A review on some plants having anti-inflammatory activity

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Abstract

Inflammation is a healthy process resulting from some disturbance or disease. The signs of inflammation are redness elevated heat, swelling, pain, loss of function. Inflammation process plays a protective role in our body and in some conditions produces some negative effects such as conditions include the inflammatory disorders rheumatoid arthritis, osteoarthritis, inflammatory bowel diseases, retinitis, multiple sclerosis, psoriasis and atherosclerosis. For overcoming this problem, search of newer drugs is very requisite and necessary and there are many of phytoconstituents present in plants which are playing a very important role in the treatment of inflammation. The present review shows some plant phytochemicals which having anti-inflammatory activity that have been tested in inflammatory models using modern scientific technique.

Keywords: Inflammation, Prostaglandins, NSAIDs, Anti-inflammatory activity.

Introduction

Inflammation is a host defence mechanism of the body and it’s an essential immune response that enables the body to survival during infection or injury and maintains tissue homeostasis in noxious conditions. According to the modern concept, inflammation is a healthy process resulting from some disturbance or disease. Inflammation is a normal response to any noxious stimulus that threatens the host and may vary from localized response to a generalized one. In other words “Inflammation is the major and complex reaction of the body against infection upon tissue injury.” The role of inflammation as a healing, restorative process, as well as its aggressive role, is also more widely recognized today. But in some conditions appears to be no resolution and a chronic state of inflammation develops that may last the life of the individual. Such conditions include the inflammatory disorders rheumatoid arthritis, osteoarthritis, inflammatory bowel diseases, retinitis, multiple sclerosis, psoriasis and atherosclerosis. To overcome this problem different kind of safe and effective anti-inflammatory agents are available, including aspirin and other nonsteroidal anti-inflammatories, with many more drugs under development. So these agents which are helpful to reduce the inflammatory response are called anti-inflammatory agent. Inflammation has a very big variety of pathological and physiological response.

Process of Inflammation

Inflammation is a localized protective reaction of cells tissues of the body to allergic or chemical irritation, injury and/or infections. The symptoms of inflammation are
characterized by pain, heat, redness, swelling and loss of function that result from dilation of the blood vessels leading to an increased blood supply and from increased intracellular spaces resulting in the movement of leukocytes, protein and fluids into the inflamed regions. This is very necessary to understand the role of chemical mediators of inflammation. These mediators are the substances released as plasma proteins, or that come from cells like mast cells, platelets, neutrophils and monocytes/macrophages. They are triggered by allergic or chemical irritation, injury and infections. These mediators, depending on the duration of injury determine the severity of inflammation and are termed pro-inflammatory fundamental factors. These substances bind to specific target receptors on the cells and may increase vascular permeability, promote neutrophil chemotaxis, stimulate smooth muscle contraction, increase direct enzymatic activity, induce pain and/or mediate oxidative damage.

Examples of chemical mediators include: nitric oxide, prostaglandins, leukotrienes, vasoactive amines (histamine, serotonin), and cytokines. Although some of the cytokines (IL-1, IL-6, IL-8 and granulocyte-macrophage colony-stimulating factor) play an important role in orchestrating the inflammatory process, especially interleukin-1 (IL-1) and tumor necrosis factor-a (TNF-a). IL-1 and TNF are considered principal mediators of the biological responses to bacterial lipopolysaccharide (LPS, also called endotoxin). They are secreted by monocytes and macrophages, adipocytes, and other cells. Working in concert with each other and various cytokines and growth factors (including IL-8 and granulocyte-macrophage colony-stimulating factor) they induce gene expression and protein synthesis in a variety of cells to mediate and promote inflammation. Prostaglandin (PGE2) or prostacyclin (PGI2) release increase blood flow as well as increase blood vessel permeability by assisting in releasing of nitric oxide from endothelium derived releasing factor which cause again vasodilatation and help in sticking platelet and other chemo toxin (bradykinin, histamine). While LTs generally are pro-inflammatory LTB4 is a potent chemotactic agent for polymorphonuclear leukocytes, eosinophils, and monocytes. In higher concentrations, LTB4 stimulates the aggregation of polymorphonuclear leukocytes and promotes degranulation and the generation of superoxide. LTB4 promotes adhesion of neutrophils to vascular endothelial cells and their trans-endothelial migration and stimulates synthesis of pro-inflammatory cytokines from macrophages and lymphocytes.

**Types of inflammation**

**Acute inflammation** - Acute inflammation usually has becoming within minutes or at most hours after tissue injury, and may be characterized by the classical symptoms of redness, heat, oedema. It’s a short term process. It is characterized by the exudation of fluids and plasma proteins and the migration of leukocytes, most importantly neutrophils into the injured area. This acute inflammatory response is useful to the defense mechanism aimed at killing of bacteria, virus and parasites while still facilitating wound repairs.

**Chronic inflammation** - Chronic inflammation is of a more prolonged duration and histologically by the presence of lymphocytes and macrophages, resulting in fibrosis and tissue necrosis. The chronic inflammation increases the development of the degenerative diseases such as rheumatoid arthritis, atherosclerosis, heart disease, Alzheimer, asthma, acquired immunodeficiency disorder (AIDS), cancer, congestive heart failure, multiple sclerosis, diabetes, infections, gout, IBD-inflammatory bowel disease, aging and other neurodegenerative CNS depression. Chronic inflammation also has been implicated as part of the cause of the muscle loss that occurs with aging. 9 all of which are associated with immunopathological that appears to play a key role in the onset of the condition.

**Plants with anti-inflammatory potential**

**Azadirachta indica**

The anti-inflammatory potential of Azadirachta indica was using carbon tetrachloride extract of Azadirachta indica fruit skin and its isolated constituent azadiradione at
two different dose levels (50 and 100 mg kg\(^{-1}\) body weight). Anti-inflammatory activity was observed using carrageenan-induced paw oedema model. The results concluded that the animals treated with 100 mg kg\(^{-1}\) dose of carbon tetrachloride extract and azadiradione exhibited significant anti-nociceptive and anti-inflammatory activities. This study had rationalized the ethno medicinal use of the plant for wound, burns and injury by tribal people.\(^{11}\)

**Cassia occidentalis**

Sreejith et al was evaluated anti-inflammatory potential of whole plant of *Cassia occidentalis* using ethanolic extract. For investigation of anti-inflammatory potential dose taken 250 mg/kg and using carrageenan induced paw edema model. The result revealed that significant reduction in malondialdehyde levels of murine hepatic microsomes and significantly reduced carrageenan induced inflammation in mice at a dose of 250 mg/kg.\(^{12}\)

**Hedera rhombea**

The anti-inflammatory potential of *Bryophyllum pinnatum* was investigated by ojewole et al. The study was undertaken to investigate anti-inflammatory and of the plant leaf aqueous extract in experimental animal models. In this experiment using fresh egg albumin-induced pedal (paw) oedema model and drug taken Diclofenac 100 mg/kg. The results revealed of this experimental animal study suggest that *Bryophyllum pinnatum* leaf aqueous extract possessed anti-inflammatory. The different flavonoids, polyphenols chemical constituents of the herb are speculated to account for the observed anti-inflammatory of the plant.\(^{14}\)

**Bryophyllum pinnatum**

The and anti-inflammatory actives of the leaves of *Hedera rhombea* Bean were investigated and using methanol and butanol fractions and evaluated by carrageenan induced edema method showed considerable analgesic activity, anti-inflammatory activity was found in the methanol, butanol and ether fractions by carrageenan induced edema test.\(^{13}\)
The ethanolic root extract of Swertia chirata was chosen for pharmacological screening of anti-inflammatory activities in animal models. The anti-inflammatory activity was using the carrageenan-induced rat paw edema model and taken rat paw edema model induced by carrageenan. The result revealed that the extract was found to reduce significantly (p<0.001) the formation of edema at the 400 mg/kg dose level and showed 57.81% (p<0.001) inhibition of edema volume at the end of 3 h, the ethanolic extract of swertia chirata reduced the inflammation.

**Zingiber officinale**

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.

**Sida cordifolia**

The aqueous extract of Sida cordifolia was evaluated by Franzotti (2000). The leaves of Sida cordifolia were taken for carrageenan-induced rat paw edema at a dose of 400 mg/kg administered orally, but did not block the edema induced by arachidonic acid.

**Pluchea indica**

The anti-inflammatory activity of the methanolic fraction of a chloroform extract of Pluchea indica roots was investigated and evaluated by Sen (1991). The extract showed significant inhibitory activity against carrageenan-, histamine-, serotonin-, hyaluronidase- and sodium urate-induced pedal inflammation and also inhibited carrageenan- and cotton pellet-induced granuloma formation.

**Ricinus communis**

Ilavarasan *et al*. 2006 was investigated the anti-inflammatory activity of methanolic extract of Ricinus communis (Euphorbiaceae) Linn. The root was studied in Wistar albino rats. The methanolic extract at doses 250 and
500 mg/kg of anti-inflammatory activity in carrageenan-induced hind paw edema model. The results of the study indicate that the methanolic extract of *Ricinus communis* root possesses significant anti-inflammatory activity in acute and chronic inflammatory models in rats.\(^\text{19}\)

*Thespesia populnea*

The aqueous and ethanol extracts of *Thespesia populnea* leaves were evaluated in animal models for anti-inflammatory activity and established by Ilavarasan (2012). The extracts reduced paw oedema induced by carrageenan in rats. The results obtained in this study suggest that *Thespesia populnea* extracts have anti-inflammatory properties.\(^\text{20}\)

*Achillea millefolium*

The anti-inflammatory potential of aqueous extract *Achillea millefolium* was investigated and measured by the mouse paw edema test. The result revealed by the isolation of a material which reduces inflammation by 35%.\(^\text{21}\)

*Aconitum heterophyllum*

Verma *et al.* (2010) was investigated the anti-inflammatory activity of ethanolic root extracts of *Aconitum heterophyllum* has been evaluated in cotton pellet-induced granuloma in rats. The anti-inflammatory properties of the extract and the effects were compared to diclofenac sodium. The extract has reduced inflammation.\(^\text{22}\)

*Aegle marmelos*

The aqueous extract of the root bark of Bilwa was prepared and tested for anti-inflammatory activity in albino rats using Carrageenan induced paw edema model and cotton pellet induced granuloma and the standard drug was taken indomethacin and Bilwa. The result revealed that anti-inflammatory activity was expressed the inhibition.\(^\text{23}\)

*Emblica officinalis*
Muthuraman et al. (2011) was investigated anti-inflammatory effects of phenolic compounds from *Emblica officinalis* using carrageenan and cotton pellet induced acute and chronic inflammatory animal model. The compounds were studied for their acute and chronic anti-inflammatory activity at a dose level of 20 and 40 mg/kg against standard drug diclofenac. The results indicated that in both acute and chronic reduction in the inflammation, but significant effects were observed only at high doses.²⁴

**Piper ovatum**

The anti-inflammatory potential of leaves of hydroalcholoc extract *Piper ovatum* was evaluated and investigated by Silva (2008). In this study, carrageenan-induced pleurisy in rats and croton oil-induced ear edema in mice were used as a model. The results indicate that the amide fractions piperovatine and piperlongumine showed the greatest inhibitory activity of topical inflammation induced by croton oil.²⁵

**Piper longum**

Kumar et al. 2009 was investigated anti-inflammatory activity of the *Piper longum* was studied in rats using the carrageenan-induced right hind paw edema method. The activity was compared with that of standard drug ibuprofen. The result indicated to inhibit carrageenan-induced rat paw edema and produced significant anti-inflammatory activity when compared with the standard and untreated control.²⁶

**Annona squamosal**

For investigation of Caryophyllene oxide, which was isolated from an unsaponified petroleum ether extract of the bark of the *Annona squamosal* plant and studied for its anti-inflammatory activity and evaluated by Chavan (2009). The dose taken of Caryophyllene oxide of 12.5 and 25mg/kg body wt. and unsaponified petroleum ether extract at a dose of 50 mg/kg body wt. These activities of caryophyllene oxide were given significant effect against inflammation.²⁷

**Cassia fistula**
Mukherjee et al. 2009 was investigated the anti-inflammatory potential of *Cassia fistula* leaves. For this experiment using histamine, carrageenan and dextron induced paw edema in rats. The standard drugs taken phenylbutazone and Potent anti-inflammatory activity was noted.  

**Conclusion**

Inflammation is a defense mechanism of the body and inflammation is a healthy process resulting from some disturbance or disease. But in some conditions when negative effect of the inflammatory process is produced example, these inflammatory disorders are, rheumatoid arthritis, osteoarthritis, inflammatory bowel diseases, retinitis, multiple sclerosis, psoriasis and atherosclerosis. To overcome this problem anti-inflammatory agents are very require. For this purpose variety of safe and effective anti-inflammatory agents are available, including aspirin and other nonsteroidal anti-inflammatories, with many more drugs under development. So these agents are very helpful to reduce the inflammatory response. These agents are called anti-inflammatory agents. Plants have played an important role in human health care since the ancient times. Traditional plants play a very important role in the discovery of new drugs. Now present days, inflammation is a very big challenge of mankind. So much of anti-inflammatory drugs are available, but it is believed that these drugs such as opioids and analgesia inducing drugs like NSAIDS are not useful in all cases and these drugs also produce side effects, so to overcome this problem new drugs are very requisite and in plants have many of phytotoconstituents which are helpful in inflammation and have less side effects. So in this article included some herbal medicinal plants on behalf of their phytotoconstituients which can be helpful in inflammation.

**References**

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