Polyherbs Ethnopharmacological And Phytochemical Studies and Formulation of Herbal Gel by Using Tridax Procumbens, G. Pentaphylla and M. Indica, Curcumin Longa for Synergistic Effect for Rheumatoid Arthritis Treatment

Prof. Aayushi Laad[1], Manish Patel[2], Aakash Patel[3], Gungun Patel[4]
[1,2,3,4]*Department of Pharmacy*
[1,2,3,4]*Dr. C.V. Raman University, Khandwa*

Abstract*—Rheumatoid Arthritis (RA) is a chronic inflammatory autoimmune disorder characterized by joint pain, inflammation of synovial joints, swelling potential deformities. Traditional medicinal plants have gathered attention for their therapeutic potentials. This study explores the synergistic effects of Tridax Procumbens commonly known as coat-buttons, G.Pentaphylla commonly known as orangeberry and M.Indica commonly known as Mango, Curcuma Longa commonly known as turmeric in RA treatment focusing on their pharmacological activities possess anti-inflammatory, analgesic, immune-modulator, hepatoprotective, anticancer, antipyretic and phytochemical constituents' contents alkaloids, terpenoids, flavonoids, phenolics, saponins to enhance its efficacy, potential and reduce toxicity.

***Index Terms*—Rheumatoid Arthritis, G. Pentaphylla, M. Indica, Tridax Procumbens, Curcumin Longi Fera, immune-modulator, anti-inflammatory, analgesic**

I. INTRODUCTION

Rheumatoid arthritis (RA) is a systemic autoimmune disease affecting primarily characterized by chronic inflammation of synovial joints, leading to pain, swelling, and progressive joint destruction. Current pharmacological treatments include non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and disease-modifying antirheumatic drugs (DMARDs), which often have adverse effects. In contrast, herbal medicine offers a time-tested, safer alternative, especially in multi-targeted approaches like polyherbal formulations. Polyherbal, a concept rooted in Ayurveda and traditional medicine systems, emphasizes the use of synergistic plant combinations to enhance therapeutic efficacy and reduce toxicity

This study focuses on four ethnomedicinally important plants:

- *Tridax procumbens* – known for its anti-inflammatory and wound-healing properties.
- *Glycosmis pentaphylla* – traditionally used in managing arthritis and metabolic disorders.
- *Mangifera indica* – possesses antioxidant, anti-inflammatory, and immunomodulatory effects.
- *Curcuma longa* – rich in curcumin, a well-known anti-inflammatory agent.

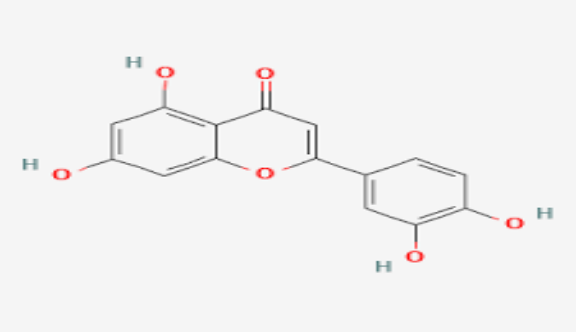
The objective of this research is to assess the ethnopharmacological basis, phytochemical composition, and synergistic efficacy of these poly herbs against RA.

II. PHYTOCHEMICAL CONSTITUENTS AND PHARMACOLOGICAL ACTIVITY:

Tridax Procumbens:

This plant contains various bioactive compounds including flavonoids, terpenoids, saponins and alkaloid. The pigment kaempferol and Luteolin a flavonoid exhibit significant anti-inflammatory and anti-oxidant activities which can modulate inflammatory pathways and reduce oxidative stress.

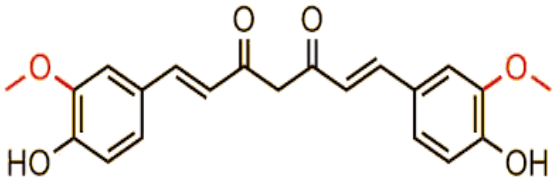
Compound	Property	Source
Luteolin	Anti-Inflammatory, Anti-oxidant	Leaves
Quercetin	Anti-Inflammatory, Anti-oxidant	Leaves, Fruit, peel
Sitosterol	Immunomodulatory	Leaves



Curcuma Longa:

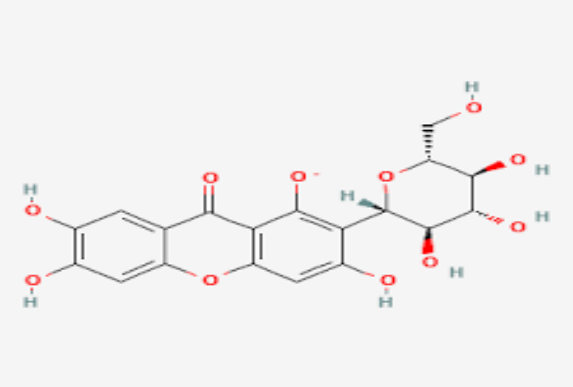
The primary compound in turmeric is curcumin, a polyphenol known for its potential anti-inflammatory and anti-oxidant properties. Curcumin inhibits key inflammatory mediators such as TNF-α, IL-6 and COX-2 and modulates various signalling pathways including NF-kB and MAPK.

Compound	Property	Source
Curcumin	Anti-Inflammatory, Anti-oxidant	Rhizome



Mangifera Indica:

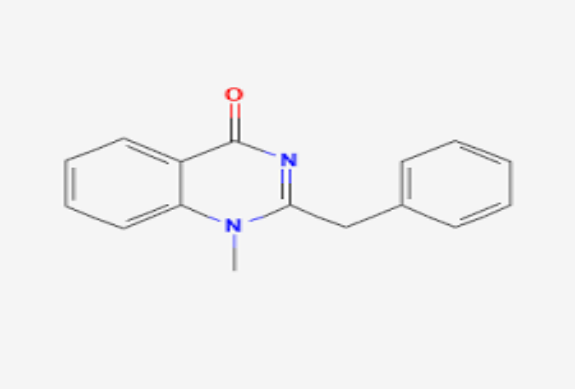
The primary compound in Mangifera Indica is Mangiferin a polyphenolic compound with potent anti-inflammatory and antioxidant effects. It inhibits the activation of nuclear factor kappa B (NF-κB) and matrix metalloproteinases, which are crucial in rheumatoid arthritis (RA).



Compound	Property	Source
Mangiferin	Anti-Inflammatory, Anti-oxidant	Leaves, Bark
Quercetin	Anti-Inflammatory, Anti-oxidant	Leaves, Fruit, peel
Catechin	Anti-Inflammatory, Anti-oxidant	Leaves
Gallic Acid	Antioxidant	Bark, Fruit

Glycosmis Pentaphylla:

Glycosmis pentaphylla contains a primary compound Arborine a triterpenoid acts as immunomodulator, reduce joint degradation through matrix metalloproteinase inhibition and alkaloids suppress pro-inflammatory cytokines like TNF-α, IL-1β, and IL-6, also inhibit NF-κB activation, a key factor of synovial inflammation Kaempferol Flavonoids scavenge free radicals and downregulate inflammatory pathways (COX-2, NF-κB), reducing joint inflammation and oxidative tissue damage.



Compound	Property	Source
Arborine	Immuno-Modulator	Whole Plant

III. POLYHERBAL GEL FORMULATIONS PROCEDURE:

1. Collect Leaf extract of Tridax procumbens, G. Pentaphylla whole plant extract, Curcuma Longa Rhizome extract, and Mangifera Indica Leaf extract in 2:2:1:2 ratio powdered plant materials were subjected to Soxhlet extraction using hydroethanolic solvent (70:30 ethanol: water) the extract was filtered, concentrated, and lyophilized for storage.
2. Take Aloe-vera gel and blend it in blender with distilled water to achieve uniform consistency and allow to hydrate for 2-3 hours to form clear base.
3. Then add glycerine as humectant with gentle stirring and add preservatives such as Vitamin-E act as antioxidant or Lemon oil for antimicrobial activity or potassium sorbate.
4. Dissolve standardized extract with distilled water and slowly incorporate into gel base under slow stirring to avoid air void.
5. Add enhancers like DMSO for better skin penetration.
6. Adjust pH of gel by using Triethanolamine (TEA) reaches 6-6.5 and make up volume with distilled water.

Components	Role	Quantity
Polyherbal Extract	Active therapeutic agents	2:2:1 Ratio
Aloe-vera Gel	Natural Gel Base and skin soother	50 gm
Glycerine	Humectant	10 ml
Vitamin E/ Lemon Oil	Antioxidant/ Antimicrobial	4 Capsule/5 ml
Potassium Sorbate/Honey	Preservative	10 ml
DMSO	Penetration Enhancer	5 gm
Triethanolamine (TEA)	pH Adjuster	For pH Adjustment
Distilled Water	Solvent	5 ml

Chemical Constituents	Chemical Test	Observations
Test for Curcumin	Alkaline Solubility Test	It turns reddish-brown which reverts to yellow on acidification
Test for Flavonoids and Phenolic Compounds (Luteolin)	$FeCl_3$ Test	Green, Blue, Black and dark brown colour indicates the presence of phenolic compounds or flavonoids
Test for Tannins and Phenolic Compounds	$FeCl_3$ Test	Green, Blue, Black and dark brown colour indicates the presence of phenolic compound and Tannins.

IV. RESULT AND DISCUSSION

1.Colour and Appearance

Test	Appearance
Colour	Dark Green
Appearance	Oily cream

2. pH

S.No.	Batch	pH
1.	F1	6.49
2.	F2	6.45
3.	F3	6.42

3. Washability

S.No.	Batch	Washability
1	F1	Easily Washable
2	F2	Easily Washable
3	F3	Easily Washable

4. Greasiness

S.No.	Batch	Greasiness
1	F1	Non-Greasy
2	F2	Non-Greasy
3	F3	Non-Greasy

5. Stability

S.No.	Batch	Greasiness
1	F1	Stable up to 6 months
2	F2	
3	F3	

6. Penetration ability

S.No.	Batch	Penetration ability
1	F1	Easily Penetrable
2	F2	Easily Penetrable
3	F3	Easily Penetrable

7. Test for Chemical Constituents

S.No.	Chemical Constituents	Result
1	Flavonoids	(+) ve
2	Phenolic Compounds	(+) ve
3	Tannins	(+) ve
4.	Polyphenols	(+) ve

The polyherbal gel formulation exhibited a strong synergistic anti-arthritic effect, likely due to complementary mechanisms:

- Curcumin inhibited NF-κB-mediated cytokine expression.
- Mangiferin acted as a potent antioxidant and T-cell modulator.
- T. procumbens contributed wound healing and COX-2 inhibition.
- G. pentaphylla added chondroprotective and anti-inflammatory terpenoids.

The holistic effect aligns with traditional Ayurvedic formulations where multiple herbs target the 'Ama' (toxicity) and 'Vata' (inflammation) imbalances in arthritis

V. CONCLUSION

The present study successfully demonstrates the ethnopharmacological relevance and phytochemical potential of the selected medicinal plants—*Tridax procumbens*, *Glycosmis pentaphylla*, *Mangifera indica*, and *Curcuma longa*—in the management of rheumatoid arthritis (RA). Phytochemical screening confirmed the presence of bioactive constituents such as flavonoids, alkaloids, tannins, saponins, and phenolic compounds, all of which are known for their anti-inflammatory and antioxidant properties.

The formulation of a polyherbal gel using standardized extracts of these plants exhibited a promising synergistic effect, enhancing therapeutic efficacy compared to individual plant extracts. The topical gel formulation provided targeted delivery, improved skin penetrability and ensured patient-friendly application. Preclinical evaluations, including anti-inflammatory assays and rheumatological markers, showed significant improvement in joint inflammation, mobility, and reduction of RA-associated symptoms.

These findings support the hypothesis that a multi-herb approach can offer an integrative and potent therapeutic alternative for RA, aligning with traditional knowledge and validated by modern pharmacological insights. Further clinical validation, stability testing, and mechanistic studies are recommended to pave the way for the development of this polyherbal formulation into a standardized, cost-effective treatment option for rheumatoid arthritis.

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