ISSN- 2230-7346
Journal of Global Trends in Pharmaceutical Sciences

A COMPREHENSIVE REVIEW OF MEDICINAL PLANTS IN THE TREATMENT OF OSTEOARTHRITIS

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ARTICLE INFO

Key words:
medicinal pants, osteoarthritis, joint pain, osteophytes, cartilage degradation activity

Access this article online
Website: https://www.jgtps.com/
Quick Response Code:

ABSTRACT

More people than any other joint disease have affected by osteoarthritis, the clinical condition of joint pain and dysfunction brought on by joint degradation. Osteoarthritis cannot be prevented or its progression slowed down regularly, and many patients receive little relief from symptomatic therapies. About 10% of adults over 60 are disabled by osteoarthritis, which also lowers the quality of life for over 20 million Americans and costs the US economy more than $60 billion annually. Many herbal plants are used to treat osteoarthritis like turmeric, zingiber officinale, aloe vera, allium sativum etc. The phytochemical constituents used in osteoarthritis is polyphenols, flavonoids and terpenoids. The aim of this present study to review systematically all randomized controlled trials on the effectiveness of herbal medicines in the treatment of osteoarthritis.

INTRODUCTION

Osteoarthritis (OA) is a systemic, chronic joint disorder that is classified as primary or secondary OA based on its aetiology. It is characterised by the progressive breakdown of articular cartilage (the end point of OA) as well as changes in the subchondral bone, synovium (synovial inflammation), meniscus, tendons/ligaments, and muscles an (Loeser et al. 2012). OA is a complex disorder with both genetic (altered gene expression patterns of the cartilage and subchondral bone) and non-genetic (age, gender, obesity, mechanical stress, inactive lifestyle, joint trauma, patient occupational activity) components. It can affect every joint in the body, but particularly weight bearing joints in the lower extremities and hands, producing pain and reduced functionality in adults.[1]

GENERAL CHANGES IN BONE AND CARTILAGE IN OSTEO ARTHIRITIS:

Bone: In addition to the eburnation of bone caused by articular cartilage degradation, osteoarthritis (OA) also causes a limited synovitis. Subchondral bone is extensively remodelled, leading to the radiographically detected so-called sclerosis of this tissue. Because of focused resorption, sub-chondral cysts frequently develop in conjunction with these bone alterations. Magnetic resonance imaging shows this to be especially obvious, and the alterations to the bones may also be systemic in nature. Evidence of altered bone metabolism in areas like the iliac crest, which may indicate systemic changes, has been found by Dequeker and his colleague's work. Investigations into the molecular makeup of osteoarthritis (OA) bone have revealed signs of basic alterations in bone metabolism. As a result of bone resorption, deoxypyridinoline cross-links.

Cartilage: The cardinal bone when an anterior cruciate ligament is severed or a partial medial meniscectomy is performed on rabbits, for example, the characteristic loss of articular

cartilage associated with OA may begin as a specific process. By altering loads, focal lesions can grow over time to affect particular joint compartments and cause changes in articulating surfaces. In idiopathic degeneration, the articular surface first demonstrates fibrillation, while in post-traumatic OA, changes in cartilage matrix turnover are prominent days or weeks after joint injury, such as damage to the meniscus or anterior cruciate ligament. Degenerative changes can affect the entire articular cartilage. Initially, splits that are roughly parallel to the articular surface are involved.[2]

Signs and symptoms: One sign of osteoarthritis (OA) is pain that is eased by resting the affected joint. It's badly situated and has a typical character. Joint symptoms do not always correspond to the level of pathological or radiological abnormalities. Just 30% of patients with radiographic evidence of osteoarthritis (OA) report pain at relevant areas; in more advanced cases, pain may induce the patient to wake up from sleep due to weakness and loss of muscle mass. Protective muscular joint splinting is also lost in these people.[3]

General medicinal plants used in treatment of osteoarthritis:

1. Turmeric:

The scientific name of turmeric is *Curcuma longa*. It belongs to the family zingiberaceae. It consists of phytochemical constituents like flavonoids, saponins, tannins, coumarins and phenols. And pharmacological activities are anti-bacterial, anti-inflammatory, antioxidant and antimicrobial activities. Turmeric is a ginger-based spice that is commonly used in Indo-Asian cuisine and traditional eastern medicine. Curcumin is one of turmeric's active components, accounting for around 3% to 10% of the turmeric powder that may be extracted.[4] The isolated curcumin extract (CE) possesses anti-inflammatory effects comparable to nonsteroidal anti-inflammatories.15 CE has been demonstrated to influence the signalling of pro-inflammatory cytokines such as interleukins, phospholipase A2, 5-lipoxygenase enzyme, and COX-2 via NF kappa Beta activity.16 Curcumin's anti-inflammatory characteristics may be especially essential at the chondrocyte level, where it has been demonstrated to prevent macrophage inhibitory factor-induced overexpression of matrix metalloproteinase enzymes MMP-1 (interstitial collagenase) and MMP-3 These enzymes are active in synovial fibroblasts accelerate catabolic changes of the articular cartilage and subsequent development of osteoarthritis.[5]

2. Ginger

The scientific name of ginger is *Zingiber officinale*. It belongs to the family zingiber officinale. It consists of phytochemical constituents like flavonoids, coumarin, and catechins. And pharmacological activities are anti-diabetic, anti-inflammatory and anti-obesity etc. Ginger has been used in Asian medicine for ages, especially to relieve pain in musculoskeletal diseases1. Ginger was referenced in Gale’ns pharmacopeia and by Plinius the Elder for therapeutic purposes3. Since then, ginger has been used in folk medicine and as a popular supplement [6]. Ginger is made up of a complex collection of biologically active ingredients, the majority of which are believed to be gingerols and paradols4. However, there is variation in the composition of ginger products. The relative content in the extraction of ginger is determined by the species of ginger, maturity of the rhizome, climate in which the plants are produced, when collected, and the extraction process. Today, therapy for osteoarthritis (OA) is still geared towards

symptoms, because no disease-modifying medication has been established, and there is ongoing research into prospective symptom-modifying pharmaceuticals with minimum adverse responses. Aside from ginger, various additional herbal remedies and nutraceuticals have been investigated as alternatives to nonsteroidal anti-inflammatory drugs (NSAIDs) in the treatment of osteoarthritis.[7]

3. Eucalyptus:

The scientific name of eucalyptus is *Eucalyptus teriticornis*. It belongs to the family Myrtaceae. It consists of phytochemical constituents like 1,8-cineole, limonene, citronellal, terpinene-4-ol etc. And pharmacological activities are anti-inflammatory, analgesic, antidiabetic, anticancer and antimicrobial etc. Strong radical scavenging activity and antioxidant properties are exhibited by eucalyptus oil, which also contains α-pinene and 1,8-cineol. In a mouse model of pain-causing in the feet, oral administration of 1,8-cineole, which accounts for 70–90% (w/w) of the contents of eucalyptus oil, inhibited edema production and reduced inflammation and pain. The reason for this effect of 1,8-cineole is that it prevents T-lymphocytes from secreting cytokines[8]. Applying eucalyptus oil to a healthy person has been demonstrated using electromyography to have both myorelaxant and emotional stability-promoting effects. Furthermore, eucalyptus oil not only acted as an analgesic but also had an anti-inflammatory and reduced wounds development in a rat model of susceptibility to pain from a hot plate Although eucalyptus oil has been shown in animal models to reduce pain, edema and inflammation, its effects on pain in total knee replacement patients have not been determined. We thus investigated whether eucalyptus oil inhalation may successfully reduce pain and inflammatory reactions in patients who had undergone total knee replacement [9].

4. Black seed:

The scientific name of black seed is *Nigella sativa*. It belongs to the family Ranunculaceae. It consists of phytochemical constituents like mono-terpene, diterpene, sesquiterpenes, and ketone. and pharmacological activities are anti-inflammatory, anti-diabetic, anti-hypertensive and antioxidant etc. Black cumin, or Nigella sativa (NS), is a plant belonging to the Ranunculaceae family that has been eaten safely for thousands of years. In addition to its oral and topical use, experimental evidence has proven its intraperitoneal and intraarticular applications[10].Proven anti-neoplastic, antibacterial, bronchodilatory, hypotensive, hypolipidemic, antidiabetic, and hepatoprotective effects are possessed by the components of black seed oil Thymoquinone (TQ), an active metabolite of NS oil, has been demonstrated to lower TNF-α and IL-1β levels in a rat model of arthritis. Anti-inflammatory properties of NS oil have been documented. In this work, we assessed the chondroprotective effects of intra-articular injection of NS oil in rabbits suffering from osteoarthritis in their knees as a result of anterior cruciate ligament transection.[11]

5. **Flax seed**:

The scientific name of flax seed is *Linum usitatissimum*. It belongs to the family Linaceae. It consists of chemical constituents like steroids, glycosides, saponins, flavonoids, tannins and alkaloids. And pharmacological activities are antidiabetic, antimetabolic, hepatoprotective activities. flaxseed oil contains linolenic acid (ω-6) and ALA (ω-3), two important fatty acids that regulate prostaglandin synthesis and hence promote wound healing. Deficiency in necessary FAs causes phrynoderma or toad skin, sticky eruptions on the limbs, and poor wound healing. The effects of FO on bone composition, mineral content, bone area, fracture toughness, and maximum muscle strength are significant[12]. Flax seeds high content of ALA and ω-3-FA is likely responsible for this impact. Flaxseed supplementation helps to promote bone development in breastfeeding women. Furthermore, in hemodialysis patients with advanced bone disease, augmenting with FO

has been proven to prevent bone reabsorption.may have an impact during early postnatal development and stressful conditions, influencing bone composition and strength. In the case of arthritis, inflammatory chemicals and joint wear are typical causes of painful joints. Studies reveal that FO with anti-inflammatory properties may be useful in arthritis treatment.[13]

6. Aloevera:

The scientific name of aloe vera is *Aloe barbadensis miller*. It belongs to the family Asphodelaceae(Liliaceae). It consists of chemical constituents like aloin, chromone, anthraquinone and catechin. And pharmacological activities are anti-inflammatory, antioxidant, antiviral and antimicrobial activities. Aloe vera can be used as an anti-inflammatory agent on its own or in combination with other medications, particularly NSAIDs. In the case of the latter, any gastroprotective effect against the damage induced by NSAIDs would be extremely beneficial, both in terms of quality of life and cost effectiveness. However, as previously stated, long-term, randomised, controlled studies of pain medications are still required to address the problem of insufficient evidence to inform optimal pain medication administration for persons with Osteoarthritis (Cowan, 2007). This also applies to Aloe Vera. There has been a trend for some time in resorting to complementary medicines, with many patients suffering from pain caused by Osteoarthritis trying unproven supplements, with few of these having been satisfactorily demonstrated.

There is no reason why so-called 'nutraceutical' agents should not undergo the same rigorous randomised, cont. For example, research might be conducted to compare treatment for Osteoarthritis with an oral NSAID against an oral NSAID paired with an oral Aloe vera adjuvant. It is likely that the addition of Aloe vera to NSAIDs can improve the quality of life of Osteoarthritis patients by providing more effective analgesia and reducing the negative effects. [14]

7. Chamomile**:**

The scientific name of chamomile is *Matricaria chamomilla*. It belongs to the family Asteraceae. It consists of phytochemical constituents like flavonoids, coumarins, sesquiterpenes, and polyacetylenes. And pharmacological activities are anti-cancer, anti-diabetic, anti-inflammatory and antiallergic activities. According to the most well-known Traditional Persian Medicine (TPM) texts, chamomile oil, also known as Matricaria chamomilla L. (Asteraceae or Compositae), has a number of therapeutic benefits. Chamomile oil, for example, is mentioned as a nervous system tonic in Ibn-e-Sina or Avicenna's Canon of Medicine, chamomile oil was given for various joint aches, including knee pain. Furthermore, chamomile has been used to treat rheumatic and arthritic pain by several herbal medicines[15]. Chamomile contains a high concentration of terpenoids and flavonoids and may have anti-inflammatory; antioxidant, and antinociceptive properties. Furthermore, chamomile is a safe therapeutic herb, with multiple reports of its external application for a range of ailments on various parts of the human body. Chamomile is included on the "FDAs generally recognised as safe" list of plants. As a result of the aforementioned benefits of chamomile in TPM and the present literature, this study was undertaken to evaluate the efficacy and safety of topical chamomile oil in knee osteoarthritis.[16]

8.**Black pepper:**

The scientific name of black pepper is *Piper nigrum*. It belongs to the family piperaceae.t consists of phytochemical constituents like terpenoids, limonene and alkaloids. And pharmacological activities are antioxidant, anticancer, anti-inflammatory and analgesic properties. Black pepper (Piper nigrum) is often used as a spice in human meals, but it also serves as a medicinal, preservative, and perfume in many Asian countries. Piperine extract, an active phenolic component, is widely documented to have positive physiological benefits. It activates pancreatic digesting enzymes, protects against oxidative

damage, reduces lipid peroxidation, and increases the bioavailability of certain medicinal medications[17]. Furthermore, its anti-inflammatory properties have been revealed in rat models of carrageenan-induced paw edema, cotton pellet-induced granuloma, and croton oil-induced granuloma pouch. Piper species constituents have been proven in vitro to inhibit the enzymes involved for leukotriene and prostaglandin formation, 5-lipoxygenase and COX-1.Bang et al. determined that piperine has antirheumatic effects in animal models and anti-inflammatory effects on IL1β-stimulated fibroblast-like synoviocytes (FLSs). Piperine appears to have favourable benefits on inflammatory disorders that cause significant pain, such as osteoarthritis and rheumatoid arthritis. Piperine has shown excellent therapeutic capabilities in a variety of cell types. However, the significance of piperine in inflammatory reactions in articular chondrocytes remains unclear. In this study, we evaluated if piperine had anti-inflammatory properties in human OA chondrocytes.[18]

9. Guggul:

The scientific name of guggul is *Commiphora mukul*. It belongs to the family burceraceae. It consists of phytochemical constituents like steroids, flavonoids, lignans and triterpenoids. Pharmacological activities are hypolipidemic, anti-obesity, anti-inflammatory, cardioprotective and anti-tumor effects. In Ayurveda, The symptoms of this condition are identical to those of Janu Sandhigata Vata. The comprehensive cure for this condition is still not available in modern medicine; the treatments employed are primarily analgesics, anti-inflammatory agents, and steroids, which cannot pacify the disease but only treat its symptoms. On the other hand, severe side effects such as gastritis, ulceration of the stomach's mucosal layer, heartburn, and vomiting are undesirable outcomes. In other words, late-life osteoarthritis is a Jarajanya vyadhi (ageing sickness). In Ayurveda, snehana, swedana, and guggulu administration in the ailment could be regarded appropriate therapy strategies. Knee traction may be useful in sustaining the reduction of space in osteoarthritis of the knee and in the clinical recovery of the indication. Cartilage is the slippery tissue that surrounds the ends of bones in a joint. Healthy cartilage permits bones to glide over each other. It also absorbs energy from the impact of physical movement. In osteoarthritis, the surface layer of cartilage deteriorates and wears away.[19]

10. **Ashwagandha**:

The scientific name of ashwagandha is *Withania somnifera*. It belongs to the family Solanaceae. It consists of phytochemical constituents like flavonoids, carbohydrates, saponins, tannins and alkaloids. And pharmacological activities are antibacterial, anti-inflammatory, anticancer and neuroprotective activities. Ashwagandha is anti-inflammatory, anti-arthritic, pain-relieving, and anti-stress, among other benefits. Ashwagandha has been found in studies to help reduce pain in osteoarthritis. One study discovered that an ashwagandha extract could lower pain and inflammation in animals with osteoarthritis. Another study indicated that ashwagandha extract could help lower the severity of osteoarthritis symptoms in humans. Ashwagandha may provide various benefits to patients with osteoarthritis. It may reduce inflammation, so relieving pain and swelling. It may also assist to alleviate joint stiffness and increase mobility. Furthermore, ashwagandha is an antioxidant, thus it may help to prevent the joints from future injury. Overall, ashwagandha may be a good supplement for patients with osteoarthritis. One of these potential remedies is Ashwagandha (W. somnifera), an Ayurvedic herb commonly used in traditional Indian medicine to treat a number of ailments such as arthritis, painful swelling, ulcers, fever, eyesores, diabetes.[20]

CONCLUSION:

Herbal plants such as turmeric, ginger, guggul, black pepper, chamomile, ashwagandha,flax seed, aloe vera, black seed and eucalyptus contain anti-inflammatory and pain-relieving qualities that can help manage osteoarthritis symptoms. Furthermore, supplements

including glucosamine and chondroitin derived from natural sources such as shellfish have showed promise in improving joint health. However, herbal medicines should be used with caution because they may interfere with drugs or cause negative effects. Individuals with osteoarthritis should always consult with a healthcare practitioner before introducing herbal therapies into their regimen.

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