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Anti-inflammatory activity of the flower extracts of *Solanum nigrum* in Rats.

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Abstract:

Plan: The present study was designed to investigate the anti inflammatory potential of the ethanolic and aqueous extract of *Solanum nigrum* flowers.

Methodology: Anti inflammatory activity was performed using cotton pellet granuloma in rats. Ethanolic and aqueous extracts of higher dose (300 mg/kg) exhibited maximum anti inflammatory activity.

Outcome: Extracts of *Solanum nigrum* may be useful in the treatment of inflammation and pain.

Key words: Anti-inflammatory activity, *Solanum nigrum* flower (SNF)

1. Introduction

Inflammation is a cardinal last defense response to injury of tissue ischemia, autoimmune responses or infectious agents. Inflammation is a major component of the damage caused by autoimmune diseases and is also a fundamental contributor to diseases such as cancer, diabetes and cardiovascular disease [1]. Chronic inflammation is the reaction arising when the acute responses is insufficient to eliminate the pro-inflammatory agents. Chronic inflammation includes a proliferation of fibroblast and infiltration of neutrophils with exudation of fluids. It occurs by means of development of proliferation cells which can either spread or form granuloma.

Efficacy of anti inflammatory agents in inflammatory states is indicated by their ability to inhibit the increase in the number of fibroblast during granular tissue formation (2). Biochemical investigations on the mechanism of action of flavonoides have shown that these compounds can inhibit a wide variety of enzymes.(3)



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2. Materials and methods

2.1. Preparation of the extracts:

The flower of *Solanum nigrum* was procured and identified at Horticulture Department Tamil University. A voucher specimen of same has been deposited. The leaves were shade dried and powdered coarsely. Extraction was done according to standard procedures using analytical grade solvents. The powdered drug was defatted by extracting with pet. ether (60-80° C). The coarse powder of the leaves was Soxhlet extracted with 80 % ethanol. The aqueous extract was prepared by the processes of maceration [4].

2.2. Animals:

The healthy wistar albino rats of either sex weighing between 150-200 g were housed under controlled conditions of temperature (29±2° C) humidity (55±5%) and 12h light and 12h dark cycles. The animals were fed with standard pellet diet and water *ad libitum*.

2.3. Acute toxicity study:

Acute toxicity studies for aqueous and ethanolic extracts of *Solanum nigrum* were conducted as per OECD guidelines 423 using albino wistar rats. Each animal was administered aqueous and ethanolic solution of the extract by oral route. The animal was observed for any changes continuously for the first 2h and up to 24h for mortality. [5]

2.4. Cotton pellet granuloma test in rats:

Albino wistar rats weighing between 150-200gm were divided into six groups of six animals each. Group I served as control, Group II to VI received aqueous extracts (2000mg/Kg and 300mg/kg body weight) of *Solanum nigrum* and Indomethacin 10 mg/kg body weight respectively. 30 min later, two autoclaved cotton pellets 30±1.0 mg were aseptically implanted subcutaneously in the region of axillae in rats anesthetized with diethyl ether. Extracts were administered one daily for the next 7 days. [6]

On the day 8, animals were anesthetized again the cotton pellets were removed surgically, freed from extraneous tissue and dried in the oven overnight at 60° c. The dried pellets were weighted and the mean weight of granuloma tissue formed around each pellet was determined. % inhibition of granuloma tissue development was calculated using the formula:

$(T_c - T_t) / T_c \times 100$, where T_c = weight of granuloma tissue of control groups, T_t = weight of granuloma tissue of treated groups.

Statistical analysis: The interpretation of the results was done after subjecting the data obtained from various studies to statistical analysis which included one way ANOVA followed by test - Dunnett and Tukey. $p < 0.05$ is considered as statistically significant.

3. Results

Acute toxicity studies for aqueous and ethanolic extracts of *Solanum nigrum* were conducted as per OECD guidelines- 423 (5) using albino wistar rats. The animal were observed for any changes continuously for the first 2 h and noticeable behavioral changes in all the groups tested. The extracts were found to be safe up to 2000 mg/kg body weight.

In the cotton pellet granuloma study which is a sub-acute anti inflammatory model, the weight of cotton pellet was determined at the end of the study and the percentage decrease in granuloma tissue was also found out investigation of the effect of ethanolic and aqueous extracts of *Solanum nigrum* on the proliferative phase of inflammation has revealed the following results (Table).

All the extracts were found to produce significant ($P < 0.001$) decrease in the granuloma tissue as evident by the decrease in the weight of cotton pellet when compared to the control. SNF1 200 and 300 produced anti inflammatory activity comparable ($P < 0.05$) to that of indomethacin extracts. The aqueous extracts produced better ($P < 0.05$) anti inflammatory activity when compared to the ethanolic extracts at dose of 200 mg/kg body weight.

4. Discussion

Cotton pellet granuloma studies are a sub-acute inflammation model. The repair phase of the inflammatory process begins with the proliferation of fibroblasts as well as multiplication of small blood vessels. Such proliferating cells penetrate and the exudates production of a highly vascularized and reddened mass known as granulation tissue [6]. Kinine is said to be the main mediator of granuloma, as it both causes vasodilatation and increase vascular permeability in the early stages of inflammation.

Many investigations have proven that varieties of flavonoid molecules possess anti inflammatory activity in various animal models of inflammation. Especially, some flavonoids were found to inhibit chronic inflammation of several experimental animals models. Quercetin results in decreased oxidative injury. Quercetin in particular is known for its iron-chelating and iron-stabilizing properties. Direct inhibition of lipid peroxidation is another protective measure [7,8].

The aqueous extracts of *Solanum nigrum* at both the doses were found to show significant anti inflammatory activity as evident by decrease in the weight of granuloma tissue when compared to the standard drug Indomethacin.

B-ring substituted flavones are found to be capable of inhibiting cotton pellet induced granuloma in rats [7]. The results from subacute model (cotton pellet granuloma studies) suggest that the anti inflammatory activity may be by the virtue of the plants active constituents mainly the flavonoids.

5. Conclusion:

Solanum nigrum were found to decrease in the granuloma tissue as evident by the decrease in the weight of cotton pellet when compared to the control. This indicates that the flower extracts of *Solanum nigrum* has anti inflammatory activity. The flower extracts of *S.nigrum* was found to possess anti inflammatory activity.

Table 1: Effects of ethanolic and aqueous extracts of flower *Solanum nigrum* flower in granuloma tissue formation

Treatment	Weight of cotton pellet in mg	% inhibition of granuloma tissue
Control	101.25±011.25	-
Indomethacin	53.75±10.6***a	48.16±10.47
SNF Et 200 mg	73.75±8.17***a,*b	28.41±8.07
SNF Et 300 mg	64.5±9.51***a	37.54±9.39
SNFaq 200 mg	61.37±5.34***a	40.63±5.27
SNF aq 300 mg	63±3.89***a	39.02±3.84

Where a=p less than 0.001 SNF :*Solanum nigrum* flower

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