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Research Article

A Systemic Education Of Therapeutic Approaches Using Native Herbs To Treat Rheumatoid Joint Dysfunction

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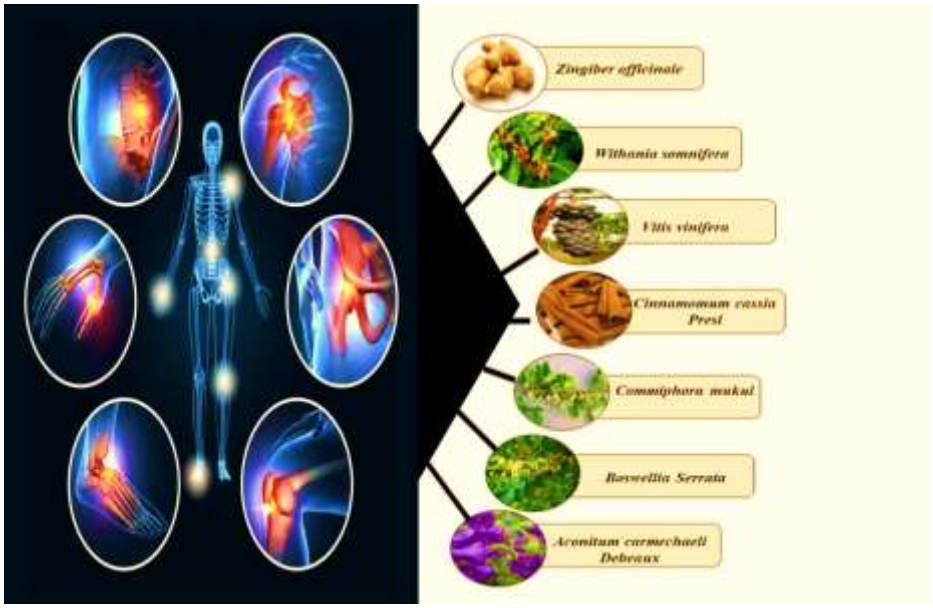
ABSTRACT

Debilitating and long-lasting, rheumatoid arthritis is an inflammatory disease that affects the bone and cartilage around joints. This systemic illness may affect the whole body, including the internal organs like the heart, lungs, and eyes. Regrettably, the adverse effects of various synthetic drugs, currently the gold standard for rheumatoid arthritis, can compromise the efficacy of therapeutic interventions. Unfortunately, no effective drug exists at this time to treat rheumatoid arthritis, and what little medical expertise there is mostly deals with the symptoms of the condition, such as inflammation and joint discomfort. Herbs and plants, in various forms, help alleviate joint inflammation and discomfort. Several medicinal plants have well-documented anti-rheumatoid arthritis properties. Plants and plant extracts have significant advantages for treating rheumatoid arthritis. This review focuses primarily on medicinal herbs that have an effect on rheumatoid arthritis.

Keywords: Arthritis, Therapeutic, Inflammatory illness, Cartilage.

Graphical abstract



Introduction

A systemic illness, rheumatoid arthritis manifests itself in a variety of ways, including rheumatoid nodules, vasculitis, inflammation of the eyes, and cardiopulmonary dysfunction [1-10]. There is no hereditary component to rheumatoid arthritis. Some people may be more predisposed to the condition than others, according to the research. Rheumatoid arthritis does not always appear in those who carry these genes. A "trigger," such as an illness or another environmental condition, is often what sets off the genetic reactions. This trigger causes an erroneous immunological response in the body. The body's defense mechanisms start attacking the joint rather than protecting it. It is possible that this is the cause of rheumatoid arthritis. This condition is characterized by an autoimmune response, in which the immune system targets healthy tissues in an incorrect manner. People with rheumatoid arthritis have thick joint linings that are packed with white blood cells, in contrast to normal joints, which have thin linings and few blood vessels. When white blood cells inflict inflammation and injury to joints, they release chemicals such as interleukin-1 (IL-1) and tumor necrosis factor alpha (TNF-alpha). Researchers have recently identified novel cytokines like IL-17, IL-182, and RANK ligand (RANKL) as contributing to the development of chronic arthritis. Synovial fibroblasts and chondrocytes in the adjacent articular cartilage release enzymes when these cytokines reach them, which breaks down the tissue. It releases a number of inflammatory cytokines and mediators. Pannus occurs when synovial cells begin to multiply and disseminate. The following phase, known as ankylosis, is characterized by fibrosis and results in a decrease in joint motion. RA causes cartilage erosion and synovial membrane thickening. When the synovial membrane gets into the interstitial space, it enlarges the joint and makes it unpleasant to move.

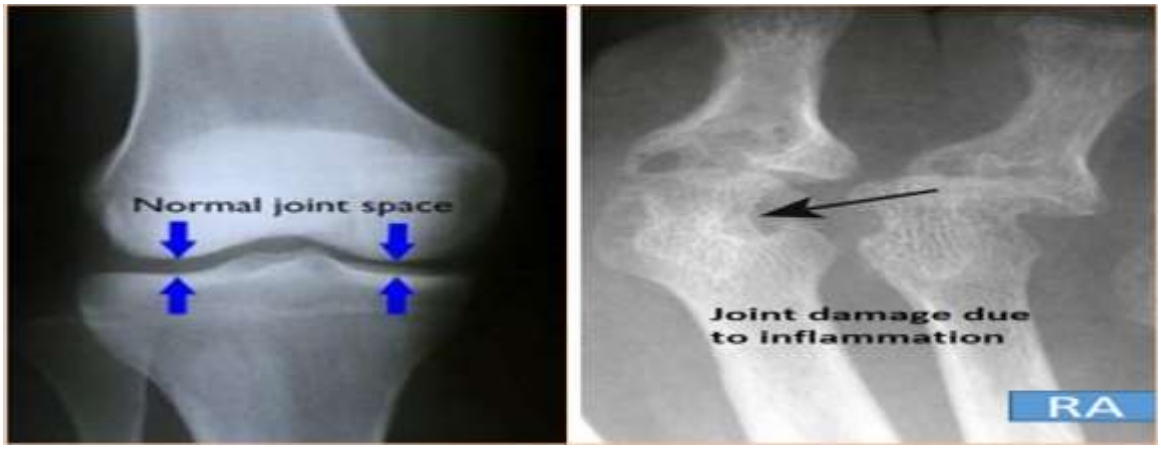


Fig. 1: Joint space normal and RA

Swelling, soreness, stiffness in the mornings of affected joints, inability to sleep, extreme weariness, weight loss, and a generalized sense of having the flu are all symptoms. Blood tests for rheumatoid arthritis might reveal the presence of rheumatoid factors, which are aberrant IgG antibodies. When antigen reacts with antigen, an antigen-antibody complex forms, causing inflammation and discomfort in the synovial membrane. In order to confirm a diagnosis, the American College of Rheumatology requires four out of seven criteria [10-20].

- ❖ Morning stiffness around the joint that lasts at least 1 hour
- ❖ Arthritis of three or more joints for at least 6 weeks
- ❖ Arthritis of hand joints for at least 6 weeks
- ❖ Arthritis on both sides of the body for at least 6 weeks
- ❖ Rheumatoid nodules under the skin
- ❖ Rheumatoid factor presents in blood testing
- ❖ Evidence of rheumatoid arthritis on X-rays

Table-1 Native Plants for the Management of Rheumatoid Inflammation of the Joints [21-30]

S. No.	Name of plants	Family	Plant parts used
1.	*Abrus precatorius* L.	Fabaceae	Root
2.	*Acacia catechu* (L.f.) Willd.	Mimosaceae	Fruits
3.	*Acacia senegal* Britton (Gum from acasia plant)	Mimosaceae	Gum
4.	*Aconitum heterophyllum* Wall.	Ranunculaceae	Root
5.	*Acorus calamus* L.	Arecaceae	Rhizome
6.	*Adhatoda beddomei* Clarke	Acanthaceae	Green leaf
7.	*Aegle marmelos* (L.) Correa	Rutaceae	Root, leaf and fruit
8.	*Ailanthus triphysa* (Dennst.) Alston	Simaroubaceae	Stem bark
9.	*Allium sativum* L.	Liliaceae	Bulb
10.	*Alpinia calcarata* Rosc.	Zingiberaceae	Root
11.	*Andrographis paniculata* (Burm. f.) Wall. *ex* Nees	Acanthaceae	Whole plant

12.	*Anethum graveolens* L.	Apiaceae	Seed
13.	*Asparagus racemosus* Willd.	Liliaceae	Tuber
14.	*Atylosia goensis* (Dalz.) Dalz.	Fabaceae	Whole plant
15.	*Azadirachta indica* A. Juss.	Meliaceae	Root, whole plant
16.	*Bacopa monnieri* (L.) Pennell	Scrophulariaceae	Whole plant
17.	*Boerhavia diffusa* L.	Nyctaginaceae	Root
18.	*Caesalpinia bonduc* (L.) Roxb.	Caesalpiniaceae	Seed, root
19.	*Calophyllum apetalum* Willd.	Clusiaceae	Seed
10.	*Carum carvi* L.	Apiaceae	Seed
21.	*Cassia fistula* L.	Caesalpiniaceae	Stem bark, root
22.	*Cedrus deodara* (Roxb.) G. Don	Pinaceae	Wood
23.	*Chonemorpha macrophylla* (Roxb.) G.Don	Apocynaceae	Root
24.	*Cinnamomum tamala* Th. Nees & Eberm.	Lauraceae	Leaves
25.	*Cinnamomum zeylanicum* Blume	Lauraceae	Flower, stem bark
26.	*Citrullus colocynthis* (L.) Schrad.	Cucurbitacae	Whole plant
27.	*Clerodendrum serratum* (L.) Moon.	Verbenaceae	Root
28.	*Coleus vetiveroides* Jacob.	Lamiaceae	Stem, root
29.	*Commiphora mukul* (Stocks) Hook.	Burseraceae	Exudate
30.	*Coriandrum sativum* L.	Apiaceae	Seed
31.	*Coscinium fenestratum* (Gaertn.) Colebr.	Minispermaceae	Stem bark
32.	*Crataeva nurvala* Buch. - Ham.	Capparidaceae	Root
33.	*Cuminum cyminum* L.	Apiaceae	Seed
34.	*Curculigo orchioides* Gaertn.	Liliaceae	Tuber
35.	*Curcuma longa* L.	Zingiberaceae	Rhizome
36.	*Cyclea peltata* Miers	Minispermaceae	Tuber
37.	*Cyperus rotundus* L.	Cyperaceae	Rhizome
38.	*Desmodium gangeticum* (L.) DC.	Fabaceae	Root
39.	*Dolichos biflorus* L.	Fabaceae	Seed
40.	*Eclipta alba* L.	Asteraceae	Whole plant
41.	*Elettaria cardamomum* (L.) Maton	Zingiberaceae	Seed
42.	*Embelia ribes* Burm.f.	Myrsinaceae	Seed
43.	*Emblica officinalis* Gaertn.	Euphorbiaceae	Fruit pulp
44.	*Erythrina variegata* L.	Fabaceae	Leaf, stem bark
45.	*Foeniculum vulgare* Mill.	Apiaceae	Seed
46.	*Fritillaria roylei* Hook.	Liliaceae	Tuber
47.	*Glycyrrhiza glabra* L.	Fabaceae	Root
48.	*Gmelina arborea* Roxb.	Verbenaceae	Root
49.	*Hemidesmus indicus* (L.) Br.	Perilocaceae	Root
50.	*Holarrhena pubescens* (Buch.-Ham.) Wall. *ex* G. Don	Apocynaceae	Seed, stem bark
51.	*Holoptelea integrifolia* (Roxb.) Planch.	Ulmaceae	Stem bark
52.	*Hordeum vulgare* L.	Poaceae	Seed
53.	*Hygrophila auriculata* (K. Schum.) Heine	Acanthaceae	Whole plant, seed
54.	*Ipomoea paniculata* R. Br.	Convolvulaceae	Tuber
55.	*Kaempferia galanga* L.	Zingiberaceae	Rhizome
56.	*Lepidium sativum* L.	Brassicaceae	Seed
57.	*Lilium polyphyllum* D.Don *ex* Royle	Liliaceae	Tuber
58.	*Malaxis acuminata* non D. Don	Orchidaceae	Rhizome
59.	*Malaxis muscifera* (Lindl.) Kuntze	Orchidaceae	Rhizome
60.	*Moringa oleifera* Bedd	Moringaceae	Leaf, seed, root, stem bark
61.	*Oldenlandia corymbosa* L.	Rubiaceae	Whole plant
62.	*Operculina turpethum* (L.) Manso	Convolvulaceae	Root
63.	*Oroxylum indicum* (L.) Benth. *ex* Kurz	Bignoniaceae	Root
64.	*Paederia foetida* L.	Rubiaceae	Whole plant
65.	*Phaseolus mungo* L.	Fabaceae	Seed
66.	*Phaseolus roxburghii* W. & A.	Fabaceae	Seed
67.	*Phaseolus trilobus* Baker	Fabaceae	Whole plant
68.	*Picorhiza kurroa* Royle *ex* Benth.	Plantaginaceae	Root
69.	*Piper chaba* Hunter	Piperaceae	Root
70.	*Piper longum* L.	Piperaceae	Fruit, root
71.	*Piper nigrum* L.	Piperaceae	Seed, leaf
72.	*Plantago ovata* Forssk.	Plantaginaceae	Seed
73.	*Pluchea lanceolata* (DC.) C. B. Clarke	Asteraceae	Tuber

74.	*Plumbago rosea* L.	Plumbaginaceae	Root
75.	*Polygonatum multiflorum* (L.) All.	Liliacae	Medha
76.	*Polygonatum vertcillatum* (L.) All.	Liliacae	Root
77.	*Pongamia pinnata* (L.) Pierre	Fabaceae	Stem bark, Leaf
78.	*Premna serratifolia* L.	Verbenaceae	Root
79.	*Pseudarthria viscida* (L.) Wight & Arn.	Fabaceae	Root
80.	*Psoralea corylifolia* L.	Fabaceae	Seeds
81.	*Pterocarpus marsupium* Roxb.	Fabaceae	Heart wood
82.	*Pterocarpus santalinus* L.f.	Fabaceae	Heart wood
83.	*Ptychotis ajowan* DC.	Apiaceae	Seeds
84.	*Ricinus communis* L.	Euphorbiaceae	Root, oil, leaf
85.	*Rubia cordifolia* L.	Rubiaceae	Root
86.	*Santalum album* L.	Santalaceae	Heartwood
87.	*Saussurea lappa* Clarke	Asteraceae	Root
88.	*Scindapsus officinalis* (Roxb.) Schott	Araceae	Dried mature inflorescence
89.	*Semecarpus anacardium* L.f.	Anacardiaceae	Seed
90.	*Sida rhombifolia* L.	Malvaceae	Root
91.	*Solanum indicum* L.	Solanaceae	Root
92.	*Solanum melongena* L.	Solanaceae	Root
93.	*Solanum melongena* L. - Wild	Solanaceae	Root
94.	*Solanum xanthocarpum* Schrad. & Wendl.	Solanaceae	Root
95.	*Stereospermum suaveolens* (G. Don) DC.	Bignoniaceaae	Root
96	*Strobilanthes heyneanus* Nees	Acantaceae	Leaf, root
97.	*Strychnis potatorum* L. f.	Loganiaceae	Seed
98.	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	Seed pulp
99.	*Terminalia chebula* Retz.	Combretaceae	Fruit, fruit pulp
100.	*Tinospora cordifolia* (Willd.) Hook.f. & Thoms.	Minispermaceae	Stem
101.	*Tragia involucrata* L.	Euphorbiaceae	Root
102.	*Tribulus terrestris* L.	Zygophyllaceae	Fruit
103.	*Trichosanthes cucumerina* L.	Cucurbitaceae	Root, whole plant
104.	*Trigonella foenum graecum* L.	Fabaceae	Seed
105.	*Valeriana wallichii* DC.	Valerianaceae	Root
106.	*Abutilon indicum* (L.) Sweet	Malvaceae	Root
107.	*Vetiveria zizanioides* (L.)	Poaceae	Root
108.	*Vitex negundo* L.	Verbenaceae	Root, leaf
109.	*Withania somnifera* (L.) Dunal	Solanaceae	Root
110.	*Zingiber officinale* Rosc.	Zingiberaceae	Rhizome
111.	*Zizyphus mauritiana* Lam.	Rhemnaceae	Seed

Fig. 2: *Aloe barbadensis*

Apart from the north-west Himalayan region of India, people grow *Aloe barbadensis* throughout Europe. For a long time, aloe vera has been a staple in traditional medicine. The active ingredients in Aloe vera include anthraquinone, anthracene, cinnamic acid, and anthranilic acid. Aloe vera can treat a wide range of skin conditions, such as minor wounds, stings, bruises, poison ivy, and eczema. Aloe vera also serves as a blood

purifier, anti-inflammatory, diuretic, uterine tonic, spermatogenic, laxative, purgative, and fever reliever, and it also possesses antibacterial and antifungal properties. The anthraquinone molecule is responsible for aloe vera's anti-arthritis properties. The anti-inflammatory and immune-system-stimulating properties of aloe vera make it an effective medicinal tool. Aloe vera extract, when applied topically to Sprague-Dawley rats, reduced inflammation and arthritis in rats with adjuvant-induced arthritis [40–45].

Fig. 3: *Withania somnifera* Linn

Ashwagandha, also known as Indian ginseng, is an essential ancient plant. Traditional Indian medicinal practices such as Ayurveda and Unani make use of Ashwagandha root. Because of their dry climates, the subtropical states of Rajasthan, Punjab, Haryana, Uttar Pradesh, Gujarat, Maharashtra, and Madhya Pradesh are ideal locations for its cultivation. The alkaloids and steroidal lactones are responsible for the root's pharmacological action. The primary alkaloids found include withanine, pseudo-withanine, tropine, somniferine, and somnine. Roots have produced two acyl glucosides: sitoindoside-7 and sitoindoside-8. Aphrodisiac, liver tonic, anti-inflammatory, and, more recently, used to treat asthma, ulcers, sleeplessness, and senile dementia are some of the traditional uses of the plant. Ashwagandha has shown promise in treating inflammatory conditions, anxiety, neurological diseases, and Parkinson's disease in both animal and human studies. Human tumour growth can be slowed or prevented by including ashwagandha in one's diet. Several health issues, including aging, anaemia, arthritis, weariness, stress disorders, and physical fitness, might benefit from its gradual and long-lasting effects. The anti-arthritic activity was seen in rats that were adjuvant-induced with arthritis when *Withenia somnifera* Linn. root powder was administered orally. [46-50].

Fig. 4: *Boswellia serrata Linn*

Throughout the Middle East, Northern Africa, and India, the moderately to largely branched Boswellia serrata Linn. tree grows. Its native Indian habitats include those in Gujarat, Madhya Pradesh, and Bihar. One can extract gummy-oleo resins by removing thin layers of *boswellia* bark. It exhibits anti-inflammatory, anti-atherosclerotic, and anti-arthritic properties due to the presence of β-bboswellic acid in the resin part. Furthermore, the gummy oleo resins' extract has a variety of medicinal uses, including those of analgesic,

sedative, anti-septic, juvenomimetic, stimulant, expectorant, and astringent. People also recognize it for its ability to restore the integrity of damaged or spasmed joint vessels. Sugars, terpenoids, and volatile oils are the primary components of *boswellia*. By inhibiting the production of pro-inflammatory cytokines and mediators, *boswellia serrata* extract has inherent anti-inflammatory effects in areas with chronic inflammation. Contrarily, Boswellia serrata Linn. slows the breakdown of glycosaminoglycan production, which means it can slow down the deterioration of joints in arthritic diseases brought on by non-steroidal anti-inflammatory medicines [51–55].

Fig. 5: Black pepper (peppercorns)

Originating in southern India, black pepper is now a popular spice crop. Additionally, it is grown in Sri Lanka, Indonesia, Brazil, and Malaysia. India dominates the cultivation of this substance. In addition to the alkaloid piperine, pipper also includes volatile oil, pungent resins, starch, and piperidine. Aromatic, stimulant, stomachic, and carminative are some of its uses. It makes the stomach secrete more acid. It also improves the absorption of a number of medications. A black pepper extract containing piperine. Oral piperine administration at doses of 20 and 100 mg/kg/day for eight days alleviates arthritis symptoms in carrageenan-induced acute paw arthritis [56-60].

Fig. 6: *Actaea racemosa* Linn.

Black cohosh, a perennial herb, has a velvety texture. Its original range extends over eastern North America, from the southernmost tip of Ontario to the centre of Georgia and, farther west, into Missouri and Arkansas. Black cohosh has a long history of medicinal usage among Native Americans. Scientists have isolated a number of chemical components from the black cohosh plant, including acteina, cimigoside, steroidal terpenes, and 27-deoxyactein. Tannins, salicylic acid, and formononetine, an isoflavone, are among the other components. It helps with a variety of issues, including arthritis, diarrhoea, dieresis, dyspepsia, renal difficulties, malaria, and

snake bites as an insect repellent. Its use can alleviate many women's health issues, including menopause. Anxieties caused by arthritis can be alleviated with the help of black cohosh [61-65].

Fig. 7: *Uncaria tomentosa*

The woody vine, known as "cat's claw," originates from the tropical forests of South and Central America and gets its name from the claw-shaped thorns that it bears. The medicinal benefits are attributed to the presence of tannins and other alkaloids. The following phytochemicals are found in it: ajmalicine, akuammigine, campesterol, catechin, chlorogenic acid, cinchonain, corynantheine, corynoxeine, daucosterol, epicatechin, harman, hirsuteine, hirsutine, iso-pteropodine, loganic acid, lyaloside, mitraphylline, oleanolic acid, palmitoleic acid, procyanidins, pteropodine quinovic acid glycosides, rhynchophylline, rutin, sitosterols, speciophylline, stigmasterol, strictosidines. Some of its uses include gastric ulcers, cancer, HIV infection, inflammation, tumors, diabetes, chronic fatigue, chron's disease, and antioxidants. Additionally, it has antimicrobial properties. A rat model of carrageenan-induced inflammation demonstrated that an extract from a cat's claw has anti-inflammatory effects by decreasing paw edema [66–70].

Fig. 8: *Ginger rhizome*

When it comes to herbal supplements, ginger is among the most helpful. Its original home is in Southeast Asia, but you may find it grown all over the world, including in the Caribbean, Africa, India, Mauritius, and Australia. Production in India exceeds 30%. Ingredients that make up ginger include starch, fat, ginger oil, residual moisture, inorganic matter, and fibre. Ginger oil contains monoterpene and sesquiterpene hydrocarbons, as well as oxygenated mono- and sesquiterpine. The medicinal, aromatic, carminative, stimulant, and flavouring properties of ginger make it a versatile spice. It can help alleviate symptoms such as nausea, vomiting, and diarrhoea. Additional uses include reducing inflammation, killing germs, preventing cancer, and having antifungal and antimicrobial properties. Ginger extract is one of the best cures for arthritic joint pain that

doctors offer. The primary component is zingiberene, which is a sesquiterpene. The anti-inflammatory action of this natural substance is due to sesquiterpene lactones [71–75].

Fig. 9: Turmeric rhizome

India, China, Sri Lanka, Indonesia, Jamaica, and Peru all grow turmeric for its rhizome. Curcuminoids, a yellowish component, are present in turmeric, along with volatile oils, resins, starch grains, and the spice itself. Curcumin is the main ingredient in curcuminoids. Curcumin, found in the plant Curcuma longa's rhizomes, has anti-inflammatory properties, as shown in the study. It is used in wound healing, hepatoprotection, neuroprotection, and a variety of other applications. It inhibits cell proliferation, prevents spasms, kills germs, and fights cancer. Both the acute and chronic stages of arthritis were suppressed by a daily intraperitoneal injection of a modest dosage of pure curcuminoids (4 mg total curcuminoids/kg/d) [76–78].

Fig. 10: *Calotropis procera Linn*

The flowering plant species Calotropis procera Linn., which belongs to the Apocynaceae family of dogbanes, is originally from Indochina, South Asia, Western Asia, and Tropical Africa. Studies have demonstrated the presence of anti-inflammatory, analgesic, anti-oxidant, and antifungal properties in several parts of this plant. Numerous animal studies have revealed the strong anti-inflammatory effects of this plant's latex. The latex petroleum extract clearly demonstrates significant antibacterial activity. There is evidence that latex and its methanolic extract can block the inflow of inflammatory cells and the production of edema when exposed to different inflammagens. Additionally, it enhances locomotor functions in rats with monoarthritis that has been produced experimentally. The roots of Calotropis procera Linn. exhibited anti-inflammatory effects in a cotton pellet-produced granuloma and carrageenan-induced paw edema model when administered dosages of 180 mg/kg (methanol extract) and 200 mg/kg (other extracts) [79–80].

Fig. 11: *Camellia sinensis* Linn

An evergreen shrub or little tree, *Camellia sinensis* Linn. Originating in mainland China and Southeast Asia, *Camellia sinensis* Linn. is currently grown in tropical and subtropical climates all over the globe. Polyphenols, including catechins and flavonols, are the plant's active ingredients in *Camellia sinensis* Linn. Caffeine and aromatic oils round out the ingredients. The most significant catechin in green tea is the powerful antioxidant (-) epigallocatechin. In the arthritic joints of mice given green tea, there was a significant suppression of the inflammatory mediators COX-2, IFNγ, and TNFα, reflecting the lower incidence and severity of collagen-induced arthritis. Green tea-fed animals had reduced levels of total immunoglobulin G (IgG) and type II collagen-specific IgG in both their blood and arthritic joints [81–85].

Fig. 12: *Ficus bengalensis* Linn

Originating in the Indian subcontinent, this tree grows to be quite huge and sprawling. In the form of aerial roots, it sends off propagating roots that spread downward. The plant's medicinal ingredients have a stellar reputation for treating a wide range of conditions, including dysentery, diarrhea, diabetes, leucorrhoea, menorrhagia, neurological diseases, and more. Astringent, hemostatatic, anti-septic, anti-inflammatory, antioxidant, and anticancer agents are all found in this group's bark, leaves, and fruits. The substances listed include beta-sitosterol alpha-D glucose (19–20), pentatriacontan-5-one, glucoside, leucocynidin 3-0-α-D galactosyl cellobioside, and beta-sitosterol alpha-D glucose. Additionally, the bark yielded a glycoside of leucopelargonidin, which had antidiabetic properties. Using Freund's complete adjuvant, the formalin-induced arthritis, and the agar-induced arthritis models, researchers investigated the anti-rheumatic effect of a methanolic extract of *Ficus bengalensis* bark (MFB). The extract inhibited edema significantly, particularly in cases with secondary immunological arthritis, and also inhibited formalin-induced pain in two stages. Several phytochemicals, including terpenoids, alkaloids, glycosides, flavonoids, and steroids, are present in the methanolic extract. Flavonoids, tannins, saponin, and steroids may be responsible for its anti-rheumatic and autoimmune system-modifying properties [85-87].

Fig. 13: *Cedrus deodara*

Originating in the western Himalayas of Afghanistan, Pakistan, India (Himachal Pradesh and Uttarakhand), Tibet (the southernmost region), and Nepal (the western region), Cedrus deodara is a native of these regions. Ayurvedic practitioners have long relied on Cedrus deodara wood to alleviate inflammatory conditions and rheumatoid arthritis. Proteins, glycosides, alkaloids, flavonoids, phenolic chemicals, and saponins make up the bulk of the substance. The anti-inflammatory and anti-arthritic properties of *Cedrus deodara* have led to its usage in medical practice. The paw swellings on the injected limbs were a measure of the polyarthritis phase in rats with full adjuvant-induced arthritis, and *Cedrus deodara* substantially prevented this phase [88–94].

Fig. 14: *Barringtonia racemosa* Linn

The coastal swamp woods and estuary borders of numerous Polynesian islands, as well as the Indian Ocean, Sri Lanka, Malaysia, Thailand, Laos, southern China, northern Australia, and the Ryukyu Islands, are home to Barringtonia racemosa Linn. This plant has chemicals like stigmasterol, gallic acid, dihydromyticetin, 3, 3'-dimethoxy ellagic acid, and bartogenic acid. It possesses anti-inflammatory, anti-oxidant, and anti-microbial properties. Its active ingredient, bartogenic acid (BA), is responsible for its use in rheumatoid arthritis. Complete Freund's adjuvant (CFA) causes arthritic lesions in rats, both primary and secondary, and hematological disturbances. BA protects animals against these effects [95–96].

Fig. 15: *Mangifera indica* Linn

Mangifera indica Linn is a type of mango. Its commercial fruit output has led to its cultivation across tropical and subtropical regions. Polyphenols, flavonoids, triterpenoids, isomangiferin, tannin, and gallic acid derivatives are its main components. Mangiferin is a compound found in mango that is extracted in high quantities from the fruit's bark, young leaves, and older leaves. Mangiferin has powerful antioxidant action. Hypoglycemic, anti-allergic, antifungal, antimicrobial, anti-inflammatory, antiviral, hepatoprotective, and antidiabetic are only a few of its pharmacological activities and potential health advantages. Mangifera indica methanolic extract has anti-inflammatory effects as measured by arthritic index, paw edema, and rheumatoid factor [97-100].

Fig. 16: *Tinospora cordifolia* Linn

Tinospora cordifolia Linn may be found throughout China and the tropical Indian subcontinent. Tinosporaceae, tinosporide, cordifolide, cordifol, heptacosanol, clerodane furano diterpene, diterpenoid furanolactone, tinosporidine, columbin, and b-sitosterol are the main ingredients. This plant's benefits include a stronger immune system and a greater ability to withstand infections. Aside from being anti-inflammatory and antipyretic, the bitter principle has antiperiodic and antispasmodic effects. Treating rheumatoid arthritis is one of its uses. In rats with collagen-induced arthritis, it reduces paw volume at a dosage of 100 mg/kg [101-105].

Fig. 17: *Ncytanthes arbortristis* Linn

Another name for the *Ncytanthes arbortristis Linn* plant is a tiny tree or shrub. Southern Asia is where it may be found, ranging from the northern regions of Pakistan and Nepal to the northern regions of India. Mannitol, b-amyrin, b-sitosterol, benjoic acid, and benjoic ester of longanin, as well as nycthanic acid, are all components that are present in it. In addition to its usage as a laxative, diuretic, and diaphoretic, it is also employed in the treatment of rheumatoid arthritis, as well as in the elimination of roundworm and threadworm in children, and it is employed to alleviate coughing. In the hind paw of rats, the leaves of *Nyctanthes arbortristis* Linn. were able to prevent the acute inflammatory edema that was caused by a variety of phlogistic agents, including carrageenin, formalin, histamine, 5-hydroxytryptamine, and hyaluronidase. It is possible to considerably decrease both the acute and chronic stages of arthritis that are produced by formaldehyde. Additionally, it was shown that Nyctanthes arborists Linn. can suppress the inflammation that is caused by immunological approaches, including Freund's adjuvant arthritis [102-].

Conclusion

The evidence suggests that certain plants possess anti-rheumatoid arthritis properties similar to those of manufactured antidepressants. Because of the numerous negative consequences associated with synthetic antidepressants, we may use botanical formulations to treat anti-rheumatoid arthritis. These formulations exhibit a reduced occurrence of negative consequences compared to synthetic antidepressants.

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