Exploration of the Healing Role of Ficus Benghalensis Bark in Rheumatoid Arthritis

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***Abstract*—For centuries, humans have turned to plants not only for medicine, but also for comfort and healing. Among these, Ficus represents one of the largest and most meaningful genera within the Moraceae family. Ficus benghalensis, widely found across many parts of Asia, has long held a respected place in traditional healing practices. Scientific studies have shown that this plant is rich in natural constituents such as sugars, proteins, essential and Volatile oils, phenolic compounds, flavonoids, alkaloids, tannins, saponins, terpenoids, and glycosides, all of which contribute to its medicinal value.**

Rheumatoid arthritis is a chronic autoimmune condition that deeply affects daily life, causing ongoing joint pain, inflammation, and gradual joint damage. Living with this disease often means managing discomfort over long periods, which highlights the need for therapies that are not only effective but also gentle and supportive. Traditional medicinal plants, rooted in long-standing human experience, offer valuable insights in this direction.

The present study takes a gentle and reflective "approach to understanding the potential role of the perial root powder of Ficus benghalensis in "rheumatoid arthritis. By bringing together traditional knowledge and available scientific evidence, this "work seeks to explore how the plant's anti- inflammatory, antioxidant, and immunomodulatory properties may contribute to easing the burden of chronic joint inflammation. Existing research suggests that extracts and isolated compounds from Ficus benghalensis show meaningful antioxidant and anti-inflammatory activity, which may help explain its supportive role in rheumatoid arthritis care.

Overall, this study emphasizes the importance of looking beyond symptom control to appreciate the healing relationship between nature and human health. Ficus benghalensis emerges not merely as a medicinal plant, but as a gentle natural companion with the potential to support the management of rheumatoid arthritis.

***Index Terms*—Ficus benghalensis, Rheumatoid arthritis, Anti-inflammatory, Immunomodulatory, Analgesic. Antianoxidant,**

I. INTRODUCTION

Rheumatoid arthritis (RA) is a long-term autoimmune condition that affects not only the joints but also the overall well-being of those who live with it. The disease usually begins quietly, affecting the small joints of the hands and feet on both sides of the body.

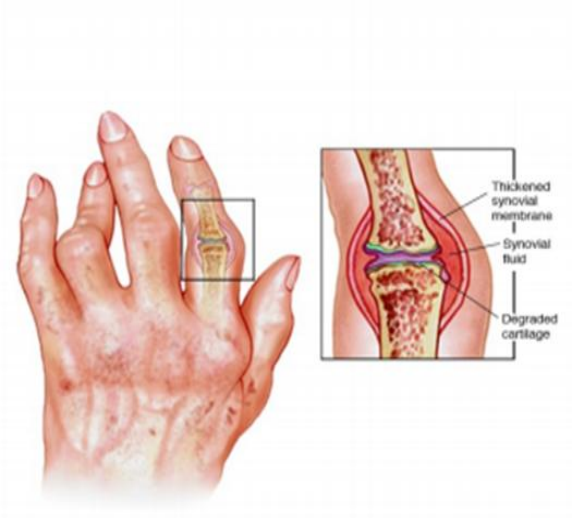


Fig. 1 Rheumatoid Arthritis

As time passes, the inflammation may spread to larger joints and, in some cases, involve organs such as the skin, eyes, heart, kidneys, and lungs. Continuous inflammation gradually damages the protective cartilage and bone within the joints, while tendons and ligaments lose their strength

This slow destruction often leads to visible deformities, reduced mobility, and persistent pain,

making everyday activities increasingly difficult for patients.

All this damage to the joints causes deformities and bone erosion, usually very painful for a patient. Common symptoms of RA include morning stiffness of the affected joints for >30min, fatigue, fever, weight loss, joints that are tender, swollen and warm, and rheumatoid nodules under the skin. The onset of this disease is usually from the age of 35 to 60years, with remission and exacerbation. It canals afflict young children even before the ago 16years, referred to as juvenile RA (JRA), which is similar to RA except that rheumatoid factor is not found. Causes Rheumatoid arthritis is a multifactorial disease, meaning that no single cause is responsible for its development. Instead, it arises from a complex interaction of genetic vulnerability and environmental influences.

1 . Genetic predisposition (HLA-DRB1 shared epitope, family history).
2. Autoimmune reaction where the body attacks its own synovial joints.
3. Environmental triggers like smoking, infections, and pollution.
4. Hormonal, lifestyle, and microbiome factors that increase immune activation.

Stages of rheumatoid arthritis:

Rheumatoid arthritis often unfolds quietly, yet profoundly, in the lives of those affected. Its progression can be seen in four stages, each reflecting a deeper impact on daily life and mobility:

Stage 1 : The Beginning of Discomfort

In the earliest stage, inflammation starts in the soft tissues around the joints. You may notice mild stiffness or tenderness, especially in the morning. At this point, the joints may feel slightly uncomfortable, but X-rays usually do not show any visible damage. Life can still feel normal, though subtle changes are starting beneath the surface.

Stage 2: Growing Awareness

Inflammation begins to affect the cartilage, slowly limiting movement and flexibility. Morning stiffness may last longer, and everyday tasks like opening jars or walking may become a little more challenging. The joints may feel tender, warm, or swollen, serving as a constant reminder that the body is under stress.

Stage 3: Noticeable Change and Struggle

The inflammation intensifies and starts to damage the bones themselves. Pain, stiffness, and swelling increase, and the range of motion is further reduced. Physical changes in the joints may become visible. At this stage, the impact on daily life is more significant — even simple movements can feel burdensome, reminding patients of the persistent nature of RA.

Stage 4: Living with Long-Term Impact

While active inflammation may slow down, the damage to the joints continues. Pain, swelling, and stiffness can remain severe, limiting mobility and independence. Everyday activities may require extra care or assistance, and coping with the disease becomes a central part of life. Emotional resilience is as important as physical management in this stage, as the long-term nature of RA shapes daily experiences.

II. NEED OF NATURAL ALTERNATIVES

Living with rheumatoid arthritis often means long-term dependence on medications that may control symptoms but can also cause unwanted side effects with prolonged use. This reality has encouraged growing interest in natural and plant -based alternatives that are gentler on the body.

Traditional medicinal plants, known for their anti - inflammatory, antioxidant, and immune- balancing properties, offer hope as supportive therapies. Exploring such natural options is not only about managing symptoms, but also about improving quality of life through safer, more holistic approaches to care

Ficus benghalensis

India has long been celebrated for its deep knowledge of medicinal plants, and the Himalayan region is recognized as one of the world's most important biodiversity zones. Since ancient times, humans have turned to plants not only to treat illnesses but also to nurture health, relying on the rich and diverse chemistry they provide to

extract therapeutic compounds that support life in countless ways.

Among these revered plants stands Ficus benghalensis, commonly known as the Indian Banyan Tree. With more than 700 species, the Ficus genus is one of the most diverse in the plant kingdom, including deciduous and evergreen trees, climbers, creepers, shrubs, and even plants that grow on rocks or near streams. Across cultures, the tree is known by many names: "Opoto" in Yoruba, "Banyan" in English, "Bar" in Hindi, and "Avaroha" in Sanskrit. The English name " Banyan" comes from the British, who observed a community called "Baniya" resting under its generous shade.

The Indian Banyan is not just a tree—it is a living symbol. Its sprawling branches and aerial roots evoke the idea of eternal life, which is why it is considered sacred and one of the four " Nalpamara" trees, traditionally planted near homes and temples. Historically, it has been celebrated in ancient texts such as the Atharva Veda and in Ayurveda, reflecting its long- standing importance in preventive and therapeutic medicine.

Beyond its spiritual and cultural significance, Ficus benghalensis possesses remarkable biological properties. It is a large evergreen tree with a broad canopy and aerial roots that form
natural pillars. Its leaves are large, elliptical, and leathery, while the small, red fruits are edible. The bark, brownish-grey with rough, fissured surfaces, is particularly valued in medicine. The tree produces a latex-like substance that has self-healing properties and helps the plant defend itself against physical injury, reflecting nature's resilience and ingenuity.

Fig. 1 Ficus benghalensis PLANT PROFILE

A. Monograph

Synonym: Banayan tree, Indian banyan, Vada tree.

Biological source: It consist of bark of Ficus benghalensis belonging to family : Moraceae

Habitat: The tree is large and deciduous, with a broad, spreading canopy that gives it a majestic presence in any landscape.

Description: La. Its aerial roots descend gracefully from the branches, forming natural pillars that support its enormous structure and create a striking visual appearance.

Fruits: the fruits are small, red, and edible, providing nourishment for both wildlife and humans alike.

Leaves: The leaves are large, elliptical, and leathery, creating a dense canopy that shelters birds and small animals, contributing to the local ecosystem.

Bark: typically brownish-grey to light grey with rough, fissured surfaces due to lenticels

B. TAXONOMICAL CLASSIFICATION

Kingdom: it belongs to kindom Planate —Plants

Subkingdom: Its Subkingdom is Tracheobiont

Super division: Its Superdivision is Spermatophta

Division: its Division is Magnolipophyta Class: It belongs to class Magnoliopsida

Subclass: It belongs to subclass Hamamelididac

Order: It has order of Urticales

Family: The family of Ficus benghalensis is Moraceae

Genus: Ficus

C. Species: bengalensis (L):

1) Ficus Benghalensis (Indian banyan and thewish fulfilling tree)
2) Ficus Religiosa (Bodhi tree and Sacreid tree)
3) Ficus Racemosa (Goolar fig)
4) Ficus Carica (Common fig)

Fig. 3 Ficus benghalensis branch

D. CHEMICAL CONSTITUENTS:

1 . Flavonoids (Major Anti-inflammatory Constituents): Quercetin, Kaempferol, and Rutin

are present in the bark, helping to reduce inflammation and support the body's natural defense mechanisms.

2. Triterpenoids / Terpenoids: Compounds such as Lupeol, β-Amyrin, Friedelin, Oleanolic acid, and Ursolic acid provide protective benefits for bones, cartilage, and connective tissues.

3. Phytosterols: β-Sitosterol and Stigmasterol contribute to regulating the immune system and maintaining overall health.

4. Phenolic Compounds: Gallic acid, Ellagic acid, Caffeic acid, and Chlorogenic acid act as natural antioxidants, protecting cells from oxidative stress and supporting well-being.

5. Tannins: Leucocyanidins (proanthocyanidins), Condensed tannins, and Leucoanthocyanins help reduce inflammation and provide additional protective effects.

6. Glycosides: Phenolic and terpenoid glycosides enhance the therapeutic potential of the plant, reinforcing its traditional use in healing practices

E. DRUG PROFILE

1 . Quercetin

Molecular formula: C15H1OO7

Molecular weight: 302.24 g/mol Synonyms:

3,3',4',5,7-Pentahydroxyflavone

Meletin

Sophoretin

Natural origin: Widely distributed in plants such as Ficus benghalensis (bark & leaves), onions (Allium cepa), apples, berries, tea, and Ginkgo biloba.

Mechanism of Action

1 . Calming Inflammatory Signals: Quercetin inhibits the NF-κB signaling pathway, which reduces the activation of genes responsible for chronic inflammation, helping joints feel less swollen and painful.

2. Lowering Harmful Cytokines: It decreases levels of pro-inflammatory molecules such as TNF-α, IL-1β, and IL-6, soothing the immune system and reducing joint tenderness

3. Reducing Tissue-Damaging Enzymes: By down-regulating COX-2 and iNOS, Quercetin helps lower the production of prostaglandins and nitric oxide, which are responsible for pain and joint tissue damage

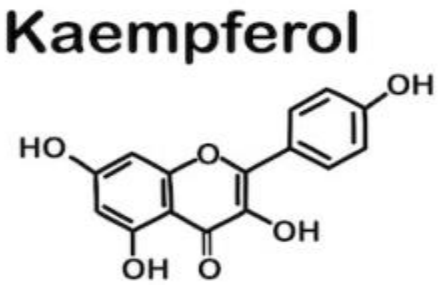
4. Protecting Against Oxidative Stress: Quercetin scavenges reactive oxygen species, shielding joint tissues from oxidative damage and supporting overall cellular health.

5. Balancing Immune Cells: It modulates the activity of macrophages and T-cells, preventing the overactive immune responses that lead to chronic inflammation and progressive joint damage.

2. Kaempferol (Kemp)

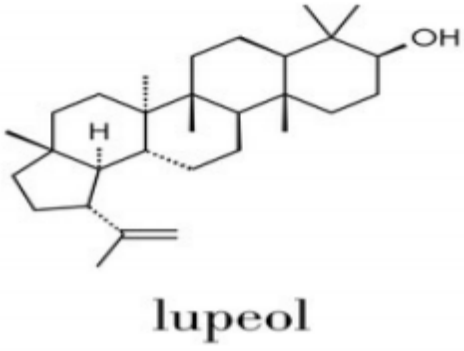
Molecular formula: C15H1OO6

Molecular weight: 286.24 g/mol



Synonyms:
3,4',5,7-Tetrahydroxyflavone
Kempferol Kaempherol
Natural origin: Present in Ficus benghalensis

bark and leaves, tea, broccoli, spinach, apples, Ginkgo biloba, and Camellia sinensis
Mechanism of action (Anti-rheumatoid):
1 . The compounds in Ficus benghalensis gently calm overactive inflammatory signals by inhibiting NF-κB and MAPK pathways. They reduce harmful molecules like TNF-α, IL-1β, and IL-6, easing joint swelling, pain, and stiffness. In this way, the plant supports the body's natural balance and protects delicate joint tissues.
2. Stop COX-2 and 5-LOX, reducing prostaglandins and leukotrienes
3. Antioxidant action reduces ROS-mediated cartilage damage
4. Prevents osteoclast differentiation, reducing bone erosion in RA.
3. Lupeol
Molecular formula: C3OH5OO
Molecular weight: 426.72 g/mol



Synonyms: Fagarsterol
Monohydroxylupeol Lupeol alcohol
Natural origin: Found in Ficus benghalensis bark, mango (Mangifera indica), olive (Olea europaea), aloe (Aloevera), ginseng, and Crataeva nurvala
Mechanism of action (Anti-rheumatoid):
It softly quiets the NF-κB signaling pathway, easing the body's overactive inflammatory responses. At the same time, it gently lowers pro-inflammatory molecules like TNF-α, IL-1β, and IL-6. These actions together help calm joint swelling and pain, nurturing the body toward balance and comfort.

Inhibits COX-2 and iNOS, decreasing prostaglandins and nitric oxide
Antioxidant action reduces oxidative stress–induced joint damage
Inhibits macrophage activation and synovial hyperplasia, protecting cartilage and boneQuercetin (Anti-Rheumatoid Effects)
E. Chemical test for Ficus benghalensis Bark Constituents
Below are the standard qualitative (chemical) tests used to identify the main constituents present in Ficus benghalensis bark

1 . Chemical test for Flavonoids

Test	Procedure	Observatio n	Inference
Shinod a Test	Add magnesiu m turnings + 2-3 drops of conc. Hcl to extract	Pink color	Flavonoi d s present
Alkalin e Reagen t Test	Add NaOH solution then dilute acid	Yellow color that disappears on acid addition	Flavonoi d s peesent

2. Chemical test for Triterpenoids

Test	Procedur e	Observati on	Inference
Salkowski	Add	Reddish-	Triterpen oi

Test	chloroform + conc. H2SO4	brown layer	ds present
Liebermann Burchard Test	Add acetic anhydride + conc. H2SO4	Blue- green color	Triterpenoi ds present

3. Chemical test for Tannins

Test	Procedure	Observation	Inference
Ferric Chloride Test	Ad 5% FeCl3 solution	Blue-black or green color	Tannins present
Gelatin Test	Add gelatin solution + Nacl	White precipitate	Tannins present

G. Mechanism of action :

These constituents may help alleviate rheumatoid arthritis symptoms by:

1 . Calming Pro-Inflammatory Signals: Compounds in Ficus benghalensis, such as flavonoids and triterpenoids, help reduce the production of pro-inflammatory molecules like TNF-α and IL-1β . This calming effect soothes joint swelling, tenderness, and pain, allowing the body to regain balance.

2. Reducing Oxidative Stress and Inflammation: The plant's natural antioxidants—including flavonoids, phenolic acids, and terpenoids—scavenge harmful free radicals, protecting joint tissues from oxidative damage. Additionally, it helps lower levels of inflammatory molecules such as TNF-α, IL-1β, and IL-6, creating a healthier joint environment.

3. Balancing the Immune Response Ficus benghalensis gently enhances the activity of immune cells like macrophages and neutrophils, and also activates natural killer cells. This modulation ensures that the immune system responds appropriately, preventing overactive inflammation while maintaining its protective functions.

4. Protecting Joints and Preventing Cartilage Damage: The plant's compounds may inhibit enzymes like metalloproteinases, which are responsible for cartilage breakdown. Furthermore, it can prevent RANKL-induced osteoclast activity, reducing bone erosion and protecting joint structure overtime

H. Pharmacological activity

1 . Antirheumatic/ Anti-inflammatory activity:
Glycosides and triterpenoid show anti-inflammatory action.

2. Antioxidant :
Chemical constituents showing antioxidant property include flavonoids, phenolic, tannins, terpenoids, vitamins, saponins, alkaloids, phytosterols, glycosides, certain essential oils that neutralize free radicals and reduce oxidative stress.

3. Antidiabetic:
Flavonoids, as they significantly improve insulin secretion, enhance glucose uptake and reduce oxidative stress.

4. Analgesic:
Flavonoids is main analgesic constituent of this plant.

5. Antimicrobial:
Alkaloids, flavonoids, tannins and phenolic compounds are the main plant constituents that show antimicrobial activity.

6. Wound-healing:
Flavonoids, tannins, triterpenoids and saponins are the key plant constituents responsible for wound-healing activity.

7. Immunomodulatory:
Flavonoids, saponins, polysaccharides and triterpenoids are the major plant constituents that exhibit immunomodulatory activity.

8. Antidiarrheal:
Tannins are the primary antidiarrheal constituents.

9. Antiulcer:
Flavonoids show antiulcer activity.

10. Antihelminthic :
Alkaloids presents the bark show antihekminthic activity

2. SCOPE AND FUTURE PROSPECTS

1 . Traditional and ethnomedicinal relevance - Compilation of ancient Ayurvedic, folk and regional uses of Ficus benghalensis for inflammatory and arthritic diseases. Historical importance as recorded in Atharva Veda, Ayurveda, and ethnobotanical literature.

2. Botanical and taxonomical overview -
Morphology, taxonomy, habitat distribution and plant parts used—especially bark, aerial roots and latex involved in antiinflammatory therapy.

3. Phytochemical composition -
Comprehensive description of major bioactive constituents, including:Flavonoids (quercetin, kaempferol, rutin) Triterpenoids (lupeol, β-amyrin, friedelin) Sterols (β-sitosterol, stigmasterol) Phenolic acids, tannins, glycosides Focus on compounds scientifically correlated with anti-inflammatory and antirheumatoid action.

4. Pharmacological activities relevant to RA - Anti-inflammatory
Antioxidant
Immunomodulatory Anti-arthritic
Anti-ulcer, wound-healing, antimicrobial (supportive activities)

5. Evidence-based evaluation of Anti- Rheumatoid Activity -
Insights from Laboratory and Animal Studies on Ficus benghalensis:
Paw edema models
Freund's adjuvant-induced arthritis Cytokine modulation studies
COX/LOX inhibition
Restoring cellular balancen
Summary of animal toxicity and safety studies.

6. Mechanisms of action -
Detailed mechanisms relevant to RA, including: Suppression of pro-inflammatory cytokines
Inhibition of enzyme pathways (COX, LOX)
Reduction of ROS and oxidative stress
Stabilization of cartilage and synovial tissues
Modulation of immune response

7. Future perspectives -
Potential for development of: Standardized extracts
Polyherbal formulations
Novel drug delivery systems (gel, tablets, nanoformulations)
Opportunity for integrating Ficus benghalensis into modern RA therapeutic strategies.

III. LIMITATIONS

1 . Insufficient clinical data:
Human clinical trials are insufficient, and the majority of the evidence comes from in vitro and animal research.

2. Variability in the content of phytochemicals
The geographical source, season, and extraction technique all affect the active ingredients, which results in uneven effectiveness.

3. Inadequate bioavailability:
Because of their quick metabolism and poor oral absorption, flavonoids and triterpenoids have less therapeutic efficacy.

4. The absence of a standard dosage :
Clinical acceptance is restricted in the absence of pharmacopeial standards and set dose guidelines.

5. Potential medication interactions:
CYP450 enzymes may be impacted by constituents like quercetin, which could change how RA drugs are metabolized.

6. Safety issues:
Long-term toxicity data are limited; caution advised in pregnancy, lactation and chronic use.

IV. CONCLUSION

This review shows that the bark of Ficus benghalensis has strong potential as a natural remedy for managing rheumatoid arthritis.
The bark of Ficus benghalensis is packed with a variety of beneficial natural compounds, including

flavonoids like Quercetin and Kaempferol, tannins, phenolic compounds, saponins, and triterpenoids such as Lupeol and β-Sitosterol, all of which work together to support joint health and reduce inflammation.

These natural constituents work together to reduce inflammation, fight oxidative stress, relieve pain, and help regulate immune responses, which are all important in controlling rheumatoid arthritis.

Scientific studies support the traditional use of Ficus benghalensis bark in treating inflammatory and joint-related disorders.

Research has shown that its extracts can reduce joint swelling, stiffness, and inflammatory markers, while generally remaining safe at therapeutic doses.

Unlike many synthetic drugs that acton a single target, the bark's multiple active compounds act on different pathways, which may help manage the disease more effectively with fewer side effects over long-term use.

However, most of the evidence available so far comes from laboratory and animal studies.

More clinical trials in humans, along with proper standardization and formulation development, are needed to confirm its effectiveness and safety.

Overall, Ficus benghalensis bark appears to be a promising natural option for the management of rheumatoid arthritis and could be used as a supportive or alternative therapy alongside conventional treatment in the future.

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