IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Human Journals
Review Article
October 2022 Vol.:25, Issue:3

A Review on Herbal and Allopathic Treatment for Rheumatic Arthritis

IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Lovely Prabha[*1], Vinay Jain[2], Gyan Prakash[1], Prabhakar[3], Rohit Kumar Bijauliya[4]

[1]*SCHS Pharmacy College, Bhognipur, Kanpur Dehat, Uttar Pradesh, India.*

[2]*Shri Ram College of Pharmacy, Banmore, Morena, Gwalior, Madhya Pradesh, India*

[3]*Bhagwan Aadinath College of Pharmacy, Lalitpur, Uttar Pradesh, India.*

[4]*BIU College of Pharmacy, Bareilly International University, Bareilly, U.P., India*

Submitted: 23 September 2022
Accepted: 28 September 2022
Published: 30 October 2022

Keywords: Rheumatoid Arthritis, Inflammation, Diagnosis, Allopathic and herbal Treatment

ABSTRACT

In essence, rheumatoid arthritis is an autoimmune condition that results in chronic inflammation of the body's joints and other tissues. Rheumatoid arthritis is a condition that can afflict people of all ages, but its precise cause is still unknown. The joints are severely injured with RA, which ultimately results in their degeneration and deformity. This essay provides an overview of the medicinal plants that contain phytoconstituents that can be utilised to treat RA and the various Rheumatoid Arthritis treatments. These healing plants can be studied further for upcoming research after their phytoconstituents have been collected, purified, and used in pharmacological studies. Researchers rely on natural treatments to treat many ailments with efficacy, safety, and with fewer side effects because even contemporary medications used to treat symptoms better provide only transient relief and have severe adverse effects.

HUMAN JOURNALS
www.ijppr.humanjournals.com

INTRODUCTION:

Approximately 1-3 percent of people worldwide suffer with rheumatoid arthritis, an autoimmune inflammatory condition. Joint inflammation is indicated by the word arthritis (where "artho" stands for the joint and "it is" for the inflammation). Due to the production of specific chemicals and enzymes that start to eat away at the cartilage and bones, RA develops when our immune system targets the tissues close to joints. Although the cause of RA is uncertain, it is a result of an immune system that is not operating properly.

Inflammation in the joints can result in deformity, discomfort, swelling, and joint destruction. Other internal organs, including the eyes, lungs, heart, and nerves, may sporadically be impacted. Individual symptoms differ greatly from one another. In many cases, RA begins by infecting a few joints, and then over the course of a few weeks or months, it spreads to additional joints throughout the body. The non-specific symptoms of RA include fatigue, discomfort in and around the joints, fever, and weight loss/poor appetite. However, RA can also advance dramatically and quickly. RA can gradually extend to more joints on both sides of the body, frequently in a "symmetrical" pattern.

Pain, swelling, redness, and stiffness are all considered to be signs of inflammation in medicine. One of the most common joints affected by arthritis are the spine, hip, and knee, but it can also affect other weight-bearing and non-weight-bearing joints in the body. Joint pain, stiffness, swelling, and fatigue are signs of arthritis. Untreated inflammation can cause joint deterioration, injury, and incapacity. With more joints afflicted, RA often develops over a few weeks to months. [1]

Epidemiology: About 1.3 million adults in the United States had RA in 2005, and 1.5 million had it by the end of the following year. There are no more recent statistics on the prevalence of RA in the United States in the literature. All racial and ethnic groupings are susceptible to RA. [2] In wealthy nations, RA affects 0.5% to 1% of the population (or 0.6% in the United States). In comparison to men, women are two to three times more likely to acquire RA. [2, 3, 4] Although it can also develop in youngsters and young adults, RA often manifests around middle age and is more prevalent in older persons. For women, the lifetime chance of acquiring an autoimmune inflammatory rheumatic illness is 1 in 12, while for men it is 1 in 20, or 8.3%. In particular, women have a lifetime risk of 1 in 28 (3.6%) and males have a chance of 1 in 59 (1.7%) of having adult-onset RA. [5] The severity of RA has decreased over time, in part because of earlier diagnoses and more potent medication regimens, but

trends in RA incidence, prevalence, and mortality differ depending on the population under study. [4, 6]

Etiology: Although the precise origin of RA is still unknown, genes, the environment, and hormones may play a role in the condition's autoimmune onset and development. [2, 3, 7] Some risk factors appear to raise the likelihood of developing RA, including advanced age (RA incidence is highest in those over 60 years old), gender (RA incidence is higher in women), genetics (especially HLA class II genotypes, such as HLA-DRB1), smoking (tobacco, cigarettes), history of live births (RA risk is higher in nulliparity), early life exposures (RA incidence is higher in children whose mothers smoked), and obesity (higher risk with increasing body weight). [7, 5, 8] Anticipated protein antibodies (ACPAs) or rheumatoid factors (RFs) seropositive patients are also at a higher risk of developing RA.It's interesting to note that women who breastfeed seem to have a lower risk of RA. Prior to the development of efficient disease-modifying anti rheumatic medications (DMARDs) and biological therapies, individuals with RA were more likely to pass away from infections, malignancy, and premature atherosclerosis. [2]

Pathophysiology: Inflammation of the synovial membrane, along by cytokines and chemokines, typically causes joint swelling in RA. Tumor necrosis factor (TNF), interleukin-6 (IL-6), and granulocyte-macrophage colony-stimulating factor are the most important substances in the inflamed area. By stimulating endothelial cells and encouraging immune system cell accumulation within the synovial compartment, cytokines and chemokines either initiate or intensify the inflammatory response. The receptor activator of nuclear factor kappa-B ligand (RANKL), which is expressed on B cells, T cells, and fibroblasts, can eventually cause osteoclast production in activated fibroblasts, B cells, T cells, monocytes, and macrophages. Preosteoclasts, dendritic cells, and macrophages all have RANK receptors. In addition, metalloproteinases and other enzymes gradually break down the cartilage matrix in joints. [7]

Diagnosis: Although the signs and symptoms of RA and those of other rheumatic diseases can coexist, classification criteria can help in diagnosis. [5, 7] Multiarticular pain and aching, morning stiffness, tenderness and swelling, and bilateral or symmetrical joint involvement are the most common complaints of RA patients (e.g., both hands, both knees). Additionally, patients may exhibit weakness, weariness, fever, and/or weight loss. With the discovery of incredibly precise biomarkers, the laboratory diagnosis (measurable sign) of RA has

improved in addition to physical symptoms. In addition to higher levels of C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), autoantibodies (such as ACPA, RF) are frequently associated with more severe joint damage and higher mortality. [7]It should be noted that RF has a direct role in the processes that lead to cytokine and macrophage activation. When RF interacts with ACPAs, the effects of inflammation and subsequent joint degeneration are amplified. The concentrations of ACPA and RF should fall while receiving RA therapy. Patients may develop RF seronegativeness although ACPA seronegativeness is uncommon.

Treatment:

Allopathic Treatments for Rheumatoid Arthritis: Preventing long-term joint damage and reducing inflammation are the main goals of treating RA. In the process of treating RA, pain control is also crucial. Disease-modifying anti-rheumatic medicines (DMARDs) and a more recent class of medications termed biologics are the cornerstone of the treatment for RA. Corticosteroids The adrenal glands of the body naturally create the steroid hormone cortisol. The ability of cortisol to reduce inflammation is one of its key functions. Because steroids may cause more long-term negative effects, In order to assist control inflammation while slower-acting DMARDs take action or in the case of inflammatory arthritis, they are frequently used as a measure. To minimise adverse effects, steroids should ideally be administered for the shortest duration possible at the lowest dosage. NSAIDs: Non-Steroidal Anti-Inflammatory Drugs A class of medications known as non-steroidal anti-inflammatory medicines (NSAIDs) is used to treat arthritis-related inflammation and discomfort. These drugs can manage the symptoms, but they can't stop the progression or harm. NSAIDs can reduce joint pain or suppress it, but they cannot treat or stop the condition. [1]

The synovium is a delicate, thin lining that performs a number of crucial tasks. Joint lubricants like hyaluronic acid and the collagens that make up the synovium's structural framework are produced by synovial cells. Only 1-3 cells make up the intimal layer or synovial lining. This lining becomes 8–10 cells thick in RA. The Subintimal portion of the synovium is where the synovial blood arteries are found; this region typically has very few cells. In RA, T and B lymphocytes, macrophages, mast cells, and mononuclear cells are significantly infiltrated in the subintimal region. Type II collagen, which makes up the majority of cartilage, is typically an extremely flexible tissue that can absorb a lot of impact and stress. Bony degradation is a symptom of RA, and type I collagen makes up the majority

of bone tissue. The mediators produced by synovial cells that have been triggered may potentially cause bone damage. The synovial cavity is a small area with only a few cells and 1-2ml of very viscous fluid caused by hyaluronic acid. The neutrophil is the most common type of cell in synovial fluid. The synovial fluid is extremely inflamed. [2]

Herbal treatment for Rheumatic arthritis:

The current work is a collection of data on plants used in the traditional Indian medical system that may be effective in treating rheumatoid arthritis. In the form of single herbs, combination medications, and poly herbal formulations, these plants are used.

***Achyranthes bidentata* Blume (Amaranthaceae):** The amaranth family includes the flowering plant species Achyranthes bidentata Blume (ABB). Polysaccharides, triterpene saponins, sterones, and other active components are found in plants, which are used as traditional Oriental medicines. ABB primarily has antitumor, antiviral, anti-inflammatory, and analgesic pharmacological effects [8]. Additionally, ABB has a protective impact on the cartilage of the rabbit knee joint, as it increases TGF-1 expression, inhibits cytokine IL-1 expression, and slows cartilage deterioration [9]. In CIA model rats, ABB therapy dramatically decreased paw oedema, inflammatory cell proliferation, and bone deterioration [10].

***Alangium salvifolium* (Alangiaceae):** Alangiumsalvifolium stem barks were tested for acute toxicity and anti-arthritic efficacy in rats using Fruend's adjuvant arthritis paradigm. Significant anti-arthritic action has been shown by all of the extracts (petroleum ether, ethyl acetate, chloroform, and methanol). [11]

***Aconitum kusnezoffii* Reichb (Ranunculaceae):** Due to its anti-inflammatory effects, the dry root of Aconitum kusnezoffii Reichb. (caowu) has been used for many years to treat RA and joint discomfort. The primary bioactive properties of A. kusnezoffii have been attributed, according to pharmacological research, to the diterpenoid alkaloids aconitine, mesaconitine, hypaconitine, neoline, talatizaminebeiwutine, and deoxy-aconitine [12]. Recent studies have demonstrated the significant anti-inflammatory properties of benzoylaconitine (BAC) from the root of A. kusnezoffii, which suppresses the production of IL-6 and IL-8 in human synovial cells [13, 14]. With strong cytocompatibility for activated macrophages, encapsulated mPEG-PLGA NPs (NP/BAC) with increased bioavailability offer a viable RA therapeutic approach. By blocking the NF-B signaling pathway, NP/BAC dramatically

reduced the release of the pro-inflammatory cytokines TNF- and IL-1 (60–70%). In an in vivo CIA model, NP/BAC also reduced edoema of the ear (69.8%) and paw (87.1%) [14, 15].

***Aquilaria agallocha* (Thymelaeaceae):** The in-vitro BSA denaturation method and the in vivo Freund's adjuvant induced arthritic rat model were used to study the effects of the ethanolic extract of Aquilaria agallocha (EEAA) leaves and the Aquilaria agallocha oil (AAO) from Heart Wood. The in-vitro model for inhibiting protein denaturation as well as paw volume, haematological indicators, and radiography of the hind legs were investigated. Additionally, the antiarthritic action of EEAA and AAO was also confirmed by radiographic and haematological tests. [16]

***Alpinia galangal* Linn. (Zingiberaceae):** Galangin (5, 10, 20 mg/kg) and MEAO treatment significantly ((P0.001) inhibited the paw swelling, prolonged the paw withdrawal latency, and decreased the paw thickness in rats with adjuvant-induced arthritis. Diclofenac was administered as usual. The elevated level of serum lysosomal enzyme activity, specifically aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phophatase, was decreased by galangin (20 mg/kg) and MEAO (ALP). By restoring the altered haematological parameters, galangin, MEAO demonstrated anti-arthritic efficacy. In arthritic rats treated with galangin and MEAO, histopathological analysis revealed decreased cartilage degradation, influx of inflammatory cells, pannus development, fibrin deposition, synovitis, and chronic inflammation. [17]

***Astragalus membranaceus* Bunge (Leguminosae):** It is one of the most well-known traditional Oriental medicines and has been in use for a long time [18]. Additionally, drainage action, new tissue formation, and superficial resistance have all been observed to be strengthened [19, 20]. The immunomodulatory and anti-inflammatory mechanisms of TFA were demonstrated by Jinxia et al. in 2018. Following TFA treatment, RT-PCR was used to determine the mRNA expression levels of TNF-, IL-6, IL-1, IL-10, iNOS, and COX-2 in LPS-stimulated RAW 264.7 macrophages. These findings imply that TFA controls the MAPK and NF-B signaling pathways in RAW 264.7 macrophages to exhibit immunomodulatory and anti-inflammatory actions.

***Barleria prionitis* L. (Acanthaceae):** Rats were subjected to Freund's Complete Adjuvant- and formaldehyde-induced acute non-immune and chronic immunological arthritis to test the anti-arthritic potential of Barleria prionitis L. leaves fraction. Both acute and chronic models showed a dose-dependent and substantial reduction of oedema. [22]

***Callicarpa macrophylla* Vahl (Verbenaceae):** The suppression of protein denaturation model and the model for stabilising the membrane of human red blood cells were used to assess the in-vitro anti-arthritic activity of the ethanolic extract of Callicarpa macrophylla Flower. Diclofenac sodium was a commonly prescribed medication. Results showed that Callicarpa macrophylla ethanolic extract has considerable anti-arthritic action at various doses when compared to Diclofenac sodium, a commonly prescribed medication. The findings of the current study suggest that an ethanolic extract of Callicarpa macrophylla flower had anti-arthritic properties. [23]

***Cardiospermum halicacabum* Linn (Sapindaceae):** Wistar rats with CFA-induced arthritis were used as test subjects for the anti-rheumatic effects and antioxidant capabilities of C. halicacabum leaves (EECH). Rats with arthritis were given EECH orally at doses of 250 and 500 mg/kg per day for 20 days fifteen days after CFA induction. As a benchmark, sodium diclofenac was employed. The full cartilage regeneration in the EECH-treated groups was confirmed by ultrasonography and histological images of the hind leg. [24]

***Cinnamomum cassia* Presl (Lauraceae):** Citronella cassia Presl, a tropical aromatic evergreen tree of the Lauraceae family often known as cassia or cinnamon, is frequently utilised in conventional Oriental medicine. From C. cassia, more than 160 compounds have been discovered. Terpenoids, phenylpropanoids, and glycosides are the primary components [25]. The primary ingredients in C. cassia have a variety of pharmacological properties, including those that are anti-platelet aggregation, antithrombotic, pro-angiogenesis, vasodilating, and microcirculation-improving [26]. As well as these additional properties, C. cassia has anticancer, anti-inflammatory, analgesic, antibacterial, antiviral, cardiovascular-protective, cytoprotective, neuroprotective, immunomodulatory, and anti-tyrosinase activity. [25, 26]

***Citrullus colocynthis* Linn (Cucurbitaceae):** In order to cure osteoarthritis in chondrocyte cells and monocytes/macrophages, the study examined the effects of an ethanol extract of colocynth root on pro-inflammatory cytokines COX-2, INOS, IL-1, TNF-, and NO. According to our findings, Citrullus colocynthis root ethanol extract can lower pro-inflammatory cytokine expression levels in inflamed cells brought on by the same osteoarthritis condition, suggesting that this plant may one day be employed to treat osteoarthritis. [27]

***Commiphora myrrha* Nees (Burseraceae):** Guggulu extract has been shown to be helpful in several animal trials using common osteoarthritis (OA) models. Prior to this study, guggulu was investigated for OA in both animal and human studies. The aim of this study was to evaluate the efficacy of guggulu for treating OA-related pain, stiffness, and other symptoms. [28]

***Commiphara wightii* (Burseraceae):** During medication treatment, guggul decreased the thickness of the joint swelling, proving that it had a positive impact on experimental arthritis. After a month of treatment, gum guggul showed promise as a supplement to relieve osteoarthritis symptoms and considerably raise the WOMAC (Western Ontario and McMaster Osteoarthritis Index) overall score. [29]

***Cordia dichotoma* Forst (Boraginaceae):** Natural C. dichotoma polymer (fruit gum) was used to create transdermal films, together with varying amounts of plasticizer (glycerin 0.10, 0.20, and 0.25% w/v), preservative (methyl paraben 0.1% w/v), and medication (neomycin 0.2% w/v). On glass plates, the films were cast while under controlled drying conditions. Results were contrasted with those of the common medication, diclofenac sodium. The amount of oedema inhibition, which is a marker of anti-inflammatory potential, was found to be highest in rats treated with 0.20% (w/v) glycerin, indicating considerable anti-inflammatory action of cordiadichotoma. [30]

***Coriandrum sativum* (Apiaceae):** CS seed hydroalcoholic extract (CSHE) was tested for its antiarthritic properties in adult Wistar rats utilising the formaldehyde and Complete Freund's adjuvant (CFA) induced arthritis models. Additionally, the expression of pro-inflammatory cytokines, which are mostly produced by macrophages, was assessed. The serum TNF- level was calculated using the ELISA technique. The expression of TNF-R1, IL-1, and IL-6 in the synovium was examined using immune histochemistry. In both formaldehyde and CFA-induced arthritis, CSHE caused a dose-dependent reduction of joint swelling as compared to control mice. [31]

***Curcumae longae* (Zingiberaceae):** CS seed hydroalcoholic extract (CSHE) was tested for its antiarthritic properties in adult Wistar rats utilising the formaldehyde and Complete Freund's adjuvant (CFA) induced arthritis models. Additionally, the expression of pro-inflammatory cytokines, which are mostly produced by macrophages, was assessed. The serum TNF- level was calculated using the ELISA technique. The expression of TNF-R1, IL-1, and IL-6 in the synovium was examined using immune histochemistry. In both

formaldehyde and CFA-induced arthritis, CSHE caused a dose-dependent reduction of joint swelling as compared to control mice. [31]

***Euphorbia antiquorum* Linn (Euphorbiaceae):** Rat paw oedema caused by carrageenan was used to assess the impact of the extracts against acute inflammation. Cotton pellets were used to cause granulomas in rats, and complete Freund's adjuvant (CFA) was used to cause arthritis in rats. The findings suggested that the anti-inflammatory and anti-arthritic properties of the triterpenoids found in both EA extracts. [35]

***Euphorbia tirucalli* Linn (Euphorbiaceae):**The triterpenoid fraction isolated from Euphorbia tirucalli Linn (TET) was tested in a collagen-induced arthritis model for its anti-arthritic efficacy (CIA). [36]

***Ficus benghallensis* (Moraceae):** On Freund's adjuvant-induced arthritis in rats, the anti-arthritic efficacy of ethanol and an aqueous root extract of Ficus benghalensis was assessed. Oral administration of the crude ethanol and aqueous root extract at a dose of 300mg/kg body weight was done for 28 days. The findings show that both extracts shield the rats against FCA-induced primary and secondary arthritic lesions, changes in body weight, and haematological disturbances at a dose of 300 mg/kg b.w. The results demonstrated a strong anti-arthritic efficacy of root extracts from Ficus benghalensis against rat arthritis induced by FCA. [37]

***Heliotropium indicum* Linn (Boraginaceae):**The study involved 196 patients (65 men and 131 women) with genu varum abnormalities who were treated topically with phytotherapeutic regimens to normalise them. Anatomical measures, biochemical data, and radiological pictures are examined before (0 sitting) and after the 42 treatment sittings in order to find the normalisation. The current findings unambiguously demonstrate that normalisation of genu varum deformities is accomplished within 42 sittings by topical application of phytoconstituents (aqueous extracts) from recognised Indian medicinal plants (Cissus quadrangularis, Heliotropium indicum, Rosmarinus officinalis, and Calotropis gigantea). [38]

***Hemidesmus indicus* (Apocynaceae):**Hemidesmus indicus exhibits protective effect against arthritis, and the activity may be due to the presence of triterpenoids. The anti-arthritic activity was investigated on the roots of Hemidesmus indicus in rats. [39]

***Jatropha curcas* Linn. Euphorbiaceae:** The outcomes showed that, in comparison to the control group, the ethanolic extract of J. curcas leaves at doses of 150 mg/kg, 300 mg/kg, and 600 mg/kg significantly decreased arthritis ratings (p0.05) (CFA). Mobility scores were reduced by the J. curcas leaf extract at dosages of 150 and 300 mg/kg BW. According to histopathology investigations, J. curcas extract prevented oedema and cartilage loss in arthritic joints. [40]

***Juglans regia* Linn (Juglandaceae):** Cotton pellet tests and xylene-induced ear oedema were used to examine anti-inflammatory effects. Both extracts demonstrated some anti-inflammatory effect in the xylene test. Against the chronic inflammation, the extracts displayed anti-inflammatory effect. J. regia leaves have been shown to have anti-inflammatory and antinociceptive effects against both acute and chronic inflammation. J. regia extracts have the potential to be effective analgesics and anti-inflammatory treatments for conditions like rheumatoid arthritis. [41]

***Justicia gendarussa* Burn (Acanthaceae):** Using the Freund's adjuvant-induced and collagen-induced arthritic rat models, the anti-arthritic potential of the alcoholic extract of the herb Justicia gendarussa was assessed. The ethanolic extract of Justicia gendarussa and regular aspirin were administered to the rats. The anti-arthritic effects of the ethanolic extract of Justicia gendarussa were statistically comparable to aspirin's. According to the findings, Justicia gendarussa's alcoholic extract has strong anti-arthritic potential. [42]

***Kaempferia galangal* Linn (Zingiberaceae):** Using an activity-guided methodology, this study assessed the anti-inflammatory effects of Kaempferia galanga (KG). The potential of these extracts (2 g/kg each) to prevent carrageenan-induced rat paw oedema was examined. These findings support the hypothesis that the anti-inflammatory effects of KG may be caused by its ability to inhibit cyclooxygenases 1 and 2. This plant's EPMC may contain the active anti-inflammatory compound. [43]

***Lantana camara* Linn (Verbenaceae):** On albino rats, the extract from Lantana camara var. Linn leaves was tested for its anti-arthritic properties. The acute non-immunological model was used in this abstraction. Turpentine was used to create the arthritis. Lantana camara's ethanolic extract demonstrated a substantial (P0.05) and dose-dependent inhibitory impact on an acute arthritic model. In this study, an ethanolic extract of Lantana camara outperformed aspirin in terms of anti-arthritic efficacy. [44]

***Lawsoniainermis Linn* (Lythraceae):** Lawsoniainermis hydroalcoholic extract is tested for anti-arthritic efficacy using the Freund's adjuvant-induced arthritis model and the formaldehyde-induced arthritis model. Both adjuvant-induced arthritis and a formaldehyde-induced arthritis model are significantly reduced by the hydroalcoholic extract of Lawsoniainermis. [45] Ethanolic extract of Lawsoniainermis Linn (EELI) was tested against Freund's Complete Adjuvant (FCA)-induced arthritis in rats for its anti-arthritic properties. When compared to Diclofenac sodium, the ethanolic extract of LawsoniaInermis exhibits good anti-arthritic efficacy. [46]

***Ligusticum chuanxiong* Hort (Umbelliferae):** Chuanxiong Rhizoma, also known as Ligusticum chuanxiong Hort, is a medicinal herb that has been used extensively to cure a number of illnesses. Ligustulide, 3-butyrolactone, and cypressene are the three primary substances found in L. chuanxiong [47]. Ferulic acid, tetra-methylpyrazine (also known as ligustrazine or chuanxiongzine), palmitic acid, carotene, and -sitosterol are also present. The antioxidant, neuroprotective, anti-fibrosis, antinociceptive, anti-inflammatory, and antineoplastic properties of L. chuanxiong have been demonstrated in numerous biological and clinical research. [48, 49, 50]

***Mangifera indica* Linn, Anacardiaceae:** Methotrexate (MTX) with Mangifera indica extract (Vimang tablets, 300 mg) on lowering disease activity in rheumatoid arthritis (RA). Twenty RA patients were randomly assigned to either the experimental group (n = 10) that received the extract supplementation (900 mg/day) or the control group (n = 10) that received the usual treatment (n = 10) prior to the 180-day study. The experimental group received MTX (12.5 mg/week) in combination with NSAIDs and/or prednisone (5-10 mg/day). At 90 days, only the MTX-Vimang group had improved ACR by 80% (p 0.001). 70% of patients in the MTX-Vimang group completely eliminated gastrointestinal side effects as a result of the prior treatment, and 100% of patients in the MTX-Vimang group lowered their use of NSAIDs (p 0.01). [51]

***Myxopyrum serratulum* (Oleaceae):** Protein denaturation was used to measure in vitro antiarthritic activity, while HRBC membrane stabilisation was used to measure in vitro anti-inflammatory activity. At 200 g/ml, 61.25% of ethanolic extracts were found to be stabilised on the HRBC Membrane. At 200 g/ml, it was discovered that ethanolic extracts had a 67.51% inhibition rate on the Protein Denaturation technique. According to in vitro research done

using the aforementioned techniques, the ethanolic extract has better action that is comparable to that of the medication Diclofenac Sodium. [52]

***Naravelia zeylanica* Linn (Ranunculaceae):** Freud's adjuvant-induced arthritis model was used to test the anti-arthritic efficacy in albino rats. Paw volume percentage increases were observed 7 days and 21 days following the medication administration. Rats treated with chloroform extract, ethanolic extract, and Prednisolone 10 mg/kg p.o. showed a moderate reduction in paw volume in the right and left paw when compared to control group rats. Statistics indicated that both extracts (200 mg/kg) were significant (p 0.01). The presence of flavanoids, triterpenoids, and phenolic chemicals in both extracts may be the cause of the activity. [53]

***Oroxylum indicum* Linn (Bignoniaceae):** In rats given different Oroxylum indicum extracts, the relative percentage inhibition potential of paw volume was determined to be ethyl acetate extract (67.69%), chloroform extract (64.61%), and n-butanol extract (58.46%), in that order. In all groups of animals pretreated with root bark extracts, the haematological parameters RBC count and haemoglobin content showed a considerable rise, whereas total WBC count and ESR showed a significant drop. When compared to the other rats, only the ethyl acetate pre-treated rats' levels of lipid peroxide and cathepsin-D considerably decreased in terms of biochemical parameters like catalase and glutathione. [54]

***Pandanus odoratissimus* Linn (Pandanaceae):** Rats with carrageenan-induced acute and formalin-induced chronic paw oedema were used to measure the anti-inflammatory effect. P. odoratissimus methanolic extract was administered in doses of 25, 25, and 100 mg/kg. The plant extract at a concentration of 100 mg kg-1 shown considerable anti-inflammatory effect after 3 hours of observation, increasing the suppression of paw oedema in rat models of acute (68.9) and chronic (64.29) paw edoema generated by carrageenan and formalin, respectively. [55] P. odoratissimus (kewda) has been used as a treatment for rheumatic fever, arthritis, and rheumatism. 2-phenyl ethyl methyl ether terpene-4-ol, -terpineol, 2-phenyl ethyl alcohol benzyl benzoate, and other compounds are the main ingredients of hydrodistilled kewda oil. Both methanolic and hydroalcoholic extracts were tested in rodent models by carrageenan-induced paw edema, albumin induced plantar edema, acetic acid induced vascular permeability, and castor induced diarrhoea. In all these animal models both extracts have shown significant anti-inflammatory activity. [56]

***Paeonia lactiflora* Pallas (Paeoniaceae):** The Chinese Experience Medicine books "Treatise on Cold Pathogenic" and "Synopsis of Golden Chamber" [57, 58] identified P. lactiflora's medicinal properties. The root of P. lactiflora is used to extract the compound total glycoside of paeony (TGP). Paeoniflorin, hydroxy-paeoniflorin, paeonin, albiflorin, and benzoyl-paeoniflorin are all beneficial components of TGP [59]. In 1993, 450 RA patients participated in the first TGP clinical trial [60]. The therapeutic response was attained in 71.7% of patients receiving TGP. A phase III trial with 1016 individuals was carried out after the clinical trial of TGP for RA patients. [61]

***Piper nigrum* (Piperaceae):** On fibroblast-like synoviocytes generated from rheumatoid arthritis patients, interleukin 1 (IL1)-stimulated piperine was investigated for its in vitro anti-inflammatory efficacy. On rat models of carrageenan-induced acute paw discomfort and arthritis, piperine's analgesic and antiarthritic effects were examined. At days 8 and 4, respectively, piperine dramatically decreased the nociceptive and arthritic symptoms in rats. Piperine considerably decreased the inflammatory region in the ankle joints, according to histological staining. [62]

***Pongamia pinnata* Linn (Fabaceae):**Inhibition of protein denaturation and HRBC in vitro techniques were used to test the anti-arthritic and anti-inflammatory effects of P. pinnata hydroalcoholic extract.[63, 64] Comparison of the in-vitro anti-arthritic effects of ethanolic extracts of Pongamia pinnata (linn.) pierre seeds with methanolic extracts of Punica granatum linn. rind. For the investigation, two in-vitro models were chosen: membrane stability of human red blood cells (HRBCs) and suppression of protein denaturation. Diclofenac sodium was a commonly prescribed medication. The outcomes of the two models demonstrated that EEPP, MEPG, and the reference medication diclofenac sodium all demonstrated concentration-dependent reduction of protein (egg albumin) denaturation as well as stability toward HRBC membrane.[65]

***Rubia cordifolia* Linn (Rubiaceae):** By injecting Freund's Complete Adjuvant and Bovine type II Collagen, arthritis is developed in albino rats. Comparing the effectiveness of the plant extract to that of the widely used non-steroidal anti-inflammatory medicine Aspirin allows for evaluation. Different blood markers and the change in paw volume are used to measure the effectiveness of the treatment. Rubia cordifolia ethanolic extract demonstrated notable anti-arthritic efficacy that was statistically comparable to aspirin. [66]

***Sida cardifolia* Linn (Malvaceae):** Cardifolia Sida L is used to relieve inflammation in folk medicine. a 50% ethanolic Sidacardifolia extract. L demonstrated strong anti-oxidant and anti-inflammatory efficacy when tested on rats and compared to the medication deprenyl. [67]

***Strychnos potatorum* Linn (Loganiaceae):** The current study reports the impact of Strychnos potatorum Linn seeds' aqueous extract (SPE) and whole seed powder (SPP) on arthritic rat paw edoema caused by Freund's complete adjuvant (FCA). [68]

***Tridax procumbens* (Asteraceae):** Using the Freund's Complete Adjuvant (FCA) paradigm, it was determined that Tridax procumbens (Asteraceae) whole plant ethanolic extract had anti-arthritic effects on female Sprague Dawley (SD) rats. [69]

***Tripterygium wilfordii* Hook F:** There is a lengthy history of using Tripterygium wilfordii Hook F (TWHF) to reduce RA symptoms. TWHF exhibits a range of pharmacological properties, including anti-inflammatory, anti-tumor, and immune system-regulatory properties [70]. Recent clinical follow-up research by Zhou et al. treated RA patients with TWHF for two years in a row. Intent-to-treat and per-protocol analyses were used to compare the clinical indices and radiographic data that were gathered over the course of two years. 109 patients in all completed the test during the course of the two-year therapy term. According to the study's findings, TWHF monotherapy did not perform worse than methotrexate monotherapy in RA patients. [71]

***Trachyspermum ammi* (Apiaceae):** Following immunisation, rats were given Trachyspermum ammi extract (TAE) orally once day for 21 days at a rate of 100 mg kg-1. In the joints, measurements of oxidant product levels and antioxidant enzyme activity were made. The levels of oxidative stress markers like thiobarbituric acid reactive compounds and inflammatory markers like elastase were both markedly elevated when arthritis was induced. Reduced glutathione (GSH), a non-enzymatic antioxidant, and the activity of enzymatic antioxidants like superoxide dismutase and catalase both declined. By using the protein denaturation method, the anti-arthritic activity of grape seed ethanolic extract was assessed. [72]

CONCLUSION:

There are a variety of medications for arthritis, including NSAIDs, steroids, and others. Although these medicines have serious adverse effects, they can reduce pain and help control

the condition to some extent. For the traditional Indian medical system, quality control and uniformity must be strengthened. Additionally, this publication strengthens the facts related to plants and could aid in the advancement of phytopharmacology research. In order to create effective medications to treat RA patients, combination therapies and herbal formulations should be created employing resources from medicinal plants in light of modern research.

REFERENCES:

1. http://arthritis.ca/getmedia/6c39edce-5b2d-498d-bd60 28d33f3e1850/Rheumatoid-Arthritis-Causes-Symptoms-and Treatments.pdf?ext=.pdf
2. U.S. Department of Health & Human Services. Rheumatoid arthritis. https://report.nih.gov/nihfactsheets/ViewFactSheet.aspx?csid=63. Accessed January 13, 2019.
3. U.S. National Library of Medicine. Rheumatoid arthritis. https://medlineplus.gov/rheumatoidarthritis.html. Accessed January 13, 2019.
4. Arthritis Foundation. Arthritis by the numbers/book of trusted facts & figures. www.arthritis.org/Documents/Sections/About-Arthritis/arthritis-facts-stats-figures.pdf. Accessed January 13, 2019.
5. Smolen JS, Aletaha D, Barton A, et al. Rheumatoid arthritis.Nat Rev Dis Primers.2018;4:18001.
6. Minichiello E, Semerano L, Boissier MC. Time trends in the incidence, prevalence, and severity of rheumatoid arthritis: a systematic literature review.Joint Bone Spine.2016;83(6):625-630.
7. CDC. Rheumatoid arthritis (RA). www.cdc.gov/arthritis/basics/rheumatoid-arthritis.html. Accessed January 13, 2019. 7. Smolen JS, Aletaha D, McInnes IB. Rheumatoid arthritis.Lancet.2016;388(10055):2023-2038.
8. Shu S., Qiong W., You-bin L. Studies on chemical constituents and pharmaceutics activity of Achyranthes bidentata BI. Strait Pharm. J. 2011;23:1–6. [Google Scholar]
9. Xuelian S., Yuan L., Honghai Z. Effect of Total Saponins of Achyranthes on Knee Osteoarthritis Rabbit Cartilage Histomorphology and Contents of IL-1β and TGF-β1 in Synovial Fluid. Tradit. Chin. Drug Res. Clin. Pharmacol. 2016;27:14–19. [Google Scholar]
10. Zheng W., Lu X., Fu Z., Zhang L., Li X., Xu X., Ren Y., Lu Y., Fu H., Tian J. Identification of candidate synovial membrane biomarkers after Achyranthes aspera treatment for rheumatoid arthritis. Biochim. Biophys. Acta. 2016;1864:308–316. doi: 10.1016/j.bbapap.2015.12.010. [PubMed] [CrossRef] [Google Scholar]
11. Jubie S, Jawahar N, Ruby k, Gowramma B, Murugan V, Suresh B. Antiarthritic activity of bark extract of Alangiumsalvifolium wang. Rasayan J Chem. 2008; 1(3): 433-436.
12. Sun H., Wang M., Zhang A., Ni B., Dong H., Wang X. UPLC-Q-TOF-HDMS analysis of constituents in the root of two kinds of Aconitum using a metabolomics approach. Phytochem. Anal. 2013;24:263–276. doi: 10.1002/pca.2407. [PubMed] [CrossRef] [Google Scholar]
13. Song B., Jin B., Li Y., Wang F., Yang Y., Cui Y., Song X., Yue Z., Liu J. C19-Norditerpenoid Alkaloids from Aconitum szechenyianum. Molecules. 2018;23:1108. doi: 10.3390/molecules23051108. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
14. Yu H.H., Li M., Li Y.B., Lei B.B., Yuan X., Xing X.K., Xie Y.F., Wang M., Wang L., Yang H.J., et al. Benzoylaconitine Inhibits Production of IL-6 and IL-8 via MAPK, Akt, NF-κBSignaling in IL-1β-Induced Human Synovial Cells. Biol. Pharm. Bull. 2020;43:334–339. doi: 10.1248/bpb.b19-00719. [PubMed] [CrossRef] [Google Scholar]
15. Gai W., Hao X., Zhao J., Wang L., Liu J., Jiang H., Jin H., Liu G., Feng Y. Delivery of benzoylaconitine using biodegradable nanoparticles to suppress inflammation via regulating NF-κBsignaling. Colloids Surf. B Biointerfaces. 2020;191:110980. doi: 10.1016/j.colsurfb.2020.110980. [PubMed] [CrossRef] [Google Scholar]
16. Habibur Rahman, M. ChinnaEswaraiah, A. M. Dutta Anti-arthritic activity of leaves and oil of Aquilaria agallocha Saudi J. Life Sci 2016; Vol-1, Iss-1:34-43.
17. Vijaykumar M. Kale and Ajay G. Namdeo antiarthritic effect of galangin Isolated from rhizomes of alpinia officinarum in complete freund's adjuvant-induced arthritis in rats. Int J Pharm Pharm Sci, 2012; Vol 6, Issue 4, 499-505.

18. Zhang L.J., Liu H.K., Hsiao P.C., Kuo L.M., Lee I.J., Wu T.S., Chiou W.F., Kuo Y.H. New isoflavonoid glycosides and related constituents from astragali radix (Astragalus membranaceus) and their inhibitory activity on nitric oxide production. J. Agric. Food Chem. 2011;59:1131–1137. doi: 10.1021/jf103610j. [PubMed] [CrossRef] [Google Scholar]
19. Qi L.W., Yu Q.T., Li P., Li S.L., Wang Y.X., Sheng L.H., Yi L. Quality evaluation of Radix Astragali through a simultaneous determination of six major active isoflavonoids and four main saponins by high-performance liquid chromatography coupled with diode array and evaporative light scattering detectors. J. Chromatogr. A. 2006;1134:162–169. doi: 10.1016/j.chroma.2006.08.085. [PubMed] [CrossRef] [Google Scholar]
20. Xiao H.B., Krucker M., Albert K., Liang X.M. Determination and identification of isoflavonoids in Radix astragali by matrix solid-phase dispersion extraction and high-performance liquid chromatography with photodiode array and mass spectrometric detection. J. Chromatogr. A. 2004;1032:117–124. doi: 10.1016/j.chroma.2003.09.032. [PubMed] [CrossRef] [Google Scholar]
21. Li J., Xu L., Sang R., Yu Y., Ge B., Zhang X. Immunomodulatory and anti-inflammatory effects of total flavonoids of Astragalus by regulating NF-KB and MAPK signalling pathways in RAW 264.7 macrophages. Pharmazie. 2018;73:589–593. [PubMed] [Google Scholar]
22. Manjusha Choudhary, Vipin Kumar , Pankaj Kumar Gupta, Surender Singh Anti-arthritic activity of Barleriaprionitis Linn. leaves in acute and chronic models in Sprague Dawley rats Bulletin of Faculty of Pharmacy, Cairo University, 2014; Volume 52, Issue 2, Pages 199–209.
23. Santosh Kumar Gupta, Amit Gupta, A.K. Gupta, Dhirendra Pakash, Vedpal In Vitro Anti-Arthritic Activity Of Ethanolic Extract Of Callicarpa Macrophylla Flower Int. Res. J. Pharm. 2013; 4 (3) 160-162.
24. Ramachandran Jeyadevi, ThilagarSivasudha, Angappan Rameshkumar, Lakshmanan Dinesh Kumar Anti-arthritic activity of the Indian leafy vegetable Cardiospermum halicacabum in Wistar rats and UPLC–QTOF–MS/MS identification of the putative active phenolic components Inflamm. Res. 2013; 62:115–126.
25. Zhang C., Fan L., Fan S., Wang J., Luo T., Tang Y., Chen Z., Yu L. Cinnamomum cassia Presl: A Review of Its Traditional Uses, Phytochemistry, Pharmacology and Toxicology. Molecules. 2019;24:3473. doi: 10.3390/molecules24193473. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
26. Yang Y.L., Luo B., Zhang H., Zheng W.J., Wu M.L., Li S.Y., Gao H.Y., Li Q., Ge Y.W., Yang Q. Advances in quality research of Cinnamomum cassia. Zhongguo Zhong Yao Za Zhi. 2020;45:2792–2799. [PubMed] [Google Scholar]
27. Akhzari M, Mirghiasi SM, Vassaf M, Bidgoli MSM, Tari ZS the Effect of Citrullus Colocynthis on the Reduction of Inflammatory Agents in Osteoarthritis. Mol Biol4: 2015; 147. doi: 10.4172/2168-9547.
28. B. B. Singh, L. C. Mishra, S. P. Vinjamury, N. Aquilina, V.J. Singh, and N. Shepard, "The effectiveness of Commiphoramukul for osteoarthritis of the knee: an outcomes study," Alternative Therapies in Health and Medicine, 2003; vol. 9, no. 3, pp.74–79.
29. Patwardhan SK, Bodas KS, Gundewar S. Coping with Arthritis Using Safer Herbal Options, International Journal of Pharmacy and Pharmaceutical science 2010; 2(1): 1-11.
30. Shahapurkar AA, Jayanthi Drug neomycin release from Cordia dichotoma transdermal film and anti-inflammatory activity. Int Res J Pharm. 2011; 2(9):107–109.
31. Vinod Nair, Surender Singh, and Y.K. Gupta Evaluation of disease modifying activity of Coriandrum sativum in experimental models Indian J Med Res 135, 2012; pp 240-245.
32. Hosseini A., Hosseinzadeh H. Antidotal or protective effects of Curcuma longa (turmeric) and its active ingredient, curcumin, against natural and chemical toxicities: A review. Biomed. Pharmacother. 2018;99:411–421. doi: 10.1016/j.biopha.2018.01.072. [PubMed] [CrossRef] [Google Scholar]
33. Drugs and Lactation Database (LactMed) National Library of Medicine (US); Bethesda, MD, USA: 2006. Turmeric. [Google Scholar]
34. Kocaadam B., Şanlier N. Curcumin, an active component of turmeric (Curcuma longa), and its effects on health. Crit. Rev. Food Sci. Nutr. 2017;57:2889–2895. doi: 10.1080/10408398.2015.1077195. [PubMed] [CrossRef] [Google Scholar]
35. Anand Nirmal Harpalani, Ashok DundappaTaranalli, Kishor Vasant Otari, Ravindra Veerayya Karadi, Rajkumar VirbhadrappaShete Anti-inflammatory and Anti-Arthritic potential of aqueous and alcoholic extracts of Euphorbia antiquorum Linn. Pharmacologyonline 2: 2011; 287-298.

36. Pramod Chandrasenan, M. V. Neethu, V. M. Anjumol, Vysakh Anandan, Raj Selvaraj Triterpenoid fraction isolated from Euphorbia tirucalli Linn. Ameliorates collagen induced arthritis in Wistar rats Journal of Applied Pharmaceutical Science 2016; Vol. 6 (01), pp. 070-075.
37. Lokesh K Bhardwaj, Kaushal K Chandru, U.S. Sharma Evaluation of Anti-arthritic activity of Ficus benghalensis Linn. root extracts on Freund's adjuvant induced Arthritis in rats The Journal of Phytopharmacology 2016; 5(1): 10-14.
38. ApurbaGanguly Normalization of Varus/Valgus Deformities in Osteoarthritis by External Application of Phytoconstituents: Confirmed With Anatomical Observations and Biochemical Profiles and Radiological Images AnatPhysiol, 2016; 6: 224.
39. Alka Mehta, Neeraj K Sethiya, Chetan Mehta, GB Shah Anti-arthritis activity of roots of Hemidesmus indicus R.Br. (Anantmul) in rats Asian Pacific Journal of Tropical Medicine, 2012; 130-135.
40. Baroroh, Sobri, Rachmani, et al Jatropha curcas leaves exert anti-arthritic activity on adjuvant-induced arthritis in rats UniversaMedicina 2014; Vol.33 - No.1-8.
41. H Hosseinzadeh, H Zarei, E Taghiabadi, Antinociceptive, Anti-Inflammatory and Acute Toxicity Effects of Juglans Regia L. Leaves in Mice Iran Red Crescent Med J 2011; 13(1):27-33.
42. Paval J, et al Anti-Arthritic Potential of the Plant Justicia Gendarussa Burm F Clinics 2009; 64(4):357-60.
43. Muhammad Ihtisham Umar Bioactivity-Guided Isolation of Ethyl-p methoxycinnamate, an Anti-inflammatory Constituent, from Kaempferia galanga L. Extracts Molecules, 2012; 17, 8720-8734.
44. Rohit Gundamaraju, D.S Helen Sheeba, C. Ramesh Evaluation of Anti-Arthritic Effects of lantana camara var linn. Using Acute Model on Albino Rats an International Journal of Advances in Pharmaceutical Sciences, 2012; volume 3 issue 5 pages 272-277.
45. Kore K.J., Shete R.V., Desai N.V. Anti-Arthritic activity of Hydroalcoholic extract of LawsoniaInnermis Int. J. Drug Dev. & Res., 2011; 3 (4): 217-224.
46. Mariam Abdul Hussein Kadhem Anti-Arthritic Activity of Ethanolic Extract of LawsoniaInermis in Freund S Adjuvant Induced Arthritic Rats (IOSR-JAVS) 2016;Volume 9, Issue 6 Ver. II, PP 01-06.
47. Li W., Tang Y., Chen Y., Duan J.A. Advances in the chemical analysis and biological activities of chuanxiong. Molecules. 2012;17:10614–10651. doi: 10.3390/molecules170910614. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
48. Yuan X., Han B., Feng Z.M., Jiang J.S., Yang Y.N., Zhang P.C. Chemical constituents of Ligusticum chuanxiong and their anti-inflammation and hepatoprotective activities. Bioorg. Chem. 2020;101:104016. doi: 10.1016/j.bioorg.2020.104016. [PubMed] [CrossRef] [Google Scholar]
49. Du J.C., Xie X.F., Xiong L., Sun C., Peng C. Research progress of chemical constituents and pharmacological activities of essential oil of Ligusticum chuanxiong. Zhongguo Zhong Yao Za Zhi. 2016;41:4328–4333. [PubMed] [Google Scholar]
50. Huang C., Cao X., Chen X., Fu Y., Zhu Y., Chen Z., Luo Q., Li L., Song X., Jia R., et al. A pectic polysaccharide from Ligusticum chuanxiong promotes intestine antioxidant defense in aged mice. Carbohydr. Polym. 2017;174:915–922. doi: 10.1016/j.carbpol.2017.06.122. [PubMed] [CrossRef] [Google Scholar]
51. Ana M. López Mantecón, Gabino Garrido, René Delgado-Hernández and Bárbara B. Garrido-Suárez Combination of Mangifera indica L. Extract Supplementation Plus Methotrexate in Rheumatoid Arthritis Patients: A Pilot Study Phytother. Res. 2014; Pages 1163–1172.
52. Sreeshma PS, Regi Raphael K, Alby Alphons Baby Pharmacognostic Studies of leaves of Naravelia Zeylanica (Linn) DC. South Indian Journal of Biological Sciences 2016; 2(1): 179-182.
53. R. Sutharsingh, S. Kavimani, B. Jayakar, M. Uvarani and A. Thangatirupathi Anti Inflammatory and Anti-Arthritic Activities Of Aerial Parts Of NaraveliaZeylenica (L)Dc. IJRPC, 2011; 1(3): 303-307.
54. Mamatha Karnati, Rodda H Chandra, CiddiVeeresham, and BookyaKishan Anti-arthritic activity of root bark of Oroxylum indicum (L.) vent against adjuvant-induced arthritis Pharmacognosy Res. 2013; 5(2): 121–128.
55. R. Londonkar, A. Kamble, and V. C. Reddy, "Anti-inflammatory activity of Pandanus odoratissimus extract," International Journal of Pharmacology, 2010; vol. 6, pp. 311–314.
56. N. R. Kumar, Sanjeeva, D. Padmalaxmi et al., "Antioxidant activity of methanol extract of Pandanus fascicularisLam,"Journal of Pharmacy Research, 2011; vol. 4, no. 4, pp. 1234–1236.

57. Zhao Q.L., Bian X.K., Qian D.W., Zhang T., Zhu Z.H., Guo S., Yan H., Wang T.J., Chen Z.P., Duan J.A. Comparative study on differences of Paeonia lactiflora from different habitats based on fingerprint and chemometrics. Zhongguo Zhong Yao Za Zhi. 2019;44:3316–3322. [PubMed] [Google Scholar]
58. Ma X., Chi Y.H., Niu M., Zhu Y., Zhao Y.L., Chen Z., Wang J.B., Zhang C.E., Li J.Y., Wang L.F., et al. Metabolomics Coupled with Multivariate Data and Pathway Analysis on Potential Biomarkers in Cholestasis and Intervention Effect of Paeonia lactiflora Pall. Front. Pharmacol. 2016;7:14. doi: 10.3389/fphar.2016.00014. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
59. Zhang L., Wei W. Anti-inflammatory and immunoregulatory effects of paeoniflorin and total glucosides of paeony. Pharmacol. Ther. 2020;207:107452. doi: 10.1016/j.pharmthera.2019.107452. [PubMed] [CrossRef] [Google Scholar]
60. Zhang W., Dai S.M. Mechanisms involved in the therapeutic effects of Paeonia lactiflora Pallas in rheumatoid arthritis. Int. Immunopharmacol. 2012;14:27–31. doi: 10.1016/j.intimp.2012.06.001. [PubMed] [CrossRef] [Google Scholar]
61. Jiang H., Li J., Wang L., Wang S., Nie X., Chen Y., Fu Q., Jiang M., Fu C., He Y. Total glucosides of paeony: A review of its phytochemistry, role in autoimmune diseases, and mechanisms of action. J. Ethnopharmacol. 2020;258:112913. doi: 10.1016/j.jep.2020.112913. [PubMed] [CrossRef] [Google Scholar]
62. Jun Soo Bang, Da Hee Oh et al Anti-inflammatory and antiarthritic effects of piperine in human interleukin 1β-stimulated fibroblast-like synoviocytes and in rat arthritis models Arthritis Research & Therapy 2009, 11:R49
63. Divya Singh, Rahul Nainwani, Tripta Sharma, Rupesh K. Gautam In-Vitro Anti-Inflammatory and Anti-Arthritic Activity of Hydroalcoholic Extract of Pongamia Pinnata (L.) Pierre Seed International Journal of Pharma Research & Review, 2013; 2(12):20-25.
64. Divya Singh, Rahul Nainwani, Amit Gupta in-Vivo Anti-Inflammatory and anti-Arthritic activity of Hydroalcoholic Extract of Pongamia pinnata (l.) Pierre seed Int J Pharm Pharm Sci, 2014; Vol 6, Suppl 2, 798-803.
65. Rupesh k. Gautam, sanjaysharma, komalsharma comparative evaluation of anti-arthritic activity of pongamia pinnata (linn.) Pierre and punica granatum linn. : An in -vitro study Int J Pharm Pharm Sci, 2013; Vol 5, Suppl 4, 721-724.
66. Jaijesh P, Srinivasan KK, Bhagath Kumar P, Sreejith G, Ciraj Am Anti-Arthritic Property Of The Plant Rubia Cordifolia Lin. Pharmacologyonline 1: 2008;107-113.
67. Divya Mani Polireddy Evaluation of Anti-Arthritic Activity of Ethanolic Extract of SidaCardifolia International Journal of Scientific & Technology Research 2015; Volume 4, Issue 11, 86-96.
68. Petchi RR, Vijaya C, Parasuraman S. Anti-arthritic activity of ethanolic extract of Tridax procumbens (Linn.) in Sprague Dawley rats. Pharmacognosy Res. 2013; 5(2):113-7.
69. Ekambaram S, Perumal SS, Subramanian V. Evaluation of antiarthritic activity of Strychnospotatorum Linn seeds in Freund's adjuvant induced arthritic rat model. BMC Complement Altern Med. 2010; 13; 10:56.
70. Bao J., Dai S.M. A Chinese herb Tripterygium wilfordii Hook F in the treatment of rheumatoid arthritis: Mechanism, efficacy, and safety. Rheumatol. Int. 2011;31:1123–1129. doi: 10.1007/s00296-011-1841-y. [PubMed] [CrossRef] [Google Scholar]
71. Zhou Y.Z., Zhao L.D., Chen H., Zhang Y., Wang D.F., Huang L.F., Lv Q.W., Liu B., Li Z., Wei W., et al. Comparison of the impact of Tripterygium wilfordii Hook F and Methotrexate treatment on radiological progression in active rheumatoid arthritis: 2-year follow up of a randomized, non-blinded, controlled study. Arthritis Res. Ther. 2018;20:70. doi: 10.1186/s13075-018-1563-6. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
72. Ananda deeban, Karthic Anand, Lakshmi. T: In vitro Anti Arthritic Activity of Grape Seed Ethanolic Extract International Journal of Pharmacognosy and Phytochemical Research, 2015; 7(5); 977-979.