WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 12, 200-212. Review Article ISSN 2277– 7105

A REVIEW ON PLANTS HAVING ANTI INFLAMMATORY ACTIVITY

Krishna Reddy Indela[1]*, Anil Kumar Yerragopu[2] and Santosh Kumar Chamarthi[3]

Department of Pharmacology, Hindu College of Pharmacy, Amaravathi Road, Guntur-522002, Andhra Pradesh, India.

Article Received on
05 August 2020,

Revised on 25 August 2020,
Accepted on 15 Sept. 2020

DOI: 10.20959/wjpr202012-18738

***Corresponding Author**
Krishna Reddy Indela
Department of Pharmacology, Hindu College of Pharmacy, Amaravathi Road, Guntur-522002, Andhra Pradesh, India.

1. ABSTRACT

Inflammation is a healthy process of body resulting from some disturbance or diseases. Traditional plants play a very important role in the discovery of new drugs and less adverse effects. Plants have played an important role in human health care since the ancient times. So to overcome this problem new drugs are very requisite and in plants have many of phytochemical constituents are polyphenols, lignans, anthraquinones, flavonoids, alkaloids, terpenoids, saponins, polysaccharides and peptides. Which are helpful in inflammation and have less side effects. So in this article included some herbal medicinal plants on behalf of their phytochemical constituents which can be helpful in inflammation.

2. INTRODUCTION

Inflammation is the immune system's response to harmful stimuli, such as pathogens, damaged cells, toxic compounds, or irradiation and acts by removing injurious stimuli and initiating the healing process.[1] 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 antiinflammatory agents are available, including aspirin and other nonsteroidal antiinflammatories, with many more drugs under development. So these agents which are

helpful to reduce the inflammatory response are called anti-inflammatory agent.[2] It is mainly characterized by the redness, swollen joints and joint pain, its stiffness and loss of joint function.

Types of inflammation

It is mainly of two types. They are

Acute inflammation:-It is characterised by the exudation of fluids and plasma proteins; and the migration of leukocytes, most notably neutrophils into the injured area. This acute inflammatory response is believed to be a defense mechanism aimed at killing of bacteria, virus and parasites while still facilitating wound repairs.[6]

Chronic inflammation

Chronic inflammation is prolonged and persistent inflammation marked chiefly by new connective tissue formation; it may be a continuation of an acute form or a prolonged low-grade form. Inflammation is the common clinical conditions and rheumatoid arthritis (RA) is a chronic debilitation auto immune disorder.[3]

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.[4]

Process of Inflammation

Inflammation processes can be categorized into four distinct groups

1. Changes in the blood flow supply to the affected area cause changes in smooth muscles cell function causing vasodilatation.
2. Contraction of cytoskeleton in endothelial cells causing alterations in vascular permeability engendered.
3. Passage of phagocytic leukocytes from capillary vessels into the surrounding interstitial spaces to the site of injury or inflammation.
4. Phagocytosis.[5]

The symptoms of inflammation

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-3 -4,-5,-6,-10,-13) released are beneficial by acting as anti-inflammatory mediator within the cells.[6]

Mechanism of inflammation

The inflammatory process is a combination of many pathways like a synthesis of prostaglandin, interleukin or other chemo toxin, adhesive protein receptor action, platelet-activating factors. All can act as chemotactic agonists. Inflammation initiates with anystress on the membrane or by other trigger or stimuli, these activate hydrolysis of membrane phospholipid by phospholipase A into arachidonic acid, which further substrate for cyclooxygenase and lipooxygenase enzyme and byproduct of these are prostaglandins PGE2, PGH2 and leukotrines like LTC4, LTB4 etc.[7] Several cytokines also play essential roles 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 (includingIL-8 and granulocyte-macrophage colony-stimulating 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 releasingof nitric oxide from endothelium derived releasing factor which cause again vasodilation and help in sticking platelets 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.[8]

3. Plants having anti- inflammatory activity:

Murraya Koenigii* (Rutaceae*)

Murrayakoenigii is known as ‘curry patta’ in Hindi.

It belongs to the family Rutaceae.

Uses:- Traditionally, the plant is used as a stimulant, stomachic, analgesic and for the treatment of diarrhea, dysentery; insect bites and also used to allay heat of body.

Other uses: Wound Healing, Antidiarrhoeal, Anthelmintic, Antibacterial, Antifungal, Antiulcer, Antiobesity, and Hypoglycaemic activities.

Saurabh Patel et.al 2014 was investigation of the anti-inflammatory activity of methanol extracts of leaves of *Murrayakoenigii* as potent anti-inflammatory agent in carrageenan induced inflammation in albino rats at the dose of 400 mg/kg.[9]

***Zingiber officinale* (Zingiberaceae)**

Ginger (*Zingiber officinale*) is generally used as digestive health (indigestion, constipation and ulcer). It belongs to the family Zingiberaceae.

Shimoda et al 2010 was investigated the e 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.[10]

***Aconitum heterophyllum* (Ranunculaceae)**

Useses:- Antidiarrheal, expectorant, diuretic, hepatoprotective, antipyretic and analgesic, antioxidant, alexipharmic, anodyne, anti-atrabilious, anti-flatulent, anti-periodic, anti-phlegmatic, and carminative properties.

Verma et al. 2010was 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.[11]

***Aegle marmelos* (Rutaceae)**

Uses:- Anti-cancer, anti-ulcer, anti-microbial and anti-inflammatory.

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 at doses 100mg/kg.[12]

Mirabilis jalapa

Uses:- Antispasmodic, antibacterial, antiviral, antifungal, and protein synthesis inhibition. manjith sigh et.al 2010 was evaluated using carrageenan and formalin-induced paw edema models in Wistar albino rats. The anti-inflammatory activity was found to be dose dependent in carrageenan-induced paw edema model. The aqueous extract has shown significant ($P < 0.05$) inhibition of paw oedema, 37.5% and 54.0% on 4th hour at the doses of 200 and 400 mg/kg, respectively. Similar pattern of paw edema inhibition was seen in formalin-induced paw edema model. The maximum percentage inhibition in paw edema was 32.9% and 43.0% on 4th day at the doses of 200 and 400 mg/kg, respectively. The results of present study demonstrate that aqueous extract of the leaves of Mirabilis jalapa possess significant ($P < 0.05$) anti-inflammatory potential.[14]

***Bryophyllumpinnatum* (Crassulaceae)**

Uses:- Antifungal, antiulcer, antiinflammatory, analgesic, antihypertensive, potent anti-histamine and anti-allergic activity.

The anti-inflammatory potential of Bryophyllumpinnatum 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 Bryophyllumpinnatum leaf aqueous extract possessed anti-inflammatory. The different flavonoids, polyphenols chemical constituents of the herb are speculated to account for the observed antiinflammatory of the plant.[15]

***Solanum nigrum* (Black night shades)**

It belongs to family Solanaceae.

Uses:- Inflammation, tuberculosis, and diuretics.

The result obtained from the experiment it is concluded that the methanolic extract of Solanum nigrum (375 mg/kg) having good anti-inflammatory activities and it shown dose dependent activities. The results support the traditional use of this plant in inflammatory conditions and suggest the presence of biologically active components which may be worth further investigation and elucidation.[16]

***Piper ovatum* (Piperaceae)**

Uses:- anti-microbial and anti-inflammatory.

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 piperlonguminine showed the greatest inhibitory activity of topical inflammation induced by croton oil.[17]

***Viola betonicifolia* (Violaceace)**

Viola betonicifoliabelongs to family of Violaceace. The folk use ofthis plant is antipyretic, astringent, diaphoretic, anticancerand purgative. Intraperatonial administration of VBME at the dose of100, 200 and 300mg/kg produced a significant*P<0.05, **P<0.01 antiinflammatory effect induced by carrageenan and histamine. The reduction in paw edema at the dose of 300mg/kg was 60.880%.after 2 hour when compared to control.[18]

***Azardirachtaindica* (Meliaceae)**

Uses:- Anti-inflammatory, antiarthritic, antipyretic, hypoglycemic, antigastric ulcer, antifungal, antibacterial, and antitumour activities.

The anti-inflammatory potential of Azardirachtaindica was using carbon tetrachloride extract of Azadirachtaindica fruit skin and its isolated constituent azadiradione attwo 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.[19]

***Achillea millefolium* (Asteraceae)**

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%.[20]

Boswellia serrata

Uses:- diarrhoea, dysentery, ringworm, boils, fevers, skin and blood diseases, cardiovascular diseases, mouth sores, bad throat, bronchitis, asthma, cough, vaginal discharges.

Shaik Mannur Ismail et.al 2016investigating the different doses of B. serrata and Indomethacin treated rats showed an inhibition of Carrageenan induced paw edema in all observed time intervals as compared to Carrageenan induced paw edema. The inhibition of paw edema was observed greater in rats treated with B. serrata at high dose (35.97%) followed by Indomethacin and histopathological finding of cellular infiltrates and found to be greater at higher concentration i.e., 200 mg/kg/b/wt as compared to standard drug.Thesestudy proves that *B. serrata* has high anti-inflammatory activity and supports its usage in traditional medicine as herbal anti-inflammatory medicine.[21]

4. CONCLUSION

Inflammation is a healthy process of body resulting from some disturbance or diseases. 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 but long term use of these agents leads side effects. Many anti-inflammatory agents like aspirin, indomethacin and other nonsteroidal anti-inflammatories (NSAIDs) with many more drugs under development.

So these drugs also not useful all cases of inflammation and produce adverse effects like, kidney problems, bleeding risks and ulcers.

Traditional plants play a very important role in the discovery of new drugs and less adverse effects. Plants have played an important role in human health care since the ancient times. So to overcome this problem new drugs are very requisite and in plants have many of phytochemical constituents are polyphenols, lignans, anthraquinones, flavonoids, alkaloids, terpenoids, saponins, polysaccharides and peptides. Which are helpful in inflammation and have less side effects. So in this article included some herbal medicinal plants on behalf of their phytochemical constituents which can be helpful in inflammation.

5. REFERENCES

1. Medzhitov R. Inflammation 2010: new adventures of an old flame. Cell, 2010; 140: 771–776. [PubMed] [Google Scholar].
2. Dinarello C. Anti-inflammatory Agents: Present and Future. Cell, 2010; 140: 935–950.
3. Kumar S, Bajwa B S, Singh Kuldeep et al. Synthesis and biological evaluation of substituted 4-arylthiazol-2-amino, International journal of advances in Pharmacy, Biology and Chemistry, 2013; 2(2): 41-46.
4. Toth M. Age-related differences in skeletal muscle protein synthesis: relation to markers of immune activation. AJP: Endocrinology and Metabolism, 2004; 5: 288.
5. Barbosa-Filho, J. M., Piuvezam MR, Moura MD., Anti-inflammatory activity of alkaloids: A twenty-century review. Revista Brasileira de Farmacognosia, 2006; 16(1): 109-139.
6. Iwalewa E, McGaw L, Naidoo V, Eloff J. Inflammation: the foundation of diseases and disorders. A review of phytomedicines of South African origin used to treat pain and inflammatory conditions. African Journal of Biotechnology, 2007; 6: 2868-288.
7. Villarreal G, Zagorski J, Wahl SM. Inflammation: Acute. Ethno pharmacology, 2000; 72: 275.
8. Dalgleish AG, O'Byrne KJ. Chronic immune activation and inflammation in the pathogenesis of AIDS and cancer. Advanced Cancer Research, 2002; 84: 231-276.
9. Saurabh Patel et.al Evaluation of Anti Inflammatory Activity of Hydroalcoholic Leaves Extracts of Polyherbal Combination of Vitex Negundo and MurrayaKoenigii against Carrageenan Induced Paw Edema in Rats Journla of Molecular Pharmaceutics & Organic Process ResearchAbe et al., J Mol Pharm Org Process Res, 2014; 2: 3. available on DOI: 10.4172/2329-9053.1000119.
10. H. Shimoda, S.-J. Shan, J. Tanaka et al., "Anti-inflammatory properties of red ginger (Zingiber officinale var. Rubra) extract and suppression of nitric oxide production by its constituents," Journal of Medicinal Food, 2010; 13(1): 156–162.
11. Verma S, Ojha S, Raish M. Anti-inflammatory activity of Aconitum heterophyllum on cotton pellet-induced granuloma in rat. Journal of Medicinal Plants Research, 2010; 4: 1566–1569.
12. Benni JM, Jayanthi MK, Suresha RN. Evaluation of the antiinflammatory activity of Aegle marmelos (Bilwa) root. Indian Journal of Pharmacology, 2011; 43: 393-7.
13. Singh M, Kumar V, Singh I, Gauttam V, Kalia AN. Anti-inflammatory activity of aqueous extract of Mirabilis jalapa Linn. leaves. Pharmacognosy Res, 2010; 2(6):

364-7. avilable on doi: 10.4103/0974-8490.75456. PMID: 21713140; PMCID: PMC3111696.

14. Ojewole J. Antinociceptive, anti-inflammatory and antidiabetic effects of Bryophyllumpinnatum (Crassulaceae) leaf aqueous extract. Journal of Ethnopharmacology, 2005; 99: 13–19.
15. Ravi V1et. Al Anti-Inflammatory Effect of Methanolic Extract of Solanum nigrum Linn BerriesInternational Journal of Applied Research in Natural Products, 2009; 2(2): 33-36.
16. Silva DR, Baroni S, Svidzinski AE, Bersani-Amado CA, Cortez DA. Anti-inflammatory activity of the extract, fractions and amides from the leaves of nonePiperovatumVahl (Piperaceae) none. J Ethnopharmacol, 2008; 116: 569-753.
17. Naveed Muhammad, Muhammad Saeed and Haroon Khan Antipyretic, analgesic and anti-inflammatory activity of Viola betonicifolia whole plant Muhammad et al. BMC Complementary and Alternative Medicine, 2012.
18. Ilango K, Maharajan G, Narasimhan S. Anti-nociceptive and anti-inflammatory activities of Azadirachtaindica fruit skin extract and its isolated constituent azadiradione. Natural Product Research, 2012; 27: 1463-7.
19. Goldberg AS, Mueller EC, Edward E, Desalva SJ. Achillea millefolium, Achillea millefolium. Journal of Pharmaceutical Sciences, 1991; 58: 938-941.
20. Shaik Mannur Ismail1 et.al Evaluation of anti-inflammatory activity of Boswellia serrata on carrageenan induced paw edema in albino Wistar rats International Journal of Research in Medical SciencesIsmail SM et al. Int J Res Med Sci, 2016; 4(7): 2980-2986. DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20161989.