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Comparative Evaluation of in vitro Anti-Inflammatory Activity of Selected Medicinal Plants from Andhra Pradesh

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ABSTRACT

An in vitro anti-inflammatory activity of three different medicinal plants growing around Chevuturuvillage, Mylavaram, Andhra Pradesh was tested in the current study. Each plant extract was subjected to phytochemical analysis. Two methods were used to assess anti-inflammatory activity: Carrageenan-induced rat paw oedema, Dextran-induced rat paw oedema, and cotton pellet-induced granuloma are the three conditions studied. T cordifolia has the potential to be used as an anti-inflammatory and antipyretic medication in the future, according to this study. The presence of several phytoconstituents in extracts of Trichodesma zeylanicum, Sansevieria zeylanica, and Capparis zeylanica may be responsible for this activity. Anti-inflammatory activity was comparable to that of standard medications, according to the statistical analysis. The findings suggest that Capparis zeylanica root bark has anti-inflammatory effects.

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INTRODUCTION

Inflammation is the body's reaction to a foreign invader, such as bacteria, parasites, or viruses. Inflammation is a protective response to irritation, injury, or infection that is defined by five cardinal indicators of inflammation: rubor (redness), calor (heat), tumour (swelling), dolor (pain), and functio laesa (function) (loss of function). [1] Majno, identified acute inflammation using these five cardinal indications. Inflammation is one of the most common pathologic processes observed in medical practise. It is more frequently encountered by a practising physician than degenerative, neoplastic, congenital, immunologic, or toxic disorders. Furthermore, it is a persistent aspect of many other diseases that, while not classified as killers, cause significant misery and disability. Chronic rheumatoid arthritis, acne, psoriasis, chronic liver and kidney illness, and rheumatic heart disease are all caused by inflammation. Many of the symptoms and complications of many diseases are caused by inflammation, such as necrosis of the inflammatory exudates in tuberculosis; a thick, fibrinous inflammatory exudate obstructs the upper respiratory tract in diphtheria; and the multiple emboli of bacterial endocarditis are made up of fibrin, bacteria, and inflammatory cells. [2].

Trichodesma zeylanicum (Burm.fR.Br. is a member of the Boraginaceae family. It can be found in disturbed land, crop fields, wayside vegetation, and sandy riverbeds. It sprouts late in the season and can take over cropland, preventing harvest. It can

be found on roadsides and stony arid wastelands up to 1500 metres high in India. [3]. The family Boraginaceae includes R.Br. It can be found in disturbed soil, crop fields, roadside ditches, and sandy riverbeds. It germinates late in the growing season and can take over cropland, preventing harvest. It can be found on the sides of roads and in stony dry wastelands up to 1500 metres in elevation throughout India. [4]. Leaves are used in Nigeria to treat fever, scorpion bites, and as an analgesic. [5]

Sansevieria zeylanica (L.) Willd. (Asparagaceae), is a perennial evergreen plant. It is indigenous to the South East Asian region, particularly India and Sri Lanka. [6]. Antiseptic ointments can be made from the dried rhizomes. Purgative, tonic, expectorant, and anti-fever medicines are all made from the rhizome. The herb has traditionally been used to cure infected wounds. Antifungal activities of an aqueous extract of the plant have been established by modern research. Abdominal pains, earaches, diarrhoea, and haemorrhoids are all treated. [7].

Capparis zeylanica Linn (Capparidaceae) is an evergreen climbing shrub with 3-6mm long recurved thorns that produce stems 2 - 5 metres long, occasionally up to 10 metres long. The plant is collected in the wild for local usage as medicine and, on rare occasions, as food. [8]. Anti-inflammatory drug screening and development is a pressing need in today's society, and many research have been conducted around the world to assess anti-inflammatory medications derived from indigenous medicinal plants. The current study additionally looked at the anti-inflammatory efficacy of Ethanol extracts of Trichodesma zeylanicum (TZ), Sansevieria zeylanica (SZ), and Capparis zeylanica (CZ).

MATERIALS AND METHODS

Collection and processing of plant material

Chevuturu village, Krishna district, Andhrapradesh was used to harvest Trichodesma zeylanicum (TZ) roots, Sansevieria zeylanica (SZ) rhizomes, and Capparis zeylanica (CZ) root bark. Prof. P. Satyanarayana Raju M.SC., M. Phill., Ph.D., Taxonomist, Department of Botany & Microbiology, Acharya Nagarjana University, recognised the plants.

Preparation of extract

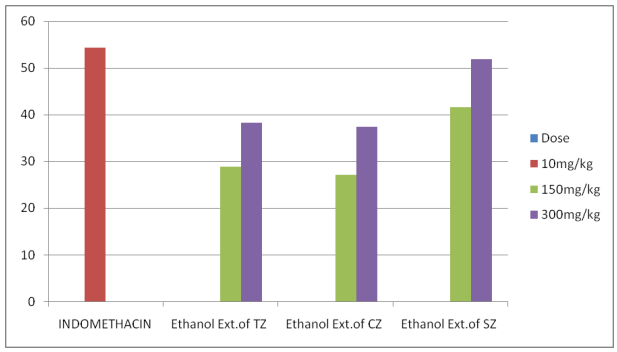
Individually, 1000 mL of ethanol was extracted from fine powdered TZ roots, SZ rhizomes, and CZ root bark. The solvents were evaporated under reduced pressure using a rotary vacuum evaporator at temperatures below 50°C. The extracted material was collected, the yield estimated, and the material was kept at 4°C for future use.

Preliminary Phytochemical Screening

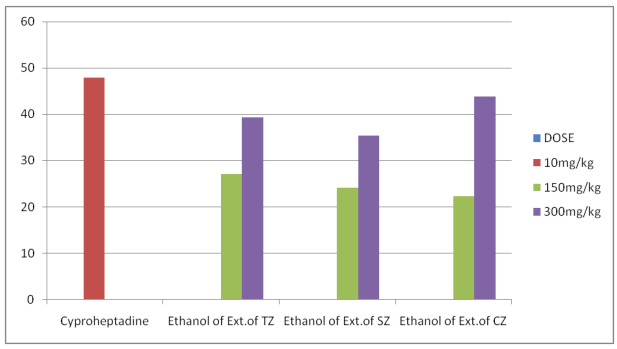
Standard screening procedures were used to check for the presence of various phytochemical ingredients in the extract. [9].

Experimental Animals

Adult Swiss Albino mice (25-30 g) and Albino Wistar rats (150-200 g) of both sexes were used in this investigation. The animals were procured from the Sri Vasavi Institute Of Pharmaceutical Sciences in Andhra Pradesh and were kept at a temperature of 20°C with a 12:12 h light/dark cycle and free access to food and water. The animals were given free access to water and fasted for 12 hours before the experiment. The Institute Animal Ethics Committee approved all of the procedures, and the studies were carried out in accordance with the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) rules on animal experimentation.



Graph 1: Effect of Ethanol extract of TZ, SZ and CZ on carrageenan-induced rat paw oedema



Graph 2: Effect of Ethanol extract of TZ, SZ and CZ on dextran-induced rat paw oedema

Acute toxicity study

Acute toxicity testing was carried out in accordance with OECD–423 recommendations [10]. The mice used were Swiss Albino mice of either sex. The animals were fasted for four hours but had unrestricted access to water. The fasted mice were divided into

Table 1: Effect of Ethanol extract of TZ, SZ and CZ on carrageenan-induced rat paw oedema

Treatment	Dose	% Increase in paw volume	% inhibition
Carrageenan control	-	62.55 ± 1.27	-
Indomethacin	10 mg/kg	28.59 ± 1.53^a	54.42
Ethanol Ext. of TZ	150 mg/kg	43.86 ± 1.69^a	28.90
	300 mg/kg	36.87 ± 1.84^a	38.26
Ethanol Ext. of SZ	150 mg/kg	42.46 ± 2.46^a	27.12
	300 mg/kg	35.40 ± 1.35^a	37.42
Ethanol Ext. of CZ	150 mg/kg	39.28 ± 1.50^a	41.59
	300 mg/kg	30.07 ± 1.04^a	51.92

Each value represents the mean $\pm$ S.E.M., n =6. ^{a}P< 0.001 compared with control, Dunnett's t-test after analysis of variance

Table 2: Effect of Ethanol extract of TZ, SZ and CZ on dextran-induced rat paw oedema

Treatment	Dose	% Increase in paw volume	% inhibition
Dextran control	-	44.67 ± 1.04	-
Cyproheptadine	10 mg/kg	23.16 ± 1.54^a	47.92
Ethanol Ext. of TZ	150 mg/kg	32.54 ± 1.21^c	27.01
	300 mg/kg	27.98 ± 1.91^a	39.32
Ethanol Ext. of SZ	150 mg/kg	34.42 ± 1.74^b	24.02
	300 mg/kg	29.96 ± 1.82^b	35.32
Ethanol Ext. of CZ	150 mg/kg	30.52 ± 1.24^b	22.32
	300 mg/kg	26.12 ± 1.42^b	43.76

Each value represents the mean $\pm$ S.E.M., n =6. ^{a}P< 0.001, ^{b}P<0.01, ^{c}P< 0.05 compared with control, Dunnett's t-test after analysis of variance

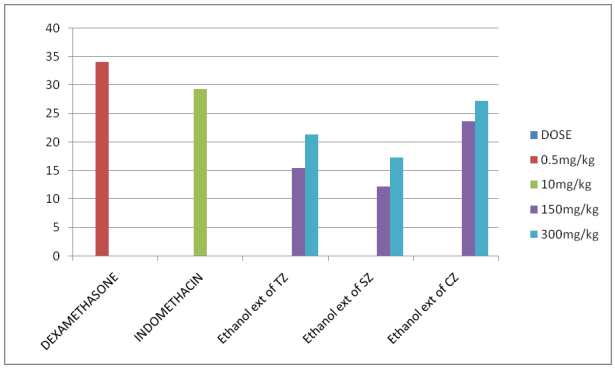
Table 3: Effect of Ethanol extract of TZ, SZ and CZ on cotton pellet-induced granuloma in rats

Treatment	Dose	Weight of granulation (mg)	% Inhibition
Control	-	111.88 ± 3.40	
Dexamethasone	0.5 mg/kg	73.35 ± 3.18^a	34.12
Indomethacin	10 mg/kg	78.85 ± 2.54^a	29.30
Ethanol ext of TZ	150 mg/kg	93.63 ± 2.24^a	15.42
	300 mg/kg	88.28 ± 2.46^a	21.32
Ethanol ext of SZ	150 mg/kg	96.44 ± 2.62^a	12.22
	300 mg/kg	92.64 ± 2.40^a	17.26
Ethanol ext of CZ	150 mg/kg	85.46 ± 2.42^a	23.62
	300 mg/kg	81.42 ± 2.28^a	27.26

Each value represents the mean $\pm$ S.E.M., n = 6. ^{a}P< 0.001 compared with control, Dunnett's t-test after analysis of variance

three or six groups, each with three or six mice. TZ, SZ, and CZ ethanol extracts were given orally at a dose of 5 mg/kg. A similar volume of 1 percent (w/v) aqueous carboxy methylcellulose solution was given to the control animals. Each group's mortality was tracked for 3 or 7 days. The treatment was repeated for greater doses such as 50, 300, and 2000 mg/kg if no death was seen.

The animals were watched for two hours to see if there were any changes in their autonomic or behavioural responses. Each group's mortality was tracked for seven days. The 150 mg/kg and 300 mg/kg doses were chosen based on preliminary toxicity testing results. Orally administered ethanol extracts of TZ, SZ, and CZ to mice at doses ranging from 5 to 2000 mg/kg caused no significant changes in autonomic or behavioural responses during the observation period. The body weights did



Graph 3: Effect of Ethanol extract of TZ, SZ and CZ on cotton pellet-induced granuloma in rats

not change appreciably. Up to 3 or 7 days of observation, no death was detected. As a result, the extract appears to be safe for administration up to 2000 mg/kg, with biological doses of 150 mg/kg and 300 mg/kg body weight, respectively.

Anti-inflammatory activity

Carrageenan-induced rat paw oedema

Oedema was induced in each rat by injecting 0.1ml of a newly made 1 percent carrageenan suspension (Sigma, St. Louis, USA) into the right hind paw. Using a plethysmometer, the paw volume was measured before (0 h) and 3 h after carrageenan injection. The rats were placed into eight groups, each with six rodents. The first group was given carrageenan as a control, while the second received Indomethacin (10 mg/kg) as a normal medicine. The third to eighth groups of rats were given ethanol extracts of TZ, SZ, and CZ (150 and 300 mg/kg, respectively). All of the treatments were administered orally 1 hour before the carrageenan injection. Carrageenan (1 percent w/v in saline, 0.1 ml) was subplantarly injected into the right hind paw of rats to cause paw oedema. Using a plethysmometer, the volume of the paw was measured before (0 h), 1, 3, and 5 h after injection of carrageenan challenge, according to the method described by [11] Winter et al. Because of the carrageenan injection, the oedema was manifested as an increase in paw volume.

Dextran-induced rat paw oedema

Oedema was induced in each rat by injecting 0.1ml of a 1 percent freshly made dextran suspension subplantarly into the right hind paw. Merlos et al. [12] used a plethysmometer to quantify paw volume before (0 h) and 30 minutes after dextran challenge. The rats were placed into eight groups, each with six rodents. The first group was given dextran as a control, whereas the second was given the conventional medicine cyproheptadine (10 mg/kg). The third to eighth groups of rats were given ethanol extracts of TZ, SZ, and CZ (150 and 300 mg/kg, respectively). All of the treatments were administered orally 1 hour before the dextran injection.

Cotton pellet-induced granuloma

The rats were divided into nine groups, each of which had six rats. The animals were anaesthetized after their fur was shaved off. Through a single needle incision, sterile pre-weighed cotton pellets (50 1 mg) were implanted in the axilla region of each rat [13]. The first group acted as a vehicle control [aqueous carboxymethyl cellulose solution, 1 percent (w/v)]. The conventional medicine dexamethasone 0.5 mg/kg was given to the second group, while indomethacin 10 mg/kg was given to the third group. The ethanol extracts of TZ, SZ, and CZ (150 and 300 mg/kg, respectively) were given orally to the fourth to ninth groups of rats for seven days after cotton pellet implantation.

The animals were anaesthetized again on the seventh day, and the cotton pellets were surgically removed and made free of extraneous tissues. The pellets were dried at 60°C after being incubated at 37°C for 24 hours. The increase in the pellets' dry weight was taken as a measure of granuloma development.

Statistical analysis

The data was presented as a mean standard error of the mean (S.E.M.). One-way analysis of variance was used to identify the difference in reaction to test medications and control drugs, followed by Dunnett's t-test or student t-test. P0.05 was seen as substantial.

Results and Discussion

Carrageenan-induced rat paw oedema

The ethanol extracts of TZ, SZ, and CZ (150 and 300 mg/kg) significantly inhibited the swelling generated by carrageenan in a carrageenan–induced rat paw oedema model at 5 hours when compared to control. After 5 hours of carrageenan administration, the ethanol extract of CZ (150 and 300 mg/kg) inhibited carrageenan-induced rat paw oedema by 41.59 and 51.92 percent, respectively, whereas indomethacin inhibited carrageenan-induced rat paw oedema by 54.42 percent. (Table 1, Graph 1).

Dextran-induced rat paw oedema

Ethanol extracts of TZ, SZ, and CZ, as well as Cyproheptadine, were given in oral doses of 150 and 300 mg/kg 30 minutes after dextran challenge and sig-

nificantly reduced paw oedema. At 300 mg/kg, the ethanol extract of CZ inhibited dextran-induced rat paw oedema by 43.76 percent (P 0.001), whereas Cyproheptadine inhibited dextran-induced rat paw oedema by 47.92 percent (P 0.001). (Table 2, Graph 2).

Cotton pellet-induced granuloma

After implanting sterile cotton pellets under the skin of rats given the vehicle control (5ml/kg) for 7 days, the weight of the pellets increased from 50 0.5 mg to 111.88 3.40 mg on average. When rats were given ethanol extracts of TZ, SZ, and CZ to treat cotton pellet–induced granuloma, all of the ethanol extracts significantly reduced the formation of granulation tissues when compared to rats given vehicle control (Table 3, Graph 3). In this mouse, ethanol extracts of CZ (150 and 300 mg/kg) inhibited granuloma weight by 23.62 and 27.26 percent, respectively. Dexamethasone and indomethacin, two common medicines, demonstrated 34.12 and 29.30 percent inhibition, respectively.

Bioactive components such as Saponins, Flavonoids, Phenols, Tannins, Terpenoids, and trace amounts of carbohydrates and amino acids were found in preliminary phytochemical screening of leaf extracts.

The efficacy of carrageenan-induced oedema for anti-inflammatory drug testing has been attributed to the considerable cellular migration that occurs in this kind of acute inflammation. As a result, oedema formation suppression provides a crude indicator of cell migration inhibition. [14].

The dextran-induced rat paw oedema was successfully decreased by the ethanol extracts of TZ, SZ, and CZ, but the impact was smaller than that of cyproheptadine. Dextran-induced oedema [Rowely and Benditt, 1956] is a well-known experimental model in which the oedema is caused by the release of histamine and serotonin from the mast cell. As a result, it's possible that CZ has anti-inflammatory properties through reducing the production, release, or activity of inflammatory mediators including histamine and serotonin, which are involved in inflammation.

The cotton pellet granuloma bioassay in rats is a common experimental paradigm for studying medication effects on chronic inflammation. After pellet implantation, Swingle and Shideman [15] observed three phases of inflammation. Proliferation occurs between the third and sixth days and can be slowed down by anti-inflammatory steroids like dexamethasone or non-steroidal anti-inflammatory medication. As a result, the goal of this investigation was to see if ethanol extracts of TZ, SZ, and CZ could change the final phase of the cotton pellet–induced granuloma. In rats with cotton pellet-induced granuloma, ethanol extracts of TZ, SZ, and CZ showed considerable anti-inflammatory action. This was due to its ability to block the proliferative phase of the inflammatory process, which included an increase in the number of fibroblasts and collagen and mucopolysaccharide synthesis during the formation of granuloma tissue [16].

CONCLUSION

The anti-inflammatory properties of Trichodesma zeylanicum roots, Sansevieria zeylanica rhizomes, and Capparis zeylanica root bark were discovered in this study. These findings back the traditional healers' assertions regarding the plant's effectiveness in treating inflammatory illnesses. At the concentrations tested, the ethanol extract of Sanseiveriazeylanica had strong anti-inflammatory benefits in experimental animal models. The findings also back up the plant's traditional use in the treatment of a variety of painful and inflammatory illnesses. According to the findings of this investigation, an ethanol extract of Capparis zeylanicademonstrated strong anti-inflammatory activity. The findings of this research may provide some scientific support for the use of Capparis zeylanica root bark as a non-specific anti-inflammatory drug in traditional medicine. The ethanolic extract of Capparis zeylanica has considerable anti-inflammatory properties when compared to the three plants Trichodesma zeylanicum, Sansevieria zeylanica, and Capparis zeylanica. This supports the traditional usage of these plants in inflammations.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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