



The Potential of *Nyctanthes arbor-tristis* in Arthritis Management

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ABSTRACT

Nyctanthes arbor-tristis, or night flowering jasmine has therapeutic properties and has been used in Ayurveda for centuries. This review discusses its possible application in arthritis treatment, highlighting its anti-inflammatory, analgesic, and immunomodulatory effects. Alkaloids, flavonoids and essential oils contained in the plant are primarily responsible for the positive effects on arthritis symptoms; the authors of the study note. Studies emphasize its role in the regulation of inflammatory processes, pain alleviation and improvement in joint mobility, making it a possible therapeutic alternative for arthritis. This review discusses the active compounds, mechanisms of action, and clinical evidence, illustrating the potential of the plant in arthritis management.

KEYWORDS: *Nyctanthes arbor-tristis*, arthritis, anti-inflammatory, analgesic, clinical evidence, therapeutic properties.

Introduction

Arthritis is an umbrella term used for a range of conditions that cause inflammation (Oedema) of joints leading to pain, swelling, and stiffness. It affects one or more joints, causing stiffness and pain. The two most common types are osteoarthritis, which happens as a result of wear and tear, and rheumatoid arthritis, an autoimmune disorder that causes the body to attack its own joints. Others include gout, lupus and psoriatic arthritis.” Arthritis can affect people of all ages and vary from mild to severe. Treatment usually centers on symptom management, maintaining joint function and preventing further damage.

Nonsteroidal anti-inflammatory drugs (NSAIDs) and steroids are often used to relieve symptoms like pain and inflammation, but these are only temporary solutions and can also cause side effects to some degree.

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) (e.g., ibuprofen, aspirin)

NSAIDs are frequently used to relieve pain and inflammation in arthritis patients. Although they provide short-term relief of symptoms they do not really address the etiology of the disease. But there are multiple downsides to the chronic use of NSAIDs:

- **Temporary Relief:** NSAIDs are effective at providing temporary pain and inflammation relief but do not change the course of arthritis.
- **Gastrointestinal Issues:** Long-term use of NSAIDs can cause gastrointestinal problems, including irritation, ulcers, and bleeding, which can be especially concerning for those with pre-existing digestive disorders.
- **Kidney Damage:** Using NSAIDs over an extended period can affect kidney function adversely, particularly in individuals with previous kidney problems, and might cause kidney damage.
- **Increased Risk of Cardiovascular Events:** Long-term use of NSAIDs has been associated with an increased risk of cardiovascular events, such as heart attack and stroke, particularly in people who are already at risk.

Steroids (e.g., prednisone)

Medication: Steroids such as prednisone are commonly prescribed to help quickly suppress inflammation during arthritis flares. Despite their effectiveness at suppressing inflammation, extended courses of steroids can cause severe adverse events that include:

- **Decreased Inflammation During Flare-Ups:** They really work when it comes to decreasing inflammation quickly, providing relief during flare-ups, so they are a must-have when dealing with acute arthritis symptoms.
- **Compromised Immune System:** Prolonged use of steroids can also suppress the immune system, putting the body at a greater risk of infections and other complications.
- **Osteoporosis:** Long-term steroid treatment can lead to a reduction in bone density, increasing the risk of fractures and other skeletal problems.
- **Fluid Retention and Mood Changes:** Steroids can retain water in the body, which result in weight gain, and they can also cause mood swings, irritability, or anxiety, impacting quality of life.

- Hormonal disturbances: Long-term usage of steroids can interrupt the normal production of corticosteroids in the body, also leading to adrenal suppression and dependency on steroids therapy.

The Future of Pain Management: The Potential Application of *Nyctanthes arbor-tristis* as a Natural Analgesic

Night-flowering Jasmine (Parijat) (*Nyctanthes arbor-tristis*), this is an extremely popular Ayurvedic herb to treat pains and inflammation. This plant hails from Southeast Asia and has been used for centuries due to its medicinal properties.

Nyctanthes arbor-tristis is quite popularly used for treating the swelling, joint pain and inflammation in Ayurveda. Compounds in the plant's leaves, flowers and roots are thought to be pain-relieving and anti-inflammatory. Used to help treat conditions like arthritis, gout and other inflammatory woes, its use is well-known.

An array of alkaloids, flavonoids and antioxidants make for a powerful blend responsible for its therapeutic effects, helping to reduce inflammation and relieve pain. According to Ayurveda, the importance of *Nyctanthes arbor-tristis* is that it provides a natural, safer treatment for chronic pain and inflammation as compared to conventional medicines like NSAIDs and steroids that have their own serious side effects.

Objective of the Review:

This review aims to reveal the anti-arthritic potential of *Nyctanthes arbor-tristis* focusing on its phytochemical profile, therapeutic potential and clinical significance. They achieve this by delivering a comprehensive review of the bioactive constituents, pharmacological activities, and potential therapeutic functions in arthritis.

Phytochemistry of *Nyctanthes arbor-tristis*

Night jasmine or Parijat (*Nyctanthes arbor-tristis*) is screened as having broad and extensive study of its phytochemical properties on the human body in previous reports, especially concluded beneficial in managing inflammatory diseases as arthritis. Many bioactive molecules (alkaloids, flavonoids, glycosides, triterpenoids, phenolic compounds, and essential oils) found in plant extracts are responsible for its pharmacological activities.

1. Alkaloids

Nyctanthine, an alkaloid and a major bioactive component of *Nyctanthes arbor tritis*. They are the primary contributors to the plant's anti-inflammatory pain-relieving benefits — hence its use for arthritis in alleviating pain and inflammation. These alkaloids affect cellular pathways implicated in inflammation, thus further enhancing the overall therapeutics activity of the mother plant.

2. Flavonoids

Nyctanthes arbor-tristis contains flavonoids such as quercetin and kaempferol. Known for their potent antioxidant and anti-inflammatory properties, these compounds. To decrease oxidative stress usually elevated in inflammatory diseases like arthritis, flavonoids by scavenging free radicals. The MOS also has an antioxidant action, which helps to alleviate inflammation and protects cells from damage.

3. Glycosides

It has numerous glycosides responsible for its therapeutic effects. These constituents increase the plant's immune-modulatory and anti-inflammatory actions. Glycosides have also been used to treat inflammatory disorders, as they reduce joint swelling and aid immune function. Glycosides are sometimes used as a remedy for inflammatory disorders such as arthritis.

4. Triterpenoids

Hippocranine alkaloid exhibited significant anti-inflammatory and analgesic activities. These compounds indeed help alleviate pain and inflammation, reinforcing the plant's use in relation to joint-related complaints. Inhibitory mechanisms on important inflammatory mediators via triterpenoids may also contribute to pain-relieving potentials in inflammatory conditions.

5. Phenolic Compounds

Contains phenolic compound which has high antioxidant activity. These compounds are vital to neutralizing free radicals, reducing oxidative stress and fighting cellular damage. Less oxidative damage means less ongoing inflammation, which is particularly valuable when dealing with chronic inflammatory conditions like arthritis.

6. Essential Oils

Nyctanthes arbor-tristis essential oils also add therapeutic value. The anti-inflammatory, antimicrobial and analgesic properties of these oils are among the reasons why this plant is effective in treating pain and inflammation. The essential oils enhance the plant's other compounds that benefit joint function and reduce pain in those with arthritis.

Biological Activities of *Nyctanthes arbor-tristis* in Treating Arthritis

Nyctanthes arbor-tristis (Night-flowering Jasmine or Parijat) has number of pharmaceutical properties that could be useful and us a natural meaning to manage our arthritis. The different bioactive compounds in the plant target multiple steps in the pathophysiological process of arthritis, including inflammation and pain, oxidative injury, immune dysfunction and cartilage destruction. Mechanism of action of *Nyctanthes arbor-tristis* in treatment of arthritis:

1. Anti-inflammatory Effects

The alkaloids, flavonoids, triterpenoids, and glycosides are responsible for *nyctanthes arbor-tristis*'s very strong anti-inflammatory activities. These compounds inhibit vital pro-inflammatory enzymes, such as cyclooxygenase (COX), lipoxygenase (LOX), and pro-inflammatory cytokines, that is,

TNF- α , IL-1, IL-6, and it reduces inflammation. Reduction of these inflammatory mediators also eases joint swelling and inflammation, key symptoms of arthritis.

2. Pain (Analgesic) Effects

Pain relieving effects are due to the presence of alkaloids and triterpenoids in *Nyctanthes arbor-tristis*. These compounds work by blocking pain pathways in the body, including downregulation of pain-triggering substances such as prostaglandins and bradykinin. This relieves chronic arthritis-related pain and improves the patient's quality of life.

3. Antioxidant Effects

Flavonoids and phenolic compounds of *Nyctanthes arbor-tristis* serve as strong antioxidants which help to neutralize the free radicals and reactive oxygen species (ROS). Oxidative stress plays an important role in the progression of arthritis; By decreasing this stress these compounds protect joint tissues including cartilage and synovial fluid and slow the progression of the disease.

4. Modulation of Immune Function

Nyctanthes arbor-tristis contains glycosides and alkaloids that modulate immune system activity. These compounds help protect against the hyperactivity of immune cells, which is critical for autoimmune varieties of arthritis, including rheumatoid arthritis. *Nyctanthes arbor-tristis* is antimicrobial and acts to modulate aspects of the immune response, limiting the attack of the immune system on the joints and preventing inflammation and joint damage.

5. Disease Modifying Action in Cartilage Destruction

Certain bioactive compounds in *Nyctanthes arbor-tristis* may help prevent cartilage degradation by preventing the activity of matrix metalloproteinase, as seen in conditions such as osteoarthritis where joint tissues are degraded by such degrading enzymes. This mechanistic restorative effect is an important contributor to the functional maintenance of the joint through its lifecycle.

6. Antimicrobial Effects

Nyctanthes arbor-tristis also has antimicrobial properties that can help prevent infections which may aggravate arthritis symptoms as most essential oils extracted from *Nyctanthes arbor-tristis*. In people with diminished immunity, or those on chronic medication, there can be infections that worsen the inflammation, and the plant's antimicrobials can offset associated complications.

7. Improvement in Joint Function

Nyctanthes arbor-tristis enhances the range of movement and flexibility in joints by decreasing inflammation, minimizing pain, and regulating the immune system. This is especially useful for people who suffer from arthritis and have stiff joints that have limited range of motion. The effects of the plant help to rehabilitate joints, improving daily activities and quality of life.

Anti-inflammatory Properties of *Nyctanthes arbor-tristis*.

Nyctanthes arbor-tristis (known as Nightflowering Jasmine or Parijat) has therapeutic attributes which have strong anti-inflammatory properties good for inflammatory disorders like arthritis. The inflammation that is a hallmark of arthritis is caused by recruitment of a number of proinflammatory pathways in the body, such as release of inflammatory cytokines and enzymes. Determining the therapeutic potential of *Nyctanthes arbor-tristis* involves understanding the underlying mechanisms by which it exerts its effects on these processes ultimately leading to reduction of pain, swelling and tissue damage. Below is a summary of how the plant helps exert anti-inflammatory properties:

1. Inhibition of Inflammatory Enzymes

Alkaloids and triterpenoids from *Nyctanthes arbor-tristis* contribute significantly to COX and LOX inhibition for the formation of pro-inflammatory prostaglandins and leukotrienes. These compounds propel the inflammatory response and promote pain in diseases like arthritis. *Nyctanthes arbor-tristis* suppresses both COX and LOX that helps with reducing inflammation (and related pain) in the joints due to arthritis.

2. Decreased Inflammatory Cytokines

Recent studies shown that Flavonoids and Glycosides in *Nyctanthes arbor-tristis* decreases the production of essential inflammatory cytokine like TNF- α , IL-1, IL-6. These cytokines can drive chronic inflammation and joint destruction seen in autoimmune diseases such as rheumatoid arthritis. These substances play a huge role in weakening the chronic inflammatory processes that cause the degradation of tissues in joints, which is one of the most frightening diseases today — *Nyctanthes arbor-tristis* will help lower their levels.

3. Effects on Inflammatory Pathways

Nyctanthes arbor-tristis bioactive components also modulate inflammatory signaling pathways in cells. In particular, they are able to modulate the nuclear factor-kappa B (NF- κ B) pathway, thereby affecting the expression of several inflammatory mediators. *Nyctanthes arbor-tristis* also contributes to controlling joint inflammation by modulating NF- κ B activation and thus attenuating the inflammatory response cascade.

4. Inflammation through the Antioxidant Role

Nyctanthes arbor-tristis contains flavonoids and phenolic compounds, which play a role in anti-inflammatory action through free radical and reactive oxygen species (ROS) quenching¹⁵. One of the key triggers for inflammation in arthritis is oxidative stress — an imbalance in the body between free radicals and antioxidants that can damage cells, proteins, and genes. These antioxidant compounds combat oxidative damage, which may further aggravate inflammation and damage joints.

5. Regulation of Immune Response

Nyctanthes arbor-tristis not only exerts direct anti-inflammatory actions, but also regulates the immune system. This regulates immune cell activity, which helps prevent the excessive immune response seen in autoimmune types of arthritis. The mutant SOD1 knock-in system has been shown to regulate the immune system in such a way as to diminish the chronic inflammation seen in diseases like RA, thus protecting the joints from further injury mediated by the immune system.

The Analgesic Effect of *Nyctanthes arbor-tristis* on Pain

Nyctanthes arbor-tristis (Parijat or Night-flowering Jasmine) are revered to alleviate pain and help in conditions like arthritis. The plant's analgesic effects arise from its multitude of bioactive agents that complement one another and play a role in alleviating pain and enhancing the quality of life for chronic pain patients. Here are the sections explaining the contribution of *Nyctanthes arbor-tristis* in the case of pain relief:

1. Blocking Pain-Causing Agents

Alkaloid and Triterpenoids obtained from *Nyctanthes arbor-tristis* are effective in stopping the synthesis of pain-producing substances like Prostaglandin and bradykinin. These chemicals play a role in activating pain receptors in the body. *Nyctanthes arbor-tristis* reduces the pain and discomfort because of lower levels in them useful in the management of chronic pain seen in arthritis.

2. Modulation of Pain Pathways

Compounds in the plant also interact with the body's pain signaling mechanisms. They act on certain receptors that play a role in sending pain signals, such as opioid receptors, thus helping to alleviate the perception of pain. This action helps to enhance the overall pain-relieving effects of the *Nyctanthes arbor-tristis*, as it provides relief for individuals suffering from chronic pain due to ailments such as arthritis.

3. Relieving Pain Associated With Inflammation

Since inflammation is one of the leading factors behind pain in the case of arthritis, *Nyctanthes arbor-tristis*' anti-inflammatory actions indirectly also have analgesic effects. This works by decreasing inflammation by inhibiting the release of inflammatory mediators such as cytokines and enzymes which reduces the pressure and irritation in the joints thus relieving pain associated with arthritis.

4. Central Nervous System Influence

There's some evidence that certain compounds in *Nyctanthes arbor-tristis* have some CNS (central nervous system) influence in how pain signals are processed by the brain. These compounds influence neurotransmitter activity which inhibits the sensation of pain and helps also alleviate chronic pain due to inflammation such as in arthritis.

5. Joint Action of Different Compounds

The synergistic effect of its various bioactive compounds, like flavonoids, glycosides, and essential oils, have been proven to promote analgesic activity. This combination of compounds creates a combined analgesic effect, stronger and more sustained than any individual active compound could achieve alone, contributing to longer pain relief.

Nyctanthes arbor-tristis: A Review of Its Immunomodulatory Activities

Nyctanthes arbor-tristis (Night-flowering Jasmine or Parijat) has important immunomodulatory action, which is essential for regulating the immune system, especially in inflammatory diseases like arthritis. These effects are mediated by various bioactive compounds found within the plant, which can up- or down-regulate immune responses as necessary, thus aiding in the maintenance of immune homeostasis. Here is how *Nyctanthes arbor-tristis* affects immunity:

1. Immune Cell Activity Regulation

Alkaloids and glycosides which are bioactive compounds in *Nyctanthes arbor-tristis* modulate T-cells, B-cells, and macrophages activity. By inhibiting the activity of such cells, *Nyctanthes arbor-tristis* ensures an optimum activity of the immune system, preventing it from over-reacting, that is attacking the body's healthy tissues which is the hallmark of autoimmune diseases such as rheumatoid arthritis.

2. Regulation of Cytokine Production

It is also involved in cytokine upregulation, the signaling molecules involved in regulating immune and inflammatory responses. In conditions such as arthritis, pro-inflammatory cytokines, such as TNF- α , IL-1, and IL-6 play a role in promoting inflammation. Its selective action on these cytokines can help reduce the excessive immune response, which in turn helps to control the inflammation and prevents further damage to the joints.

3. Balance Th1/Th2 Immune Responses

Nyctanthes arbor-tristis had been acting as an immunoregulator, regulating the Th1 pathway and Th2 pathway and keeping a homeostasis immune response. These signaling pathways play a key role in shaping effector functions of the immune response. In autoimmune diseases, like rheumatoid arthritis, dysregulation of these pathways leads to increased inflammation and damage to the tissue. Bioactive compounds from the plant modulate the activity of immune subsets and restore balance to the immune response, allowing for a smoother, less damaging process.

4. Anti-autoimmune Activity

In autoimmune diseases, the immune system turns against the body's own tissues. *Nyctanthes arbor-tristis* has the potential to prevent this at the level of regulating the activation of the immune system. Its compounds help to quiet the frenzied response to an immune attack, a significant contributor to autoimmune degenerates like rheumatoid arthritis, diminishing the danger of joint devastation.

Collectively termed the Inhibition of Inflammatory Mediators

Inhibition of immune cell activation and modulation of inflammatory mediator secretion by *Nyctanthes arbor-tristis* prevents inflammation from becoming a self-perpetuating cycle. This is especially important in conditions like arthritis where chronic inflammation can cause tissue damage. The therapeutic plant has immunomodulatory effects that mitigate this ongoing inflammation, helping to maintain joint function and preventing further joint degradation.

Limitations and Future Perspectives

Non-steroidal anti-inflammatory drugs (NSAIDs) and steroids are traditionally used to relieve the symptoms of arthritis; however, they have several limitations such as side effects and inability to target the mechanism of action in the disease. They can cause serious complications like gastro-intestinal problems, kidney damage, heart problems, and immune suppression if used over a longer period. These limitations highlight the critical necessity for alternative treatment options that are more effective and less harmful.

Limitations of Current Therapeutic Approaches

1. **Safety Profile:** NSAIDs and steroids have wide-ranging side effects, with digestive problems, cardiovascular risks, bone thinning and immune suppression. Such side effects restrict the long-term use of these drugs in particular for people who require ongoing arthritis treatment.
2. **Symptom relief vs. disease modification:** While NSAIDs and steroids are effective at getting rid of painful swollen joints, they do nothing to halt the path of the disease. They act mainly as symptomatic treatments, therefore, not providing long-term disease-modifying approaches.
3. **Addiction/Dependence:** The long-term use of steroids can result in addiction, adrenal suppression and other medical problems that make it challenging to safely stop using steroids. These risks are especially relevant in patients with chronic arthritis, especially the elderly.

New Therapies: Therapeutic Novelty and Directions for Charity

Therefore even more seek alternative treatment of many diseases, the common over-the-counter drugs have limitations in these so the most of us prefer herbal remedies for lesser side combined effect also is safest in a long run. In this regard, plants instead of chemical drugs, e.g. *Nyctanthes arbor-tristis*, possessing anti-inflammatory, anti-pain and immune-regulatory effects are potential candidates to be employed in this area. These herbal contraindications should be validated by clinical trials to prove their safety and efficacy systemically.

1. **Still more targeted approaches in biologics:** Biologic therapies — these are medications that block specific pathways in the immune system — are an even more targeted approach to arthritis treatment. These therapies target the inflammatory pathways propagating the disease rather than just symptom control. We look forward to seeing more studies in the future, on how to achieve the best out of biologics with regard to costing and risk of infections.
2. **The Future of Disease-Modifying Agents:** Given the increasing knowledge regarding the genetic and molecular basis of arthritis, we can expect additional targeted disease-modifying agents to become developed in the coming years. An article titled “Cancer generation in prostata cells with a mutated copy of Krüppel-like factor 4” There is an urgent need for studying biomarkers in relation to disease progression and treatment response.
3. **Regenerative Medicine for Joint Repair:** In Osteoarthritis where the cartilage between joints gets worn stem cell therapy and tissue regeneration techniques can be used to regenerate damaged cartilage and joint tissues. Still in the experimental phase, however, these strategies could provide long-term solutions that target the root cause of joint degradation, eliminating the need for more invasive intervention like joint replacement.
4. **Combination Therapies:** On the other hand, the future may see combination therapies that integrate medication, biologics, and herbal remedies to not only manage arthritis symptoms but also address the condition's root causes. This integrative therapy arrives at a much more multidimensional approach to maximize therapeutic results than any standalone technique, and will provide better clinical outcomes without the weaknesses and deleterious aspects of a sole treatment modality.

Conclusion

Nyctanthes arbor-tristis (Night-flowering Jasmine), offers a promising natural therapeutic alternative to arthritis as this possesses robust anti-inflammatory, analgesic, and immune-modulator properties. The plant is rich in many bioactive components such as alkaloids, flavonoids, glycosides, triterpenoids and essential oils, which all play a role in its biological activity. These compounds act synergistically to decrease inflammation, analgesia, and moderate immune system activity, providing a potential alternative to standard arthritis therapy, including NSAIDs and steroids, both of which can be detrimental in the long term.

Although empirical studies and folk applications seem to indicate that *Nyctanthes arbor-tristis* has potential applications in the treatment of arthritis, there is much room for improvement in terms of clinical studies to ultimately establish the safety, effectiveness, and long-time effects of *Nyctanthes arbor-tristis* on arthritis. Due to its favorable therapeutic profile and low risk of adverse effects, this plant could be a valuable adjunct or substitute for currently used medicines for arthritis and provide a safer and perhaps more sustainable treatment option for patients.

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