Research Article **CODEN: IJRPJK** **ISSN: 2319 – 9563**

International Journal of Research in Pharmaceutical and Nano Sciences

Journal homepage: **www.ijrpns.com**

AN OVERVIEW ON ANTI-INFLAMMATORY ACTIVITY OF INDIAN HERBAL PLANTS

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ABSTRACT

Inflammation is the complex biological response of vascular tissues to harmful stimuli including pathogens, irritants or damaged cells. Mainly NSAIDs are effective for the treatment of pain. The factor limits the use of the NSAIDs is the gastrointestinal toxicity. It is mainly the developments of potent anti-inflammatory drugs and from the natural products which are under considerations. The herbal products are rich source for discovery of new drugs because of its chemical diversity. Herbal products from medicinal plants are playing a major role to cure many diseases associated with the inflammation. The conventional drugs are available in the market to treat the inflammation which produces various side-effects. Due to these side-effects there is need for the search of newer drugs with less or no side-effects. The review analyses extracts and phytochemicals derived from the Indian herbal plants evaluated for the possible anti-inflammatory activity.

KEYWORDS

Indian medicinal plants, Phytoconstituents and Inflammatory activity.

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INTRODUCTION

Inflammation

Inflammation is a defined as a sequence of events that occurs in the response to noxious stimuli and infection or trauma[1]. It is mainly characterized by the redness, swollen joints and joint pain, its stiffness and loss of joint function[2]. It is mainly of two types. They are

Acute inflammation

Acute inflammation is usually of sudden onset, marked by the classical signs in which vascular and exudative processes predominate.

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]. Currently inflammation is treated by using NSAIDs. NSAIDs are the most commonly used drugs worldwide. They are prescribed for orthopedic conditions such as soft-tissues injuries, osteoarthritis and fractures etc[4]. NSAIDs are one of the best classes of drug to prevent and treat the postoperative pain[5]. The side-effects with currently used drugs are gastrointestinal ulceration and bleeding, renal damage, hyperglycemia, hypertension. 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 needed and there are many efforts for finding the anti-inflammatory drugs from indigenous herbal plants[6].

Plants that are Natural Anti-Inflammatory Agents

Unlike modern Allopathic drugs which are single active compounds that can specifically target one pathway, herbal remedies work in a way that depends on orchestral approach. A plant contains a multitude of several molecules that synergistically act on targeted elements of the cellular complex pathway[7]. Medicinal herbs have been source of wide range of biologically active compounds for many centuries and they have been used extensively as crude drugs or as pure components for treating varieties of disease conditions. When compared to synthetic ones, natural remedies are having less side-effects and toxicity. So, now days the usages of herbal remedies are increased when compared to allopathic drugs[8]. In the development of potential therapeutic agents, medicinal plant plays an important role. There are over 1.5 million practitioners of traditional medicinal system using medicinal plants in preventive, promotional and curative applications[9]. India with its biggest repository of medicinal herbs in the world may maintain an important position in the production of raw materials either directly for crude drugs or as the bioactive components in the formulation of pharmaceuticals and cosmetics etc[10].

Importance of Indian Herbal Plants

The present review is dedicated to herbal formulations, extracts and the bioactive or active constituents isolated and identified from the Indian plants, which have been previously reported to have an anti-inflammatory activity. The role of natural products as remedies has been recognized since ancient times. A medicinal plant is any plant used in order to relieve, prevent or cure a disease or to alter physiological and pathological process or any plant employed as a source of drugs or their precursors. 80% of the world`s population till relies upon plants for primary health care. Even today in western medicine and despite in synthetic chemistry 25% of prescription medicines are still derived either directly or indirectly from plants[11]. Nearly 50,000 species of higher plants have been used for medicinal purposes. They are also used in food, cleaning, personal care and perfumery. In systems of traditional healing, major pharmaceutical drugs have been either derived from or patterned after compounds from biological diversity[12].

Table No.1: List of Indian Herbal Plants having Anti-Inflammatory Activity

S.No	Plant Name	Family	Part used	Chemical constituents	Other activities	Reference
1	***Acacia catechu***	Leguminosae	Bark and Stem	Tannins, catechin, Quercetin, Catechuic acid	Analgesic activity	Patil SS *et al.*, (2010)
2	***Allium sativum***	Liliaceae	Bulbs	Allicin, (S-allyl-l-cysteine sulfoxide), (diallyl thiosulfinate) peptides, steroids, terpenoids, flavonoids, and phenols.	Treatment for all rheumatic and catarrhal conditions, rheumatoid arthritis	Dhanapal R *et al.*, (2004)
3	***Abutilon indicum***	Malvaceae	Leaves	phenolics, terpenoids, flavanoids, pigments and other natural oxidants including Vitamin A, Vitamin C and Vitamin E	Anti-ulcer, Anti-pyretic, Antioxidant, Analgesic	Sridhar C, Krishnaraju AV *et al.*, *(*2006)
4	***Andrographis paniculata***	Acanthaceae	Aerial plant	Diterpenoids, Diterpene, Lactone, 5,7,2,3-tetramethoxy flavonone	Anti-typhoid, Anti-fungal, Anti-oxidant, Anti-pyretic, Hypertension and ulcer	Park EK *et al.*, (2006)
5	***Anacardium occidentale***	Anacardiaceae	Bark	bassorin, p-hydroxy benzoic, gallic acid and Quercitol	Anti-inflammatory activity and Anti-oxidant	Mota ML, Thomas R G *et al*,. (1985)
6	***Azadirachta indica***	Meliaceae	Leaves	Terpenoids, Nimbin, Nimbidin	Anti-microbial, Anti-fungal, Anthelmintic, Antiviral, Antipyretic	S.Kumar *et al.*, (2013)
7	***Alternanthera sessilis***	Amarnthaceae	Leaves	Alpha and beta spinosterols	Wound healing activity	Wan D,Liu Y *et al.*, (2004)
8	***Berberis asiatica***	Berberidaceae	Stem	Alkaloids, berberine, palmatine, present as chlorides	anti-viral, anti-tumor, anti-diabetic, anti-oxidant	Sridhar C, Krishnaraju AV *et al.*,*(*2006)
9	***Boswellia serrata***	Burseraceae	Bark	Oleo gum resin, triterpenes of oleanane, ursane and euphane series	Antiseptic, analgesic, anti-arthritic activity	Arya Vikrant *et al*.,(2011)
10	***Beta vulgaris***	Amaranthaceae	Fruits	high in nitrate, nitric oxide, nitric acid	Antiseptic, Anemia, Gastritis, Gastric with duodenal ulcers	Channa S *et al.*, (2006)
11	***Bacopa monnieri***	Scrophulariaceae	Whole plant	Triterpene, Betulinic acid	Rheumatism	S.Kumar *et al.*, (2013)
12	***Bryonopsis laciniosa***	Cucurbitaceae	Whole plant	Goniothalamin, punicic acid	Jaundice, inflammation, fever	Tiwari S *et al*., (2008)
13	***Bauhinia racemosa***	Caesalpiniaceae	Stem bark	Flavonoids, saponins, Glycosides, tannins	Analgesic	Wan D,Liu Y *et al.*, (2004)
14	***Syzygium aromaticum***	Myrtaceae	Flower buds	Eugenol, caryophyllene, alphahumulene, eugenyl, methyl eugenol, acetyl eugenol	Anticancer	Mota ML, *et al* (1985)
15	***Chrysanthemum indicum***	Asteraceae	Leaves	D1-camphor, azulene, chrysanthenone	Used in migraine	Krishna raju AV *et al.*, (2006)

16	***Curcuma domestica***	Zingiberaceae	Rhizome	Alkaloids, glycosides, saponins, resin, oleoresins, sesquiterpene la ctones and oils (essential and fixed).	Stomachic, blood purifier, antiseptic also in sprains	Kupeli E *et al.*, (2001)
17	***Curcuma longa***	Zingiberaceae	Rhizome	Desmethoxy curcumin, Bisdemethoxy curcumin	Used in rhinitis, wound healing, common cold, skin infection, as blood purifier	S. Kumar *et al.*, (2013)
18	***Cyperus rotundus***	Cyperaceae	Whole plant	Cyperene, mustakone, kobusone and isokobusone, patchoulenone	Potent anti-inflammation activity in Carrageenan induced oedema, Cotton pellet induced granuloma	Bisset N *et al.*, (1994)
19	***Cassia fistula Linn.***	Caesalpini aceae	Roots, Leaves, Bark	Flavonoid, fistucacidin, tannins, phlibaphenes	Purgative, febrifugal, astringent	S.Kumar *et al.*, (2013)
20	***Euphorbia heterophylla***	Euphorbiaceae	Whole plant	Flavonoid, Quercrtin	Treatment of constipation, bronchitis and asthma	Nadkarhi AK *et al.*, (2002)
21	***Emblica officinalis***	Euphorbiaceae	Leaves	Tannins, alkaloids, amino acids, vitamin C, Carbohydrates, gallic acid	Antipyretic, diabetic, anti-cancer, Antiulcer, anti-oxident	S.Kumar *et al.*, (2013)
22	***Glycyrrhiza glabra***	Papilionaceae	Roots Leaves	Glycyrrhizin, glucose, sucrose, resins	Antipyretic, anti-inflammation properties	Hallur ms *et al* (2002)
23	***Gymnema sylvestre***	Asclepidaceae	Flowers	Gymnemic acids, gymnemasaponins	adjuvant induced arthritis Antidiabetic, to treat anemia	Perianayag am *et al.*, (2004)
24	***Hibiscus vitifolius***	Malvaceae	Seeds	gossypetin glucuronide-hibifolin (from flowers), gossypin	Anti-inflammatory activity in carragenin induced oedema, granuloma pouch.	Chi Y. Jong H, Son K *et al.*, (2006)
25	***Murraya koenigii***	Rutaceae	Leaves	P-elemene, p-caryophyllene, o-phellandrene, carbazole alkaloids, bioactive coumarins	Anti-oxident, hypoglycemic activity, antimicrobial, antifungal, anticancer, immunomodulatory	Arya Vikrant *et al.*, (2011)
26	***Mangifera indica***	Anacardiaceae	Leaves	Flavanoids, polyphenolics, triterpenes, tannins	Analgesics	Arya Vikrant *et al.*, (2011)
27	***Moringa oleifera***	Moringaceae	Root, Bark	Alkaloids, moringin, moringninie, pterygospermin	Anti-bacterial, counter-irritant action, wound healing	Arya Vikrant *et al.*, (2011)
28	***Momordica charantia***	Cucurbitaceae	Leaves	Alkaloids, charantin, charine, momorcharins, momordenol, momordicilin,	Antipyretic, Emetic and Purgative	Kupeli E *et al.*, (2002)
29	***Nyctanthes arbor-tristis***	Oleaceae	Bark	Flavanol, glycosides, b-sitosterol, nyctanthic acid	Analgesic, Used to treat rheumatism and fever	Chi Y. Jong H,son K *et al.*, (2006)
30	***Ocimum sanctum L.***	Labiatae	Leaf	Volatile oil, terpinoids, eugenol, thymol, estragole	Expectorant, analgesic, anticancer, anti-	Channa S *et al.*, (2006)

					asthmatic, antiemetic, diaphoretic, anti-diabetic, anti-stress agents	
31	***Piper longum L.***	Piperaceae	Fruits, Root	piperlongumine, piperlonguminine, sesamine	Used as counter irritant and analgesic for muscular pain and inflammation	S.Kumar *et al.*, (2013)
32	***Parthenium hysterophorus L.***	Asteraceae	Leaves	Saponines, histamine, Parthenin, histarine.	Anti-oxident, hypoglycemic activity	Shruthi D.P.*et al.*, (2012)
33	***Phyllanthus polyphyllus***	Euphorbiaceae	Whole plant	Benzoic acid, [4-0-methyl gallic acid, justicidin B, diphyllin	Asthma bronchitis, asthma, rheumatoid arthritis, septic stock	S.Kumar *et al.*, (2013)
34	***Psoralea corylifolia***	Fabaceae	Seeds	Psoralone, isopsoralone, psoralen, isopsoralen, isoflavone	tonify the kidneys, healing of bone fractures, hair loss	Hukkeri *et al*., (2002)
35	***Ricinus communis***	Euphorbiaceae	Roots	Stearic, palmitic, ricinoleic, arachidic, linolenic, linoleic and oleic acid	Analgesic, Antihistamine	S.Kumar *et al.*, (2013)
36	***Rubia cordifolia***	Rubiaceae	Root	Purpurin, xanthin, glycosides, manjisthin, resins	Analgesic	Annamalai Panduranga n *et al.*, (2008)
37	***Sida acuta***	Malvaceae	Leaves and Roots	Ecdysterone	rheumatic affections and antipyretic	Husni Twail *et al*., (2009)
38	***Solanum nigrum L.***	Solanaceae	Leaf	Acetic acid, tartaric acid, malic acid and citric acid, solanine, alpha, b-gama chaconines, solanine	Antioxident	Tiwari S *et al*., (2008)
39	***Sterculia scaphigera hance***	Sterculiaceae	Seeds	Alkaloids,flavonoids,terpen oids,polysaccharides,sterols, tannins, phenolic	Analgesic, antioxidant, antiulcer	Rajagopa P.L.*et al*., (2013)
40	***Adhatoda vasica***	acanthaceae	Whole plant	Vasicine, vasicinone	Cold, cough, asthma, sedative expectorant, antispasmodic, anthelmintic.	S.Kumar *et al.*, (2013)
41	***Tinospora crispa***	Menisperma ceae	leaves	Sodium, potassium, calcium, iron, aluminium, copper, zinc	Chronic rheumatism	S.Kumar *et al.*, (2013)
42	***Zingiber officinale***	Zingiberaceae	Rhizomes	Volatile oils, oleoresin, linoleic acid, trace elements	Anti-oxident, antibacterial, antiseptic, carminative properties	S.Kumar *et al*., (2013)
43	***Trigonella foenum graecum***	Fabaceae	leaves	Amino acid, fatty acid, vitamins, Saponins, folic acid	Anti-oxidant ,Anti-cancer, Anti-diabetic	Fedelicashi shtoppo *et al*., (2009)
44	***Mentha spicata***	Lamiaceae	whole plant	Phenols, Flavonoids, glycosides, tannins, terpenoids and small amount of Saponins	Anti-oxidant, Nutritive	P.Arumuga m *et al.*, (2008)
45	***Cleome gynandra L.***	Cleomaceae	Whole plant	Alkaloids, glycosides, flavonoids, Saponins, tannins, carbohydrates,	Anti-oxidant, relieves, joint pain	Narendhira Kannan RT *et al*.,

				steroids.		(2005)
46	***Portulaca pilosa L.***	Portulacaceae	Whole plant	Alkaloids, glycosides, flavonoids, Saponins, tannins, carbohydrates, steroids.	Hypoglycemic, nutritive	Narendhira Kannan RT *et al.*, (2005)
47	***Vitex leucoxylon,***	verbenaceae	Whole plant	Flavonoids	Febrifuge, astringent	Arya Vikrant *et al.*, (2011)
48	***Myrtus communis***	Myrtaceae	Leaves	Phytophenols, monoterpenes, alpha-pinene, cineole.	Narcotic analgesic	Podder MK *et al*., (2011)
49	***Amaranthus viridis***	amaranthaceae	Whole plant	Steroids, alkaloids, glycosides, flavonoids, phenolic compounds	Analgesic, diuretic and galactagogue	M.Rup pett *et al.*, (1991)
50	***Elephantopus scaber***	Asteraceae	Leaves	Glycosides, stigmasterol, deoxyelephantopin	Cardiac tonic, treat ulcers and eczema, diuretic, analgesic	Khan MD *et al*., (2011)

CONCLUSION

Since ancient times natural remedies have played a vital role in human health care systems in the discovery of new plant drugs. Most of the human populations are affected by inflammation related disorders worldwide. So it is believed that current analgesia inducing drugs such as NSAID`s are not at all useful in all cases due to their side-effects like liver dysfunction, GIT irritation, etc. There are number of agents that suppress immune system based on their capacity to inhibit cox-1 mechanism. But they cause severe unwanted side effects on long term administration. So to avoid the side-effects novel herbal formulations are encouraged. For rheumatoid arthritis currently available drugs are primarily directed towards the control of pain or inflammation associated with sinovitis. Traditionally large number of herbal species has been used as folk medicines against inflammatory disorders. Many of them have been studied scientifically and proved to be useful anti-inflammatory agents. The core chemicals classes of anti-inflammatory agents have been reported from natural sources to engage a wide range of compounds. Such compounds are polyphenols, lignans, anthraquinones, flavonoids, alkaloids, terpenoids, saponins, polysaccharides and peptides. From the study done so far, it has been believed that flavonoids are major anti-inflammatory agents. Some of them act as phospholipase inhibitors and some have been reported as TNF-α inhibitors in different inflammatory conditions. Biochemical investigations have been also shown that flavonoids are able to inhibit both cyclo oxygenase and lipoxygenase pathways of arachidonic metabolism depending upon their chemical structures. Alkaloids containing pyridine ring system have been reported to have striking anti-inflammatory activity. Eg. Berberine from Berberis is traditional remedy to treat rheumatisms. Significantly terpenoids inhibit the development of chronic joint swelling. However, still many herbal plants have not undergone through scientific investigations for inflammation and rheumatism. Hence it is need of time that all such herbal medicines should be considered for determination of their pharmacological activities by isolation of single entity responsible for anti-inflammatory activity and development of suitable formulation which would be beneficial against inflammatory disorders.

ACKNOWLEDGEMENT

All authors would like to thanks Sree Vidyanikethan College of Pharmacy, A. Rangampet, Tirupati, Andhra Pradesh, India for supporting for the fulfillment of this work

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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