Traditionally used herbal plants in anti-inflammatory activity: An Overview

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ABSTRACT

Inflammatory diseases including different types of rheumatic diseases are a major and worldwide problem. Gastrointestinal side effect is the major problem associated with the presently available non-steroidal anti-inflammatory agents. Now a day's world population moves towards herbal remedies for treatment of such ailments. The numbers of plants have been screened for their anti-inflammatory and anti-arthritis activity, but only few of them reached up to the clinical level. This problem is mainly due to purely academic oriented research. Researchers have to lay emphasis on the phytoconstituents obtained form that plant for the specific treatment of such disease and not only to increase the number of plants having anti-inflammatory activity but have to work towards tapping their therapeutic utility by finding out the mechanism of action at molecular level. This review article is a try to provide an overview of reported anti-inflammatory activities of recently used until now between 2012 to 2013 herbal plants highlighted with interesting profile of activities.

Keywords: Inflammation, Inflammation disorder, Anti-inflammatory herbal plants.

INTRODUCTION

The nature has provided a complete source of remedies to cure the diseases of mankind and is best friend of pharmacy. The natural drugs are effective in action without side effects. Drugs obtained from plant source constitute a major part of therapeutics in the traditional systems of medicine. Herbal medicine is a triumph of popular therapeutic diversity. Plants are valuable for modern medicine as they are used as sources of direct therapeutic agents, serve as raw materials for elaboration of more complex semi synthetic chemical compounds, chemical structures derived from plant sources can be used as models for new synthetic compounds and plants can be used as taxonomic markers for the discovery of new compounds [1]. Pain is a subjective experience which is hard to define exactly. Typically, it is a direct response to an unattire event associated with tissue damage, such as injury, inflammation or cancer, but severe pain can arise independently of any obvious predisposing cause (e.g. trigeminal neuralgia), or persist long after the precipitating injury has healed (e.g. phantom limb pain). The management of pain is always multidisciplinary and involves pharmacotherapy, cognitive behavioral therapy and physiotherapy. Pain can be classified into two types: Integumental pain which is superficial and related to skin muscle and joints and visceral pain this is deep seated and related to heart, kidney, stomach, gall bladder etc. The cause of the pain may be physiologic, inflammation and neuropathic. Analgesics are the drugs which decrease the pain sensation. There are 2 types of analgesic agents: Opioid analgesics and Non steroidal anti-inflammatory agents (NSAIDs). Opioid analgesics are mainly used to treat visceral pain while NSAIDs are most commonly employed agents for the treatment of integumental pain [2]. The inflammatory process is the response to an injurious stimulus. It involves a complex array of enzyme activation, mediator release, extravasations of fluid, cell migration, tissue breakdown and repair [2, 3]. No matter what the initiating stimulus, the classic inflammatory response includes calor (warmth), dolor (pain), rubor (redness), and tumor (swelling). Inflammatory responses occur in three distinct temporal phases, each of which apparently mediated by different mechanisms an acute phase, characterized by transient vasodilation and increased capillary permeability; a delayed, subacute phase characterized by infiltration of leukocytes and phagocytic cells and a chronic proliferative phase, in which tissue degeneration and fibrosis occur [7]. Steroidal anti-inflammatory drugs and more commonly non-steroidal anti-inflammatory drugs are used in the therapeutics for the treatment of inflammatory conditions. Classical non-steroidal anti-inflammatory drugs (NSAIDs) have nonselective action towards cyclooxygenase (1 and 2) which results in certain mechanism based side effects like dyspepsia, gastrointestinal ulcers, bleeding and nephrotoxicity [8]. The major drawback of NSAIDs is their gastric ulcer formation due to gastric irritation while opioid therapy is associated with induction of tolerance and dependence, so they are not successful in all cases [9, 10]. There are many studies reporting on in vivo anti-inflammatory activity of medicinal plants or their derivatives. Based on these data, an evaluation of the anti-inflammatory potential of containing products from several phyto-geographic origin is of major importance for its indication in inflammatory processes [11]. In this present review covers the recently herbal plants used traditionally in anti-inflammatory activity until now.

Anti-Inflammatory Activity reported on following Herbal Plants:

Aacia Nilotica:

The anti-inflammatory effects of the aqueous extract of A. nilotica pods (Family of Fabaceae), administered orally at doses of 50 and 100 mg/kg were evaluated in vivo using various models of both acute and chronic inflammations. Xylene-induced ear oedema in mice and carrageenan-induced paw oedema were used to evaluate the acute effect of the plant extract. Chronic inflammation was evaluated using cotton pellet-induced granuloma in rats. The aqueous extract of A. nilotica pods decoction produced a significant inhibition (44.16%) of xylene-induced ear swelling in mice as compared with untreated mice. On the other hand, the plant extracts also inhibited rat paw oedema induced by carrageenan and the granuloma formation induced by the cotton pellets in rats in a dose dependant manner. The highest dose of A. nilotica extract (100 mg/kg) produced a maximum inhibition of 64.41 and 25.62% respectively for the carrageenan-induced paw oedema and the cotton pellet-induced induced granuloma in rats [12].

Ajuga Bracteosa:

The methanolic extract of plant Ajuga bracteosa (Family of Labiatae) was investigated for its anti-inflammatory activity in carrageenan induced rat paw oedema, egg albumin induced inflammation in rats and the study was further supported with in
vitro anti-inflammatory study by using Human red blood cell membrane stabilization method. Three doses of the extract (ABE-250, 500, and 1000 mg/kg, i.p.) were used in this study and used in carrageenan sodium (Smg/kg, i.p.) was used as standard. The plant (500 and 750 mg/kg, i.p.) significantly (P<0.05) reduced increased in paw volume induced by carrageenan and egg albumin. This plant also showed significant stabilization toward Human red blood cell membrane stabilization membrane [51].

Allium Sativum:
The present study describes anti-inflammatory activity of garlic oil (Family of Liliaceae), caused by formalin and histamine in animals. Pharmacological tests have found out that garlic oil has a strong anti-inflammatory effect and is as effective as indomethacin. It can be used as anti-inflammatory agent of plant origin [52].

Alpinia Nigra:
The extract of the rhizome of Alpinia nigra (Family of Zingiberaceae) obtained by cold extraction of mixture of equal proportions of petroleum ether, ethyl acetate and methanol was chosen for Phytopharmaceutical screening. Anti-inflammatory activity was assessed by carrageenan-induced paw oedema method. Healthy Swiss albino rats of either sex weighing 120-180 g were used for the test; twenty-four mice, aged 4-5 weeks, were randomly selected and divided into four groups with six animals in each group. Each group was given a particular treatment i.e. control, positive control and two different doses of the extract. In carrageenan-induced paw oedema model, Alpinia nigra at doses of 200 and 400 mg/kg, caused significant inhibition of paw oedema by 27.13% (p<0.001) and 34.97% (p<0.001) respectively, 4 hour after carrageenan administration [53].

Achyranthes Aspera:
Achyranthes aspera leaves (Family of Amaranthaceae) and whole plant (ie. Aqueous extracts of Achyranthes aspera leaves/Aqueous extracts of A. aspera whole plant were studied in albino mice using carrageenan induced left hind paw oedema. Both extracts were subjected to preliminary phytochemical and anti-inflammatory activity. The extract was also used to study for acute toxicity in Swiss albino mice. Both the extracts showed no toxicity at the doses used. The extracts also showed significant anti-inflammatory activity. The study revealed that Achyranthes aspera leaves reduced the inflammation induced by carrageenan by 42.85%. The results indicated that the aqueous extract plus vitamin C was not as well as previous groups regarding the peak of inflammation on the 2nd day, it was indicated that the average inflammation in Formalin,Dill-Oil and Dichlofenac gel groups were 0.44 (SEM = 0.03), 0.15 (SEM = 0.04) and 0.36 (SEM = 0.08), respectively. The paw volume changes in groups receiving Dill-oil and Dichlofenac-gel, after the daily formalin injection in 8 days compared to the blank group, had a significant decrease (p < 0.001). The Dill group showed even more decrease in the paw volume compared to the Dichlofenac one. The results of paw volume measurement analyzed by the Pethysmometer manifest that the Dill-Oil is able to decrease the paw volume significantly [54].

Annona Muricata:
The aim of this study was to investigate acute and chronic anti-inflammatory potential of an ethanolic leaf extract of A. muricata (AML) (Family of Annonaceae) in animal models. The ethanolic extract of A. muricata leaf extract was prepared. muricata leaf extract was prepared orally to experimental animals used. The anti-inflammatory activity was determined by xylene-induced ear oedema in mice. The results demonstrated that AML is effective for both acute and chronic inflammation. Thus, these results have suggested that AML possesses anti-inflammatory activity. The findings also suggest that AML presents notable may be mediated by suppressing pro-inflammatory cytokines [55].

Argemone Mexicana:
This present study deals with evaluation of the anti-inflammatory and analgesic properties of a lyophilized leaf extract of Argemone mexicana Linnaeus (Family of Papaveraceae) on laboratory animal. The anti-inflammatory study was done by using carrageenan-induced paw oedema method. It was found that lyophilized extract can be effective in acute inflammatory disorders and in that case, it showed significant anti-inflammatory dose-dependent effect (p<0.001) at the dose level of 250 mg/kg and 500 mg/kg. These results support the use of Argemone mexicana Linnaeus, for the treatment of pain and inflammation sickness [56,57].

Asparagus Racemosus:
This present study is aimed to appraise the anti-inflammatory activity of ethanolic extract of Asparagus racemosus roots (Family of Liliaceae). Carrageenan is used to induce inflammation, the result of this study revealed that Asparagus racemosus show potent effect on anti-inflammatory, carrageenan [21].

Avicennia Marina:
This study was designed to investigate the effects of mangrove extract (Family of Acanthaceae) with vitamin C in a rat model of rheumatoid arthritis. To do this, 36 rats in 6 groups (healthy, arthritic, arthritic treated with 200mg/kg of the extracts, arthritic with 400 mg/kg, arthritic treated with Vitamin C+400mg/kg extracts and arthritis were treated with vitamin C) were distributed. Rheumatoid arthritis was induced by injection of complete Freund's adjuvant: The results showed that the group treated with high dose of vitamin C and high dose of extract have greatest impact on reducing inflammatory markers and improving joint lesions and the effect of high-dose groups treated with the extract plus vitamin C was not as well as previous groups [22].

Basella Alba:
In this present investigation an attempt was made to screen the anti-inflammatory activity of Basella alba leaf (Family of Basellaceae). From this study, it can be concluded that, Basella alba possesses a good anti-inflammatory activity. In the cotton pellet induced inflammation and induced carrageenan-induced inflammation, the animals treated with the plant extract have shown a
significant activity at 500 mg/kg dose (p<0.001) which was comparable with the standard drug. In view of the percentage inhibitions of the plant was studied, in which the plant extract was found effective. The overall result of this study indicates that the methanolic extract of Basella alba has interesting anti-inflammatory properties [23].

**Bauhinia Purpurea:**

The aim of this study was to evaluate the anti-inflammatory efficacy of ethanolic extract of Bauhinia purpurea bark (BEP) (Family of Leguminaceae) in Sprague Dawley (SD) rats. Carrageenan induced paw oedema and air pouch inflammation, arachidonic acid induced ear edema and complete Freund’s adjuvant (CFA) induced hematomatous alterations were studied in control and experimental rats. Administration of EB (200mg, 400mg, 600mg/kg body weight) showed a significant and dose dependent inhibition of paw oedema and ear oedema and also reversed the haematological alterations near to normalcy. Acute toxicity studies demonstrated non toxic nature of EB even at higher doses. Therefore, our results demonstrate that EB has potent anti-inflammatory properties validating the folk medicinal use of this species [24,25].

**Bauhinia Variegata:**

The methanolic and aqueous fraction of the bark of Bauhinia variegata (Family of Leguminaceae) was investigated for its acute inflammation potential in animals. Albino rats were used for the experiment respectively. Anti-inflammatory activity determined by carrageenan induced paw oedema and dextran induced paw oedema. The extract of the bark administered orally at a dose 200 mg/kg and 250 mg/kg. The anti-inflammatory activity of methanolic and aqueous fraction of Bauhinia Variegata was carried out. The anti-inflammatory activity determined by carrageenan induced paw oedema were not too significantly different (P<0.05) from the control at 200 mg/kg and 250 mg/kg. The aqueous fraction of the methanol extract significantly inhibited (P<0.05) carrageenan induced paw oedema in rat at 250 mg/kg. Significant activity against dextran induced paw oedema in rats was exhibited by both methanol extract (P<0.01) and aqueous extract (P<0.05) when administered orally at 200 mg/kg and 250 mg/kg. The bark powder of Bauhinia Variegata contains flavone glycosides, flavonoids. It is revealed from the screening models used that the methanol and aqueous fraction of this plant showed the acute anti-inflammatory activity. The activity was attributed to the presence of phytoconstituents in the tested extract [26].

**Boerhavia Repens:**

This study was to evaluate the anti-inflammatory activities of the whole plant B. repens (Family of Nyctaginaceae). The roots, stems and the leaves of the plant B. repens was sun dried and extracted using methanol. The anti-inflammatory activity was evaluated using the carrageenan induced paw oedema in rats. The crude methanolic extract at a dose of 600 mg/kg showed very potent anti-inflammatory activity in carrageenan induced rat paw oedema model with 68.5% inhibition of paw oedema after the fourth hour of study [27].

**Boswellia Serrata:**

*In vitro* antioxidant activity and *in vitro* inflammatory activity of leaf extract of Boswellia serrata (Family of Burseraceae) were studied. The methanolic leaf extract was tested for the presence of phytochemicals. The anti-inflammatory activity was evaluated by HRBC method. Phytochemical screening reveals the presence of saponins, tannins, anthraquinones, terpenoids, and flavonoids. The methanolic extract of Boswellia serrata exhibited higher reducing power and anti-inflammatory activity [28].

**Brassica juncea:**

*Brassica juncea* (Family of Brassicaceae) has been used since ancient times and it is popularly known as mustards. The aim of present study was to evaluate the anti-inflammatory activity of petroleum ether and ethanolic extracts of *Brassica juncea* against carrageenan induced paw oedema. Acute toxicity study was performed up to 2gm/kg p.o and animals did not show any mortality and behavioral changes. Hence we selected 250 & 500 mg/kg p.o as low and high doses. Both the extracts inhibited carrageenan induced paw oedema in a dose dependent manner and among the two extracts ethanolic extract shows better anti-inflammatory activity when compared to petroleum ether extract [29].

**Bulbophyllum kainense:**

This work is used on the evaluation of the anti-inflammatory activity of various extracts of *Bulbophyllum kainense* (Family of Orchidaceae). Psuedobulb using experimental models. Four different extracts (Petroleum ether chloroform, Ethanol and aqueous) were tested. The anti-inflammatory activity of HRBC (Human Red Blood Cell Membrane Stabilization Method) was evaluated for the *in vitro* anti-inflammatory property because the phospholipase A2 of the lysosomal membrane is analogous to the lysosomal membrane and its stabilization implies that the various extracts may as well stabilize lysosomal membranes. The plant extract showed significant activities in both of the anti-inflammatory assays as compared to diclofenac drug dependent manner. This investigation suggests that ethanolic extract has anti-inflammatory potential activity [30].

**Calanthe Triplicata:**

The present investigation is focussed to find out phytoconstituents which are effective on anti-inflammatory activity of various extracts of entire plant (shrub) of *Calanthe triplicata* (Williemet) Ames (Family of Orchidaceae). Gas Chromatography-Mass Spectrometry (GC-MS) was used for the analysis of phytoconstituents in ethyl acetate and methanol extracts. *In vitro* activities of anti-inflammatory effects were carried out in petroleum ether, chloroform, ethyl acetate and methanol extracts by HRBC (Human red blood cell membrane) stabilization and inhibition of protein denaturation method respectively. The concentration level of 100, 200, 400, 600, 800, 1000, 2000μg/ml were used to screen *in vitro* activities with the standard drug of diclofenac sodium (400 and 600μg/ml). GC-MS analysis of ethyl acetate extract revealed that the presence of a flavonoid compound 4H-Pyrane-3, 2, 3-dihydro-5.5 dihydroxy which has already been reported as an anti-inflammatory effect [31].

**Callicarpa Macrophylla:**

Aqueous as well as ethanolic extracts of its roots (at two concentrations 200 & 400 mg/kg) were evaluated for its anti-inflammatory potentials using tail immersion test and carrageenan paw oedema method in albino rats respectively. Whereas ethanolic root extract have superior anti-inflammatory spectrum than aqueous one. Results are highly promising and ascertain that roots of *Callicarpa macrophylla* (Family of Verbenaceae) have anti-inflammatory potential, comparable to that of standards [32].

**Cannosa Perforlata:**

This study was intended to evaluate the anti-inflammatory activity of ethanolic extract of *Cannosa perforlata* whole plant (Family of Gentianaceae) in carrageenan induced paw oedema in wistar albino rats at the dose level of 150 and 300mg/kg of administration. Ethanolic extract exhibits potent anti-inflammatory activity at 300 mg/kg at 3 hrs. After administration in compare with reference standard indomethacin. This study established anti-inflammatory activity of whole plant of this plant [33].

**Carica Papaya:**

The aqueous leaf extract of *Carica papaya* (CPE) (Family of Caricaceae) was investigated for anti-inflammatory activities in mice and rats. Standard phytochemical methods were used to test the presence of saponins, alkaloids, tannis, anthraquinones, cardiac glycosides, cyanogenetic glycosides and flavonoids. Carrageenan and histamine-induced rat paw oedema were conducted to evaluate anti-inflammatory activity of the plant. Results showed that the extract at 100 and 200mg/kg body weight slightly reduced the formation of the oedema induced by carrageenan and histamine. This study revealed the potential of *C. papaya* leaf aqueous extract in reducing pain and inflammation, suggesting that it has some anti-inflammatory activities, hence, justifying its ethnovegetarian uses. The acute toxicity test showed that the plant is relatively safe to use [34].

**Cassia Auriculata:**

This present study was undertaken to evaluate the anti-inflammatory activity of aqueous, methanolic, ethyl acetate and hydromethanolic extracts of *Cassia auriculata* leaves (Family of Fabaceae). The study was carried out using the pharmacological model of carrageenan induced rat paw oedema. Among all extracts methanolic extract showed maximum anti-inflammatory potential. Indomethacin (10mg/kg) was used as reference compound in the present study. The anti-inflammatory activity of methanolic extract

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may be due to presence of alkaloids, flavonoids, tannins and steroids [39].

Cassia Fistula:
The extracts were found to possess significant anti-inflammatory effect in both acute and chronic models. Cassia fistula Linn. (Family of Caesalpinaceae) has many therapeutic uses. The aqueous extract of dried fruits of "Cassia fistula" was prepared. The anti-inflammatory activity of these extracts was investigated using the CFA-induced paw oedema model in rats. This aqueous extract showed maximum anti-inflammatory activity at 400 mg/kg dose. It showed maximum percentage inhibition of 41.15%, which was comparable with the positive control dexamethasone, which showed 47% inhibition. Further, the acute toxicity study with the extract showed no sign of toxicity up to a dose level of 2000 mg/po. Thus it could be concluded that cassia fistula bark extracts (CFA & CFM) possess significant anti-inflammatory activity [40].

Cassia Purpurea:
The ethanolic extract of A. Cassia purpurea (Family of Caesalpinaceae) has indicated the presence of steroid, flavonoid and triterpenoids, hydrolysable tannins types of compounds. Since these compounds are of pharmacological interest, coupled with the use of this plant in traditional medicine, prompted us to check Cassia purpurea for possible anti-inflammatory activity by HIRBC (Human Red Blood Cell) membrane stabilization method by the inhibition of protein denaturation method. The ethanolic extracts of the plant exhibited notable anti-inflammatory activity and remarkable analgesic activity. The maximum membrane stabilization of Cassia purpurea was found to be 98.54%. Hence, the ethanolic extracts of Cassia purpurea demonstrated the anti-inflammatory activity [41].

Celtis Australis:
The ethanolic extracts of air dried stem bark and fruits of Celtis australis (Family of Ulmaceae) were prepared at 30-50°C with 95% EtOH for 15h. The solvent was evaporated under reduced pressure and the powdery extracts so obtained were used for present study along with crude fatty acids obtained from column elution of n-C6H12-CHC3 (6-4) of B0AC fruit extract. Crude extracts and fatty acids were screened for analgesic and anti-inflammatory activities by oral administration of three different doses at 100, 250 and 500 mg/kg of each test sample on Swiss albino mice and Sprague-Dawley rats, respectively. All doses (i.e. 100, 250, and 500 mg/kg) of test samples were found active when compared with negative control [42].

Cissus Multistriata:
 This present study was undertaken to evaluate anti-inflammatory properties of methanol extract from the leaves of Cissus multistriata (Family of Vitaceae) which was screened for anti-inflammatory activity in experimental animals using ethanolic extract. Anti-inflammatory activity was also studied on the plant using the paw oedema method on different groups of rats. The methanolic extract of C. multistriata exhibited potent anti-inflammatory activity at 150 mg/kg bw at 4 h after administration to group 4 when compared with reference standard drug (Indomethacin). Group 2 had 7% inhibition of oedema as compared to 55% inhibition offered by the extract at 150 mg/kg, thus showing a great effect at higher doses. It has significantly demonstrated high anti-inflammatory potential at 150 mg/kg bw [43].

Clerodendron Fragrans:
The anti-inflammatory activity of the leaves of Clerodendron fragrans (Family of Verbenaceae) has been evaluated using carragenan, formaldehyde, histamine and egg white-induced rat paw oedema and cotton pellet-induced granuloma models in rats. The extract of Clerodendron fragrans (AECL) exhibited significant (p<0.01) anti-inflammatory activity in acute and chronic inflammatory animal models. At 500 mg/kg the aqueous extract exhibited maximum inhibition of 50.9% in carragenan-induced rat paw oedema whereas the standard ibuprofen showed inhibition of 56.8% after 3 h of carragenan challenge. The extract (250 and 500 mg/kg) was found significant (p<0.01) anti-inflammatory activity in formaldehyde, histamine and egg white-induced rat paw oedema. In the chronic model (cotton pellet induced granuloma), the AECL (500 mg/kg) produced maximum inhibition of 38.5% in granuloma weight compared with 44.0% reduction in granuloma weight for the standard [44].

Clerodendrum Phlomidis:
This study was carried out to evaluate anti-inflammatory activity of aqueous extract of root bark of Clerodendrum phlomidis (CP) (Family of Verbenaceae) in models of acute and chronic inflammation in rats. Anti-inflammatory activity of CP was evaluated in models of acute inflammation viz. carrageenan induced rat paw oedema and acetic acid and peritonitis in mice. The anti-inflammatory activity against chronic inflammation was assessed in models of carrageenan-induced ear oedema model using Albino Wistar rats. The activity of CP was compared with aspirin and Dashamoolarishta (a multi-ingredient formulation containing Clerodendrum phlomidis) which served as positive controls. The present study demonstrates anti-inflammatory activity of aqueous extract of root bark of CP and also provides a scientific basis for inclusion of CP in the Dashamoolarishta formulation [45].

Clerodendrum Viscosum:
The present study was designed to investigate the analgesic and anti-inflammatory activity of ethanol extract of Clerodendrum viscosum root (EECVR) (Family of Verbenaceae). Coarse powders of Clerodendrum viscosum root was subjected to successive maceration process with petroleum ether, ethyl acetate, chloroform and ethanol. Anti-inflammatory activity of EECVR was investigated by carrageenan-induced paw oedema in Swiss albino mice. This extract also exhibited significant (p<0.001) anti-inflammatory effect in carrageenan-induced paw oedema. In this study,Moreover, presence of alkaloid in EECVR may be the responsible for the potential anti-inflammatory activity [46, 47].

Cynoza Dioscoridis:
The ethanol (70%) extracts of Cynoza dioscoridis (Family of Compositae) was performed prior investigation. Successive extraction of the plant organs was carried out with petroleum ether 60-80°C, chloroform, ethyl acetate and ethanol 90%, and percentage yield of extractives was determined. The anti-inflammatory activity of the total ethanol (70%) extracts was evaluated in vivo by the carrageenan-induced rat paw oedema method, as compared to indomethacin. The ethanol (70%) extract of the leaf showed the highest percentage of oedema inhibition [48].

Crinum Defuxum:
The anti-inflammatory activity of the bulbs of the plant has been investigated in the present study in order to establish its traditional claims. The ethyl acetate, chloroform and ethanol extracts of bulbs of Crinum defuxum (Family of Amaryllidaceae) were screened for anti-inflammatory activity by using carrageenan induced rat paw oedema method. This study revealed that the ethyl acetate extract of the plant had significant anti-inflammatory activity than the chloroform and ethanol extracts. The study supports the ethnomedical use of this plant for inflammatory conditions [49].

Crotalaria Burhia:
In present study anti-inflammatory activities were assessed using acetic acid-induced writhing and formalin induced pain in mice and acetic acid-induced peritonitis in mice. This studies demonstrated that oral administration of methanolic extract of whole plant (including aerial parts and root) of C. burhia (MECB) (Family of Amaryllidaceae) (100, 200, 400 mg/kg) exhibited significant anti-inflammatory effect. In formalin induced pain MECB 400 mg/kg significantly inhibited the inflammation induced pain better than the pain resulting from neurogenic phase. In subacute anti-inflammatory model using formaldehyde induced hind paw oedema observed [50].

Cucumis Sativus:
The present study was conducted to study the anti-inflammatory activity of Cucumis sativus (Family of Cucurbitaceae) seed in Carragenan-induced paw oedema model and xylene induced ear oedema model using Albino Wistar rats. A significant inhibition of carragenan-induced rat paw oedema was observed with the two doses of the aqueous extract tested in the present study. The results from present study indicate the efficacy of the acetone extract as a therapeutic agent in acute as well as chronic inflammatory conditions. Thus it could be concluded that Cucumis sativus seed extracts possess significant anti-inflammatory properties [51].
Cynodon Dactylon:
In this study an anti-inflammatory property of chloroform-
methanol extract of the whole plant was isolated from Cynodon dactylon Pers. (Dhub Grass) (Family of Poaceae) was investigated in carrageenan induced rat paw oedema. The extract showed significant inhibition of carrageenan induced rat paw oedema at the doses of 125, 250 and 500 mg/kg used for both acute and chronic models in the study and is comparable with standard [46,47].

Cytotoxicine lyrata Coss: This present study was aimed at evaluating the chloroform extracts of whole part of Cytotoxicine lyrata coss (Family of Asteraeae) anti-inflammatory activity. Anti-inflammatory activity of chloroform extracts of whole part of Cytotoxicine lyrata coss was evaluated by carrageenan induced hind paw oedema and formalin induced paw oedema method. Chloroform extracts of whole part of Cytotoxicine lyrata coss produced significant anti-inflammatory activity when evaluated by carrageenan induced hind paw oedema and formalin induced paw oedema method respectively. The results suggest that the chloroform extracts of whole part of Cytotoxicine lyrata coss possess anti-inflammatory [50].

Cynanchum acutum: In this study the anti-inflammatory activity of ethanolic extract of Cynanchum acutum (Family of Apocynaceae) was evaluated. The effects of ethanolic extracts of Cynanchum acutum were studied on carrageenan induced paw oedema. Results of this study indicated that the ethanolic extract decreased the oedema induced in hind paw. It has been concluded that ethanolic extract of Cynanchum acutum (200 mg/kg bw) has a good anti-inflammatory activity against carrageenan induced paw oedema [51].

Cynoglossum zeylanicum: In the present study, Cynoglossum zeylanicum whole plant (Family of Boraginaceae) was extracted with ethanol and evaluated for anti-inflammatory activity in rats using a carrageenan induced paw oedema method. Ethanolic extract exhibits potent anti-inflammatory activity at 150mg/Kg 3rd hr after administration is compared with reference standard drug Indomethacin. Observed pharmacological activity in the present study provides scientific validation of ethnomedicinal use of this plant in treating acute inflammation [52].

Datura Stramonium: Three experiments were performed, Exp-1 and Exp-2 were designed to study the anti diarrheal effect and the effect on enter pooling induced by castor oil for two treated groups (T1 and T2) orally dosed with Datura stramonium leaves (Family of Solanaceae) hydroethanolic extract at 50 and 100mg/Kg BW, compared with IP dosed atropine sulphate and control groups, each consist of 6 mice. In Exp-3 same dosed DS groups were used to study the anti-inflammatory effect that measured by using formalin test compared with Tramadol HCL at 40 mg/Kg IP and Diclofenac (0.75mg/Kg BW) IP as reference. The results of anti-inflammatory effect due to its phytochemical contents [53].

Dichrostachys Glomerata: This present study has been undertaken to assess the analgesic and the anti-inflammatory properties of methanolic extract Dichrostachys glomerata fruit (Family of Mimosaceae). Pain was induced in mice by the intraperitoneal administration of 1% acetic acid, and formalin. Carrageenan and histamine (1%) were used to induce inflammation in rat paws. At the doses of 25 and 50 mg/kg, D. glomerata significantly inhibited pain induced by acetic acid with a percentage inhibition of 80.0 and 76.0 %, respectively. The neurogenic pain induced by formalin was significantly inhibited by the plant extract at the doses of 25 and 50 mg/kg (56.1% and 61.46% inhibition respectively) while the inflammatory phase was significantly inhibited at all the doses tested. The extract (25 mg/kg) significantly reduced paw oedema induced by carrageenan with 79.85% inhibition at after 30 minutes while the oedema induced by the serotonin was also significantly inhibited the plant extract [54].

Drgacena Cinnabari Balf: This present study, we evaluate the anti-inflammatory activity of ethanolic extract obtained from Drgacena cinnabari balf resin (Family of Agavaceae), using chemical and thermal models which will induce acute pain and inflammation in animal models. The significant reduction in inflammation at the doses (50 and 150 mg/kg, p.o.) [P<0.001] at 3 hours by two method. The results show that Dracena cinnabari Balf has peripheral analgesic and anti-inflammatory activities, supporting the traditional application of this plant in treating various diseases associated with inflammation and pain [55].

Eichhornia Crassipes: The various solvent extracts of Eichhornia crassipes (Mart.) Solms (Family of Pontederiaceae) was studied for its anti-inflammatory activity on formaldehyde induced paw oedema in Male Swiss Albino mice. Due the presence of wide range of phytochemical constituents in the petroleum ether, ethyl acetate and aqueous extracts of Eichhornia crassipes. It was found that all the tested extracts of leaves and shoot portion of Eichhornia crassipes possess significant anti-inflammatory activity. Percent inhibition obtained from anti-inflammatory activity has shown that the extracts have very strong activity to prevent pains which provides strong scientific evidence to the folkloric use of this plant in the treatment of inflammation in animals [56].

Eupatorium Triplinerve: The petroleum-ether extract of E. triplinerve Vahl (Family of Asteraeae) was subjected to preliminary phytochemical screening. The acute anti-inflammatory effect was studied by carrageenan induced hind paw oedema method in rats. Anti-toxicity studies showed that the extract was non-toxic up to a maximum dose of 2000 mg/kg body weight. Petroleum-ether extract exhibited significant inhibition of acetic acid induced writhing, reduced the paw-licking response time significantly in formalin test and increased the withdrawal latency time in tail immersion test. Carrageenan induced hind paw oedema was significantly reduced in rats. The present study indicates that the petroleum-ether extract of Eupatorium triplinerve Vahl has potential anti-inflammatory activity [57].

Typha Angustifolia: The acute anti-inflammatory activity of pollen grains of T. angustifolia (Family of Typhaceae) was studied using the carrageenan as phlogistic agent, whereas its chronic anti-inflammatory activity was investigated by the percentage inhibition of cotton pellet-induced granuloma. Both aqueous and 70% methanolic extracts of pollen grains of T. angustifolia showed significant dose-dependent inhibition of carrageenan-induced paw oedema as compared to the control (P<0.001). The results of this study indicate that extracts of pollen grains of T. angustifolia are effective in the treatment of both acute and chronic inflammatory conditions and thus support its traditional utilization [58].

Feronia Elephantum: Ethanol extract of Feronia elephantum leaf and bark (Family of Rutaceae) were investigated for its anti-inflammatory activity in animal models. The anti-inflammatory activity was estimated volumetrically by measuring the mean increase in hind paw volume of rat with the help of Plethysmometer. Indomethacin in the dose of 10 mg/Kg was used as standard drug. The plant extracts were given in the doses of 200 and 400 mg/Kg body weight. Control group received 0.5% NaCl (saline) solution. All the doses were administered orally. Results showed that ethanol extract of leaf had potent and significant anti-inflammatory activity [59].

Flegueea Virosa: The aqueous extract of Flegueea virosa (Family of Euphorbiaceae) dried root was investigated to determine its total yield, phytochemical constituents, acute toxicity, anti-inflammatory activity in groups of Wistar rats. Acute toxicity was done with modified method of Lorke in phases one (500-5000mg/kg) and two (6000-10,000mg/kg) to ascertain the safety of the extract. Yeast-induced pyrexia and egg albumin-induced oedema in rats were done by oral administration of the extract at doses of 100, 200 and 400mg/kg. A yield of 11.8% was obtained after extraction. Acute toxicity testing indicated that Flegueea virosa extract (FVE) given orally up to the dose of 10,000mg/kg caused no death in rats. The anti-inflammatory studies each showed that while 100mg/kg of the extract did not exert a significant effect, 200mg/kg and 400mg/kg exhibited significant (p<0.05) inhibition of egg albumin induced inflammation and yeast-induced pyrexia. These results suggest that the Flegueea virosa root aqueous extract produces fairly reasonable amount of extract and contains phytochemicals which perhaps possess anti-inflammatory activity [60].
**Ganoderma Applanatum:**
The extract of *Ganoderma applanatum* (Family of Ganodermataceae) was subjected to phytochemical screening for the identification of secondary metabolites. Using intraperitoneal doses of 150, 300, 600 and 1200 mg/kg body weight, in vivo anti-inflammatory screening was carried out in rats using the rat paw oedema test. Dose and time dependent suppression of egg-white induced oedema in the rat paw test was observed, with maximum percentage suppression occurring at 600mg/kg [61].

**Helianthemum Lippii and Launaea Residifolia:**
They were extracted successively by using microwave technique with three different solvents of different polarities. The anti-inflammatory activity was evaluated using Carrageenan-induced paw oedema method. The methanol and chloroform extract showed significant the petroleum ether extracts of both plants did not show any significant effect. In addition, the anti-inflammatory activities of various extracts showed a significant percentage inhibition of paw oedema for H. lippii (Family of Cistaceae) extracts in methanol and chloroform but not in petroleum ether. Moreover, the results exhibit different percentage inhibitions of paw oedema for L. residifolia (Family of Asteraceae) extracts in methanol, chloroform and petroleum ether. The anti-inflammatory effects produced by the extracts may be attributed individually or collectively to the flavonoids and tannins. H. lippii and L. residifolia can be introduced as new plant sources for anti-inflammatory agents [62].

**Hibiscus Tilicaceae:**
The purpose of this study was to evaluate and compare the anti-inflammatory activity of methanolic wood extract of *Hibiscus tilicaceus* Linn (Family of Malvaceae) in experimental acute and chronic inflammation. The in vivo anti-inflammatory activity was studied using the acute (Carrageenan induced paw oedema) and chronic (Cotton pellet induced paw oedema) tests. Dose and time dependent suppression of egg-white induced oedema in the rat paw test was observed, with maximum percentage suppression occurring at 600mg/kg [63].

**Nicotiana Tabacum:**
The methanol aqueous chloroform and hexane extracts of *Nicotiana tabacum* leafy galls (Family of Solanaceae). This shows that infection by *R. fascians* favoured the production of anti-inflammatory compounds in *N. tabacum*. The study indicates the benefit of plant galls used in traditional medicines against various pathologies [64].

**Ixora Coccinea:**
This present study was an endeavour to evaluate anti-inflammatory activity of methanolic extract of *Ixora coccinea* flowers (ICF-ME) (Family of Rubiaceae). The in vivo anti-inflammatory was evaluated in rats by using carrageenan-induced paw oedema, as an acute anti-inflammatory model. Quantitative estimation of total polyphenolic content of *I. coccinea* flowers was estimated by ICF-ME (100mg/kg) significantly decreased paw volume, after oral administration of ICF-ME in carrageenan injection. Presence of phytochemical like flavonoids, glycosides, and tannins in the ICF-ME might contribute to the observed anti-inflammatory activity [65].

**Kalanchoe Pinna:**
It is aimed to investigate of ethanol and aqueous extracts of dried stem of plant *Kalanchoe pinna* (Lam) Pers. (Family of Crassulaceae) against with Anti-inflammatory activity in mice. Normally herbal products are free from side effects/ adverse effects and they are low cost medicines, which will be beneficial for human being. The main objective of this work is to develop potent Anti-inflammatory having no or minimum side effects from indigenous plants for the therapeutic management [66].

**Kigelia Africana:**
*Kigelia africana* (Lam) Benth.(Family of Bignoniaceae) has various ethno-medicinal uses in different parts of Africa. In the present study, the anti-inflammatory property of the extract was assessed in rats using the carrageenan-induced paw edema model. Graded doses (25, 50 and 100 mg/kg) of *Kigelia africana* extract were administered intra-peritoneally 30 minutes prior to the induction of mechanical, thermal or chemically-induced pain in the rats and mice. At a dose of 50 mg/kg the percentage of pain inhibition was 49.20% (p<0.01) while at 100 mg/kg, the inhibition was 71.12% inhibition (p<0.01). In addition, the extract produced significant anti-inflammatory effect in the rats. These results confirm and justify the traditional use of *Kigelia africana* stem bark for anti-inflammatory properties [67].

**Ocimum Canum, Ocimum Adscendens, Leucas Linifolia and Thymus Vulgaris:**
This research evaluated anti-inflammatory activity in a methanol extract of four medicinal plants of *Lamiaceae* family. The anti-inflammatory activity was studied by Lox assay. *Thymus vulgaris* extract showed the highest total phenolic content followed by *Ocimum canum*, *Ocimum adscendens* and *Leucas linifolia* respectively. *Thymus vulgaris* extract showed the highest anti-inflammatory activity followed by *Ocimum canum*, *Leucas linifolia* and *Ocimum adscendens* respectively [68, 69].

**Leucas Clarkei:**
*Leucas clarkei* (Family of Lamiaceae) dried whole plant material (1500gm) was packed in sotshet apparatus and extracted successively with Pet. Ether (PE) to deit the drug, petroleum ether was removed from the powdered defitted drug which was then extracted with benzene(BE), chloroform(CE) and 95% of Ethanol (EE) as increasing polarity and all extracts screened for anti-inflammatory activity using carrageenan induced paw oedema method [70].

**Litsea Sebifera:**
In this study, we demonstrated anti-inflammatory activity of the *Litsea sebifera* (Family of Lauraceae). The in vivo anti-inflammatory effects of the different extracts of *Litsea sebifera* have been studied in mice. The anti-inflammatory activity was evaluated in carrageenan and egg white induced hind paw edema in mice. Oral administration of petroleum ether, ethanolic and aqueous extract of *Litsea sebifera* at a dose 100 mg/ kg were shown significantly reduction in the elevated body temperature of mice induced by acetone acid and paw edema which was compared with standard aspirin [marketed product]. Anti-inflammatory activity induced by carrageenan egg white induced hind paw oedema of the tested extract was comparable with that of the standard drug aspirin [71].

**Melastoma Malabathricum:**
*Melastoma malabathricum* leaf (Family of Melastomataceae) was extracted with ethanol and evaluated for anti-inflammatory activity in rats using a carrageenan induced paw oedema method. Ethanol extracts potent anti-inflammatory activity at 500mg/kg at 3hr. After administration. The study was compared with standard drug indomethacin (10mg/kg). On served pharmacological activity in the present study provides scientific validation of Ethnomedicinal uses of this plant in treating acute inflammation [72].

**Mikania Scandens:**
This present experiment was conducted to assess the anti-inflammatory property of hydroalcoholic extract of the flowers from *Mikania scandens* (Family of Asteraceae) against the denaturation of protein in vitro. The test extract at different concentrations was incubated with egg albumin under controlled experimental conditions and subjected to determination of anti-inflammatory activity. The anti-inflammatory property. Diclofenac sodium was used as the reference drug. The present results exhibited a concentration dependent inhibition of protein (albumin) denaturation by the test extract [73].

**Krameria Pauciflora:**
The plant *Krameria pauciflora* MOC et. Sessé ex DC. (Family of Krameriacae) is used as an anti-inflammatory in traditional medicine. The aim of this study was to evaluate the in vivo anti-inflammatory effects of a methanol extract from the roots of *K. pauciflora*. Dichloromethane and ethyl acetate extracts obtained by partitioning the methanol extract were also evaluated. Complete methanol and dichloromethane extracts showed anti-inflammatory effects at 3 mg/kg. An anti-inflammatory effect similar to indomethacin (10 mg/kg) was observed when the methanol and dichloromethane extracts, which contain a cycloartane-type triterpene and an sterol, were administered orally at several doses (3, 10, 30 and 100 mg/kg), whereas no anti-inflammatory effect was
observed at any dose for the ethyl acetate extract, which contains catechin-type flavonoids [34].

Naringi Crenulata:
Ethanol extracts of Naringi crenulata leaf and bark (Family of Rutaceae) were evaluated for its anti-inflammatory activity at the dose levels of 250mg/kg and 500mg/kg body weight using a Carrageenan induced paw oedema method (acute inflammatory). Results showed that both leaf and bark ethanol extracts had potent and significant anti-inflammatory activity. These results were also comparable with reference drug indomethacin used in this study [35].

Nyctanthes Arbor Tristis:
Stem bark of Nyctanthes arbor-tristis Linn. (Family of Oleaceae) was extracted in methanol to evaluate their anti-inflammatory activities. The anti-inflammatory activity was assessed by Carrageenan-induced rat paw oedema using diclofenac sodium as standard drug at a dose of 100mg/kg of body weight and expressed in terms of mean increase in paw volume ± SEM. Stem bark extract was given at a dose of 250mg/kg and 500mg/kg of body weight. Both standard drugs and extracts were administered orally to the animals. Control received distilled water orally. Results showed that Nyctanthes arbor-tristis Linn. had potent anti-inflammatory activities [36].

Oscillatoria Annae:
The present study was designed to investigate anti-inflammatory and antinoceptive activities of Oscillatoria annae. The anti-inflammatory activity were studied in both acute and chronic inflammation models, serotonin were used to induce the inflammation in rat hind paw and cotton pellet enhanced granuloma method was used for chronic inflammation model. The methanolic extract of Oscillatoria annae exhibited significant dose-dependent activity on the tested experimental animal models, and also on the extract significantly reduced in the acetic acid-induced abdominal contractions and the increased reaction time of mice in hot plate method, tail flick response and tail immersion method. This study has shown that the methanolic extract from the Oscillatoria annae does possess significant anti-inflammatory activity [37].

Pergularia Daemia and Solanum Xanthocarpum:
This work is of used on the evaluation of the anti-inflammatory activity of stem and leaf extracts of Pergularia daemia (Family of Apocynaceae) and Solanum xanthocarpum (Family of Solanaceae). The prevention of hypo-tonicity induced HRC membrane lysis was taken as a measure of the anti-inflammatory activity. The anti-inflammatory activity of the ethanol extracts of stem and leaves were compared to that of the standard drug Hydrocortisone. The percentage protection of lysis for Standard hydrocortisone 0.08 mg/ml is 97±.024%, the maximum percentage protection of lysis was observed in ethanol extract of Pergularia daemia stem 12.0 mg/ml is 78.58±0.33% [38].

Parthenium Hysterophorus:
The present study was conducted to evaluate the antioxidant and anti-inflammatory activity by Parthenium hysterophorus Linn (Family of Asteraceae). The anti-inflammatory activity was done by in-vivo model i.e. the carrageenan induced rat paw edema model. This extract reduced carrageenan induced rat paw edema in a dose dependent manner, achieving high degree of anti-inflammatory activity using standard Indomethacin. The study shows that Parthenium hysterophorus Linn shows a significant anti-inflammatory activity [39].

Peperomia Peltiulid:
The aspirin of the present research was to explore the anti-inflammatory activity of ethyl acetate extract of Peperomia peltiulida (Family of Piperaceae) in mice. Acquired immune deficiency syndrome (AIDS), and hypercholesterolemia and against pain. In the present study P. peltiulida has significant anti-inflammatory effect after 4 hr with 3.47± SEM. The present study indicates significant anti-inflammatory effects of P. peltiulida. The present investigation established the pharmacological evidence to support the folk lore claim and that of the plant has anti-inflammatory activity [40].

Pretasites Formosanus:
Aqueous methanolic (50%) extracts of leaves of P. formosanus (Leaves-MeOH extract) (Family of Compositae) showed the strongest inhibitory effect against NO production by lipopolysaccharide (LPS)-induced RAW 264.7 cells with an IC50 of 22.85 μg/mL. In an in vivo assay, 200 mg/kg of the extract also significantly suppressed carrageenan-induced paw oedema. The results indicate that P. formosanus possess anti-inflammatory activity [41].

Phyllanthus Fraternus:
Aqueous and ethanolic whole plant extracts of Phyllanthus fraternus (Family of Euphorbiaceae) were evaluated in vivo for their anti-inflammatory activities on carrageenan-induced paw oedema in Sprague-Dawley rats. Some of the phytochemicals found in the extracts have previously been implicated as anti-inflammatory agents. The extracts at doses 100mg/kg and 200mg/kg showed modest anti-inflammatory activity in a dose dependent manner. The results suggest that whole plant extract of P. fraternus possess anti-inflammatory activity and will be useful in the search for novel anti-inflammatory agents [42].

Piper Betle:
The methanolic extract of Piper betle leaves (MPBL) (Family of Piperaceae) was evaluated for anti-inflammatory activity using carrageenan induced hind paw oedema model. The extract of MPBL, at the dose of 100 and 200 mg/kg, produced a significant (p<0.05) increase in pain threshold in hot plate method whereas significantly (p<0.05) reduced the writhing caused by acetic acid and the number of licks induced by formalin in a dose-dependent manner. The same ranges of doses of MPBL caused significant (p<0.05) inhibition of carrageenan-induced paw edema after 4 h in a dose-dependent manner [43].

Plumeria Rubra:
The extract of Plumeria rubra (Family of Apocynaceae) was also investigated for the anti-inflammatory effect on Long Evans rats using carrageenan induced rat paw oedema method. For anti-inflammatory study, 24 rats were divided into 4 different groups each receiving either distilled water, standard drug or the extract at the doses of 250 and 500 mg/kg bw [44].

Polygala Javana:
The study was intended to evaluate the anti-inflammatory activity of whole plant of Polygala Javana (Family of Polygalaceae). The anti-inflammatory study was carried out by using carrageenan induced paw oedema. The ethanolic extract of whole plant of Polygala javana was injected at different dose such as 100 and 200 mg/kg body weight and the study was compared with standard drug Indomethacin (10mg/kg). The extract exhibited significant anti-inflammatory activity, which supports the traditional medicinal utilization of plant [45].

Polygonaum Sibiricum:
The fresh Polygonatum sibiricum rhizome extracts (Family of Liliaceae) were tested for anti-inflammatory activity was evaluated by the inhibition of nitric oxide (NO), inducible nitric oxide synthase (iNOS), as well as tumor necrosis factor-alpha (TNF-α) protein [46].

Psidium Guajava:
This present study assessed two defatted successive solvent (ethyl acetate and methanol) extracts of P. guajava leaf (Family of Myrtaceae) for their acute anti-inflammatory potential by carrageenan induced hind paw oedema in wistar albino rats. Both the test extracts exhibited significant and comparable anti-inflammatory activity. The methanol extract was found to be a bit more active than the ethyl acetate extract. The present preliminary study demonstrated promising acute anti-inflammatory activity of P. guajava leaf in wistar rats [47].

Sarcostemma Secamone:
This study was intended to evaluate the anti-inflammatory activity of the whole plant of Sarcostemma secamone (Family of Asclepiadaceae). The anti-inflammatory activity study was carried out by using carrageenan induced paw oedema. The methanolic extract of whole plant of Sarcostemma secamone was injected at different doses such as 150 and 300 mg/kg body weight and the study was compared with standard drug Indomethacin (10mg/kg). The extract exhibited significant anti-inflammatory activity, which supports the traditional medicinal utilization of the plant [48].
Sargentodoxa Cuneata:  
An experiment was conducted to determine the concentration of emodin in the main bioactive content of aqueous extracts of Sargentodoxa cuneata (SC) [Family of Sargentodoxaceae]. In addition, the anti-inflammatory activity and the effects of ESC on pelvic inflammation rats were studied. ESC significantly decreased the levels of TNF-α and IL-6 of the model rats compared with indomethacin. The content of emodin in ESC was 0.2 mg/g SC, with its strong anti-inflammatory activities, can be used to treat both acute and chronic inflammation and to relieve the associated pain [90].

Solamun Nigrum:  
This present study was designed to investigate the anti-inflammatory potential of the ethanolic and aqueous extract of Solanum nigrum flowers (Family of Solanaceae). Anti-inflammatory activity was performed using cotton pellet granuloma in rats. Ethanolic and aqueous extracts of higher dose (300 mg/kg) exhibited maximum anti-inflammatory activity. Extracts of Solanum nigrum may be useful in the treatment of inflammation and pain [90].

Stachys Schtschegleevii:  
Extracts of the flowering aerial parts of Stachys schtschegleevii Sann. (Family of Lamiaceae). In this study, the anti-inflammatory properties of total methanolic extracts of the flowering aerial parts of two Stachys species in rats were investigated by carrageenan-induced paw oedema and formalin test. Intraperitoneal injection of the extracts, 60 min before induction of inflammation, resulted in inhibition of carrageenan-induced rat paw oedema in dose dependent manner (doses 50, 100 and 200 mg/kg). In the formalin test, the extract (50, 100 and 200 mg/kg) had a low effect in the first phase (0–5 min) of the formalin-induced anti-inflammatory effects in formalin test and carrageenan-induced paw oedema [91].

Stachyterpheta Cayennensis:  
This present study was designed to assess the anti-inflammatory activity of the aqueous and ethanolic extracts of the whole plant of Stachyterpheta cayennensis (Family of Verbenaceae). The studies were carried out by in-vitro HRBC membrane stabilisation method using different concentrations of aqueous (1000, 500, 250 mcg/ml) and ethanol (1000, 500, 250 mcg/ml) extracts. The results showed that both the extracts has got a significant anti-inflammatory activity on human red blood cells when compared with the standard drug diclofenac (50 mcg/ml) and distilled water as control [92].

Sterculia Villosa:  
The acute oral toxicity showed that the ethanolic extract of S. villosa barks (Family of Sterculiaceae) was safe until 4000 mg/kg body weight and no macroscopic or organ abnormalities were observed in acute oral models. The investigations on Albino (Wistar) rats at dosage of 100, 200 and 400 mg/kg of ethanolic extract of Sterculia villosa barks were made for anti-inflammatory action by using carrageenan induced paw oedema and cotton pellet granuloma technique. The results of the study suggested significant doses dependent activity of extracts as compared to control group for both acute and chronic inflammation [93].

Strychnos Potatorum:  
In this present study, Strychnos potatorum linn (Family of Loganiaceae) (Strychnaceae) was studied. The anti-inflammatory activity of hydroalcoholic extract was comparable to that of the standard drug Hydrocortisone. The percentage protection for the hydroalcoholic extract and hydrocortisone were 100 at μg/ml. the hydroalcoholic extract of Strychnos potatorum Linn seed has significant anti-inflammatory activity [94].

Swerica Chirata:  
The ethanolic root extract of Swertia chirata (Family of Gentianaceae) was chosen for pharmacological screening and analgesic and anti-inflammatory activities in animal models. The anti-inflammatory activity was assessed using the carrageenan induced rat paw oedema model. In rat paw edema model induced by carrageenan, the extract was found to reduce significantly (P<0.01) the formation of edema at the 400 mg/kg dose level and showed 57.81% (P<0.001) inhibition of edema volume at the end of 3 h. Swertia chirata possesses potent anti-inflammatory activities. The results signify the traditional uses of Swertia chirata, for inflammation and pain [95].

Syndrella Nodiflora:  
Methanolic extract of the leaves of Syndrella nodiflora (Family of Asteraceae) has been evaluated for anti-inflammatory potential against carrageenan and formalin induced paw edema in rats, respectively. The extract also showed significant inhibition of paw edema in rats at the doses of 50, 100 and 200 mg/kg b.wt. after 4hrs. In both the models (carrageenan and formalin induced method) 50% inhibition was found at a dose of 200 mg/kg b.wt , which is almost similar to that of the standard drug used as anti-inflammatory agent [96].

Syzygium Guineense:  
Ethanolic extract of the leaves of Syzygium guineense (Family of Myrtaceae) was investigated in rats for anti-inflammatory activities. The activities of the extract were tested on the egg white induced oedema model. Lower concentration of 200 mg/kg possessed insignificant (P>0.05) anti-inflammatory effects. Phytochemical test revealed that the extract contains flavonoids, tannins, cardiac glycosides and sapoins. These results support some of the use of the plant in folk medicine [97].

Tecomaria Capensis:  
This present work aims at evaluating the anti-inflammatory activity of Tecomaria Capensis (Family of Bignoniaceae) by HRBC membrane stibilization. The prevention of hypo-tonicity induced HRBC membrane lysis was taken as a measure of the anti-inflammatory activity. The anti-inflammatory activity of the crude Ethyl Acetate extract (EAE), Ethanol extract (EE), Water extract (WE) of leaves part of Tecomaria Capensis were compared to that of the standard drug diclofenac. The ethanolic extract of Tecomaria capensias has significant anti-inflammatory activity in comparison to aqueous extract and ethyl acetate extract of the same plant and with standard drug diclofenac [99].

Tectona Grandis:  
The methanolic extracts of the frontal and mature leaves of Tectona grandis (Family of Verbenaceae) were comparatively evaluated for anti-inflammatory activity. The anti inflammatory activities were evaluated using carrageenan induced paw oedema models in rats respectively. The results of the anti-inflammatory activity have shown that the frontal leaf extract when administered at a dose of 250 mg/kg body weight had significant activity after 15 min which was comparable to the standard. However the mature leaves extract did not show any significant activity at the same dose [90].

Trigonella Foenum-Graecum, Zhermeria Majdrae, Achillea Wilhelsii and Viola Tricolor:  
The anti-inflammatory activity of methanol extracts of tested plants were evaluated using hot-plate and carrageenan-induced oedema methods respectively. The plant extracts were studied by i.p administration at three doses of 100, 200 and 400mg/kg. In the hot-plate test, the extracts of T. foenum-graecum (Family of Fabaceae) 100 mg/kg and Z. majdrae (Family of Lamiaceae) 200 and 400 mg/kg significantly increased the tolerance to pain in female albino mice in comparison to control. The administration of T. foenum-graecum at doses of 100 and 200mg/kg and V. tricolor (Family of VWolaceae) 400mg/kg significantly reduced the paw oedema in male rat which measured in all the times of observation after carrageenan administration in comparison to control and reference (Ibuprofen, 400mg/kg) [100].

Typhonium Trilobatum:  
In this present study, The extract of Typhonium trilobatum [Family of Araceae] xylene-induced ear oedema model was used to evaluate the anti-inflammatory activity. Acute toxicity test was carried out to fix the safe doses of the plant extract. The plant extract demonstrated a significant inhibition of writhing (P<0.01) compared with the control group in significantly inhibited the xylene induced ear oedema formation (P<0.05) at the doses of 250 and 500 mg/kg body weight [101].

Viola Betonicifolia:  
The methanolic extract of whole plant of V. betonicifolia (Family of Violaceae) was employed to assess the anti-inflammatory activity was tested in carrageenan induced paw edema and histamine induced inflammatory tests. BALB/c mice were used at test doses of 100, 200 and 300mg/kg body weight intra-peritoneally (i.p). anti-inflammatory activities in various
animal models and this strongly supports the ethnopharmacological uses of Viola betonicifolia as anti-inflammatory plant [101].

**Vitex Leucoxylon:**  
Various functions of hydro alcoholic extract and ethanolic extract of the *Vitex leucoxylon* Linn. leaves (Family of Verbenaceae) of were screened for anti-inflammatory activity by human red blood cell (HRBC) membrane stabilization method. The prevention of hypotonicity-induced HRBC membrane lysis was taken as a measure of the anti-inflammatory activity. All the fractions showed a biphasic effect on the membrane stabilization. Their activities are comparable to that of the standard drug prednisolone. However their activities decreased with time [102].

**CONCLUSION:**  
Plants have played a significant role in human health care since the ancient times. Traditional plants exerts great role in discovery of new drugs. Majority of human population worldwide is getting affected by inflammation related disorders. It is believed that current analgesia inducing drugs such as opiates and NSAIDS are not useful in all cases, because of their side effects like GIT irritation, liver dysfunction and much more [103]. There are number of immunosuppressing agents and these have been based on their COX-1 inhibition mechanism, but they cause severe side effects on long term administration. So, selective inhibitors of COX-2 were developed to avoid side effects of COX-1 inhibitors. However, one of these inhibitors has been reported to increase the risk of myocardial infarction and atherothrombotic events. Thus, it is likely that COX-2 inhibitors will not be suitable for the treatment of chronic inflammatory diseases, such as rheumatoid arthritis [104]. For rheumatoid arthritis currently available drugs are primarily directed towards the control of pain or the inflammation associated with spondylosis. Large number of herbal species has been used traditionally or as folk medicines against inflammatory disorders. Many of them have been studied scientifically and proved to be beneficial anti-inflammatory agents. Despite the divergent bioactivities of the plant medicines against various diseases, active components of most plant extracts have not been elucidated thoroughly, due to their complex mixture. However, the core chemical classes of anti-inflammatory agents from natural sources have been reported to engage a vast range of compounds such as polyphenols, flavonoids, terpenoids, alkaloids, anthraquinones, lignans, polysaccharides, saponins and peptides [105, 106]. From the study done so far, it has been elucidated that flavonoids are major anti-inflammatory agents. Some of them act as phospholipase inhibitors and some have been shown to inhibit COX-1 on different inflammatory conditions. Biochemical investigations have also shown that flavonoids can inhibit both cyclooxygenase and lipoygenase pathways of arachidonic metabolism depending upon their chemical structures [107, 108]. Alkaloids in asserted skeletal type based on pyridine ring system have been reported to have striking anti-inflammatory activity, e.g., berberines from Berberisis traditional remedy against rheumatism [109]. Terpenoids significantly inhibit the development of chronic joint swelling. Terpenoids may affect different mechanism relevant to inflammations arising in response to varied etiological factors [109]. However, still many herbal medicines for inflammation and rheumatism have not undergone through scientific investigations. Hence, it is a need of time that all such herbal medicines should consider for determination of their pharmacological activities, isolation of single entity responsible for anti-inflammatory activity and development of suitable formulation which would be beneficial against inflammatory disorders.

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**REFERENCES:**


Nacoulma AP, Compaoré M, Lorenzi M, Kiendrebeogo M, Nacoulma OG. In vitro antioxidant and anti-inflammatory activities of extracts from Nicotiana tabacum L. (Solanaceae)


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