



Natural Herbs: A Boon to Anti-inflammatory Activity

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ABSTRACT:

The utilization of medicinal plants and their secondary compounds has seen a growing trend as a complementary approach in disease treatment. Inflammation encompasses a broad spectrum of pathological conditions, including rheumatic ailments, immune-mediated disorders, diabetes, cardiovascular incidents, among others. This review presents several herbs whose anti-inflammatory properties have been assessed through clinical and experimental research. Among these are *Curcuma longa*, *Zingiber officinale*, *Rosmarinus officinalis*, *Borago officinalis*, evening primrose, and Devil's claw. Acknowledging the multifaceted nature of inflammation treatment, this review endeavors to adopt a comprehensive therapeutic strategy involving herbal remedies and lifestyle modifications.

Keywords:- Anti-inflammatory Activity, Herbal Medicine, Inflammation etc

INTRODUCTION

It is associated with Inflammation is caused by injury to a living tissue. There can be four primary indicators of inflammation. i.e pain, redness, heat or warmth and swelling. When there is an injury to any part of the human body, the arterioles dilate. This produce redness by increased the blood circulation towards the injured tissue.[1] The mechanisms of inflammation involve a series of events in which the metabolism of arachidonic acid plays an important role. It is metabolized by the Cyclooxygenase (COX) pathway to prostaglandins and thromboxane A₂, whereas the 5-lipoxygenase (5-LOX) pathway to eicosanoids and leukotrienes (LT's), which are known to act as chemical mediators in a variety of inflammatory events.(2). There are mainly two types of inflammation which are as follows .

ACUTE INFLAMMATION

It is associated with increased vascular permeability, capillary infiltration and emigration of leukocytes.

CHRONIC INFLAMMATION

Inflammation is a common clinical conditions and rheumatoid arthritis (RA) is a chronic debilitating autoimmune disorder, that affects about 1% of the population in developed countries(3).The classic signs of inflammation are local redness, swelling, pain, heat and loss of function(4). Nitric oxide (NO) is a gaseous short lived free radical has been implicated as a mediator of inflammation and modulation of biosynthesis or activity of NO results in amelioration of acute inflammation and experimental arthritis model(5,6). NO is generated via the oxidation of the terminal guanidine nitrogen atom of L-arginine by the enzyme Nitric Oxide Synthase(NOS). Three major isoforms of Nitric Oxide Synthase (NOS) have been identified.Two expressed constitutively, are calcium/calmodulin dependent and are classified together as constitutive NOS isoforms (cNOS). The third is cytokine-inducible, calcium/calmodulin independent isoform of NOS (iNOS) is regulated in the gene by a variety of inflammatory mediators(7). Increased NOS activity or NO release have been demonstrated in both acute and chronic models of inflammation(8). Further, administration of L arginine a precursor for NO synthesis increased the paw swelling in adjuvant

arthritis(9). NSAIDS are among the most commonly used drugs worldwide. They are prescribed for orthopaedic conditions such as osteoarthritis, soft-tissue injuries and fractures etc(10).

There are representative anti-inflammatory herbs in almost each family in the plant kingdom. Many of these plants have proven oral and documented evidence of their use in the treatment of inflammatory disorders in traditional medicine. For some plants, inherent anti-inflammatory activity is inferred from other identified pharmacological activities related to modulation of the complex inflammatory response. At present, there is mounting scientific evidence for the anti-inflammatory activity of many herbs. For some, the anti-inflammatory activity has been extensively studied while preliminary evidence has been established for others. A number of anti-inflammatory constituents have been isolated and characterized structurally and pharmacologically .

PLANTS WITH REPORTED ANTIINFLAMMATOTY ACTIVITY

1.Caralluma tuberculata N.E. Brown. (Asclepiadaceae)

C. tuberculata is a plant largely grown in Pakistan and India (11).The ethanolic extract has been reported to possess significant anti-inflammatory and analgesic activities. Experimental data indicated that the ethanolic extract significantly inhibited carrageenan-induced inflammation in rats. The extract also decreased granuloma formation by cotton pellets in treated rats[11].



Fig No 1: Caralluma tuberculata

2.Tithonia diversifolia (Hemsl.) Gray (Compositae)- Aerial parts of *T. diversifolia* are among the constituents of the herbal remedy “Wuu-jao-jih ing” (12) used in folk medicine in Taiwan [13]. It is employed in the treatment of hepatitis, cystitis and jaundice [14]. The anti inflammatory activity of aqueous extract of the aerial part has been reported [13]. The results show that the aqueous extract inhibited paw edema induced by carrageenan. The extract was found effective in the two phases of the carrageenan induced inflammatory response [13].



Fig No 2: Tithonia diversifoli

3. *Adhatoda vasica* (Acanthaceae)

Adhatoda vasica L. is an indigenous herb belonging to family Acanthaceae. The plant has been used in the indigenous system of medicine in worldwide as herbal remedy for treating cold, cough, whooping cough, chronic bronchitis, asthma, sedative expectorant, antispasmodic, anthelmintic, rheumatism and rheumatic painful inflammatory swellings. The drug is employed in different forms such as fresh juice, decoction, infusion and powder. It is also given as alcoholic extract and liquid extract or syrup(15). This plant contains alkaloids, tannins, flavnoids, terpenes, sugars and glycosides(16). The anti-inflammatory potential of ethanolic extract has been determined by using carrageenan-induced paw edema assay, formalin-induced paw edema assay in albino rats. The ethanolic extract of *Adhatoda vasica* produced dose dependent inhibition of carrageenan and formalin-induced paw edema(17).



Fig No 3: *Adhatoda vaasica*

4. *Cassia fistula* L. (Caesalpiaceae)

Cassia fistula tree is one of the most widespread in the forests of India. The whole plant possesses medicinal properties useful in the treatment of skin diseases, inflammatory diseases, rheumatism, anorexia and jaundice. The bark extracts of *Cassia fistula* possess significant anti-inflammatory effect in the acute and chronic anti-inflammatory model of inflammation in rats. Reactive oxygen species (ROS) generated endogenously or exogenously are associated with the pathogenesis of various diseases such as atherosclerosis, diabetes, cancer, arthritis and aging process. ROS play an important role in pathogenesis of inflammatory diseases. The main constituents responsible for anti inflammatory activity of *Cassia fistula* are flavnoids and bio-flavnoids(18).



Fig No 4: *Cassia fistula* L

5. *Sida cordifolia* Linn. (Malvaceae)

Sida cordifolia is a perennial subshrub of the mallow family Malvaceae. It has naturalized throughout the world and is considered an invasive weed in Africa, Australia, Hawaiian islands, New Guinea and French Polynesia¹⁹. *Sida cordifolia* is used in folk medicine for the treatment of inflammation of the oral mucosa, blenorrhoea, asthmatic bronchitis and nasal congestion²⁰. It has been investigated as an anti-inflammatory.



Fig No 5: *Sida cordifolia* Linn.

6. *Mangifera indica* Linn. (Anacardiaceae)

Mangifera indica grows in the tropical and subtropical region and its parts are commonly used in folk medicine for a wide variety of remedies (23). The plant *Mangifera indica* has been reported for various therapeutic uses in traditional medicines such as, a fluid extract or the infusion of the bark is used in monorrhagia, leucorrhoea, bleeding piles and in case of haemorrhage from the lungs. Idibs of the leaves calcined are used to remove warts of eyelids. Dried powdered leaves are used in diabetes. Dried flowers in decoction or powder are useful in diarrhea, chronic dysentery and gleet (24). The ethyl acetate and ethanol extracts of the roots of *Mangifera indica* has been reported to have considerable anti-inflammatory activity as compared with standard drug Diclofenac sodium (25). The phytochemical analysis revealed the presence of flavonoids. The flavonoids have potent anti-inflammatory activity prostaglandin synthesis⁽²⁶⁾.



Fig No 6.: *Mangifera indica* Lin

7. *Ricinus communis* Linn. (Euphorbiaceae)

Ricinus communis Linn. is found almost everywhere in the tropical and subtropical regions of the world. Anti-inflammatory and free radical scavenging activities of the methanolic extract of *Ricinus communis* root was studied by Ilavarasan et al in Wistar albino rats. The methanolic extract exhibited significant anti-inflammatory activity in carrageenan-induced hind paw edema model. The methanolic extract showed significant free radical scavenging activity by inhibiting lipid peroxidation. The observed pharmacological activity may be due to the presence of phytochemicals like flavonoids, alkaloids and tannins in the plant extract(28).



Fig No 8: *Ricinus communis* Linn.

8. *Sesbania sesban* Linn. (Leguminosae)

The genus *Sesbania sesban* contains about 50 species, the majority of which are annuals. The greatest species diversity occurs in Africa with 33 species. Although the annual species have received attention, recent research has focused on perennial species. Of the perennial species, *Sesbania sesban* has shown potential(29). It is a small perennial tree with woody stems, yellow flowers and linear pods (30).According to the data from literature the phytochemical investigation of crude saponin extract revealed the presence of various constituents like terpenoidal and steroidal saponins, tannins and flavnoids which had been reported to have anti-inflammatory activity(31).This was proved by inhibition of carrageenan oedema by crude saponins extract. The crude saponin extract have been able to control the increase in Paw edema in early phase and also in late hours related to inhibition of prostaglandins release. Hence, it can be said that the present anti-inflammatory activity of crude saponin extract might be due to its action on the early and latter phase of inflammation(32).



Fig 8 - . *Sesbania sesban* Linn

9. *Ageratum conyzoides* L. (Asteraceae)

A. conyzoides is a plant known in Brazil variously as “Mentrasto”, “Erva de So Joao” and used in traditional medicine for its anti-inflammatory, analgesic and anti-diarrhoeal properties [26]. In some African countries, *A. conyzoides* is used as an antienteralgic and antipyretic drug [27]. Experimentally, the leaf extract has been shown to be effective in the treatment of chronic pain in osteoarthritis [28] and in causing a fall in rectal temperature [29]. Reports showed that the essential oil exhibited significant anti inflammatory effect [30] while the water-soluble fraction of the 70% ethanol leaf extract exhibited anti-inflammatory and analgesic properties [31]. Further experimental evidence suggest that the water-soluble fraction of the 70% ethanol leaf extract inhibited zymosan-induced neutrophil migration into the peritoneal cavity [32]. The fraction was however ineffective on zymosan and dextran-induced edema [32], suggesting that the extract could act by inhibiting cyclooxy genase enzyme [32].



Fig No 9: *Ageratum conyzoides* L.

10 . *Aloe vera* Linn Burm. f. (Liliaceae)

A. vera is a pineapple-like plant with rosettes of fleshy, sword-shaped toothed leaves found in rocky hills and near streams in swampy places [33]. The anti-inflammatory activity of the fresh juice has been reported [34]. The fresh juice obtained from leaves of the plant inhibited carrageenan induced rat paw edema to a degree comparable to that of ibuprofen. However, in chronic inflammation model, the extract did not significantly reduce granuloma weight in treated animals. The fresh juice was effective in acute inflammation but exhibited no effect in chronic inflammation [34]. Atta and Alkofahi [22] have reported that the ethanolic extract significantly reduced the weight of xylene-induced ear edema in mice with a calculated inhibition of 71%. In separate investigations, Aloe gel has been reported effective in inflammation induced by kaolin, carrageenan, albumin, gelatin, mustard and croton oil [35]. Aqueous or chloroform extracts of the gel have been reported to inhibit carrageenan-induced inflammation and migration of neutrophils [36].

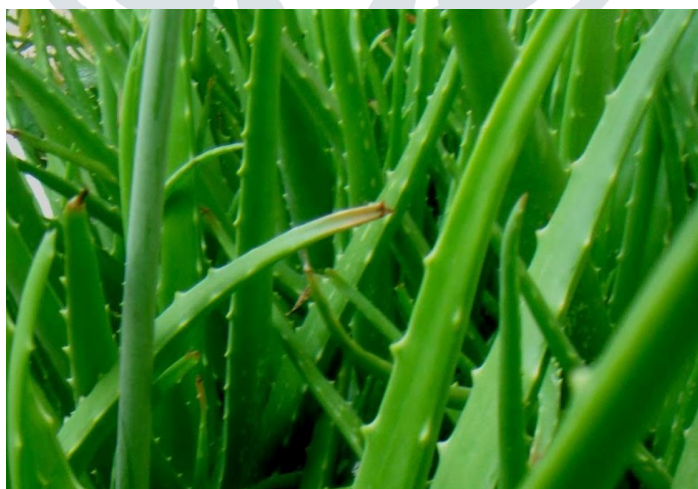


Fig No 10: *Aloe vera* Linn Burm. F.

11 *Anthurium cerrocampanense* Croat (Araceae)

A. cerrocampanense is a rarely epiphytic terrestrial and deeply rooted plant [38]. The anti-inflammatory activity of the aqueous, ethanolic and dichloromethane extract on topical inflammation of the mouse ear, and edema of the rat paw induced by carrageenan, dextran, arachidonic acid, zymosan and C16-PAF was also reported [38]. The report indicated that all the extracts exhibited anti-inflammatory activity with the dichloromethane extract as the most active in both acute and topical inflammation. Further investigation of the dichloromethane extract revealed that it inhibited dextran, carrageenan and zymosan-induced rat paw edema which is associated with histamine and serotonin release [39, 40, 41]. The extract was however not active in arachidonic acid-induced inflammation of the rat paw suggesting the absence of involvement of the lipoxygenase pathway. [38] 2.6 *Aspilia africana* CD Adams (Compositae) *A. africana* formerly known as *Wedelia africana* Pers or *Aspilia latifolia* is a weed widespread in Africa [42]. The crushed leaves have been used for patients suffering from rheumatic pains [43]. Healing of wounds occurs when treated with the crushed leaves. [44] The anti-inflammatory activity of isosaline and ethanolic leaf extracts based on their effects on heat and hypotonicity-induced lysis of bovine red blood cells has been reported [45]. Both extracts stabilized bovine red blood cell membrane against heat and hypotonicity induced lysis, producing effects comparable to that of indomethacin, a standard anti inflammatory drug [45].



Fig No *Anthurium cerrocampanense* Croat

12. *Bacopa monnieri* Linn.(Scrophulariaceae)

The *Bacopa monnieri* is a creeping, glabrous, succulent herb, rooting at nodes and habitat of wetlands and muddy shores. Earlier, it is used as a brain tonic to enhance memory development, learning and concentration. The plant has also been used in India and Pakistan as a cardio tonic, digestive aid and to improve respiratory function in cases of bronchoconstriction. The plant possesses anti-inflammatory activity on carrageenan-induced rat paw edema and it has shown 82% edema inhibition when compared to indomethacin. *Bacopa monnieri* also significantly inhibited 5 lipoxygenase (5-LOX), 15 (LOX) and cyclo oxygenase-2 (COX-2) activities. *Bacopa monnieri* possesses significant anti-inflammatory activity that may well be relevant to its effectiveness in the healing of various inflammatory conditions in traditional medicine. The anti-inflammatory activity of *Bacopa monnieri* is due to the triterpenoid and bacoside present in the plant. The ability of the fractions containing triterpenoids and bacosides inhibited the production of pro-inflammatory cytokines such as tumour necrosis factor- α and interleukin-6. This was tested using lipopolysaccharide activated peripheral blood mononuclear cells and peritoneal exudates cells in vitro. So, *Bacopa monnieri* has the ability to inhibit inflammation through modulation of pro-inflammatory mediator release.



Fig No 12: *Bacopa monnieri* Linn.

CONCLUSION:

The scope of this paper does not permit an exhaustive evaluation of all plants purported to possess anti-inflammatory effects. Instead, we have focused on highlighting herbs with substantial evidence supporting their efficacy in inflammation management. Herbal medicine plays a significant role in complementary medicine, with numerous studies supporting the anti-inflammatory properties of various herbs. Among the herbs discussed, *Curcuma longa* stands out with the most clinical evidence across different inflammatory conditions such as rheumatoid arthritis (RA), uveitis, and inflammatory bowel disease (IBD). Additionally, other herbs mentioned have shown promising results in both clinical and experimental settings. The inflammatory process involves multiple mechanisms and treatment modalities, with various cytokines orchestrating enzyme activation, mediator release, fluid extravasation, vasodilation, cell migration, and tissue damage. Experimental findings highlight the potential of herbs to modulate proinflammatory cytokines, although further large-scale clinical studies and meta-analyses are needed to address any discrepancies.

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