

SYSTEMATIC REVIEW ON MEDICINAL HERBS SHOWING ANTI-INFLAMMATORY ACTIVITY

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Abstract: Botanical medicine and phytomedicine are other names for herbal medicine. Herbalism is a form of traditional medicine or folk medicine that relies on the use of plant materials for medicinal purposes, such as seeds, berries, roots, bark, flowers, and extracts. Different plants contain different active ingredients, and these ingredients can vary in both their level of activity and concentration. The word "INFLAMMATION" is derived from the Latin word for ignite, which actually means to burn or blaze. It describes how live tissue responds to all types of injury and includes cellular, humoral, neuralgic, and vascular responses at the site of injury.

Keywords: Inflammation, Medicinal Herbs, Anti-inflammatory Activity.

Introduction

A series of actions that take place in reaction to unpleasant stimuli, infection, or trauma can be referred to as the inflammatory process¹. Localized redness, swelling, discomfort, heat, and loss of function are indications of inflammation. Kinins, eicosanoids, complement proteins, histamine, and monokines are only a few of the chemical mediators that generate and regulate the inflammatory events that underlie these manifestations². The most widely prescribed medications worldwide are NSAIDs. One of the greatest pharmacological classes for preventing and treating postoperative pain is the NSAID class³.

Following are the two types of inflammation:

- A. Acute inflammation
- B. Chronic inflammation

A. Acute inflammation

Acute inflammation is the inflammation which starts quickly. It becomes severe in a short while. It can be an early reaction of the body to detrimental stimuli and then its rapid onset of action appears for a few days⁴.

B. Chronic inflammation

Chronic inflammation is also referred to as slow, long-term inflammation lasting several months to years. Generally, the extent and effects of chronic inflammation vary with the cause of the injury and the ability of the body to repair and overcome the damage.⁵

Inflammation's Function

Inflammation, which is a component of the immune response, is crucial in protecting the body from pathogens like viruses, bacteria, fungus, and other parasites. Leukocytes, erythrocytes, and plasma constituents are released into the afflicted tissue during acute inflammation. Chronic inflammation may develop if the inflammation is not treated⁶.

Chronic inflammation is caused by biochemical factors such as dietary fat imbalance, a lack of particular chemicals that negatively affect the development of anti-inflammatory cells, and specific nutrient deficiencies⁷.

The causes of inflammation are

The inflammatory process is a generation of prostaglandin, interleukin or other chemo toxin, action of sticky protein receptors, and platelet-activating factors, among many others. They can all function as chemotactic agonists. When the membrane is under stress or is exposed to other stimuli, phospholipase A hydrolyzes the membrane phospholipid into arachidonic acid, which then serves as a substrate for the enzymes cyclooxygenase and lipoxygenase. As a result, prostaglandins PGE₂, PGH₂, and leukotrienes such as LTC₄, LTB₄, and others are produced⁸⁻¹¹.

Medicinal Herbs With Anti-Inflammatory Activity

Aegle marmelos (Rutaceae)

Aegle marmelos Roxb, a member of the Rutaceae family, is most well known by the name "bilva." For anti-inflammatory properties, the root of Aegle marmelos is extracted in water. The root bark of A. marmelos has been produced as an aqueous extract. It is used to test the anti-inflammatory effects of carrageenan on albino rats with paw edema. The medication indomethacin has been used frequently. According to research, A. marmelos has anti-inflammatory properties¹².

Bryophyllum pinnatum (Crassulaceae)

Life-Plant, Pan-Futi The common name for Bryophyllum pinnatum, a member of the Crassulaceae family, is ghamari. The study's goal is to investigate anti-inflammatory. B. pinnatum's aqueous leaf extract has been developed. In various research animal models, it is employed for anti-inflammatory action. In this investigation, the anti-inflammatory activity is studied using a paw edema model. There has been use of the common medication Diclofenac (100 mg/kg). The outcomes of many experimental animal studies showed that aqueous extract of B. pinnatum has anti-inflammatory effect¹³.

Moringa oliefera (Moringaceae)

The Moringa oliefera plant, which is a member of the Moringaceae family, is also known as the "drumstick tree." For anti-inflammatory action, the stem bark of M. oliefera is extracted either ethanolic or aqueous. At the dose (300 mg/kg body

weight), the ethanolic and aqueous extracts of *M. olifera*'s stem bark exhibit anti-inflammatory effect in paw edema. Diclofenac sodium has been used as a common medication¹⁴

Cassia fistula (Caesalpiniaceae)

The common name for *Cassia fistula*, a member of the Caesalpiniaceae family, is Indian laburnum. The bark component has anti-inflammatory properties. The aqueous bark extract of *C. fistula* showed that rats have anti-inflammatory action, either acute or chronic. The research shows that this medication has anti-inflammatory properties¹⁵

Mangifera indica (Anacardiaceae)

Mangifera indica Linn, a member of the *Mangifera indica* genus, is known by the common name "mango," or "Aam." Both tropical and subtropical regions are where it rises. Parts of the *M. indica* plant are frequently used in traditional medicine to treat various ailments. It has been reported that *M. indica* possesses anti-inflammatory properties. There have been claims that the ethyl acetate or ethanolic extracts of *M. indica* roots have potent anti-inflammatory properties. Diclofenac sodium, a common medication, is compared to the effectiveness of several extracts¹⁶

Zingiber officinale (Zingiberaceae) *Zingiber officinale*, a member of the Zingiberaceae family, is sometimes known as adrak or zinziber. Acute inflammation or chronic inflammation models have been used to determine the antiinflammatory efficacy of *Z. officinale* ethanolic extract.

Hibiscus rosa sinensis (Malvaceae)

The common name for *H. rosa sinensis*, a member of the Malvaceae family, is hibiscus. *Hibiscus rosa sinensis* leaf methanolic extract is used for its anti-inflammatory properties. Rat paw edema has been induced using carrageenin and dextran in an anti-inflammatory paradigm. The widely used medication, indomethacin, has potent anti-inflammatory properties. The dosage of the plant extract has been 250 and 500 mg/kg body weight orally. The outcomes of the experiment demonstrate anti-inflammatory properties¹⁷

Sida cordifolia (Malvaceae)

Sida cordifolia, also known as heart-leaf sida, is the popular name for *Sida cordifolia* Linn, a member of the Malvaceae family. The acute anti-inflammatory toxicity of *S. cordifolia*'s aqueous extract has been studied in animal models. The manufactured extract makes use of leaves that were created before the flowering season. At a dose of 400 mg/kg orally, aqueous extract significantly inhibits the development of carrageenin-induced rat paw edema. *S. cordifolia*'s aqueous extract exhibits decreased acute toxicity in mice¹⁸

Emblica officinalis (Euphorbiaceae)

The tree *Emblica officinalis*, which is a member of the Euphorbiaceae family and grows in tropical and subtropical regions of China, India, etc., is known by the common name "amla." For anti-inflammatory action, plant leaf extract in methanol is employed. For acute inflammation in rats, carrageenan, serotonin, and histamine-induced subplantar injection have been employed. The findings suggest that *E. officinalis* extracts in both aqueous and alcoholic form have strong anti-inflammatory properties. *E. officinalis* protects against both acute and chronic inflammatory diseases, according to the findings.

Albizia lebbek (Mimosaceae)

The common names for *Albizia lebbek* Benth, a member of the Mimosaceae family, are "lebbek tree" and "flea tree." The carrageenan-induced paw-edema paradigm in rats is utilized to test the anti-inflammatory activities of the ethyl-acetate and methanolic extract of *A. lebbek*. The dosing range for the plant extract is 200–400 mg/kg¹⁹

Cassia occidentalis (Caesalpiniaceae)

The common name for *Cassia occidentalis*, a member of the Caesalpiniaceae family, is coffee senna. Anti-inflammatory activity of *C. occidentalis* is evaluated throughout the plant. Using a carrageenan-induced paw-edema model, an ethanolic extract of *C. occidentalis* with potential dose of 250 mg per kg is used to examine its anti-inflammatory activities. The results demonstrate that, at a dose of 250 mg/kg, carrageenan dramatically reduced inflammation in mice²⁰

Cynodon dactylon (Poaceae)

The common name for *Cynodon dactylon*, a member of the Poaceae family, is "Scutch, dhoob." The anti-inflammatory properties of *C. dactylon*'s aqueous extract have been investigated at many oral doses of 200, 400, and 600 mg/kg utilizing the cotton pellet technique, carrageenan, serotonin, dextran, and histamine-induced rat paw edema. It has been discovered that these two extracts have less anti-inflammatory effect²¹

Aloe vera (Liliaceae)

Aloe barbadensis Linn, a member of the Liliaceae family, is most often known by the name "aloe vera." For severe inflammation, the leaves' fresh juice is recommended. Juice extracts in aqueous or chloroform have been reported to stop irritation brought on by carrageenan (Shih and Chang, 2007). Fresh leaf juice of *A. vera* has been found to have anti-inflammatory properties that stop carrageenan-induced rat paw edema. Ibuprofen is a common medication that has potent anti-inflammatory effects. But while the fresh juice has been successful in treating acute inflammation, it has failed to do so in treating chronic inflammation²²

Calotropis procera (Asclepiadaceae)

The Asclepiadaceae plant *Calotropis procera* (Ait) R Br is also known as the rubber bush or rubber tree. It is a growing tropical plant in nature. It exhibits a number of therapeutic qualities. Various plant parts have been reported to contain ethanolic extracts that have a wide spectrum of anti-inflammatory properties. Rats' paw edema caused by carrageenan and formalin is prevented by the aqueous and acetone extracts of dry latex. Compared to phenyl butazone, a common anti-inflammatory medicine, dried latex from *C. procera* has proven to be more effective in treating edema brought on by carrageenin²³

Cissus trifoliata (Vitaceae)

Bolontibi, also known as marine ivy or possum grape, is the common name for the plant *Cissus trifoliata* Rott, a member of the Vitaceae family. It guards against rheumatoid arthritis. The ethanolic root extract exhibits anti-inflammatory action in rat and mouse models of arthritis, carrageenan-induced edema, and formaldehyde intoxication. In both acute and chronic inflammation, phenylbutazone is a common medication.

Ambrosia artemisiaefolia (Compositae)

Tamaris is the common name for the Compositae family plant *Ambrosia artemisiaefolia* Linn. The leaves are applied topically to treat inflammation. Arthritis is avoided by using leaf juice. The ethanolic leaf extract has been shown to protect rats from inflammation brought on by carrageenan and croton oil.

Curcuma longa (Zingiberaceae)

The Zingiberaceae plant species *Curcuma longa* is often known as turmeric or haldi. Rats' paw edema or formaldehyde production when exposed to carrageenan is inhibited by the dried rhizome of *C. longa*. The main inflammatory mediators present in the methanolic and aqueous extracts of *C. longa* exhibit anti-inflammatory action. To assess their inhibitory effect on the onset of inflammation-related paw edema in rats, two models of inflammation—cotton pellet and granuloma pouch—are employed. *C. longa* performs roughly as well as phenyl butazone in the carrageenin-induced edema test. The medicine has been shown in experimental studies to be less harmful than the typical drug²⁴

Ficus platyphylla (Moraceae)

The common name for *F. platyphylla* DelHoll, a member of the Moraceae family, is gamji. Acetyl salicylic acid is a common medication used to treat inflammation, along with aqueous extracts of the root and bark. Experimental research demonstrates that plant extracts in aqueous and methanolic form reduce egg albumin-induced rat paw edema.

Entada abyssinica (Mimosaceae)

Splinter bean is the common name for the Mimosaceae plant species *E. abyssinica* Steud. ExA. Rich. Plants have been used to treat arthritis pain in the past. The methanolic extract of *E. abyssinica* leaf indicates a model for anti-inflammatory potential. Results show which *E. abyssinica* methanolic extract reduces inflammation in paw edema brought on by carrageenan.

Butea frondosa (Papilionaceae)

Butea frondosa Koen, Ex Roxb., a member of the papilionaceae family, is more well known by the name Palash. To treat inflammatory diseases, the leaves are employed. *B. frondosa*'s aqueous leaf extract exhibits anti-inflammatory properties in rat paw edema caused by carrageenan. An experimental investigation showed that the anti-inflammatory effects were notable or on par with those of ibuprofen.

Calligonum comosum (Polygonaceae)

The common name for *Calligonum comosum* L. Hert., a member of the Polygonaceae family, is "fire bush." The experimental study demonstrates that the ethanolic extract of the various *C. comosum* sections reduces the growth of edema in the hind paws brought on by carrageenan²⁵

Aconitum heterophyllum (Valeraneaceae)

The common names for *A. heterophyllum*, a member of the Valeraneaceae family, are Ativisha or Patisis. Rheumatoid arthritis is treated with *A. heterophyllum*. Through the suppression of prostaglandin pathways, the ethanolic root extract of *A. heterophyllum* demonstrates effective anti-inflammatory effects. To evaluate cotton pellet-induced granuloma, transudative or proliferative components of chronic inflammation have frequently been used. *A. heterophyllum*'s inhibitory effect is quite similar to that of Diclofenac sodium. It is demonstrated by *A. heterophyllum* that ethanolic root extracts can reduce subacute inflammation²⁶

Bacopa monnieri (Scrophulariaceae)

Bacopa monnieri Linn, a member of the Scrophulariaceae family, is more commonly referred to as "brahmi." The herb exhibits anti-inflammatory effects in rat paw edema brought on by carrageenan. It demonstrates edema avoidance when compared to indomethacin. *B. monnieri* offers pertinent anti-inflammatory properties for use in conventional medications²⁷

Daphne pontica (Thymelaeaceae)

Daphne pontica Linn, a member of the Thymelaeaceae family, is also known as the "Pontic daphne," or twin-flowered daphne. Several *Daphne* species have been used to combat inflammatory disorders. Rheumatoid arthritis and inflammatory disorders have both been treated using *D. pontica*. Mice are given a formalin test or a 10.0 mg/kg ethyl acetate extract of *D. pontica*. The findings showed that the extract 10.0 mg/kg may have potential anti-inflammatory properties, supporting its usage as a medicine²⁸

Phyllanthus polyphyllus (Euphorbiaceae)

The common name Sirunelli for the plant *Phyllanthus polyphyllus* Linn, a member of the Euphorbiaceae family, is Sirunelli. It is a little plant that has anti-inflammatory properties. In conventional medicine, *P. polyphyllus* is used to treat both acute and chronic inflammation. The right hind paw of the rats was given a sub-plantar injection of 1% suspension of carrageenan with gum acacia (2%), both in normal saline. Oral doses of aqueous and ethanolic extracts (150 and 300 mg/kg) have been given. The benchmark for anti-inflammatory activity has been phenylbutazone when administered orally at a dose of (80 mg/kg).

Ricinus communis (Euphorbiaceae)

The common name of *Ricinus communis* Linn, a member of the Euphorbiaceae family, is castor bean or castor oil plant. Everywhere throughout the world's tropical and subtropical zones, *R. communis* is grown. The methanolic extract shows that it inhibits anti-inflammatory activity in the carrageenan-induced hind paw edema model and the cotton-pellet granuloma model in wistar albino rats. The research identifies the key anti-inflammatory properties of *R. communis* methanolic extract in acute or chronic inflammatory conditions in wistar rats.

Sesbania sesban (Leguminosae)

Jayanti, *Sesbania sesban* Linn, a member of the Leguminosae family, is also known as riverhemp. *S. sesban* leaves are used to make an aqueous and methanolic extract that has anti-inflammatory properties. This is demonstrated by inhibition of carrageenan oedema model. Beginning with an increase in paw edema, the extract can later be linked to an inhibition of prostaglandin release²⁹

Dodonaea viscosa (Sapindaceae)

Dodonaea viscosa is a member of the Sapindaceae family and is most often known as santa or vilayti mehndi. The leaves' anti-inflammatory properties are used. The paw-edema caused by the carrageenin model is significantly inhibited by an oral dose of

hydroalcoholic extract of *D. viscosa* leaves (300 mg/kg). The extract appears to be less harmful. This finding demonstrates the anti-inflammatory properties of *D. viscosa* leaves.

***Ruta graveolens* (Rutaceae)**

Ruta graveolens, a member of the Rutaceae family, is known by the common name "Rue." When tested on rats with carrageenan-induced paw edema, the ethanolic and methanolic extracts of *R. graveolens* demonstrated anti-inflammatory action. The considerable rise in anti-inflammatory action of *Ruta graveolens*' ethanolic extract at doses of 50 mg/kg body weight and 20 mg/kg body weight can be attributed to the inhibition of the mediators of inflammation, namely histamine, prostaglandin, and serotonin. The findings demonstrate the efficacy of *R. graveolens* methanolic extract (20 mg/kg body weight) and ethanolic extract (50 mg/kg body weight) as effective therapeutic agents in acute anti-inflammatory situations.

***Achillea millefolium* Linn. (Asteraceae)**

The perennial herb *Achillea millefolium* L., which is native to Europe, is well known for its anti-inflammatory effects in traditional medicine. The plant has historically been applied externally to cure burns, wounds, and irritated or inflamed skin. Studies have revealed that the anti-inflammatory activities are mostly due to two groups of secondary metabolites, isoprenoids and phenolics.

***Adhatoda vasica* (Acanthaceae)**

Acanthaceae family member *Adhatoda vasica* L. is a native herb. The plant has been used as a herbal cure for rheumatism, chronic bronchitis, asthma, whooping cough, sedative expectorant, antispasmodic, and painful inflammatory swellings in traditional systems of medicine around the world. The medicine is used as powder, fresh juice, decoction, infusion, and other forms. It can also be obtained as a liquid extract or syrup or as an alcoholic extract. Alkaloids, tannins, flavonoids, terpenes, sugars, and glycosides are all present in this plant. Carrageenan- and formalin-induced paw edema assays in albino rats were used to assess the ethanolic extract's anti-inflammatory properties. *Adhatoda vasica*'s ethanolic extract reduced carrageenan and formalin-induced paw edema in a dose-dependent manner.

***Daphne pontica* Linn. (Thymelaeaceae)**

Since the second century AD, *daphne* species have supposedly been associated with anti-cancer properties. The roots of *Daphne pontica*, which was said to have antitumor action, were used to identify flavonoid components like daphnodorins. Several *Daphne* species have been employed in the treatment of inflammatory diseases. Rheumatic pain and inflammatory conditions have been treated with *daphne pontica*. PGE2 and IL-1 β production is inhibited by the extracts³⁰

***Lantana camara* Linn. (Verbenaceae)**

Many *Lantana* species have aerial components that are commonly employed in traditional treatments for cancer and tumors. Tea made from leaves and flowers was consumed to treat fever, the flu, and stomachaches. The herb also has anti-diarrheal, anti-bacterial, and anti-malarial properties. According to studies, *Lantana camara* leaf aqueous extract is both highly effective and safe for treating hemorrhoids. Aqueous extract of *Lantana camara* leaves has been said to possess promising analgesic, anti-inflammatory, and anti-hemorrhoidal properties³¹

SUMMARY AND CONCLUSION

Inflammation is a healthy process brought on by an injury or illness and serves as the body's natural defensive mechanism. However, there are instances where Rheumatoid arthritis, osteoarthritis, inflammatory bowel illnesses, retinitis, multiple sclerosis, psoriasis, and atherosclerosis are inflammatory disorders that might have a deleterious impact.

Anti-inflammatory drugs are crucial for solving this issue. Aspirin and other nonsteroidal anti-inflammatory pharmaceuticals are among the many safe and efficient anti-inflammatory medications that are currently on the market for this purpose. Therefore, these substances are particularly beneficial in lowering the inflammatory response. This review makes an attempt to give scientific account of use of valuable plants as anti-inflammatory source.

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