



A DETAILED REVIEW OF MEDICINAL PLANTS ELICITING ANTI-INFLAMMATORY PROPERTIES

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ABSTRACT

The mentioned article having herbal medicinal plants possessed anti-inflammatory activity. Inflammation is a part of the biological response of vascular tissue to harmful stimuli, such as pathogen, damaged cells (or) irritants. Inflammation is a part of the body's immune response. These can be characterised by redness, swollen joints, pain, its stiffness and loss of joint function. Inflammation is one of the body unique mechanism that help body to protect itself against infection, burn, toxic chemicals, allergens. This lead to extensive development of anti-inflammatory drug. The NSAIDS are the drugs used for the treatment of inflammation, it act as anti-inflammatory drug. The herbal medicines are potency anti-inflammatory activity than the synthetic drug. Now a days the world population refer to the herbal medicines, due to over side effect (or) harmful effect over the NSAIDS(synthetic drugs).The herbal medicines play a vital role in anti-inflammatory, that has many number of phyto constituents in single herbal plant. The preview focus on herbal medicines that contain anti-inflammatory activity discusses their therapeutic uses in present review article.

KEYWORDS: Herbal plants, anti-inflammatory, NSAIDS.

INTRODUCTION

Inflammation is a severe response by living tissue to any kind of injury. There can be four primary indicators of inflammation: pain, redness, heat or warmth and swelling. When there is injury to any part of the human body, the arterioles in the encircling tissue dilate. This gives a raised blood circulation towards the area (redness).^[1] Inflammation is a part of the complex biological response of vascular tissues to harmful stimuli, such as pathogens, damaged cells or irritants. It is characterized by redness, swollen joint that is warm to touch, joint pain, its stiffness and loss of joint function.^[2] Inflammation is either acute or chronic inflammation. Acute inflammation may be an initial response of the body to harmful stimuli. In chronic inflammation, the inflammatory response is out of proportion resulting in damage to the body. Cyclooxygenase (COX) is the key enzymes in the synthesis of prostaglandins, prostacyclins and thromboxanes which are involved in inflammation, pain and platelet aggregation.^[3]

Inflammation is a normal, protective response to tissue injury caused by physical trauma, noxious chemicals or microbiological agents. 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

It is associated with infiltration of mononuclear immune cells, macrophages, monocytes, neutrophils, fibroblast activation, proliferation (angiogenesis) and fibrosis. Inflammation is a common clinical conditions and rheumatoid arthritis (RA) is a chronic debilitating autoimmune disorder^[4], that affects about 1% of the population in developed countries.^[5] The classic signs of inflammation are local redness, swelling, pain, heat and loss of functions.^[6] 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.^[7,8] 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.^[9] Increased NOS

activity or NO release have been demonstrated in both acute and chronic models of inflammation.^[10] Further, administration of Larginine a precursor for NO synthesis increased the paw swelling in adjuvant arthritis. NSAIDS are among the most commonly used drugs worldwide.

They are prescribed for orthopaedic conditions such as osteoarthritis, soft-tissue injuries and fracture, etc.^[11] NSAIDS e.g., Ibuprofen and naproxen etc. are used in the above said conditions. The other class of drugs is glucocorticoids e.g., cortisone and prednisone etc. However, besides their high costs, severe adverse reactions and toxicity, including some risk of infections in subsets of patients being treated with biological response modifiers e.g., Tumour necrosis factor, alpha blocking agents.^[12] The side-effects with currently used drugs are GI ulceration and bleeding, renal damage, hypertension and hyperglycemia. Besides the above side-effects, the greatest disadvantage in presently available potent synthetic drugs lies in their toxicity and reappearance of symptoms after discontinuation. Therefore, the screening and development of drugs for their anti-inflammatory activity is the need of hour and there are many efforts for finding anti-inflammatory drugs from indigenous medicinal plants.^[13]

PLANTS POSSESS ANTI-INFLAMMATORY ACTIVITY

***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.^[14] This plant contains alkaloids, tannins, flavanoids, terpenes, sugars and glycosides.^[15]



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^[16]

***Cassia fistula* L. (Caesalpinaceae)**



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 flavanoids and bio-flavanoids^[17]

Curcuma longa

Curcuma longa (common name is Turmeric) is an Indian indigenous plant.^[18] The most important secondary metabolite of *C. longa* is curcumin, which is responsible for anti-inflammatory effect of this plant.^[19] Many clinical trials have been done for proving the anti-inflammatory effect of curcumin. Their results suggest that curcumin can be effective in improving inflammation of rheumatoid arthritis (RA) and reducing clinical manifestation of RA, such as joint swelling and morning stiffness in comparison with phenylbutazone which is used as a positive control.^[20] Also, curcumin was tested in patients with anterior uveitis; after 2 weeks, exhaustive remission occurred.^[21]



The effectiveness of curcumin in patients with dyspepsia and/or gastric ulcer was proved by another clinical trial. In this study, subjects experienced remission after 12 weeks (maximum).^[22] Curcumin is beneficial in irritable bowel syndrome (IBS) treatment^[23] and also works as a reducing agent to delayed graft rejection (DGR) after kidney transplant surgery.^[24] Curcumin likewise has a beneficial effect in inhibition of inflammatory bowel disease (IBD) and reduction in sedimentation rate in patients who suffered from IBD.^[25] It is also proven to be beneficial in maintaining amelioration of ulcerative colitis^[26] and psoriasis (by the selective prohibition of phosphorylase kinase).^[27]

Calendula officinalis



The ethyl alcohol extract of *Calendula officinalis* flower was used for anti inflammatory activity Administration of extract produced 50.6 and 65.9% inhibition in paw volume at the dose of 250 and 500 mg/kg body wt at 3 h significant inhibition ($P < 0.001$). When dextran was used as a acute inflammatory agent there was 41.9 and 42.4% inhibition in paw volume at 3 h in the 250 and 500 mg/kg body wt. extract treated groups significant inhibition ($P < 0.001$). Significant inhibition in paw edema was also seen in the treated groups in chronic inflammatory model using formalin which was 32.9 and 62.3% on the third day after treatment with 250 mg/kg significant inhibition ($P < 0.05$) and 500 mg/kg showed significant inhibition ($P < 0.001$) of the extract^[28]

Emblca officinalis (Euphorbiaceae)



Emblca officinalis is a tree growing in subtropical and tropical parts of China, India, Indonesia and Malay peninsula. It has been used for anti-inflammatory and antipyretic activities in these areas. In the recent studies, the anti-inflammatory activity was found in the water fraction of methanol extract of plant leaves. The effects of fraction were tested on the synthesis of mediators of inflammation such as leukotriene B4, platelet activating factor (PAF) and thromboxane. The water fraction of methanol extract inhibited migration of human PMNs in relatively low concentrations.^[29]

Gymnema sylvestre



The aqueous extract of leaves of *G. sylvestre* was used for two anti inflammatory activity model like Carrageenan induced paw oedema and Cotton pellet-induced granuloma. The three doses of extract was used 200,300 and 500 mg/kg, but 500 mg/kg decreased the paw oedema by 48.53% within 4 h. After administration, while standard drug decreased the paw oedema volume by 57.6%. When compared with paw oedema volume of control. The aqueous extract at the dose 300 and 500 mg/kg produced significant reduction ($P < 0.01$) in granuloma volume when compared with control group.^[30]

Hibiscus rosa- sinensis (Malvaceae)

The methanolic extract of *Hibiscus rosa- sinensis* leaves (250 and 500 mg/kg body weight orally) was used carrageenin and dextran inducer at paw edema anti inflammatory model. Indomethacin was used as standard drug which showed significant anti-inflammatory activity.



The inhibition of edema by 17.12 and 16.46% with 250 mg/kg, 45.35%, and 44.51% with 500 mg/kg body weight after 3 h with carrageenin, dextran respectively. The plant extract at the dose level of 250 and 500-mg/kg body weight by oral route exhibited significant ($P < 0.001$) anti-inflammatory activities against all the agents used.^[31]

***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.^[32] 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 diarrhoea, chronic dysentery and gleet.^[33] 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.^[34] The phytochemical analysis revealed the presence of flavonoids. The flavonoids have potent anti-inflammatory activity by inhibiting prostaglandin synthesis.^[35]

Olea europaea

Olea europaea (commonly known as Olive in English) is a species of Oleaceae family. The positive effect of extra virgin olive oil (EVOO) on modulating postprandial plasma lipopolysaccharide, proinflammatory cytokines, TXB2 and LTB4, and diminished performance in risk of coronary heart disease has been demonstrated in healthy individuals and metabolic syndrome patients.^[36,37]



Oral olive oil has accelerated wound healing process and has alleviated hospitalizing duration in deep second-degree and more burn wound patients in comparison with sunflower oil (SFO).^[38] Also, disease activity index and tumor incidence of ulcerative colitis associated colorectal cancer and proinflammatory cytokines in mice have been alleviated after EVOO enriched diet consumption compared with that of SFO-fed mice.^[39]

Rosmarinus officinalis

Rosmarinus officinalis (common name is Rosemary in English) In an open-label trial, the effects of rosemary extract have been assessed in patients with osteoarthritis (OA), rheumatoid arthritis (RA), and fibromyalgia during 4 weeks; hs-CRP (an index for inflammation presence) was decreased noticeably in patients who had demonstrated augmentation in this index; by the way, reduction in inflammation related to pain score was observed during the treatment, but remission has not occurred in fibromyalgia scores.^[40] There is evidence that confirms anti-inflammatory potential of *R. officinalis* in molecular scope; according to this, rosmarinic acid could disturb complement system activation easily by inhibiting C3b attachment; the dose required for making this effect is very low (34 μM).^[41]



***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 llavarasan *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.^[42]

Solanum nigrum



The effect of methanolic extracts of berries of *Solanum nigrum* in carrageenan induced paw edema in rats is shown by the using of doses 125,250 and 375 mg/kg body weight. The % inhibition of paw edema was 17.08, 13.09 and 23.45% at the doses of 125,250 and 375 mg/kg body weight respectively. The methanolic extract of *Solanum nigrum* (375 mg/kg) prevented the formation of edema induced by carrageenan and thus showed significant anti-inflammatory activity ($P < 0.05$). Diclofenac sodium at 10 mg/kg inhibited the edema volume by 12.60%. On carrageenan induced acute inflammation model the methanolic extract (375 mg/kg) produced better inhibition of paw edema^[43]

Zingiber officinale (Zingiberaceae)



Shimoda *et al.* 2010 was investigated the anti-inflammatory effect of *Zingiber officinale* and prepared 40% ethanolic extract from dried red ginger and evaluated its anti-inflammatory activity using acute and chronic inflammation models. The result possessed found a potent suppressive effect on acute and chronic inflammation, and inhibition of macrophage activation seems to be involved in this anti-inflammatory effect.^[44]

CONCLUSION

Plants have played a significant role in human health care since the ancient times. Traditional plants exerts great role in discovery of new drugs. Majority of human population worldwide is getting affected by inflammation related disorders. It is believed that current analgesia inducing drugs such as opiates and NSAIDS are not useful in all cases, because of their side effects like GIT irritation, liver dysfunction and much more.^[45] This review will help the recent and future researchers in more research work on these valuable medicinal plants.

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