Whereas aspirin showed 54.28% inhibition of paw edema which was highly significant ($p < 0.001$) as compare to control at the end of 24 hours.

Table 1: Anti-inflammatory activity of Parthenium Hysterophorus extract on rats by Carrageenan-Induced Paw Edema Model.

Groups	Dose mg/kg orally	Paw Volume After Carrageenan Injection (ml) mean ± SD (percentage inhibition)					
		Before test drug	1hr	2hrs.	3hrs.	4 hrs.	24 hrs.
1-Control Distilled water	2ml	0.18 ± 0.075	0.21 ± 0.075	0.25 ± 0.054	0.40 ± 0.089	0.50 ± 0.089	0.35 ± 0.075
2- PH extract	200	0.20 ± 0.040 (11.11%)	0.21 ± 0.063 (0.0%)	0.18 ± 0.075 (28%)	0.35 ± 0.122 (12.50%)	0.40 ± 0.089 (20%)	0.26 ± 0.103* (25.71)
3- PH extract	400	0.15± 0.054 (16.66%)	0.20 ± 0.051 (4.76%)	0.18 ± 0.075 (28%)	0.30 ± 0.089 (25%)	0.40 ± 0.063* (20%)	0.23 ± 0.103** (34.28%)
4- PH extract	800	0.20 ± 0.063 (11.11%)	0.21 ± 0.075 (0.0%)	0.20 ± 0.063 (20%)	0.26 ± 0.103* (35%)	0.30 ± 0.126 ** (40%)	0.18 ± 0.098 ** (48.57%)
5-Standard Aspirin	630	0.20 ± 0.089 (11.11%)	0.21 ± 0.040 (0.0%)	0.21 ± 0.075 (16%)	0.25 ± 0.122* (37.50%)	0.23 ± 0.121 *** (54%)	0.16 ± 0.051 *** (54.28%)

Number of animals n=6; PH- Parthenium Hysterophorus; Results are expressed in Mean ± SD; *P<0.05-significant, ** P <0.01- very significant ***P < 0.001- Highly significant compare to control.

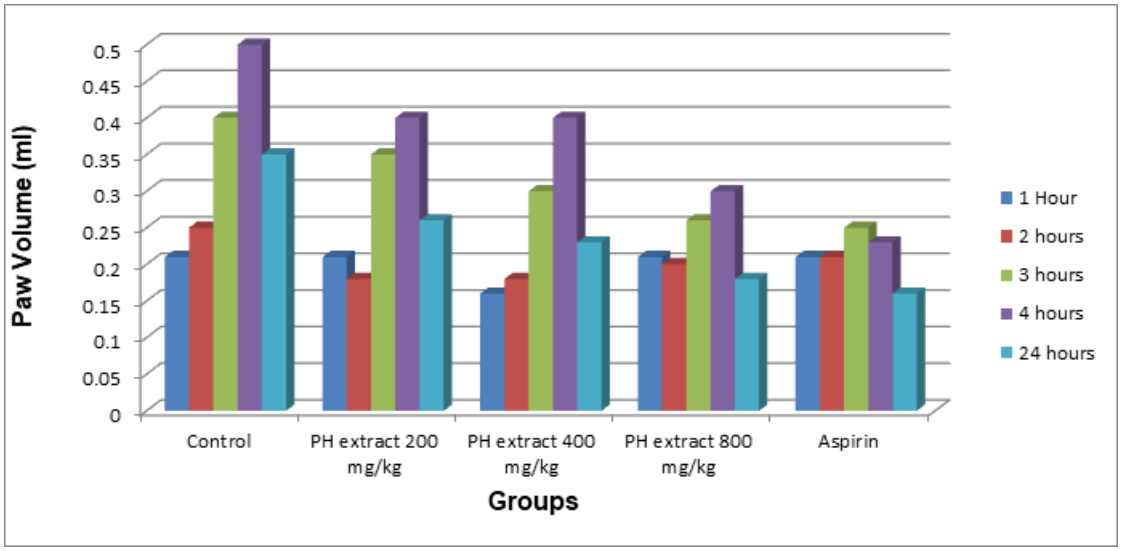

Figure 1: Anti-inflammatory activity of *Parthenium Hysterophorus* extract on rats by Carrageenan-Induced Paw Edema Model.

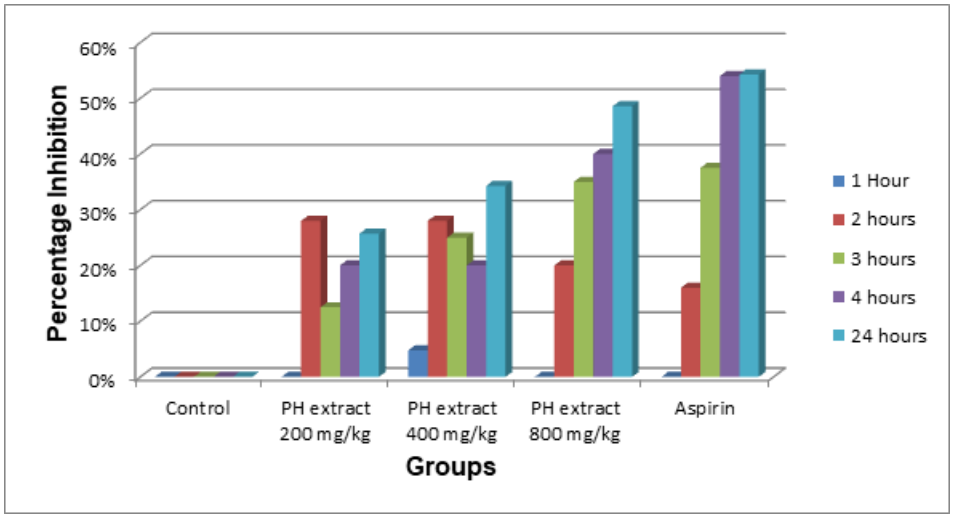

Figure 2: Anti-inflammatory activity of *Parthenium Hysterophorus* extract on rats by Carrageenan-Induced Paw Edema Model showing percentage inhibition.

Discussion:

Inflammation is one of the most important processes involved in the defence of an organism against local injury and infection, however, if often leads to painful or chronically harmful diseases requiring pharmacological treatment. The chemistry of *Parthenium hysterophorus* is now well defined. Chemotype and geographical distribution of seeds are the varying factors for the constituents of P. hysterophorus. [11] More than 45 sesquiterpene lactones were identified from leaves and flowers among them the major is sesquiterpene lactone, parthenolide, which is up to 0.9% of total constituents, [12] Twenty-three compounds, representing 90.1% or more of the volatile oils, have been identified from P. hysterophorus [13]. A literature survey has revealed that plant metabolites like Luteolin, Parthenolide, Pathenolide, Reynosin and Santamarin [14] etc may play an important role in anti-inflammatory activity.

Anti-inflammatory activity Carrageenan-induced paw edema is suitable for screening anti-inflammatory properties of natural drugs because of its sensitivity in

detecting orally active anti-inflammatory agents, particularly in the acute phase of inflammation. [15,16]. It is commonly used due to the absence of apparent systemic effects, antigenic nature of carrageenan and highly reproducible model. The development of edema in the paw of rats after injection of carrageenan is a biphasic event [17]. The initial phase observed during the first hour is attributed to the release of histamine and serotonin. The second phase of edema is due to the release of prostaglandins, protease, and lysosome [18,19], This leads to a dilation of the arterioles and venules and an increased vascular permeability. As a consequence, fluid and plasma proteins are extravasated and edema forms [20]. The mediators, including histamine, 5-HT, the kinins and their complements, have become the recent focus of attention as the metabolites of arachidonic acid (AA). Alone or in appropriate combination, AA products of the COX pathway are capable of producing the characteristic signs of inflammation: vasodilatation, hyperemia, pain, edema, and cellular filtration. The COX products, particularly prostaglandin E2 (PGE2), contribute to increased blood flow through a vasodilatation action, but the lipoxygenase (LOX) pathway is necessary for vascular leakage and edema consequently on cellular infiltration. In our study, oral administration of Parthenium hysterophorus extract at the doses of 400mg/kg and 800mg /kg showed significant ($p < 0.05$, <0.01) percent inhibition of edema at the end of 4 hours as compared to control. Whereas Parthenium hysterophorus extract at the dose of 200, 400 and 800 mg/kg showed significant ($p <0.05$, <0.01, <0.001) percent inhibition of edema as compared to control at the end of 24 hours. (Table 1 and Table 2). In a study by Pandey K et al [21] also found that ethanolic extract of Parthenium hysterophorus at the dose of 100 and 200mg/kg showed significant anti-inflammatory activity at 1, 2, 3, 4 hours as compared to control. Parthenium hysterophorus contain Luteolin, Parthenolide, Pathenolide, Reynosin and Santamarin 14 may be responsible for the inhibition of histamine, serotonin, kinins and prostaglandin. Thus contributing to its anti-inflammatory activity. The anti-inflammatory property may be due to an inhibitor of cellular phospholipases, which prevents the release of arachidonic acid in response to appropriate physiological stimuli.

Lipid peroxidation, results in cellular membrane damage which leads to swelling and cell death. The free radicals attract the different inflammatory mediators that are responsible for the general inflammatory response and tissue damage. During injury, there is an increase in the consumption of the endogenous anti-oxidants bringing about a decrease in the amount of anti-oxidants. Flavonoids may contribute an additive effect to the endogenous anti-oxidants and to inhibit the eicosanoid biosynthesis, therefore, decreasing the formation of the inflammatory metabolites which is responsible for its anti-inflammatory property. Hence by virtue of their free radical scavenging, antioxidant and anti-inflammatory properties, flavonoids may help in the healing of wounds [22]. Thus it can be suggested that phytochemical constituents present in Parthenium hysterophorus and flavonoids etc may be responsible for its anti-inflammatory activity. From our and other study it is very clear that Parthenium hysterophorus extract has potent, anti-inflammatory activity. But to establish the analgesic, anti-inflammatory and wound healing activity of Parthenium hysterophorus extract more studies are needed. [23]

Conclusion:

In the present scenario, demand for herbal products throughout the world is growing exponentially. Our approach to discovering newer anti-inflammatory agents is to search for their presence in natural sources.

Parthenium hysterophorus have been investigated for its anti-inflammatory activity in experimental models using Albino Wistar rats The hydro-alcoholic extract of Parthenium hysterophorus was used for the experiment. The anti-inflammatory activity of Parthenium hysterophorus extract was studied by the Carrageenan-Induced Paw Edema model, Parthenium hysterophorus extract showed significant anti-inflammatory activity as that of standard drug (aspirin). Parthenium hysterophorus extract contains Luteolin, Parthenolide, Pathenolide, Reynosin, Santamarin, etc which may be responsible for the inhibition of histamine, serotonin, kinins and prostaglandin contributing to its anti-inflammatory activity. The anti-inflammatory property may be due to an inhibitor of cellular phospholipases, which prevents the release of arachidonic acid in response to appropriate physiological stimuli. Thus, it can be concluded from the study that Parthenium hysterophorus extract has an anti-inflammatory activity. Further elaborative work is necessary for the better understanding of the mechanism of anti-inflammatory, activity of Parthenium hysterophorus.

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