



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Medicinal Plants With Anti-Inflammatory Activity

GANESH R .GOSAVI, EKNATH V.UNDE, SHRADDHA S. SHINDE, KUNAL V. GHUGE, AMOL S. DARADE.

Dr. Ithape Institute of Pharmacy, Sangamner, Tal- Sangamner, Dist-Ahilyanagar ,422605 ,India

ABSTRACT

It is well recognized that phytochemicals derived from plants may contain anti-inflammatory properties. Numerous research have documented the potential ability of medicinal plants' pure chemicals, crude extracts, and metal/metal oxide nanoparticles (M/MONPs) to reduce inflammation and treat disease. This paper reviews the present state of research on medicinal plant phytochemicals and their nanoparticles as anti-inflammatory medicines based on multiple investigations. About fifty medicinal plants were found to have phytochemicals that represent the class of flavonoids, terpenoids, polyphenols, saponins, tannins, alkaloids, anthraquinones, chemical constituents of essential oils, and some of their M/MONPs for the treatment of inflammatory illnesses. These plants' natural compounds showed encouraging anti-inflammatory properties to treat inflammatory illnesses of the skin, liver, heart, joints, gastrointestinal tract, nervous system, and lungs.. Additionally, a brief synopsis of the mechanism of action of phytochemicals and their M/MONPs agents against inflammation is provided. Numerous investigations into the phytochemistry, M/MONPs, and anti-inflammatory properties of phytochemicals derived from medicinal plants have produced new, safe medication with fewer adverse effects. As a result, this review might encourage researchers to look more closely at the use of natural medicinal plant items and their nanoparticles to treat various illnesses. By blocking the cyclooxygenase enzyme isoform from metabolizing arachidonic acid, which reduces prostaglandin formation, a number of nonsteroidal anti-inflammatory drugs have been shown to reduce pain and inflammation. Unfortunately, there are certain side effects associated with the administration of nonsteroidal anti-inflammatory drugs. However, certain therapeutic herbs have anti-inflammatory qualities that are either insignificant or have no negative consequences. On the African continent, there are several medicinal plants with anti-inflammatory qualities that have been shown to be effective in treating inflammatory disorders in traditional medicine. It's interesting to note that scientists have investigated several of these African medicinal plants and documented their biological and therapeutic qualities. Sadly, not a single review has documented the anti-inflammatory properties of medicinal herbs from around Africa. Uses of anti-inflammatory medicinal herbs and ethnobotanical knowledge from It has been demonstrated that certain nonsteroidal anti-inflammatory medications can lessen pain and inflammation by preventing the cyclooxygenase enzyme isoform from metabolizing arachidonic acid, which lowers prostaglandin synthesis. Regretfully, the use of nonsteroidal anti-inflammatory medications is linked to some adverse consequences. The anti-inflammatory properties of some medicinal herbs, however, are either negligible or have no adverse effects. Traditional medicine on the African continent has demonstrated the effectiveness of a number of medicinal plants with anti-inflammatory properties in the treatment of

inflammatory diseases. Interestingly, researchers have studied a number of these African medicinal plants and recorded their biological and therapeutic properties. Regretfully, no review has confirmed that medicinal herbs from all over Africa have anti-inflammatory qualities. Medicinal plant uses that reduce inflammation. It is important to describe the ethnobotanical knowledge and applications of anti-inflammatory medicinal plants from a small number of selected countries that represent different parts of the African continent. This study describes the anti-inflammatory qualities of a number of medicinal plants from different geographical regions of Africa in order to demonstrate the diversity of medicinal plants with traditional or therapeutic usage in the continent.

Keywords: INFLAMMATION, LOCAL PLANTS, MEDICINAL PLANTS, ANTI-INFLAMMATORY ACTIVITY, IN-VIVO MODELS ,MARKER COMPOUND

INTRODUCTION

When tissue injury occurs, inflammation is the body's general, protective response. Inflammation may be brought on by pathogens, abrasions, chemical irritations, cell disruption or deformation, and extreme heat. Four unique indications and symptoms of inflammation are redness, pain, heat, and swelling, according to Gerard J. Tortora (2009). The inflammatory response is divided into three basic steps: 1. Vasodilation and enhanced blood vessel permeability 2. The movement of phagocytes into interstitial fluid from the circulation 3. Fixing tissue injury (Gerard J. Tortora, 2009) These chemicals, which include histamine, kinins, prostaglandins (PGs), leukotrienes (LT), and various components of the complement system, cause vasodilation, increased permeability, and other reactions linked to inflammation. Acute inflammation, which is associated with leukocyte emigration, capillary infiltration, and elevated vascular permeability, is one of the two main types of inflammation. The infiltration of neutrophils, monocytes, macrophages, mononuclear immune cells, fibroblast activation, proliferation, and fibrosis are all associated with chronic inflammation, according to S. Kumar (2013). Long-term adverse consequences of using conventional anti-inflammatory medications: Non-steroidal anti-inflammatory medications, or NSAIDs, are widely available. NSAIDs are the most widely used and commonly prescribed anti-inflammatory medications; nonetheless, their use may be hazardous. A vast range of phytochemical substances can be produced by plants as secondary metabolites. Numerous phytochemicals have been successfully employed to treat a range of human illnesses. The World Health Organization has classified over 20,000 species of medicinal plants in an effort to identify all of them utilized worldwide. The majority of medicinal plant components have a variety of therapeutic uses and are utilized as raw medications. In traditional medicine, plants are used to cure infectious and chronic illnesses. They also hold enormous promise for the development of novel pharmaceuticals. An effort has been made to look into the anti-inflammatory properties of a few medicinal plants in this review.

PLANT WITH ANTI-INFLAMMATORY ACTIVITY

1. *Aegle marmelos* (Rutaceae): 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
2. *Bryophyllum pinnatum* (Crassulaceae): Ojewole et al. looked into the anti-inflammatory properties of *Bryophyllum pinnatum*. The purpose of the study was to examine the plant leaf aqueous extract's anti-inflammatory properties in experimental animal models. Diclofenac 100 mg/kg was used in this investigation together with a fresh egg albumin-induced pedal (paw) oedema model. According to the findings of this

experimental animal study, the aqueous extract of bryophyllum pinnatum leaves had anti-inflammatory properties. The herb's various flavonoids and polyphenols are thought to be responsible for the plant's noted anti-inflammatory properties.

3. *Lebbeck, Albizia (Mimosaceae)*: The *Albizia lebbeck* bark extract For pharmacological screening, benton that was produced by cold extracting a combination of equal parts petroleum ether, ethyl acetate, and methanol was selected. After four hours, the extract at the 200 and 400 mg/kg dose level demonstrated 27.51% and 36.68% ($P<0.001$) reduction of edema volume in a rat paw edema model caused by carrageenan.
4. *(Caesalpiniaceae) Cassia fistula*: In the acute and chronic anti-inflammatory model of rat inflammation, *Cassia fistula* bark extracts have a strong anti-inflammatory activity. Numerous diseases, including atherosclerosis, diabetes, cancer, arthritis, and the aging process, are linked to the pathophysiology of reactive oxygen species (ROS), which can be produced endogenously or exogenously. The pathophysiology of inflammatory disorders is significantly influenced by ROS. Flavonoids and bio-flavonoids are the primary components of *Cassia fistula* that give it its anti-inflammatory properties.
5. *Cassia occidentalis (Caesalpiniaceae)*: The anti-inflammatory properties of the entire *Cassia occidentalis* plant were assessed by Sreejith et al. using an ethanolic extract. Using a model of paw edema generated by carrageenan, 250 mg/kg is administered to investigate the anti-inflammatory potential. The findings showed that mice given 250 mg/kg of carrageenan experienced a considerable decrease in inflammation brought on by the substance and a significant decrease in the levels of malondialdehyde in their hepatic microsomes.
6. *Cynodon dactylon (Poaceae)*: The anti-inflammatory properties of *Cynodon dactylon* aqueous extract at varying concentrations were tested using the cotton pellet method and rat paw edema caused by carrageenan, serotonin, histamine, and dextran. Three distinct oral dosage levels of 200, 400, and 600 mg/kg were used in the study. All dosages of the *C. dactylon* aqueous extract were shown to be safe, and when taken orally, there was no mortality up to a level of 4000 mg/kg of extract. In every model, *C. dactylon* exhibited notable anti-inflammatory properties. After three and five hours, it was discovered that the extract considerably ($P<0.001$) decreased the development of edema brought on by carrageenan, serotonin, histamine, and dextran.
7. *Embllica officinalis (Euphorbiaceae)*: The tree *Embllica officinalis* grows in tropical and subtropical regions of the Malay Peninsula, China, India, and Indonesia. It has been applied in various fields for its antipyretic and anti-inflammatory properties. Recent research has shown that the water fraction of plant leaf methanol extract has anti-inflammatory properties. The fraction's impact on the production of inflammatory mediators such thromboxane, leukotriene B₄, and platelet activating factor (PAF) was examined. At comparatively low concentrations, the water part of the methanol extract prevented human PMN migration.
8. *Hibiscus rosa-sinensis (Malvaceae)*: The carrageenin and dextran-induced rat paw edema anti-inflammatory model was employed to test the methanolic extract of *Hibiscus rosa-sinensis* leaves (250 and 500 mg/kg body weight orally). As a conventional medication, indomethacine shown strong anti-inflammatory properties. After three hours, carrageenin and dextran inhibited edema by 17.12% and 16.46% with 250 mg/kg, 45.35%, and 44.51% with 500 mg/kg body weight, respectively. When taken orally at doses of 250 and 500 mg/kg body weight, the plant extract demonstrated significant ($P<0.001$) anti-inflammatory effects against all of the agents studied.
9. *Moringa oliefera (Moringaceae)*: At a dose of 300 mg/kg body weight, the aqueous and ethanolic extract of *Moringa oliefera* stem bark demonstrated a degree of inhibition after 5 hours that was comparable to the conventional medication Diclofenac sodium, with a maximum of 27.27 and 30.30% significant reduction $P<0.01$ and $P<0.05$ in the edema volume. The percentage inhibition of the conventional medication was 44.44% (25 mg/kg) of body weight, with a significant value of $P<0.01$. The alcoholic extract was observed to have a lower percentage of paw edema than the watery extract.
10. *Sida cordifolia Linn. (Malvaceae)*: The perennial subshrub *Sida cordifolia* belongs to the Malvaceae family of mallows. In traditional medicine, *sida cordifolia* is used to cure blenorrhea, asthmatic bronchitis, nasal

congestion, and inflammation of the oral mucosa. It has been studied as an anti-inflammatory⁴⁵, to promote liver growth, and to stop cell proliferation⁴⁶.



Figure 1: Some Plants have anti-inflammatory potential

MECHANISMS OF ACTION OF PLANTS WITH ANTI-INFLAMMATORY POTENTIALS

The anti-inflammatory properties of medicinal plants have been explained by a number of modes of action, including the following:

1. Inhibition of 15-Lipoxygenases (LOX): A number of inflammatory diseases are associated with the lipoxygenase group of enzymes (5, 8, 12, and 15 LOX). One important enzyme in the process of creating leukotrienes from arachidonic acids is the isomeric enzyme 15-LOX. Since many pro-inflammatory and allergy reactions are mediated by biologically active leukotrienes, 15-LOX's suppression of leukotriene production is considered a therapeutic approach for the treatment of inflammatory conditions.
2. NOS Inhibition: It is not thought that plant flavonoids generally exhibit iNOS inhibition. Plant flavonoids, however, have been shown to suppress the synthesis of nitric oxide (NO), which in turn suppresses the expression of iNOS. Additionally, flavone and amino-substituted flavones have been shown to suppress the generation of NO.
3. NOS Inhibition: It is not thought that plant flavonoids generally exhibit iNOS inhibition. Plant flavonoids, however, have been shown to suppress the synthesis of nitric oxide (NO), which in turn suppresses the

expression of iNOS. Additionally, flavone and amino-substituted flavones have been shown to suppress the generation of NO.

4. Inhibition of phospholipase A2: Prostaglandins, thromboxanes, and leukotrienes are synthesized when phospholipase A2 releases arachidonic acid, a precursor of eicosanoids, from membrane lipids. It has been demonstrated that phospholipase inhibition, by any medicinal drug, effectively treats and manages inflammatory disorders by blocking the COX and LOX pathways in the arachidonic cascade. Quercetin inhibited human neutrophils, making it the first flavonoid inhibitor of phospholipase A2 observed.⁶⁸ Certain



medicinal plants

ANTI-INFLAMMATORY HERBAL DRUGS

Herbal medicine is a significant component of supplementary medicine. For a long time, people have been using herbal medications to treat and prevent illnesses like inflammation. Since many individuals now employ herbal medicines and phytonutrients of nutraceuticals in their daily lives, the market for herbal medications and phytonutrients, or nutraceuticals, is growing quickly worldwide. Three quarters of the population, according to the World Health Organization (WHO), get their daily medical treatment from traditional and plant-based medicine. Due to their less adverse effects compared to synthetic pharmaceuticals, herbal medications are currently more in demand. There are numerous medicinal plants with anti-inflammatory qualities; some have been used for ages, while others are listed in traditional Chinese and Ayurvedic medicine. Table No. 1 below lists a few medicinal plants having anti-inflammatory properties along with their common name, biological name, anti-inflammatory plant part, and chemical ingredient from that specific plant part.

Table 1. List of Indian Herbal Plants having Anti-Inflammatory Activity

S.No	Plant Name	Family	Part used
1.	<i>Acacia Catechu</i>	Leguminosae	Bark and Stem
2.	<i>Allium Sativum</i>	Liliaceae	Bulbs
3.	<i>Abutilon Indicum</i>	Malvaceae	Leaves
4.	<i>Andrographis Paniculata</i>	Acanthaceae	Aerial plant
5.	<i>Achyranthes aspera Linn</i>	Amaranthaceae	Seeds
6.	<i>Azadirachta Indica</i>	Meliaceae	Leaves
7.	<i>Alternanthera Sessilis</i>	Amaranthaceae	Leaves
8.	<i>Berberis Asiatica</i>	Berberidaceae	Stem
9.	<i>Portulaca pilosa L.</i>	Portulacaceae	Whole plant
10.	<i>Beta vulgaris</i>	Amaranthaceae	Fruits
11.	<i>Bacopa Monnieri</i>	Scrophulari Aceae	Whole Plant
12.	<i>Bryonopsis Laciniola</i>	Cucurbitaceae	Whole Plant
13.	<i>Bauhinia Racemosa</i>	Caesalpini Aceae	Stem bark
14.	<i>Adhatoda vasica</i>	Acanthaceae	Whole plant
15.	<i>Cassia fistula Linn</i>	Caesalpini Aceae	Roots, Leaves, Bark
16.	<i>Cleome gynandra L.</i>	Cleomaceae	Whole plant
17.	<i>Parthenium hysterophorus L.</i>	Asteraceae	Leaves
18.	<i>Phyllanthus polyphyllus</i>	Euphorbiaceae	Whole plant
19.	<i>Sida acuta</i>	Malvaceae	Leaves Roots
20.	<i>Sterculia scaphigera hance</i>	Sterculiaceae	Seeds
21.	<i>Mentha spicata</i>	Lamiaceae	whole plant
22.	<i>Myrtus communis</i>	Myrtaceae	Leaves
23.	<i>Elephantopus Scaber</i>	Asteraceae	Leaves
24.	<i>Curcuma Longa</i>	Zingiberaceae	Rhizome
25.	<i>Ocimum sanctum L.</i>	Labiatae	Leaf

CONCLUSION

In conclusion One of the most significant sources of medications is plants. Since ancient times, medicinal plants have been utilized to cure a variety of illnesses because of their perceived effectiveness, accessibility, availability, and inherited practices. Future and current researchers will benefit from this review as they conduct additional studies on these priceless medicinal plants.

Examining research on the anti-inflammatory properties of particular medicinal plants used in various African locations was the goal of this review. Several plants from chosen nations in the different geographic regions (north, south, east, central, and west African countries) were identified in this review. It is evident that African nations are a storehouse of easily accessible medicinal plants that are utilized to treat and manage a wide range of illnesses, including inflammatory disorders that impact the local populace. Many medications are available for the management and treatment of inflammatory disorders in both developed and developing nations (including those in Africa); yet, many of these medications have side effects. Many Africans, particularly those who live in low-resource environments, use medicinal plants to manage pain and inflammation because they primarily rely on them to meet their health needs and feel that conventional medications have serious adverse effects. Numerous investigations have been conducted in several African nations to assess the anti-inflammatory properties of medicinal plants and to confirm their application in traditional medicine. As secondary metabolites, plants can generate a variety of phytochemical substances, many of which have been identified and are still useful in the treatment of diseases in Africa.

The intricate process of inflammation is nevertheless crucial to the host's defense. The development of chronic disease may result from the overproduction of inflammatory mediators. It is clear from this review that plant extracts can exhibit anti-inflammatory properties that impact various phases of the inflammatory process, preventing the production of cytokines and eicosanoids; additionally, preventing the inflammatory reaction cascade from starting reduces flare, itching, and excessive exfoliation. In the field of contemporary biomedicine, research on plants with inflammatory properties is one of the emerging fields. It is necessary to conduct further research on plants that have anti-inflammatory properties because many traditional healers in Africa may possess crucial knowledge about unstudied herbs.

REFERENCES

- 1) Barnes PJ. Targeting the epigenome in the treatment of asthma And chronic obstructive pulmonary disease. *Proc Am Thorac Soc.* 2009;6(8):693–696.
- 2) Garrett WS, Gordon JI, Glimber LH. Homeostasis and inflammation In the intestine. *Cell.* 2010;140(6):859–870.
- 3) Ahmed AU. An overview of inflammation: mechanism and conse - Quences. *Front Biol.* 2011;6(4):274–281.
- 4) Hotamisligil GS. Inflammation and metabolic disorders Nature Maroyi A. Traditional use of medicinal plants in south-central Zimba- Bwe: review and perspectives. *J Ethnobiol Ethnomed.* 2013;9:31.
- 5) Iwalewa EO, McGaw LJ, Naidoo, Eloff JN. Inflammation the foundation Of diseases and disorders: a review of phytomedicines of South African Origin used to treat pain and inflammatory conditions. *Afri J Biotech* 2007;6(25):2868–2885.
- 6) Street RA, Stirk WA, Van Staden J. South African traditional medicinal Plant trade—challenges in regulating quality, safety and efficacy. *J Ethnopharmacol.* 2008;119(3) :705–710.
- 7) Abdullahi AR. Trends and challenges of traditional medicine in Africa. *Afri J Tradit Complement Altern Med.* 2011;8(5 Suppl):115–123.
- 8) Gupta OC, Rizvi SA, Gupta PC. Chemical examination of a phytostero-Lin from the seeds of *Ipomoea fistulosa*. *Planta Med.* 1971;20(2):72–177. Teow CC, Truong VD, McFeeters RF, Thompson RL, Pecota KV, Yencho GC. Antioxidant activities, phenolic and carotene contents Of sweet potato geneotypes with varying flesh colours. *Food Chem.* 2007;103(3):829–838.
- 9) Pongprayoon U, Baekstrom P, Jacobsson U, Lindstrom M, Bohlin L. Compounds inhibiting prostaglandin synthesis isolated from *Ipomoea Pescaprae*. *Planta Med.* 1991;57(6):515–518.
- 10) Karawya MS, Ammar MM, Hifnawy MS, AL-Okbi SY, Mohamed DA, EL-Anssary AA. Phytochemical study and evaluation of the anti-Inflammatory activity of some medicinal plants growing in Egypt. *Med J Islamic World Academy Sci.* 2010;18(4):139–150.
- 11) Boubekri N, Belloum Z, Boukaabache R, et al. In vivo anti-inflammatory And in vitro antioxidant activities of *Genista quadriflora* Munby extracts. *Der Pharmacia Lettre.* 2014;6(1):1–7. Rao KS, Chaudhury PK, Pradhan A. Pro-inflammatory genes as Biomarkers and therapeutic targets in oral squamous carcinoma. *Food Chem Toxicol.* 2010;48(2):729–732.
- 12) Ananthi S, Raghavendran HRB, Sunil AG, Gayathri V, Ramakrishnan G, Yasanthi HR. In vitro antioxidant and in vivo anti-inflammatory potential Of crude polysaccharide from *Turbinaria ornate* (Marine Brown Alga). *Food Chem Toxicol.* 2010;48(1):187–192.
- 13) Sagnia B, Fedeli D, Casetti R, Montesano C, Falcioni G, Colizzi V. Antioxidant and anti-inflammatory activities of extracts from *Cassia Alata*, *Eleusine indica*, *Eremomastax speciosa*, *Carica papaya* and *Polyscias fulva* medicinal plants collected in Cameroon. *PLoS One.* 2014;9(8):1–10.
- 14) Asmawi MZ, Kankaanranta H, Moilanen E and Vapaatalo H. Anti-Inflammatory activities of *Emblica officinalis* Gaertn leaf extracts. *J Pharm Pharmacol.* 1993, 45:581–584.

- 15) Tomar V, Kannoja P, Jain KN, Dubey KS. Anti-nociceptive and anti-inflammatory activity of leaves of *Hibiscus rosa sinensis*. *Int J Res Ayurveda Pharm*. 2010, 1:201-05.
- 16) Chandrashekar KS, Thakur A, Prasanna KS. Anti-inflammatory activity Of *Moringa oleifera* stem bark extracts against carrageenin induced rat Paw edema. *J Chem Pharm Res*. 2010, 2:179-81.
- 17) Franzotti EM, Santos CV, Rodrigues HM, Mourao RH, Andrade MR and Antonioli AR. Anti-inflammatory, analgesic activity and acute toxicity Of *Sida cordifolia* L.(Malva-branca). *J Ethnopharmacol*. 2000, 72:273-277. Silva. Effect of aqueous extract of *Sida cordifolia* on liver regeneration After partial hepatectomy. *Acta Cir Bras*. 2006, 21:37-39.
- 18) Shimoda, H., 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.
- 19) Laloo D, Hemalatha S. Ethnomedicinal plants used for diarrhea by tribals Of Meghalaya, Northeast India. *Pharmacogn Rev*. 2011, 5:147-54.

