

REVIEWING THE ANTI RHEUMATOID ACTIVITY OF *Alpinia Calcarata*

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Abstract:

Inflammatory arthritis is prevalent among the elderly, affecting approximately one fifth of the global population. Traditional medicinal systems such as Siddha, Ayurveda, Unani, and Chinese medicine have historically mentioned herbal remedies for arthritis, yet scientific evidence supporting their therapeutic benefits has been lacking. However, advancements in modern chromatographic techniques over the past few decades have significantly improved the standardization of herbal drugs. Experimental studies have demonstrated that rhizomes of *Alpinia calcarata* possess anti-rheumatic activity, along with antibacterial, antifungal, anthelmintic, antinociceptive, anti-inflammatory, antioxidant, aphrodisiac, gastroprotective, and antidiabetic properties. Phytochemical screening has identified the presence of polyphenols, tannins, flavonoids, steroid glycosides, and alkaloids in both the extract and essential oil of this plant. The essential oil and extracts from *Alpinia calcarata* have exhibited a broad spectrum of pharmacological and biological activities.

Keywords: *Alpinia calcarata*, Rheumatoid Arthritis, Pharmacological activity, traditional use.

I. Introduction

1.1 Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a chronic, systemic inflammatory disorder characterized by autoimmune responses that mistakenly target the body's tissues and joints, leading to inflammatory synovitis. This inflammation often progresses to joint destruction, ankylosis, and damage to articular cartilage. RA predominantly affects females more than males and is commonly observed in the elderly [1]. An autoimmune disease occurs when the body's immune system, which is designed to defend against foreign invaders, malfunctions and attacks its own tissues. The synovium, a thin lining inside joints, becomes thickened during RA, causing inflammation and pain in and around the affected joints. This lining is crucial as it provides nutrients to the cartilage and synthesizes substances like collagens, fibronectin, and hyaluronic acid, which contribute to the joint's structural integrity [2].

RA primarily affects the synovial joints' lining and can lead to progressive disability, increased mortality rates, and significant socioeconomic burdens [3]. Factors influencing RA include gender, age, environmental factors, reproductive status, and genetic predisposition,

with various studies highlighting the significant role of genetics in determining individual susceptibility to RA [4].

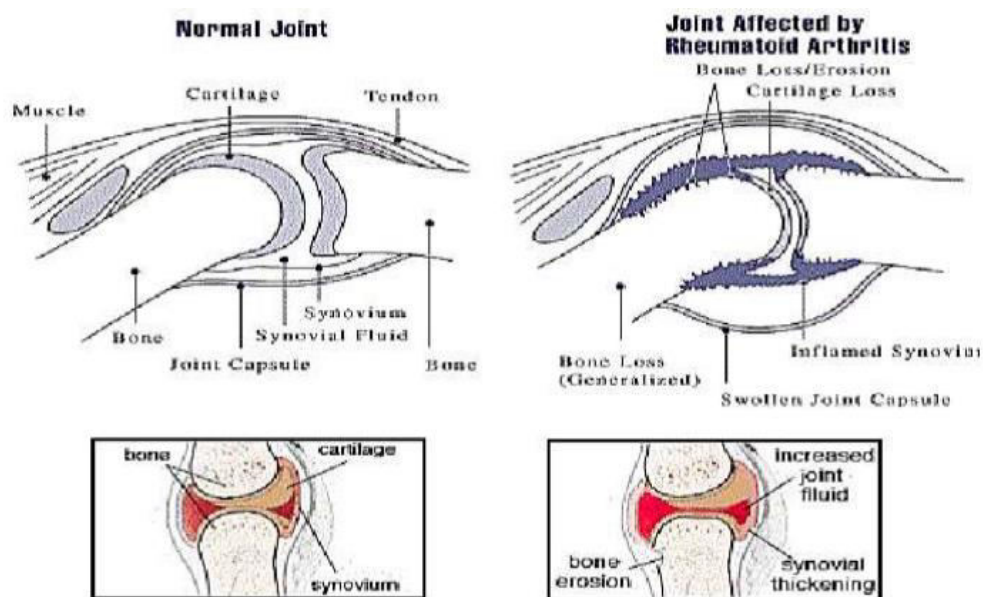


Fig.01: Diagrammatic Representation of the Normal Joint and Rheumatoid Arthritis Affected Joint

It is characterized by periods of disease flares and remissions. Chronic inflammation in rheumatoid arthritis can lead to irreversible joint damage and deformity, resulting in warm, swollen, painful, and stiff joints that worsen after rest[5]. Typically, multiple joints such as those in the fingers, hands, wrists, feet, and knees are affected symmetrically, impacting both sides of the body. The condition can also affect other parts of the body, potentially causing anemia, inflammation of the lungs, and inflammation around the heart [6].

Symptoms of symmetrical joint involvement include joint pain (arthralgia), swelling, redness, and limitations in range of motion. Early diagnosis is crucial for achieving optimal outcomes, including reduced joint damage, minimal radiological progression, absence of functional disability, and achieving remission without the need for disease-modifying antirheumatic drugs (DMARDs)[7]. The first 12 weeks after symptom onset are considered the optimal therapeutic window for initiating treatment. However, diagnosing RA early remains challenging and relies heavily on clinical history, physical examination, blood tests, and imaging studies [8].

The reasons for delayed diagnosis vary across countries with different healthcare systems. Similarly, delays in initiating DMARD therapy in RA patients can stem from both patient-related factors and decisions made by healthcare providers [9]. To assess disease activity and guide treatment decisions, rheumatologists use tools such as the Disease Activity Score using 28 joints (DAS-28), the Simplified Disease Activity Index (SDAI), and the Clinical Disease Activity Index (CDAI). Continuous and accurate monitoring of disease activity is essential to achieve clinical remission and adjust treatment plans effectively [10].

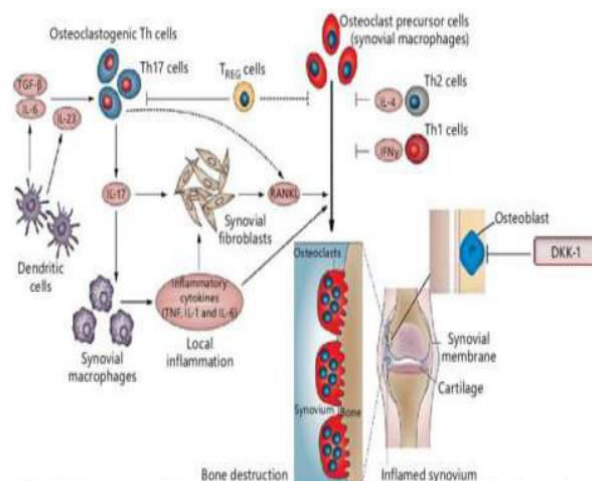


Fig.02: Diagrammatic Representation of Role of Innate and Adaptive Immunity

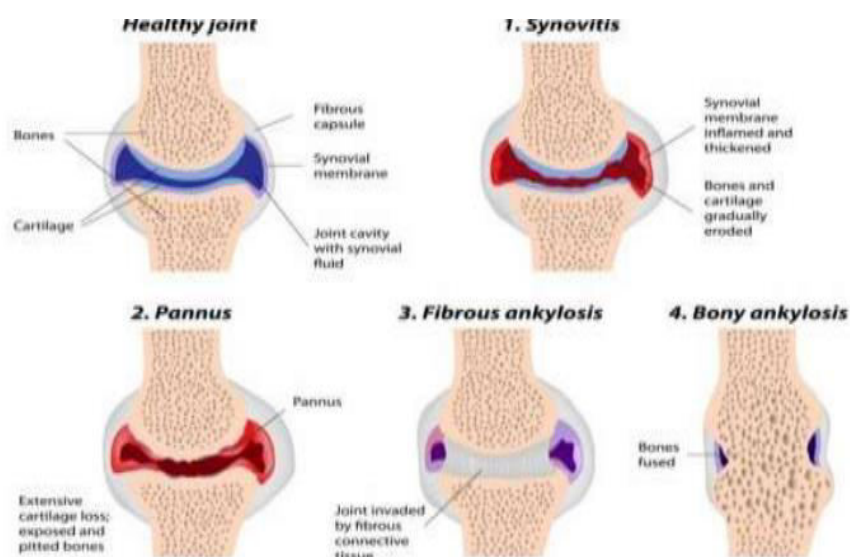


Fig.03: Diagrammatic Representation of Steps Involved In Inflammation Of RA

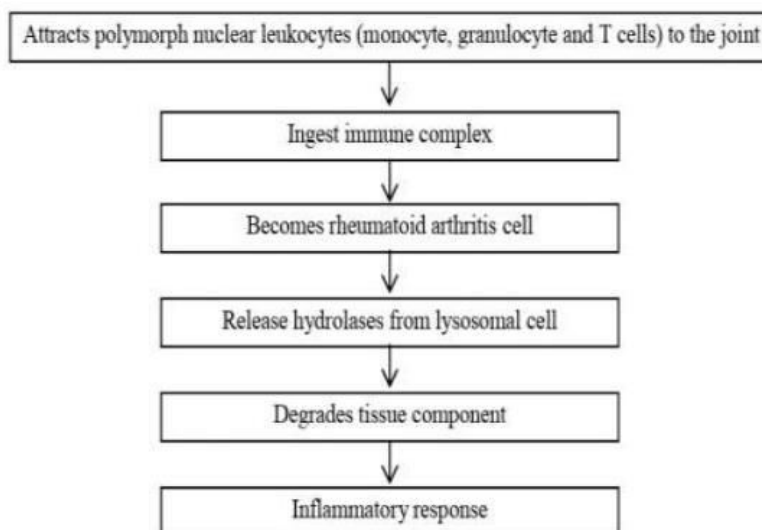


Fig.04: Diagrammatic Representation of Pathophysiology of Rheumatoid Arthritis

II. Taxonomical Classification

- Kingdom: Plantae
- Division: Magnoliophyta
- Class: Liliopsida
- Order: Zingiberales
- Family: Zingiberaceae
- Genus: *Alpinia*
- Species: *calcarata*
- Synonyms: *Alpinia calcarata* Rosk., *Alpinia erecta* Lodd. and Steud., *Alpinia bracheata* Rosk., *Alpinia cernua* Sims., *Renealmia calcarata*

III. Plant Description

- *Alpinia calcarata* is a rhizomatous perennial herb with a non-tuberous rootstock. The slender stems grow to about 75 cm in height. Its leaves are simple, alternate, lanceolate, acuminate, and long-pointed, measuring 25-32 cm long and 2.5-5 cm broad. They are glabrous on both surfaces and have a shiny upper surface.

The antinociceptive effect of *A. calcarata* rhizome was evaluated using hot water and hot ethanol extracts in albino rats across three nociception models (tail flick, hot plate, and formalin tests). Rats were orally administered with hot water extract at doses ranging from 100 to 1000 mg/kg and hot ethanol extract at doses from 100 to 1000 mg/kg. Reaction times were measured to assess the effects. Significant and dose-dependent antinociceptive activity was observed in the hot plate and formalin tests, while no significant effect was noted in the tail flick test. The hot ethanol extract exhibited slightly stronger antinociceptive effects compared to the hot water extract [11].

Anti-inflammatory Effect: The rhizomes of *Alpinia calcarata* Roscoe have long been used in traditional medicine to treat conditions such as bronchitis, cough, respiratory ailments, diabetes, asthma, and arthritis. These medicinal properties often include anti-inflammatory and antinociceptive effects. The anti-inflammatory activity of hot water and hot ethanol extracts of *A. calcarata* rhizomes was assessed using a carrageenan-induced inflammatory model. The study indicated that the extracts inhibit the synthesis of histamine and prostaglandins, suggesting these mechanisms contribute to the plant's anti-inflammatory action.

Enzymatic Effect of *A. calcarata*: A fungal strain isolated from *A. calcarata* has been identified for its ability to produce amylase. Among thirty endophytic fungi isolates from *A. calcarata*, isolate number seven, identified as *Cylindrocephalum* sp., exhibited the highest amyolytic activity and was further studied. Factors such as pH, temperature, and carbon and nitrogen sources were optimized for maximal amylase production. The highest production of amylase was observed at 30°C and pH 7.0, with maltose (1.5%) and sodium nitrate (0.3%) identified as optimal carbon and nitrogen sources, respectively.

Anti-ulcer Activity: Ethanolic extracts of *Alpinia calcarata* rhizomes have demonstrated anti-ulcer, anti-gastric secretion, and cytoprotective properties in rat models. These extracts are traditionally used to treat stomach disorders, and studies have shown significant reduction in gastric secretion and cytoprotection. Additionally, the rhizome extracts have been reported to

induce cytological and biochemical changes in rats treated with cyclophosphamide, further supporting their therapeutic potential for stomach ailments and ulcers.

There are also reports of anti-feedant and lethal properties in the extract of calcarata rhizomes. Active compounds such as acetate 1'-acetoxicaviol (C₁₃H₁₄O₄) have been identified, which exhibit insecticidal activity. Similar compounds in other galangal species have shown anti-feedant properties as well.

Conclusion:

Alpinia calcarata Roscoe holds significant importance due to its diverse pharmacological activities, warranting further research to isolate its active compounds. Traditionally used in the treatment of rheumatoid arthritis, the plant is also employed for conditions such as polyuria, coughs, stomach ailments, diabetes, colds, bronchial diseases, asthma, and heart diseases. *Alpinia calcarata* contains various chemical compounds with pharmacological properties beneficial for herbal medicine. Future research avenues could explore its potential as an anti-asthmatic agent, leveraging its rich phytochemical profile, which remains largely unexplored.

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