IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# A Review On Anti-Inflammatory Herbal Plants

**Dr. Gopal R. Sitaphale[1], Dr. Shrikant Vijayrao Joshi[2], Dr. Prafulla R. Tathe[3]**

[1]Professor, Department of Pharmacognosy, Samarth College of Pharmacy, Deulgaon Raja, Buldhana

[2]Associate Professor, Maliba Pharmacy College, Uka Tarsadia University, Maliba Campus, Bardoli-Mahuva Road, Tarsadi, Dist. Surat, Gujarat-394350

[3]Professor, Department of Pharmacology, Samarth College of Pharmacy, Deulgaon Raja, Buldhana

Corresponding author:
Dr. Gopal R. Sitaphale
Email Id: gsitafale@gmail.com
Professor, Department of Pharmacognosy, Samarth College of Pharmacy, Deulgaon Raja, Buldhana

**Abstract:** Medicinal plants and their secondary metabolites are increasingly used as complementary medicines for the treatment of various diseases. Many synthetic anti-inflammatory drugs are associated with significant side effects and toxicity. In contrast, plant-derived anti-inflammatory agents have been traditionally used to manage inflammation with minimal adverse effects. Inflammation is a biological response in which the body's white blood cells and their mediators protect against infections caused by external pathogens such as bacteria and viruses. This review highlights various medicinal plants, their active constituents, and their role in combating inflammation. Additionally, it discusses previous research studies supporting their anti-inflammatory potential. The review concludes that herbal remedies are natural, safe, eco-friendly, and generally free from side effects. As modern lifestyles become increasingly detached from nature and technology-driven, there is a pressing need to promote the use of herbal medicine for better health and well-being.

**Keywords**: Anti-inflammatory agents, Inflammation, Medicinal plants, Secondary metabolites, Herbal medicine, Synthetic drugs.

## I. INTRODUCTION

Inflammation is a fundamental defense mechanism of the body, playing a crucial role in protecting against infections, injuries, and harmful stimuli. However, dysregulated and prolonged inflammatory responses are widely recognized as underlying factors in numerous chronic disorders, including cardiovascular diseases, metabolic syndrome, cancer, and autoimmune conditions. These conditions impose a significant economic burden on individuals and society. Chronic inflammation has been implicated in the onset and progression of various pathologies, such as cardiovascular diseases and cancer.

Medicinal plants have demonstrated diverse biological activities and have been traditionally used for the management of inflammatory conditions. Currently, inflammatory disorders are primarily treated using non-steroidal anti-inflammatory drugs (NSAIDs) and corticosteroids. Although these modern drugs

provide symptomatic relief, their long-term use is often associated with adverse effects and limitations in efficacy.

Macrophages, present in various tissues, play a central role in regulating inflammation by producing large amounts of pro-inflammatory cytokines such as interleukin (IL)-1, IL-6, and tumor necrosis factor-alpha (TNF-α), along with inflammatory mediators including reactive oxygen species (ROS), nitric oxide (NO), and prostaglandin E2 (PGE2). These mediators are synthesized by key enzymes such as inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2). An excessive or uncontrolled production of these cytokines and mediators can lead to cytotoxicity, inflammation, autoimmune disorders, and neoplastic transformations in inflamed tissues. Therefore, suppressing their overproduction is a crucial target for the treatment of inflammation-related diseases.

Inflammation can be classified into two types: acute and chronic. Acute inflammation is the body's immediate response to harmful stimuli, characterized by the increased movement of plasma and leukocytes from the bloodstream to the affected tissues. This process involves complex biochemical events that activate the local vascular system, immune response, and various cellular mechanisms at the injury site. In contrast, chronic inflammation is a prolonged condition marked by the infiltration of mononuclear cells and a continuous cycle of tissue destruction and repair. Persistent inflammation can contribute to the development of several chronic diseases, highlighting the need for effective and safer therapeutic alternatives.

## II. THE ARTICLE PROVIDES A COMPREHENSIVE REVIEW OF VARIOUS MEDICINAL PLANTS, HIGHLIGHTING THEIR PHYTOCHEMICAL CONSTITUENTS, MECHANISMS OF ACTION, AND PREVIOUS STUDIES ON THEIR ANTI-INFLAMMATORY PROPERTIES.

### A. Matricaria chamomilla: Anti-inflammatory Properties

The flowers of *Matricaria chamomilla* (chamomile) contain 1–2% volatile oils, including α-bisabolol, α-bisabolol oxides A and B, and matricin, which exhibit significant anti-inflammatory properties. Studies have shown that chamomile flavonoids and essential oils penetrate deep into the skin, making them effective as topical anti-inflammatory agents.

Fig. No. 1: **Matricaria chamomilla**

One of chamomile's key mechanisms of anti-inflammatory action involves the inhibition of lipopolysaccharide (LPS)-induced prostaglandin E2 (PGE2) release and suppression of cyclooxygenase-2 (COX-2) enzyme activity. Notably, this inhibition does not affect the constitutive form of COX, thereby reducing inflammation while minimizing leukocyte infiltration.

In vivo studies have further demonstrated chamomile's anti-inflammatory efficacy. In one study, the plant's anti-inflammatory activity was evaluated in intact rats by measuring the suppression of carrageenan-

induced paw edema. The administration of an 80% ethanol extract at one-tenth of the intraperitoneal LD50 dose resulted in significant anti-inflammatory effects.

Additionally, the immunomodulatory potential of *Matricaria chamomilla* has been investigated. Intragastric and parenteral administration of chamomile-derived heteropolysaccharides was found to modulate immune responses under different cooling conditions. Specifically, these polysaccharides helped normalize immune function following air cooling and enhanced (though not completely normalized) immune responses after immersion cooling. The immunostimulatory effects of chamomile were attributed to the activation of regulatory immune cells in peripheral blood, increased sensitivity of effector cells to helper signals, and the stimulation of heavy erythrocytes with immunostimulating properties.

These findings highlight the potential of *Matricaria chamomilla* as a natural anti-inflammatory and immunomodulatory agent, supporting its traditional use in herbal medicine.

**B. Arnica montana: Anti-inflammatory Properties**

*Arnica montana* has been used for centuries in homeopathic medicine for the treatment of various pathological conditions, including contusions, wounds, rheumatism, and inflammation. The flowers of *A. montana* are particularly valued for their medicinal properties, exhibiting antiphlogistic, inotropic, antibiotic, anti-inflammatory, immunomodulatory, antiplatelet, uterotonic, antirheumatic, and analgesic effects, especially in febrile conditions.

The anti-inflammatory potential of *A. montana* has been well established. Extracts (3–30%) blended with therapeutic agents such as camphor, menthol, eucalyptus oil, mint oil, guaifenesin, topical analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), or transdermal opioid analgesics—when incorporated into a petroleum base or pluronic lecithin organogel—have been shown to reduce inflammation. Furthermore, *A. montana*, in combination with medicinal plants such as *Ruta graveolens*, *Aconitum napellus*, *Bellis perennis*, *Hamamelis virginiana*, *Hypericum perforatum*, *Calendula officinalis*, *Ledum palustre*, and *Bryonia alba*, has demonstrated efficacy in inflammation management.

Fig. No. 2: **Arnica montana**

Various analytical techniques, including gas chromatography with mass selective detection (GC-MSD), spectrophotometry, reverse-phase liquid chromatography (RPLC), and proton nuclear magnetic resonance ($^1$H NMR) spectroscopy, have been employed to quantify the presence of lactones in *A. montana*.

The molecular mechanism of *A. montana*'s anti-inflammatory activity differs from that of NSAIDs. According to Huber et al. (2011), sesquiterpene lactones present in *A. montana* significantly reduce NF-κB-mediated inflammation, penetrating the skin efficiently to exert their effects. In experimental studies, *A. montana* 6C significantly reduced carrageenan- and nystatin-induced rat paw edema, inhibiting histamine-induced inflammation while enhancing vascular permeability. Additionally, injections of *A.*

*montana* 6C, dexamethasone, or a 5% hydroalcoholic solution in Wistar rats demonstrated potent anti-inflammatory activity. These treated rats exhibited reduced edema, decreased mast cell degranulation, and an increase in lymphatic vessel diameter, indicating *A. montana*'s role in modulating the inflammatory response.

These findings highlight *Arnica montana* as a promising natural anti-inflammatory agent with potential applications in both topical and systemic treatments.

**C. Aristolochia indica**

The Aristolochia genus (family: Aristolochiaceae) includes several medicinal plants, with Aristolochia indica (Indian Birthwort) being a perennial climber found across Indian plains and low hills. Its roots contain a variety of bioactive compounds, including aristolindiquinone, ristololide, cepharadione, aristolactams, β-sitosterol-β-D-glucoside, and aristolochene.

Aristolochia indica is traditionally used to treat cholera, fever, bowel disorders, ulcers, leprosy, and venomous bites. It is also recognized for its emmenagogue, abortifacient, antineoplastic, antiseptic, anti-inflammatory, antibacterial, antioxidant, and phospholipase A2 inhibitory activities. Its leaves and bark are used in the management of intermittent fever, while ethnomedical applications highlight its role in antitumor, antibacterial, and antimicrobial treatments.

Fig. No.3: **Aristolochia indica**

Studies indicate that Aristolochia indica inhibits α-amylase and α-glucosidase enzymes, with maximum inhibition rates of 60.12% at 300 µg/ml and 57.28% at 400 µg/ml, respectively. The plant also plays a role in immunomodulation, influencing prostaglandin synthesis and inhibiting phospholipase A2 activity, thereby reducing eicosanoid and platelet-activating factor production. Another mechanism involves the regulation of arachidonic acid mobilization in human neutrophils, further contributing to its anti-inflammatory effects.

Aristolochia indica has also been studied for its ability to neutralize rattlesnake venom (Samy et al., 2008). A study by Das et al. (2010) evaluated the plant's anti-inflammatory and analgesic activity against Heteropneustes fossilis (catfish) venom in rats. The dried extract demonstrated significant analgesic activity, with an LD50 of 40 mg/kg (oral) and 29 mg/kg (intravenous), highlighting its potential as an antidote for venomous stings.

**D. Curcuma longa: Anti-inflammatory Properties of Curcumin**

Curcumin, the active compound in *Curcuma longa*, is a highly pleiotropic molecule known for its interaction with multiple molecular targets involved in inflammation. It modulates inflammatory responses by downregulating the activity of cyclooxygenase-2 (COX-2), lipoxygenase, and inducible nitric oxide synthase (iNOS) enzymes. Additionally, curcumin inhibits the production of key pro-inflammatory cytokines, including tumor necrosis factor-alpha (TNF-α), interleukins (IL-1, IL-2, IL-6, IL-8, and IL-12), monocyte chemoattractant protein (MCP), and migration inhibitory protein. It also downregulates mitogen-activated protein kinases (MAPKs) and Janus kinases.

One of curcumin's primary mechanisms of action is the suppression of nuclear factor kappa B (NF-κB) activation and the inhibition of pro-inflammatory gene expression. It achieves this by blocking the phosphorylation of inhibitory kappa B kinase (IκB), leading to decreased expression of COX-2 and iNOS, thereby suppressing the inflammatory process and tumorigenesis.

**Fig. No.4: Curcuma longa**

Curcumin further inhibits inflammatory cytokines through multiple pathways. *In vitro* studies suggest that it regulates transcription factors such as activating protein-1 (AP-1) and NF-κB in stimulated monocytes and alveolar macrophages, thereby preventing the expression of pro-inflammatory genes. Another mechanism involves the downregulation of intercellular signaling proteins, such as protein kinase C, contributing to reduced cytokine production.

**E. Rosmarinus officinalis: Anti-inflammatory and Therapeutic Properties**

The essential oil of *Rosmarinus officinalis* primarily consists of camphor, 1,8-cineole, α-pinene, borneol, camphene, β-pinene, and limonene, with their proportions varying based on vegetative stage and environmental conditions.

In an open-label clinical trial, rosemary extract was evaluated for its effects on patients with osteoarthritis (OA), rheumatoid arthritis (RA), and fibromyalgia over a four-week period. A significant reduction in high-sensitivity C-reactive protein (hs-CRP), a marker of inflammation, was observed in patients with elevated levels. Moreover, a decrease in inflammation-related pain scores was noted, though complete remission was not achieved in fibromyalgia cases.

Fig. No. 5: **Rosmarinus officinalis**

Rosemary extract has also demonstrated gastroprotective effects, showing greater efficacy than omeprazole in protecting against gastric ulcers. This benefit is attributed to its ability to inhibit neutrophil infiltration and reduce pro-inflammatory mediators such as tumor necrosis factor-alpha (TNF-α) and interleukin-1 (IL-1).

The anti-inflammatory properties of *R. officinalis* extract and its active compound, rosmarinic acid, have been further studied through the assessment of spinal inflammatory markers, including cyclooxygenase-2 (COX-2), prostaglandin E2 (PGE-2), interleukin-1 beta (IL-1β), and matrix metallopeptidase 2 (MMP-2), using western blot analysis. Additionally, nitric oxide (NO) production was evaluated through the Griess reaction at days 7 and 14 post-surgery.

Studies indicate that dietary administration of rosemary essential oil influences experimental inflammatory models in murine subjects, with effects varying according to concentration. However, the immunomodulatory properties of rosemary extracts require further investigation. The anti-inflammatory effects of rosemary essential oil should be interpreted with caution due to its potential dose-dependent contradictions.

**F. Urtica dioica: Anti-inflammatory Properties and Pharmacological Potential**

*Urtica dioica* (stinging nettle) contains a diverse range of bioactive compounds, including flavonoids, tannins, volatile compounds, fatty acids, polysaccharides, isolectins, sterols, terpenes, proteins, vitamins, and minerals. These constituents contribute to its well-documented anti-inflammatory properties.

Pharmacological studies support the traditional use of *U. dioica* in managing pain and inflammatory conditions. The plant contains multiple anti-inflammatory compounds that influence key pathways, including the inhibition of cyclooxygenase (COX) and lipoxygenase (LOX) enzymes, which are central to the inflammatory response. Additionally, *U. dioica* modulates cytokine secretion, further contributing to its therapeutic potential.

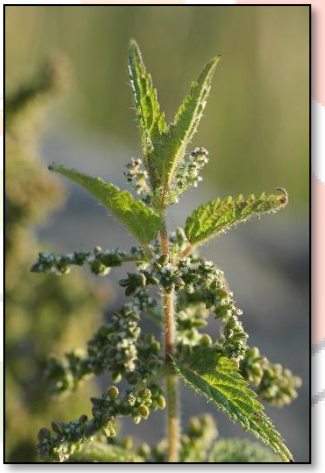

Fig. No. 6: **Urtica dioica**

Experimental studies using animal models have demonstrated significant anti-inflammatory effects of *U. dioica*. In one study, its extract exhibited dose-dependent inhibition of acute paw edema induced by formalin, highlighting its efficacy in reducing inflammation. These findings suggest that *U. dioica* may serve as a natural anti-inflammatory agent, warranting further investigation for clinical applications.

**G. Zingiber officinale: Anti-inflammatory Potential and Clinical Applications**

*Zingiber officinale* (ginger) is widely recognized for its anti-emetic properties, but it has also been used as an anti-inflammatory agent since ancient times. The bioactive compounds responsible for its anti-inflammatory effects include gingerols and essential oils. Notably, crude extracts containing both gingerols and essential oils exhibit a more potent effect in reducing joint swelling than gingerols alone.

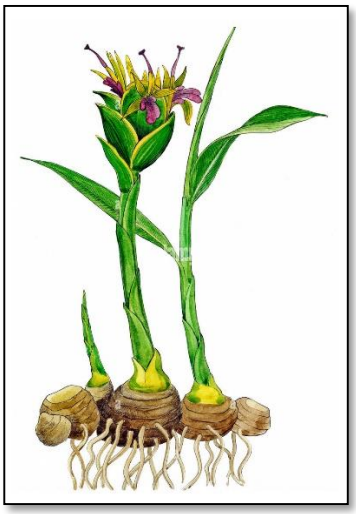

Fig. No. 7: **Zingiber officinale**

Preclinical and clinical studies suggest that *Z. officinale* exerts anti-inflammatory activity through multiple mechanisms. It modulates inflammatory pathways by inhibiting cyclooxygenase (COX) and lipoxygenase (LOX) enzymes, reducing pro-inflammatory cytokine production, and suppressing oxidative stress.

Safety evaluations indicate that *Z. officinale* is well tolerated, even at high doses, without toxic effects. In clinical studies involving patients with rheumatoid arthritis (RA) and osteoarthritis (OA), regular consumption of powdered ginger over a period ranging from three months to 2.5 years led to a reduction in pain and inflammation in approximately 75% of patients, with no reported adverse effects. These findings support the potential of *Z. officinale* as a natural anti-inflammatory agent for managing chronic inflammatory conditions.

**H. Olea europaea: Anti-inflammatory Properties and Clinical Applications**

The olive tree (*Olea europaea L.*) is primarily cultivated in the Mediterranean region, accounting for approximately 98% of global production. Phytochemical investigations have identified several bioactive compounds in *O. europaea*, including oleuropein, hydroxytyrosol, verbascoside, flavonoids, secoiridoids, triterpenes, and bio-phenols. These compounds exhibit significant anti-inflammatory properties.

A standardized olive leaf extract (Xorialyc®) has been evaluated for its anti-inflammatory action in comparison to other similar extracts. Oleuropein, a key bioactive constituent, has demonstrated potent anti-inflammatory effects, particularly in spinal cord injury models. In a study conducted on mice, oleuropein (administered at 20 mg/kg body weight) reduced inflammation when given immediately or within one hour post-injury. The pro-inflammatory cytokines TNF-α and IL-1β, which are synthesized immediately after spinal cord trauma and contribute to increased vascular permeability and inflammatory cell recruitment, were significantly modulated by oleuropein. Additionally, the extract inhibited the induction of inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2), key mediators in inflammatory pathways.

Fig. No. 8: **Olea europaea**

These findings suggest that *Olea europaea* and its active compounds hold promise as natural anti-inflammatory agents, particularly for managing inflammatory conditions and traumatic injuries. Further research is needed to explore its full therapeutic potential and optimize dosing strategies for clinical applications.

**I. Ribes glaciale: Phytochemical Composition and Pharmacological Activities**

*Ribes glaciale* extract is a rich source of bioactive compounds, including 2,2-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid), 1,1-diphenyl-2-picrylhydrazyl (DPPH), flavonoids, pyranoanthocyanins, phenolic acids, and nitrile groups. These constituents contribute to its significant anti-inflammatory and analgesic properties.

Fig. No. 9: **Ribes glaciale**

Anti-inflammatory and Analgesic Evaluation

The pharmacological potential of *Ribes glaciale* was assessed using the following experimental models:

- **Carrageenan-Induced Rat Paw Edema Model:** This model was used to evaluate the anti-inflammatory activity of the extract by measuring its ability to reduce paw swelling in rats.
- **Acetic Acid-Induced Writhing Model:** The analgesic effect was determined based on the reduction in writhing responses caused by acetic acid in experimental animals.

Phytochemical and Antioxidant Assays

- A 500 µL sample of the extract was appropriately diluted and mixed with 1 mL of 5% sodium nitrite ($NaNO_2$). After standing for 6 minutes, 1 mL of 10% aluminum chloride ($AlCl_3$) and 10 mL of 1 M sodium hydroxide (NaOH) were added. The final volume was adjusted to 25 mL with 70% ethanol and allowed to react for 15 minutes. The absorbance was recorded at 510 nm using 70% ethanol as a blank.
- For antioxidant activity assessment, extract concentrations ranging from 50–500 µg/mL were prepared in 1 mL of alcohol and mixed with 2.5 mL of phosphate buffer (0.2 M, pH 6.6) and 2.5 mL of 1% potassium ferricyanide. The mixture was incubated at 50°C for 20 minutes, followed by the addition of 2.5 mL of 10% trichloroacetic acid. After centrifugation, 2.5 mL of the supernatant was mixed with an equal volume of distilled water and 0.5 mL of 0.1% ferric chloride ($FeCl_3$). The absorbance was measured at 700 nm.

**J. Centipeda minima: Traditional Uses and Pharmacological Potential**

*Centipeda minima* has been widely used in traditional medicine for centuries to treat various ailments. More than 100 secondary metabolites have been identified from this plant, including terpenoids, flavonoids, monophenols, fatty acids, amides, and other bioactive compounds. Among these, sesquiterpene lactones are particularly abundant, both in *C. minima* and other species within the *Centipeda* genus. These

phytochemicals contribute to a range of pharmacological activities, including anti-cancer, antibacterial, anti-allergic, antiviral, anti-inflammatory, and hepatoprotective effects.

Fig. No. 9: **Centipeda minima**

Phytochemical Constituents

The key bioactive compounds isolated from *Centipeda minima* include:

- **Flavonoids**: 7,4-di-O-methyldihydrokaempferol, iristectorin-A, tricine
- **Amino acids**: 2-amino-3-phenyl-propionic acid
- **Chromones**: 4-amino-4-carboxychroman-2-one
- **Sesquiterpenes**: Arnicolide D

Anti-inflammatory and Anti-arthritic Activity

The anti-inflammatory potential of *C. minima* was assessed using a carrageenan-induced paw edema model in rats. The methodology involved:

- **Preparation and Administration:**
  - Animals were fasted for 24 hours before the experiment but had free access to water.
  - A 1% carrageenan suspension in saline (50 µL) was prepared and injected into the plantar side of the right hind paw of each rat.
  - A herbal gel formulation containing *C. minima* extract (0.2 g) was applied to the affected area by gently rubbing 50 times with the index finger.
  - The control group received only the plain gel base, while a standard group was treated with a 1% *C. minima* gel (0.2 g) in the same manner.
  - Drug application occurred 1 hour before the carrageenan injection.

- **Measurement of Paw Edema:**
  - Paw volume was measured using a plethysmometer immediately after carrageenan injection and subsequently at 1, 2, 3, and 4-hour intervals.

## III. CONCLUSION:

The rise of allopathic medicine led to a decline in interest in traditional medicinal preparations. However, in recent years, a significant shift has occurred, drawing renewed attention to herbal medicine. This resurgence is primarily driven by the high costs associated with modern drug development, the extensive time and resources required for clinical trials, the severe side effects of many pharmaceutical drugs, and the increasing resistance of microorganisms and parasites to conventional treatments.

As a result, researchers are increasingly exploring plant-based traditional medicine, particularly in the field of anti-inflammatory therapies. Inflammatory diseases, such as rheumatoid arthritis, are prevalent in both

developed and developing nations, yet the drugs used to manage these conditions often come with serious adverse effects. Several plant-derived compounds, including curcumin, resveratrol, baicalein, boswellic acid, betulinic acid, ursolic acid, and oleanolic acid, are currently being investigated for their potential as future anti-inflammatory drugs.

This review aims to assist current and future researchers in identifying medicinal plants with anti-inflammatory properties, from which active compounds can be isolated using advanced separation techniques. Such research may lead to the discovery of novel bioactive molecules with therapeutic potential against inflammatory disorders. Most studies suggest that the anti-inflammatory effects of medicinal plants are linked to the inhibition of cyclooxygenase (COX) enzymes, thereby reducing prostaglandin synthesis. However, further in-depth research is needed to elucidate the precise mechanisms of action and optimize their clinical applications.

## REFERENCES:

[1] Abel, G. & Schimmer, O, goggelmann W Aristolochic acid is a direct mutagen in salmonella,1983; 64(2): 131–133(1983).

[2] Alan D. Kaye MD, PhD, Adam M. Kaye PharmD, FASCP, FCpha, in Anesthesia and Uncommon Diseases (Sixth Edition), 2012.

[3] Al-Hindawi MK, Al-Deen IH, Nabi MH, Ismail MA. Antiinflammatory activity of some Iraqi plants using intact rats. J Ethnopharmacol 1989; 26(2): 163-8.

[4] Ali BH, Blunden G, Tanira MO, Nemmar A. Some phytochemical, pharmacological and toxicological properties of ginger (Zingiber officinale Roscoe), 2008; 46: 409–20.

[5] Amaral G. P, de Carvalho., N. R. Barcelos R. P et al., "Protective action of ethanolic extract of Rosmarinus officinalis L. in gastric ulcer prevention induced by ethanol in rats," Food and Chemical Toxicology, 2013; vol. 55: pp. 48– 55.

[6] Anna Olejnik, Wojciech Bialas, Anti-inflammatory effects of gastrointestinal digested Sambucus nigra L. fruit extract analysed in co-cultured intestinal epithelial cells and lip polysaccharide-stimulated macrophages. 19, Part A, December 2015; Pages: 649-660.

[7] Anti-inflammatory effects of ethanolic extract of Rosmarinus officinalis L. and rosmarinic acid in a rat model of neuropathic pain. 2017 Feb; 86: 441-449. doi: 10.1016/j.biopha.2016.12.049. Epub 2016 Dec 22

[8] Antioxidant and anti-inflammatory activities of aqueous extract of Centipeda minima. J Ethnopharmacol. 2013; May 20; 147(2): 395-405, 10.1016/j.jep.2013.03.025.

[9] Archer HK, Pettit MS. Analgesic and antiphlogistic compositions and therapeutic wrap for topical delivery, 1997 Patent No.US 5976547 A.

[10] B Achari; S Chakrabarty; S. Bandhopadhyay & SC Pakrashi. Heterocycles, The alkaloids, chemistry and pharmacology, 1983; 20(1): 771–774

[12] Bagad AS, et al. Comparative evaluation of antiinflammatory activity of curcuminoids, turmerones, and aqueous extract of Curcuma longa. Advances in Pharmacological Sciences, 2002; 7: 56-58.

[13] Bellavite P, Ortolani R, Conforti A. Immunology and Homeopathy, Experimental Studies on Animal Models. Evid Based Complement Alternat 2006; 3: 171–186.

[14] Brinker F, Herb contra indicators and Drug interactions, Edn 2, sandy, OR: Eelectic Medical; 1998.

[15] C.niemegeer, f. verabruggen, p. Janssen, the journal of pharmacy and pharmacology.,1964; 16: 810-816.

[16] Chang CM, Chu HT, Wei YH, Chen FP, Wang S, Wu PC, Yen HR, Chen TJ, Chang HH. The core pattern analysis on Chinese herbal medicine for Sjogren's syndrome: A Nationwide Population-Based Study. Sci Rep. 2015; 5: 9541.

[17] Compound Nguyen Thi Thuy Linh, Nguyen Thi Thu Ha, Nguyen Thanh Tra, Le Thi Tu Anh, Nguyen Van Tuyen, A Resource of Bioactive, -Reviews in Medicinal Chemistry. 2014; 2(903): 1389-5575.

[18] D. Lukaczer, G. Darland, M. Tripp et al., "A pilot trial evaluating Meta050, a proprietary combination of reduced iso-alpha acids, rosemary extract and oleanolic acid in patients with arthritis and fibromyalgia," Phytotherapy. 2005; 19(10): pp. 864–869.

[19] Dreyer LR. Homeopathic formulations useful for treating pain and/or inflammation. Patent No. 7923040.20. Leven W, Willuhn G. Spectrophotometric determination of sesquiterpenelactone S1 in Arnica Flos Dab 9 with m-dinitrobenzene. Planta Med 1986; 52: 537–538.

[20] Funk JL, Frye JB, Oyarzo JN, Timmermann BN. Comparative effects of two gingerol-containing Zingiber

[21] Goel A, Kunnumakkara AB, Aggarwal BB. Curcumin as "curecumin": from kitchen to clinic. Biochem Pharmacol 2008; 75: 787-809.

[22] HNB Garhwal University (A Central University), Srinagar Garhwal, Uttarakhand, India), Antioxidant and Antiinflammatory Activity of Ribes Glaciale Wall Extracts, Nitin Sati Department of Pharmaceutical Sciences, 2015; (7): 7. 47.

[23] Huber R Et al, Arnica and stinging nettle for treating burns – a self-experiment. Complement Therap Med 2011; 19: 276– 280.

[24] Janmejai K Srivastava, Eswar Shankar, and Sanjay Gupta, A herbal medicine of the past with bright future, 2010.

[25] Jobin C, Bradham CA, Russo MP, et al. Curcumin blocks cytokine-mediated NF-kappa B activation and proinflammatory gene expression by inhibiting inhibitory factor I-kappa B kinase activity, 1999; 163: 3474-348.

[26] Julie S jurenka, Anti-inflammatory properties of curcumin, a major constituent of Curcuma longa. A journal of clinical therapeutic March 2009; 14(2): 141-153.

[27] K.d. Rainsford, Anti-inflammatory drugs in the 21st century. sub-cellular biochemistry, 01 Jan 2007, 42: 3-27 DOI: 10.1000 7/1-4020-5688-5-1.

[28] Kawakami AP et al. Inflammatory process modulation by homeopathic Arnica montana 6CH: the role of individual variation. Evid Based Complement Alternat Med 2011; 917541.

[29] Kennedy JF et al. Analysis of the oligosaccharides from the roots of Arnica montana L., Artemisia absinthium L., and Artemisia dracuncula L. Carbohyd Polym 1998; 9: 277– 285.

[30] MiceŠtefan Juhás, Alexandra Bukovská, Stefan Čikoš, Soňa Czikková, Dušan Fabian, Juraj Koppel Institute of Animal Physiology, Slovak Academy of Sciences, Kosice, Slovak AntiInflammatory Effects of Rosmarinus officinalis Republic Received June 9, 2008.

[31] Mohammad reza farahpouri, Anti-nociceptive and Anti – inflammatory activities of hydroethanolic extract of Urtica dioica and lida khoshgozaran2 ijbpas, Jan, 2015; 49(1): 160- 170.

[32] Muralinath, E , In vitro evaluation on anti-inflammatory activity of methanol extract of Piper betle leaf. International Journal of Pharmaceutical and Chemical Sciences., 5(1); 14- 17: 2016

[33] Nirmala L, and Selvaraj P.1, Anti-inflammatory and antibacterial activities of Glycyrrhiza glabra, ISSN 1686-9141.

[34] Oberbaum M et al. The effect of the homeopathic remedies Arnica montana and Bellis perennis on mild postpartum bleeding – a randomized, double-blind, placebo-controlled study – preliminary results. 2005; 13: 87–90.

[35] Oguntibeju OO Journal of inflammation research J. Inflamm Res .2018; 11: 307-317 published online Aug 7.doi 10.2147/JIR S167789.

[36] Oyaizu M. Studies on product browning reaction prepared from glucose amine. Japan J Nutr 1986; 44: 307-15.

[37] Patel DK, Kumar R, Prasad SK, Hemalatha S. Pedalium murex Linn. (Pedaliaceae) fruits: A comparative antioxidant activity of its different fractions. Asian Pac J Trop Biomed 2011; 1(5): 395–400.

[38] Priyanka Kriplania, b, Kumar Guarvea and Uttam S. Baghaelca Guru Gobind Singh College of Pharmacy, Arnica montana L. – a plant of healing, review, 2017Aug.

[39] Sarkar A, Tripathi VD and Sahu RK3 Institute of Pharmacy, HCPG College, Varanasi, Uttar Pradesh, India, Sagar Institute of Technology, Lucknow, Uttar Pradesh, India, Columbia Institute of Pharmacy, Tekari, Raipur, Chhattisgarh, India Anti -inflammatory and Anti-Arthritis Activity of Flavonoids Fractions Isolated from Centipeda minima Leaves Extracts in Rats. 2019.

[40] Shipochliev T, Dimitrov A, Aleksandrova E. Antiinflammatory action of a group of plant extracts] Vet Med Nauki. 1981; 18(6): 87-94.

[41] Srivastava KC, Mustafa T. Ginger (Zingiber officinale) and rheumatism and musculoskeletal disorders. Med Hypotheses 1992; 39: 342-348.

[42] Uteshev BS, Laskova IL, Afanasev VA. The immunomodulating activity of the heteropolysaccharides from German chamomile (Matricaria chamomilla) during air and immersion cooling Eksp Klin Farmakol 1999; 62(6): 52-5.

[43] Valiollah Hajhashemi, Antinociceptive and antiinflammatory effects of Urtica dioica leaf extract in animal models, Vahid Klooshan Avicenna Journal of Phytomedicine Received: Oct 22, 2012; Accepted: Dec 11, 2012 Vol. 3, No. 2: Spring 2013, 193-200 AJP, Vol. 3, No. 2, Spring 2013 193 Original.

[44] Vendramini-Costa DB, Carvalho JE. Molecular link mechanisms between inflammation and cancer. Curr Pharm Des. 2012; 18: 3831-3852.

[45] Wang Q, Kuang H, Su Y, Sun Y, Feng J, Guo R, et al. Naturally derived anti-inflammatory compounds from Chinese medicinal plants. J Ethnopharmacol. 2013; 146: 9–39.