

COSTUS SPECIOSUS AND ITS ANTIPSORIATIC ARTHRITIS ACTIVITY: A REVIEW

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ABSTRACT

Objective: Psoriatic arthritis is an autoimmune disease. The marketed drugs cannot totally cure the disease state as well as they have severe side effects and for that reason researcher and scientists are going for traditional medicines. *Costus speciosus* is the plant of choice for its several positive activities against psoriatic arthritis.

Methods: Wistar albino healthy rat was taken for 0.1 ml of Freund adjuvant-induced anti-arthritic and anti-inflammatory test, and diclofenac sodium (15 mg/kg) was taken as standard drug. The paw volume was measured at different time 1st, 7th, 14th, and 21st days of experiment. In another study, the protocol is same, but indomethacin (10 mg/kg) was taken as standard drug. Another study was performed to know that the plant drug has any lipopolysaccharide (LPS)-stimulated COX-protein inhibitor activity or not. An acute anti-inflammatory property was studied in carrageenan-induced paw edema and result is measured by plethysmometer. The chronic anti-inflammatory property was studied by cotton pellet-induced granuloma formation. 400 mg/kg and 800 mg/kg dose of ethanolic extract is administered to the animal of both acute and chronic studies.

Results: In anti-arthritic and anti-inflammatory study, after the 21st day, it has found that standard drug (diclofenac sodium) decreases paw volume 40 % where the plant drug reduces it 68.33% & 75.50% at higher and lower dose respectively. In the other study the Standard drug (Indomethacin) show arthritic score of 0.83 and the extract shows 1.67 at its higher concentration. In LPS-stimulated cyclooxygenase-2 (COX-2) inhibition study, extract helps to decrease the LPS-stimulated COX-2 protein nearly similar as methotrexate without any side effect. In the cotton pellet-induced anti-inflammatory study, 400 mg/kg and 800 mg/kg dose of ethanolic extract shows similar result against standard drug.

Conclusion: Although its activity is less compared to the marketed drug, in the other sides, it has very mild adverse effect compared to the marketed Drug. It can be used as a supportive drug in the treatment of Psoriatic arthritis and by chemical modification the activity may be increased without any side effect.

Keywords: *Costus speciosus*, Psoriatic arthritis, Anti-inflammatory.

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INTRODUCTION

Psoriatic arthritis is an autoimmune disease that is why there is no such medicine which can fully cure that disease. The marketed drugs partially give some extent of relief but along with this that drugs produce a lot of side effects which ultimately make the patients physical condition worse. That is why scientists are trying to bring a new drug with same efficiency with minimum side effects.

Psoriasis is a long-lasting (chronic) inflammatory dermatitis which is characterized by brownish-red papules and plaques which are very sophisticated and covered with very fine silver-colored scales. Psoriatic arthritis is an associated disease of psoriasis. Psoriatic arthritis is similar as other arthritic conditions characterized by pain, stiffness mainly at the joint [1].

The signs and symptoms of psoriatic arthritis are very much similar with osteoarthritis and rheumatoid arthritis, and the main difference in case of osteoarthritis and rheumatoid arthritis is the appearance of the psoriasis/psoriatic patches (brownish-red patch) along with signs and symptoms of arthritis [2].

In most of the cases, first psoriasis or psoriatic patch is observed, then we realize the arthritic pain and stiffness, but in few cases, it also happened that first we get the osteoarthritis and rheumatoid arthritis signs and symptoms and after a few days the psoriatic patch appears.

Psoriatic arthritis is more frequent between the age of 30 and 55 [3]. It is more common in child than Adult [4]. Men and women are nearly

equally affected (0.7:1) [4]. One of every 100 people is affected [1]. Indians have found highest prevalence (Fig. 1) [4]. At about 15% of case of psoriasis developed into psoriatic arthritis [5] and more than 80% of patients of psoriatic arthritis have psoriatic nail lesion.

Psoriatic arthritis is classified as a seronegative spondyloarthropathy and, therefore, occurs commonly in patients with tissue type human leukocyte antigen B27 [5].

WHY WE WILL CHOOSE TRADITIONAL MEDICINE

In modern medicine, there is no satisfactory effective therapy is still available to cure the psoriatic arthritis. Our ultimate option is the marketed medicines, but they have several drawbacks. The nonsteroidal anti-inflammatory drugs and cyclooxygenase (COX) inhibitor produce hepatic and renal toxicity.

Methotrexate - Stomach and intestine ulcer, bleeding, hole in intestine, decrease platelet, sepsis, and hypersensitivity bacterial infection [6].

Cyclosporine - Dizziness, flushing, increase blood pressure, nausea, vomiting, stomach upset, and diarrhea.

Sulfasalazine - Hyperreactivity, headache, nausea, vomiting and stomach upset, and hemolytic anemia [7].

Recombinant DNA technology is not that much effective still now and last option surgery is very much expensive that is why middle class and poor people cannot choose it. Until now, we are unable to find a safe drug

or chemical moiety with minimal adverse effects, which can be taken for long durations and which will have optimum potency. For these above-mentioned reasons recently, there has been increasing interest in the use of medicinal plants. The use of medicinal plants in modern medicine suffers from the fact that though hundreds of plants are used in the world to prevent or cure diseases. However, today, it is necessary to provide scientific justification for the use of plant or its active principles.

Plant details

- Kingdom: Plantae
- Order: Zingiberales
- Family: Costaceae
- Genus: Cheilocostus
- Species: *Speciosus*

Plant macroscopic study

Costus speciosus is Commonly available in greater Sudanis and Indonesia [8].

Plant height: 2.7 m high.

Root: Tuberos

Stem: Subwoody at the base and gradually juicy.

Leaves: Oblong, spirally arranged, subsessile, silky-pubescent beneath, and sheaths coriaceous.

Flower: Dense spike, bracts orate, mucronate, bright red, corolla tube short (yellow center and lip white color flower).

Fruits: Capsule, globosely trigonus, red.

Seed: Black with white aril.

MICROSCOPY

The rhizome of *Costus speciosus* contains visible periderm, periderm with stratified cork cells is also observed. The vascular bundle contains xylem, phloem, bundle sheath surrounded by fibers, and parenchymatous ground tissue. The vascular bundles are crescent shaped consisting of sclerenchymatous fibers surrounding bundle sheath, xylem, and phloem [9].

Phytochemical parameters

Parameters	Content (%)
Ash value	
Total ash	4.25
Acid-insoluble ash	1.0
Water-soluble ash	2.5
Moisture content	3.3

Phytoconstituents [Table 1]

Alkaloid	Absent
Glycoside	Present
Flavonoid	Absent
Saponin	Present
Terpenoid	Absent
Steroid	Absent
Volatile oil	Absent

Animal model study of *C. speciosus*

Animal - Wistar albino rat (150–200 g) [10]

Condition-temperature - 25°C±0.5°C

Relative humidity - 55–65.

Food and water *ad libitum*.

In this study [Table 2], the anti-inflammatory activity of the plant drug is tested where the animals (rat) paw volume is measured at different time 1st, 7th, 14th, and 21st days of experiment. After the 21st day, it has found in this study that Standard drug decrease paw volume 40% where the plant drug reduces it 68.33% & 75.50% at higher (800 mg/kg) and lower dose (400 mg/kg), respectively [11].

The biochemical parameters such as serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT),

and alkaline phosphatase (ALP) also checked [Table 3] for getting drugs anti-inflammatory activity [11].

In another study [12],

Animal Wistar albino rat (150–200 g) of either sex.

Optimum condition-temperature - 25°C±0.5°C

Relative humidity - 55–65.

Food and water *ad libitum*.

Tumor necrosis factor- α (TNF- α) increase that means the disease is an immunogenic disease. Here, in the study, they showed that plant has ability to decrease the TNF- α level. Hence, we may say that the plant has immunosuppressive effect [12].

SGOT, SGPT, and ALP level also decreases [12].

In another study [Table 4] [13], the methanolic extract of *C. speciosus* is tested in animals where the arthritis is induced on them by Freund's adjuvant. At a dose level of 400 mg/kg and 800 mg/kg, it shows activity against paw edema (anti-inflammatory activity) 75.8 and 68.33%, respectively. The SGOT, SGPT, and ALP level also estimated and it indicated very good anti-arthritis activity [14].

In another study [15], they tried to establish that the plant extract helps to decrease the LPS-stimulated TNF- α level nearly similar to methotrexate (Fig. 2).

COX-2 inhibition establishes that the plant extract has some anti-inflammatory activity.

Sample with 50 mg/ml concentration helps to decrease the LPS-stimulated COX-2 protein nearly similar as methotrexate without any side effect (Fig. 3) [15].

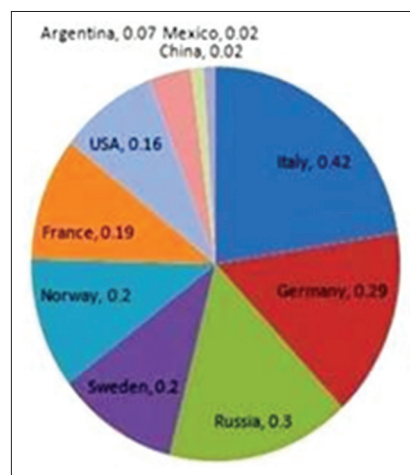


Fig. 1: Epidemiology of psoriatic arthritis

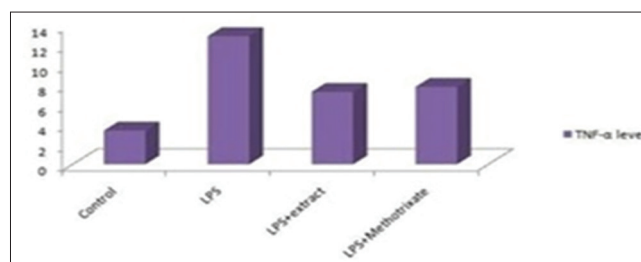


Fig. 2: Change of tumor necrosis factor- α level

Table 1: Fluorescence study [9]

Type of extract	Visible light	UV at 254 nm (short UV)	UV at 365 nm (long UV)
Aqueous extract	Brown	Light green	Cream
Chloroform extract	Brown	Dark green	Light brown
Ethanol extract	Dark brown	Green	Light brown
Methanol extract	Brown	Green	Dark brown

Table 2: Study protocol [11]

Group No.	Group name	Arthritis-inducing agent	Drug	Others
1	Control	X	X	CMC 1% (1 ml/kg b.w)
2	Standard	0.1 ml of Freund complete adjuvant	Diclofenac sodium (15 mg/kg)	CMC 1% (1 ml/kg b.w)
3	Test ₄₀₀	0.1 ml of Freund complete adjuvant	Test drug (400 mg/kg)	CMC 1% (1 ml/kg b.w)
4	Test ₈₀₀	0.1 ml of Freund complete adjuvant	Test drug (800 mg/kg)	CMC 1% (1 ml/kg b.w)

CMC: Carboxymethyl cellulose

Table 3: SGOT and SGPT level [11]

Drug	SGOT level	SGPT level
Diclofenac	63	73.5
Test drug (400)	85	92.5
Test drug (800)	78.8	89.5

SGOT: Serum glutamic oxaloacetic transaminase, SGPT: Serum glutamic pyruvic transaminase

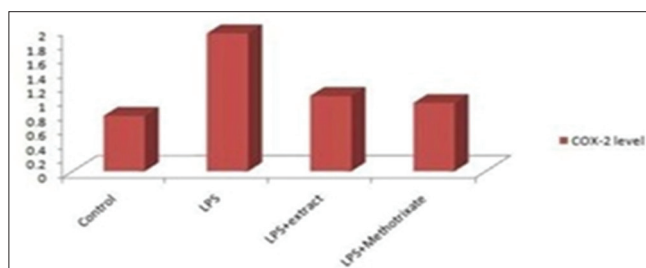


Fig. 3: Change of cyclooxygenase-2 level

In another study [16], it has been concluded that ethanolic extract of *C. speciosus* rhizome has anti-inflammatory [Tables 6 and 7] and anti-arthritic activity [Table 5]. An acute anti-inflammatory property was studied in carrageenan-induced paw edema and result is measured by plethysmometer. A chronic anti-inflammatory property was studied by cotton pellet-induced granuloma formation. 400 mg/kg and 800 mg/kg dose of ethanolic extract [16] is administered to the animal of both acute and chronic studies and the both studies show positive result [16].

Other activities of *C. speciosus*

Antidiabetic effect

Hexane, ethanolic, acetate, methanolic, and aqueous extract of *C. speciosus* are administered to streptozotocin (50 mg/kg)-induced diabetic rat at a dose of 250 and 400 mg/kg, respectively. The aqueous and methanolic extracts are most effective for lowering the plasma glucose concentration. It also normalized the other biological parameters associated with diabetes [17,18].

Antioxidant activity

The plant has a strong antioxidant activity. Superoxide and peroxide test has been performed and it has been concluded that all the parts have more or less antioxidant activity. A study showed that chloroform extract of *C. speciosus* has free radical scavenging activity [19].

Antibiotic activity

Different extract of plant has antibacterial activity against microorganism such as *Streptococcus*, *Escherichia coli*, Pneumonia,

Pseudomonas, *Bacillus*, and *Salmonella* (activity measured by disc diffusion method) [20].

Antifungal activity

Various chemical constituents have been isolated and the activity is analysed on *Alternaria* sp., *A. tenuissima*, *Botrytis cinerea* and *Fusarium lini* etc. It has been observed that the isolated component has more or less activity [21,22].

Antifertility activity

The saponins present in *C. speciosus* rhizome are most effective produce antifertility activity on rat at a dose range of 5–500 µg/100 g b.w [23].

Spasmolytic activity

It has been proved that the plant extract expresses a wide angle non-specific spasmolytic activity tested on guinea pig ileum [24].

Hepatoprotective activity

The hepatoprotective activity of ethanolic extract of *C. speciosus* rhizome was evaluated on CCl₄-induced rat [25].

The SGOT, SGPT, ALP, and serum bilirubin are significantly decreased compared to the control; the histopathology also indicates a positive response of the plant extract.

Anticholinesterase activity

The alkaloids present in the plant extract possess anticholinesterase activity in both *in vitro* and *in vivo* (activity observed on frog rectus muscle and dog blood pressure).

Estrogenic activity

1600 µg of diosgenin isolated from *C. speciosus* approximately produce similar activity of 150 µg of neoclinestrol [23].

Anticariogenic activity

The extract has anticariogenic activity.

CONCLUSION

From the above study, it can be concluded that *C. speciosus* is an effective drug that can be used in psoriatic arthritis. Although its activity is less compared to the marketed drug, in the other sides, it has very mild adverse effect compared to the marketed drug; it can be used as a supportive drug in the treatment of psoriatic arthritis. If the chemical constituent can be identified which is mainly responsible for anti-arthritic activity, then by molecular modification, the therapeutic activity may be increased as much as the marketed drugs and that will open a new way for all of us.

Table 4: Treatment protocol [12]

Group No.	Group name	Arthritis-inducing agent	Drug	Others
1	Control	X	X	CMC 0.5% (1 ml/kg b.w)
2	Standard	0.1 ml of Freund complete adjuvant (1 mg/kg)	Indomethacin (10 mg/kg)	CMC 0.5% (1 ml/kg b.w)
3	Test ₁₀₀	0.1 ml of Freund complete adjuvant (1 mg/kg)	Test drug (100 mg/kg)	CMC 0.5% (1 ml/kg b.w)
4	Test ₂₀₀	0.1 ml of Freund complete adjuvant (1 mg/kg)	Test drug (200 mg/kg)	CMC 0.5% (1 ml/kg b.w)

*This protocol is continued for 28 days. 0–28 days the arthritic score and hind paw volume (marked) are measured. CMC: Carboxymethyl cellulose

Table 5: Arthritic score [12]

Group	0 th day	7 th day	14 th day	21 st day	28 th day
Control	1.67	3.67	3.67	3.83	3.50
Standard	1.83	2.16	1.67	1.34	0.83
Test 100	1.84	3.83	3.67	3.00	2.17
Test 200	2.00	3.66	3.83	2.67	1.67

*All values are approximately changed $\pm 0.2-0.3$ (arthritic score - redness, swelling, and pain of joint)

Table 6: Determining inflammation by measuring paw volume [13]

Group	0 th day	7 th day	14 th day	21 st day	28 th day
Control	2.92	3.29	3.25	3.15	3.16
Standard	2.93	1.88	1.57	1.39	1.3
Test100	2.53	2.98	3	2.78	2.16
Test200	2.58	2.93	2.86	2.48	1.9

Table 7: Pain test [12]

Group	0 th day	7 th day	14 th day	21 st day	28 th day
Control	0.22	0.2	0.2	0.13	0.09
Standard	0.20	0.29	0.28	0.34	0.49
Test100	0.23	0.20	0.168	0.178	0.228
Test200	0.251	0.215	0.17	0.185	0.23

AUTHORS' CONTRIBUTIONS

Debpratik Chakraborty conceived of the presented idea. Nisha Lama Yolmo developed the matter and performed the computation. Debpratik Chakraborty has verified the data and methods. Prof. (Dr.) S. C. Mandal has investigated and verified this work. All the authors discussed the conclusion and contributions to the final manuscript.

CONFLICTS OF INTEREST

All authors have read the journal's policy on disclosure of potential conflicts of interest and have none to declare.

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