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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-arthritic 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 untoward 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). Opiod 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 [3, 4]. 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 local 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 [5]. 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 ulcerations, bleeding and nephrotoxicity [6]. The major drawback of NSAIDs is their gastric ulcer formation due to gastric irritation while opoid therapy is associated with induction of tolerance and dependence, so they are not successful in all cases [7, 8]. 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 origins is of major importance for its indication in inflammatory processes [9]. In this present review covers the recently herbal plants used traditionally in anti- inflammatory activity until now.

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Anti-Inflammatory Activity reported on following Herbal Plants:

Acacia 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 a 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 swilling 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 [10].

Ajuga Bracteosa:

The methanolic extract of plant *Ajuga bracteosa* (Family of Labiateae) 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 750 mg/kg, i.p.) were used in the study and diclofenac sodium (5mg/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 [11].

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 [12].

Alpinia Nirga:

The extract of the rhizome of *Alpinia nirga* (Family of Zinziberaceae) obtained by cold extraction of mixture of equal proportions of petroleum ether, ethyl acetate and methanol was chosen for Phytopharmacological screening. Anti-inflammatory activity was assessed by carrageenan-induced paw oedema method. Healthy swiss-albino rat 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 the two different doses of the extract. In carrageenan-induced paw oedema model, *Alpinia nirga* 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 [13].

Achyranthes Aspera:

Achyranthes aspera leaves (Family of Amaranthaceae) and whole plant (i.e. 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 analysis and acute toxicity of the extracts was also studied using Organization for Economic Co-operation and Development OECD guidelines 423. Acute toxicity study confirmed toxic dose of to be more than 2,000 mg/kg. Flavonoids, alkaloids, saponins and triterpenoids were the major constituents found in extracts. Aqueous extracts of *Achyranthes aspera* leaves reduced the oedema induced by carrageenan by 35.71-54.76% on intraperitoneally administration of 400 mg/kg and 800 mg/kg as compared to the untreated control group. Diclofenac sodium at 10 mg/kg inhibited the oedema volume by 42.85%. The results indicated that the Aqueous extracts of *Achyranthes aspera* leaves 800 mg/kg body weight shows more significant ($P < 0.01$, $P < 0.001$) anti-inflammatory activity when compared with the standard and untreated control respectively. Both Aqueous extracts of *Achyranthes aspera* leaves exhibit promising anti-inflammatory activity attributed to flavonoids, alkaloids, saponins and triterpenoids phytoconstituents [14].

Andrographis Paniculata* and *Bacopa Monnieri:

In this study was undertaken to screen and compare anti-inflammatory activity of aqueous extracts of the two plants by simple and reliable *in vitro* methods. Human Red Blood Cell membrane stabilization method, inhibition of nitric oxide synthesis in lipopolysaccharide stimulated white blood cells and anti-platelet aggregation activity were the methods used to establish the anti-inflammatory activity. The study revealed that aqueous extracts of *B. monnieri* (Family of Scrophulariaceae) & *Andrographis paniculata* (Family of Acanthaceae) holds better potential in clinical application of the phytoconstituents in the development of anti-inflammatory drugs [15].

Andrographis Serpyllifolia:

The study was aimed to evaluate anti-inflammatory activity (by both in-vitro and in-vivo) of both chloroform and methanol root extracts of *Andrographis serpyllifolia (Rottl. Ex Vahl.) Wt.* (Family of Acanthaceae). Methods used for the studies were In-vitro 5-Lipoxygenase inhibition assay and In-vivo measurement of rat paw oedema and ear oedema in rats. Chloroform and methanolic extracts of *A. serpyllifolia* root have shown moderate potency in inhibiting 5-LOX and shown significant anti-inflammatory activity. Despite the IC50 values are little higher, anti-inflammatory efficacy of these extracts possibly due to other mechanisms apart of 5-LOX inhibition. However, *In-vivo* anti-inflammatory studies revealed that *A. serpyllifolia* methanolic extract has shown higher degree of efficacy when compared to the chloroform extract. Hence, it is important to isolate the active principles for further testing the anti-inflammatory efficacy [16].

Anethum Graveolens:

The plant *Anethum graveolens* (Family of Apiaceae), in this study includes 3 groups of 6 male rats: Formalin, Dill-Oil and Diclofenac-gel groups. The Dill-Oil group received 2 g of Dill-Oil, containing 100 mg Dill-extract and the Diclofenac group received 2 g gel containing, 20 mg Diclofenac Na. Data were analyzed with SPSS 17 using ANOVA, Kruskal-Wallis, and Repeated-Measures. The average paw volumes changes in these groups after Formalin-induced inflammation on 1st day, were 0.31 (standard error (SEM) = 0.02), 0.30 (SEM = 0.01) and 0.32 (SEM = 0.05) respectively, with no significant difference. Regarding the peak of inflammation on the 2nd day, it was indicated that the average inflammations in Formalin, Dill-Oil and Diclofenac-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 Diclofenac-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 Diclofenac one. The results of paw volume measurement analyzed by the Plethysmometer manifest that the Dill-Oil is able to decrease the paw volume significantly [17].

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 and administered 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 [18].

Argemone Mexicana:

This present study deals with evaluation of the anti-inflammatory and analgesic properties of a lyophilized leaf extract of *Argemone mexicana* Linn. (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* Linn. for the treatment of pain and inflammation sickness [19,20].

Asphargus Racemosus:

This present study is aimed to appraise the anti-inflammatory activity of ethanolic extract of *Asphargus racemosus* roots (Family of Liliaceae). Carragenan is used to induced inflammation, the result of this study revealed that *Asphargus 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 in the carrageenan induced inflammation the animals treated with the plant extract have been shown a

significant activity at 500mg/kg dose (p<0.001) which was comparable with the standard drug. In view of the percentage inhibition also 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* have 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 (EBP) (Family of Leguminaceae) in Sprague Dawley (SD) rats. Carrageenan induced paw oedema and air pouch inflammation, arachidonic acid induced ear edema and complete freundÊs adjuvant (CFA) induced hematological alterations were studied in control and experimental rats. Administration of EBP (200mg, 400mg, 600 mg/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 EBP even at higher doses. Together, our results demonstrate that EBP has potent anti-inflammatory properties validating the folk medicinal use of this species [24,25].

Bauhinia Variegate:

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 shows 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, barks and the leaves of the plant *B. repens* was sun dried and extracted using methanol. The anti-inflammatory activity was evaluated using the carrageen induced paw oedema in rats. The crude methanolic extract at a dose of 600mg/kg showed very potent anti-inflammatory activity in carrageen induced rat paw oedema model with 68.59% 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 carrageen 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 kaitense:

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

Calanthe Triplicate:

The present investigation is focused to find out phytocomponents which are effective on anti-inflammatory activities of various extracts of entire plant (shrub) of *Calanthe triplicata* (Willemet) Ames (Family of Orchidaceae). Gas Chromatography-Mass Spectrometry (GC-MS) was used for the analysis of phytocomponents 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 flavanoid compound 4H-Pyran-4one, 2, 3-dihydro-3,5 dihydroxy-6-methyl 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 *C. macrophylla* (Family of Verbenaceae) have anti-inflammatory potential, comparable to that of standards [32].

Canscora Perfolita:

This study was intended to evaluate the anti-inflammatory activity of ethanol extract of *Canscora perfoliata* whole plant (Family of Gentianaceae) in carrageenan induced paw oedema in wistar albino rats at the dose level of 150 and 300mg/kg administrated orally. Ethanol extracts exhibit 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, tannins, 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 ethnoveterinary 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 hydroalcoholic 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

may be due to presence alkaloids, flavonoids, tannins and steroids [35].

Cassia Fistula:

The extracts were found to posses 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, diclofenac sodium, which showed 47% inhibition. Further, the acute toxicity study with the extracts showed no sign of toxicity up to a dose level of 2000 mg/p.o. Thus it could be concluded that cassia fistula bark extracts (CFA & CFM) possess significant anti-inflammatory activity [36].

Cassia Purpurea:

The ethanolic extract of A. *Cassia purpurea* (Family of Caesalpiniaceae) has indicated the presence of steroid, flavonoid and tri terpenoids, 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 HRBC (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 [37].

Celtis Australis:

The ethanol 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-CHCl3 (6:4) of EtOAc 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 text 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 [38].

Cissus Multistriata:

This present study was undertaken to evaluate anti-inflammatory properties of methanol extract from the leaves of *Cissus multistriata* (Family of Vitaceae). Inflammation was induced in experimental animals using ethanol. Anti-inflammatory activity was also studied on the plant using the paw oedema method on different groups of rats. The methanol extract of *C. multistriata* exhibited potent anti-inflammatory activity at 150 mg/kg bwt at 4 h after administration to group 4 when compared with reference standard drug (Indomethacin). Group 2 had 72% 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 b.wt [39].

Clerodendron Fragrans:

The anti-inflammatory activity of the leaves of *Clerodendron fragrans* (Family of Verbenacae) has been evaluated using carrageenan, formaldehyde, histamine and egg white-induced rat paw oedema and cotton pellet–induced granuloma models in rats. The aqueous 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 carrageenan-induced rat paw oedema whereas the standard ibuprofen showed inhibition of 56.8% after 3 h of carrageenan challenge. The extract (250 and 500 mg/kg) exhibited 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 [40].

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 induced peritonitis in mice. The anti-inflammatory activity against chronic inflammation was assessed in model of cotton pellet granuloma in rats. The activity of CP was compared with aspirin and *Dashamoolarishta* (a multi-ingredient plant formulation containing (C*lerodendrum 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* [41].

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 edema. In this study, Moreover, presence of alkaloid in EECVR may be the responsible for the potential anti-inflammatory activity [42, 43].

Conyza Dioscoridis:

The ethanol (70%) extracts of *Conyza 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 [44].

Crinum Defixum:

The anti-inflammatory activity of the bulbs of the plants 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 defixum* (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 ethanomedicinal use of this plant for inflammatory conditions [45].

Crotalaria Burhia:

In present study anti-inflammatory activities were assessed using acetic- acid induced writhing and formalin induced pain in mice and acute, subacute models of inflammation in rats. 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 40mg/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 [46].

Cucumis Sativus:

The present study was conducted to study the anti inflammatory activity of *Cucumis sativus* (Family of Cucurbitaceae) seed in Carrageenan-induced paw oedema model and xylene induced ear oedema model using Albino Wistar rats. A significant inhibition of carrageenan induced rat paw oedema comparable to that produced by indomethacin, the standard anti inflammatory drug was obtained with all the two doses of the acetone 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 [47].

Cynodon Dactylon:

In this study anti-inflammatory property of chloroform-methanolic extract 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 dose of 125, 250 and 500 mg/kg used for both acute and chronic models in the study and is comparable with standard [48, 49].

Cyathocline lyrata Cass:

This present study was aimed at evaluating the chloroform extracts

of whole part of *Cyathocline lyrata cass* (Family of Asteraceae) anti-inflammatory activity. Anti-inflammatory activity of chloroform extracts of whole part of *Cyathocline lyrata cass* was evaluated by carrageenan induced hind paw oedema and Formalin induced paw oedema method. Chloroform extracts of whole part of *Cyathocline lyrata cass* 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 *Cyathocline lyrata cass* posses 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 carrageen an 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 b.w.) 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. Ethanol extracts 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 diarrhoeal effect and the effect on enter pooling induced by castor oil for two treated groups (T1&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 Tramado HCL at 40 mg/Kg IP and Diclofenac(0.75mg/Kg BW IP)as reference drug. 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 (56.14 and 61.46% inhibition respectively) while the inflammatory phase was significantly inhibited at all the doses tested. The extract (25 mg/kg) significantly reduced 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].

Dracaena Cinnabari Balf:

This present study, we evaluate the anti-inflammatory activity of ethanolic extract obtained from *Dracaena cinnabari balf* resine (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 the ethanolic extract have peripheral analgesic as 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 Asteraceae) was subjected to preliminary phytochemical screening. The acute anti-inflammatory effect was studied by carrageenan induced hind paw oedema method in rats. Acute 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 effect 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 is 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].

Flueggea Virosa:

The aqueous extract of *Flueggea 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 (500-5,000mg/kg) and two (6,000-10,000mg/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 *Flueggea 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 *Flueggea 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 extracts exhibited 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 Tiliaceus:

The purpose of this study was to evaluate and compare the anti-inflammatory activity of methanolic wood extract of *Hibiscus tiliaceus* Linn (Family of Malvaceae) in experimental acute and chronic inflammatory animal models. The in-vivo anti-inflammatory activity was studied using the acute (Carrageenan induced paw oedema) and chronic (Cotton pellet induced granuloma) animal models. Anti-inflammatory activity was expressed as Percent inhibition (PI). The percentage inhibition increase of paw oedema was increased with time and gave maximum effect at 2 hours, then declined in case of standard extract 400 mg.kg body weights. Only the 200 and 4000 mg/kg body weight extracts exhibited significant result *(P<0.05)* when compared with control [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 carageenan-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 Pinnata:

It is aimed to investigate of ethanol and aqueous extracts of dried stem of plant *Kalanchoe pinnata* (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, there was a 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 Lamiacae) dried whole plant material (1500gm) was packed in soxhlet apparatus and extracted successively with Pet. Ether (PE) to defat the drug, petroleum ether was removed from the powdered defatted 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 acetic acid and paw oedema which was compared with standard aspirin (marketed product). Anti-inflammatory activity induced by carrageenan azznd 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 absorbance to evaluate 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 *Krameriaceae*) 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 [74].

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-1 and 500mg kg-1 body weight using a Carrageenan induced paw oedema method (acute inflammation). 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 [75].

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 extract were administered orally to the animals. Control received distilled water orally. Results showed that *Nyctanthes arbor-tristis* Linn. had potent anti-inflammatory activities [76].

Oscillatoria Annae:

The present study was designed to investigate anti-inflammatory and antinociceptive 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 [77].

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 HRBC 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 97.9±0.24%, the maximum percentage protection of lysis was observed in ethanol extract of *Pergularia daemia* stem 12.0 mg/ml is 78.58±0.33% [78].

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 [79].

Peporemia Pellucid:

The aspire of the present research was to explore the anti-inflammatory activity of ethyl acetate extract of *Peporemia pellucida* (Family of Piperaceae) in mice, Acquired immune deficiency syndrome (AIDS), and hypercholesterolemia and against pain. In the present study *P. pellucida* has significant anti-inflammatory effect after 4 hr with 3.47± SEM. The present study indicates significant anti-inflammatory effects of *P. pellucida*. The present investigation established the pharmacological evidence to support the folklore claim and that of the plant has anti-inflammatory activity [80].

Petasites 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* possesses anti-inflammatory activity [81].

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 [82].

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 [83].

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 bwt [84].

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 [85].

Polygonatum 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 [86].

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 [87].

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 ethanol 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 [88].

Sargentodoxa Cuneata:

An experiment was conducted to determine the concentration of emodin, 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 [89].

Solanum 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* Sosn. (Family of Lamiaceae), In this study, the anti-inflammatory properties of total methanolic extracts of the flowering aerial parts of two *Stachys* species in rat 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 dependant manner (doses 50, 100 and 200 mg/kg). In the formalin test, the extract (50, 100 and 200 mg/kg) had 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].

Stachytarpheta Cayennensis:

This present study was designed to assess the anti-inflammatory activity of the aqueous and ethanolic extracts of the whole plant of *Stachytarpheta 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 diclophenac (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 4000mg/kg body weight and no macroscopical 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 dose 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].

Swertia 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<0.001) 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 evident anti-inflammatory activities. The results signify the traditional uses of *Swertia chirata*, for inflammation and pain [95].

Synedrella Nodiflora:

Methanolic extract of the leaves of *Synedrela nodiflora* (Family of Asteraceae) has been evaluated for anti inflammatory potential against carrageenan and formalin induced paw edema in rat, respectively. The extract also showed significant inhibition of paw edema in rat 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 saponins. 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 stabilization. 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 capensis*has significant anti inflammatory activity in comparison to aqueous extract and ethyl acetate extract of the same plant and with standard drug diclofenac [98].

Tectona Grandis:

The methanolic extracts of the frontal and mature leaves of *Tectona grandis* (Family of Verbinaceae) 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 [99].

Tri*gonella Foenum-Graecum, Zhumeria Majdae, 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. foeunm-graecum* (Family of Fabaceae) 100 mg/kg and *Z. majdae* (Family of Lamiaceae) 200 and 400m g/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 Violaceae) 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 Violaceace) was employed to assess the anti-inflammatory activity was tested in carrageenan induced paw oedema 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 [102].

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 [103].

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 [104]. There are number of immuno-suppressing agents have been developed 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 inhibitotors. 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 arthiritis [105]. For rheumatoid arthritis currently available drugs are primarily directed towards the control of pain or the inflammation associated with sinovitis. 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 their complex mixtures. However, the core chemical classes of anti-inflammatory agents from natural sources have been reported to engage a vast range of compounds such as polyphenils, flavnoids, terpenoids, alkaloids, anthraquinones, lignans, polysaccharides, saponins and peptides [106, 107]. From the study done so far, it has been elucidated that flavnoids are major anti-inflammatory agents. Some of them act as phospholipase inhibitors and some have been reported as TNF-α inhibitors in different inflammatory conditions. Biochemical investigations have also shown that flavnoids can inhibit both cyclooxygenase and lipoxygenase pathways of arachidonic metabolism depending upon their chemical structures [108, 109]. Alkaloids in asserted skeletal type based on pyridine ring system have been reported to have striking anti-inflammatory activity, e.g Berberine from *Berberis* is traditional remedy against rheumatism [110]. Terpenoids significantly inhibit the development of chronic joint swelling. Terpenoids may affect different mechanism relevant to inflammations arising in response to varied etiological factors [111]. 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:

1. Reddy J, Gnanasekaran D, Vijay D, Rangana than TV. In vitro studies on anti asthmatic, analgesic and anti convulsant activities of the medicinal plant *Bryonia laciniosa* Linn, *Int. J. Drug Discov.,* **2010**; 2(2): 1-10.
2. Satoskar RS, Bhandarkar SD, Rege NN; Pharmacology and Pharmacotherapeutics, 21st edition, Popular Prakashan, Mumbai, **2009**; 176.
3. Vane JR, Bolting RM. New insights into the mode of action of anti- inflammatory drugs. *Inflammation Res.,* **1995**; 44: 1-10.
4. Perianayagam JB, Sharma SK, Pillai KK. Anti-inflammatory activity of *Trichodesma indicum* root extract in experimental animals. *J. Ethnopharmacol.,* **2006**; 104: 410-414.
5. Brunton LL, Parker KL, Lazo JS. Goodman & Gilman's The Pharmacological Basis Of Therapeutics, 11th edition, Medical Publishing Division, **2006**.
6. Khode S, Maddi V, Aragade P, Palkar M, Ronad PK, Mamledesai S, Thippeswamy AHM, Satyanarayana D. Synthesis and pharmacological evaluation of a novel series of 5-(substituted)aryl-3-(3-coumarinyl)-1-phenyl-2-pyrazolines as novel anti-inflammatory and analgesic agents. **2009**; 44: 1682-1688.
7. Dharmasiri JR, Jayakody AC, Galhena G, Liyanage SSP, Ratnasooriya WD. Anti-inflammatory and analgesic activities of mature fresh leaves of *Vitex negundo*. *J. Ethnopharmacol.,* **2003**; 87: 199-206.
8. Park JH, Son KH, Kim SW, Chang HW, Bae K, Kang SS, Kim HP. Anti-inflammatory activity of *Synurus deltoids*. *Phytother. Res.,* **2004**; 18: 930-933.
9. De Almeida EC, Menezes H. Anti-inflammatory activity of propolis extracts: a review, *J. Venom. Anim. Toxins Botucatu.,* **2002**; 8(2).
10. Sokeng SD, Koubé J, Dongmo F, Sonnhaffouo S, Nkono BL, Nkono Y, Taïwé GS, Cherrah Y, Kamtchouing P. Acute and chronic anti-inflammatory effects of the aqueous extract of *Acacia nilotica* (L.) Del. (Fabaceae) pods. *Aca. J. Med. Plants,* **2013**; 1(1): 1-5.
11. Singh R, Patil SM, Pal G, Ahmad M. Evaluation of in vivo and in vitro anti-inflammatory activity of *Ajuga bracteosa* Wall ex Benth. *Asian Pac. J. Trop. Dis.,* **2012**; S404-S407.
12. Nemat O, Muhitdinov A, Aminov S, Aliyev X. Anti-inflammatory activity of garlic oil extract. *Medi. Health Sci. J.,* **2013**; 14(1): 84-86.
13. Das BN, Biswas BK. Anti-Inflammatory Activity of the Rhizome Extract of *Alpinia. nigra. Int. Res. J. Pharma.,* **2012**; 2(3): 73-76.
14. Bhosale UA, Yegnanarayan R, Pophale P, Somani R. Effect of aqueous extracts of *Achyranthes aspera* Linn. on experimental animal model for inflammation. *Ancient. Sci. Life,* **2012**; 31: 202-206.
15. Desai JV, Thomas R, Kamat SD, Kamat DV. Comparative Studies on In-Vitro Anti-Inflammatory Activity of *Andrographis paniculata* and *Bacopa monnieri*. *J. Adv. Pharma. Res.,* **2012**; 2(1): 5-8.
16. Kandati V, Govardhan P, Reddy CS, Nath AR, Reddy RR. *In-vitro* and *in-vivo* anti-inflammatory activity of *Andrographis serpyllifolia (Rottl. Ex Vahl.) Wt. Int. Curr. Pharm. J.,* **2012**; 1(8): 199-204.
17. Naseri*a* M, Mojab F, Khodadoost M, Kamalinejad M, Davati A *et al.* The study of anti-inflammatory activity of oil-based dill (*Anethum graveolens* L.) extract used topically in formalin-induced inflammation male rat paw. *Iranian J. Pharma. Res.,* **2012**; 11(4): 1169-1174.
18. Foong CP, Hamid RA. Evaluation of anti-inflammatory activities of ethanolic extract of *Annona muricata* leaves. *Rev Bras Farmacogn Braz. J. Pharmacogn.,* **2012**; 22(6): 1301-1307.
19. Sourabie TS, Ouedraogo N, Sawadogo WR, J.B. Nikiema IP *et al*. Biological evaluation of anti-inflammatory and analgesic activities of *Argemone mexicana* Linn. (Papaveraceae) aqueous leaf extract. *Int. J. Pharma. Sci. Res.,* **2012**; 3(9): 451-458.
20. Prasad C, Rao KR, Rao MP, Guddeti V. Antioxidant and anti-inflammatory activity of ethyl acetate extract of The aerial parts of *Argimone mexicana. Int. J. Pharma. Chem. Bio. Sci.,* **2013**; 3(4): 1185-1190.
21. Mittal S, Dixit PK. In vivo anti-inflammatory and arthritic activity of ethanolic extract of *Asphargus racemosus* roots. *Int. Res. J. Pharm.,* **2013**; 4(4): 167-172.
22. Shafie MM, Forghani AH, Moshtaghiyan J. Anti-inflammatory effects of hydro-alcoholic extracts of Mangrove (*Avicennia marina*) and vitamin C on arthritic Rats. *Bull. Env. Pharmacol. Life Sci.,* **2013**; 2(7): 32-37.
23. Azad AK, Wan AWS, Babar ZM, Labu ZK, Zabin S. An overview on phytochemical, anti-inflammatory and anti-bacterial activity of *Basella alba* leaves extract. *Middle-East J. Sci. Res.,* **2013**; 14(5): 650-655.

24. Hari B, Padmaja TK, Naidu PB, Naik SR, Meriga B. Anti-inflammatory and antioxidant activity of ethanolic extract of *Bauhinia purpurea* bark. *Int. J. Drug Del.,* **2012**; 4: 507-514.
25. Chaudhari MG, Joshi BB, Mistry KN. In vitro anti-diabetic and anti-inflammatory activity of stem bark of *Bauhinia purpurea*. *Bull. Pharma. Med. Sci.,* **2013**; 1(2): 139-150.
26. Bairagi SM, Aher AA, Nema N, Nimase PK. Anti-inflammatory evaluation of methanol extract and aqueous fraction of the bark of *Bauhinia varigata* (Leguminoceae). *Int. J. Res. Pharm. Chem.,* **2012**; 2(1): 77-82.
27. Dey A, Abu AM, Shakar SM, Rahman A, Amin MHT. Evaluation of the anti-inflammatory and antipyretic activities of the plant *Boerhavia repens.* (Family:Nyctaginaceae). *J. Nat. Prod. Plant. Resour.,* **2012**; 2(4): 471-474.
28. Afsar V, Y Reddy M, Saritha KV. In vitro antioxidant and anti-inflammatory activity of methanolic leaf extract of *Boswellia serrata. Int. J. LifeSc. Bt. Pharm. Res.,* **2012**; 1(4): 15-23.
29. Sindhoor KL, Gurram SK, Nagarjuna S, Reddy YP. Comparative study of anti-inflammatory activity of petroleum ether and ethanolic extracts of *Brassica juncea*. Int. J. Pharm. Res., **2012**; 4(3): 1172-1176.
30. Kalaiarasan A, John SA. In-vitro screening for anti-inflammatory activity of *Bulbophyllum kaitense*. Rechib. Pseudobulb extract by HRBC method. Eastern Peninsular Flora in South India. *Int. J. Sci. Res. Publi.,* **2012**; 2(7): 1-5.
31. Mythili K, Reddy CU, Chamundeeswari D, Manna PK. GC-MS analysis of phytocomponents and *in-vitro* inhibitory effects of *Calanthe triplicate. J. Nat. Prod.* **2013**; 6: 141-146.
32. Yadav V, Jayalakshmi S, Singla RK, Patra A, Khan S. Assessment of anti-inflammatory and analgesic activities of *Callicarpa macrophylla* Vahl. roots extracts . *Web. Med. Central Pharmacol.,* **2012**; 3(5): WMC003366.
33. Thanga SKK, Ruba AA, Muthukumarasamy S, Mohan VR. Anti-inflammatory activity of whole plant of *Canscora perfoliata* Lam. *Int. Res. J. Pharm.,* **2012**; 3(11): 116-117.
34. Adedapo AA, Orherhe VE. Antinociceptive and anti-inflammatory studies of the aqueous leaf extract of *Carica Papaya* in laboratory animals. *Asian J. Exp. Bio. Sci.,* **2013**; 4(1): 89-96.
35. Mali AA, Hivrale MG, Bandawane DD, Chaudhari PD. Study of anti-inflammatory activity of *Cassia auriculata* Linn. Leaves in wistar rats. *Indian Drugs,* **2012**; 49(11): 44-47.
36. Tikole SS, Bagde P, Powar P, Shelar P. Study of the anti-inflammatory activity of *Cassia fistula* Linn. *Curr. Pharm. Res.,* **2013**; 3(3): 918-922.
37. Patil ND, Patil NP, Salunkhe PS, Bari MM, Barhate SD. *In-vitro* anti-inflammatory potential of *Cassia purpurea* (Roxb.) leaves extract on Human RBC and analgesic property on swiss albino mice. *The Pharm. Innov.,* **2013**; 2(5): 1-6.
38. Semwal RB, Semwal DK. Analgesic and anti-inflammatory activities of extracts and fatty acids from *Celtis australis* L. *The Nat. Pro. J.,* **2012**; 2: 323-327.
39. James O, Ojogbane EB, Abbah OC Tehinse MO. Anti-ulcerogenic and anti-inflammatory activity of *Cissus multistriata* extract in experimental animals. *British J. Pharmacol. Toxicol.,* **2013**; 4(3): 74-79.
40. Srinivasana KP. Bhatta SS, Kumara AJ, Rajarajan AT *et al.* Studies on anti-inflammatory activity of crude aqueous extract of *Clerodendron fragrans* in experimental animals. *Int. J. Pharma. Sci. Lett.,* **2012**; 2: 32-36.
41. Parekar RR, Dash KK, Marathe PA, Apte AA, Rege NN. Evaluation of anti-inflammatory activity of root bark of *Clerodendrum phyomidis* in experimental models of inflammation. *Int. J. Appl. Bio. Pharma. Tech.,* **2012**; 3(3): 54-60.
42. Prasanth KG, Anandbabu A, Johns T, Dinesh KB, Krishnakumar K. Ethanol extract of *Clerodendrum viscosum* vent roots: investigation of analgesic and anti inflammatory effects in male adult swiss albino mice. *Int. J. Nat. Prod. Res.,* **2012**; 1(4): 67-71.
43. Chandrashekar R, Rao SN. Acute anti-inflammatory activity of ethanolic extract of leaves of *Clerodendrum viscosum* by carrageenan induced paw oedema method in wistar albino rats. *Int. J. Res. Ayurveda Pharm.,* **2013**; 4(2): 224-227.
44. Zalabani SM, Hetta MH, Ahmed SI. Anti-inflammatory and antimicrobial activity of the different *Conyza dioscoridis* L. Desf. Organs. *Biosafety,* **2013**; 2(1): 1-3.
45. Shilpa K, Chandra HR, Krishnaveni B. Anti-inflammatory activity of *Crinum defixum* Ker-Gawl. *Int. J. Pharm. Sci. Drug Res.,* **2012**; 4(2): 147-149.
46. Kataria S, Shrivastava B, Kaur D, Sharma P. Anti-inflammatory and antinociceptive activities of *Crotalaria burhia* Bunch.- Ham. Whole plant. *Indian J. Nat. Pro. Resour.,* **2012**; 3(2): 189-196.
47. Vetriselvan S, Subasini U, Velmurugan C, Muthuramu T, Revathy JS. Anti-inflammatory activity of *Ccumis sativus* seed in carrageenan and xylene induced edema model using albino wistar rats. *Int. J. Biopharm.,* **2013**; 4(1): 34-37.
48. Yogesh HS, Kichadi SC, Muchandi IS, Gopalakrishnan B. Evaluation of anti-inflammatory activity of *Cynodon dactylon* Per. On carrageenan induced paw oedema in rats. *Indian J. Nat. Prod. Resour.,* **2013**; 4(2): 151-154.
49. Malviya KG, Shivhare UD, Srivastav P, Shivhare SC. Evaluation of anti-inflammatory potential of *Cyathocline lyrata Cass* plant extract by using carrageenan induced and formalin induced rat paw edema. *Asian J. Res. Pharm. Sci.,* **2013**; 3(2): 90-94.
50. Dixit G, Misal G, Gulkari V, Upadhye K. Formulation and evaluation of polyherbal gel for anti - inflammatory activity. *Int. J. Pharm. Sci. Res.,* **2013**; 4(2): 1186-1191.
51. Estakhr J, Javadian F, Ganjali Z, Dehghani M, Heidari A *et al*. Study on the anti-inflammatory effects of ethanolic extract of *Cynanchum acutum. Curr. Res. J. Biol. Sci.,* **2012**; 4(5): 630-632.
52. Anitha M, Daffodil ED, Muthukumarasamy S, Veerabahu RM. Anti-inflammatory activity of whole plant of *Cynoglossum zeylanicum* (VAHL Ex Hornem) Thunb. Ex. Lehm. *J. Adv. Pharm. Edu. Res.,* **2013**; 3(1): 22-22.
53. Abbas DA. Analgesic, anti-inflammatory and antidiarroheal effects of *Datura stramonium* hydroalcoholic leaves extract in mice. *Int. J. Res. Rev. Appl. Sci*., **2013**; 14(1): 193-199.
54. Atsang AAG, Dzeufiet DPD, Foyet HS, Nana P, Sokeng DS, Dimo T, Kamtchouing P. Analgesic and anti-inflammatory activities of *Dichrostachys glomerata (Forssk.) Hutch.* fruits methanolic extract in rats. *J. Phys. Pharm. Adv.,* **2012**; 2(8): 269-276.
55. Ahmed A, Sobbarry MD, Cherrah Y, Alaoui K. Anti-inflammatory and analgesic effects of ethanolic extract of Dracaena Cinnabari Balf, as endemic plant in Yemen. *Int. J. Pharma. Bio. Sci.,* **2012**; 3(2): 96-106.
56. Jayanthi P, Lalitha P, Sujitha R, Thamaraiselvi A. Anti-inflammatory activity of the various solvent extracts of *Eichhornia crassipes* (Mart.) Solms. *Int. J. Pharmtech. Res.,* **2013**; 5(2): 641-645.
57. Parimala K, Cheriyan BV, Vishwanathan S. Antinociceptive and anti-inflammatory activity of petroleum ether extract of *Eupatorium triplinerve* Vahl. *Int. J. Life Sci. Pharma. Res.,* **2012**; 2(3): 13-18.
58. Varpe SS, Juvekar AR, Bidikar MP, Juvekar PR. Evaluation of anti-inflammatory activity of *Typha angustifolia* pollen grains extracts in experimental animals. *Int. J. Pharmacol.,* **2012**; 44(6): 788-791.
59. Muthulakshmi A, Margret RJ, Mohan VR. Anti-inflammatory of ethanol extract of leaf and bark of *Feronia elephantum* Correa. *J. Curr. Chem. Pharm. Sci.,* **2012**; 2(4): 266-270.
60. Ezeonwumelu JOC, Omar AN, Ajayi AM, Okoruwa AG, Tanayen JK, Kiplagat DM, Okpanachi OA *et al*. Phytochemical screening, acute toxicity, anti-inflammatory and antipyretic studies of aqueous extract of the root of *Flueggea virosa* (Roxb. ex Willd.) in rats. *Int. J. Pharm. Biomed. Sci.,* **2012**; 3(3): 128-135.
61. Ede SO, Olaniru E, Otimenyin S, Aguiyi JC, Ekwere EO. Analgesic and anti-inflammatory activities of the ethanolic extract of the Mushroom *Ganoderma applantum. Int. J. Res. Revin. Appl. Sci*., **2012**; 13(1): 349-352.
62. Ermeli NB, Alsabri SG, Bensaber SM, Mohamed SB, Abdulmottaleb A *et al*. Screening of analgesic and anti-inflammatory activities for two Libyan medicinal plants: *Helianthemum lippii* and *Launaea residifolia*. *J. Chem. Pharm. Res.,* **2012**; 4(9): 4201-4205.
63. Borhade PS, Dalal PS, Pachauri AD, Lone KD, Chaudhari NA, Rangari PK. Evaluation of anti-inflammatory activity of *Hibiscus tiliaceus* Linn. wood extract. Int. J. Res. Pharm. Biomed. Sci., **2012**; 3(3): 1246-1250.
64. Nacoulma AP, Compaoré M, Lorenzi M, Kiendrebeogo M, Nacoulma OG. *In vitro* antioxidant and anti-inflammatory activities of extracts from *Nicotiana tabacum* L. (Solanaceae)

Leafy Galls induced by *Rhodococcus fascians. J. Phytopathol.,* **2012**; 160(11-12): 617-621.
65. Aher AN, Pal SC, Muke SA. Analgesic and anti-inflammatory activities of *Ixora coccinea* flower. *Indian Drugs,* **2013**; 50(1): 64-67.
66. Matthew S, Jain AK, James M, Matthew C, Bhowmik D. Analgesic and anti-inflammatory activity of *Kalanchoe pinnata* (Lam.) Pers. *J. Med. Plants Stud.,* **2013**; 1(2): 24-28.
67. Amali MO, Bello MK, Olatunji LO, Salawu O, Olorundare OE. Analgesic and anti-inflammatory activities of ethanolic extract of the stem bark of *Kigelia Africana* in wistar albino mice and rats. *Nig. J. Pharm. Sci.* **2012**; 11(1): 5-15.
68. BeidokhtiI MN, Prakash HS. Antioxidant and anti-inflammatory potential of selected medicinal plants of *Lamiaceae* family. *Int. J. Pharm. Pharm. Sci.,* 5(1): 100-104.
69. Kumar A, Rahal A, Chakraborty S, Tiwari R, Latheef SK, Dhama K. *Ocimum sanctum* (Tulsi): a miracle herb and boon to medical science -A Review. *Int. J. Agron. Plant Prod.,* **2013**; 4(7): 1580-1589.
70. Das SN, Patra VJ, Dinda SC. Anti-inflammatory and antidiabetic activity of *Leukas clarkei,* a rare species of Odisha, India. *Pharmacia.,* **2012**; 1(3): 110-117.
71. Akhtar MS, Asjad HMM, Irshad N, Bashir S, Khalid R. Anti-inflammatory, antipyretic and analgesic effect of the extract of *Litsea sebifera. Med. Chem. Drug Discov.,* **2013**; 4(2): 127-134.
72. Balamurugan K, Sakthidevi G, Mohan VR. Anti-inflammatory activity of leaf of *Melastoma malabathricum* L. (Melastomataceae). *Int. J. Res. Ayur. Pharm.,* **2012**; 3(6): 801-802.
73. Chandra S, Dey P, Bhattacharya S. Preliminary in vitro assessment of anti-inflammatory property of *Mikania scandens* flower extract. *J. Adv. Pharm. Edu. Res.,* **2012**; 2(1): 25-31.
74. Cisneros MÁR, Rios MY, Campos MD, A. Guadarrama BA. Phytochemical study and anti-inflammatory, antidiabetic free radical scavenger evaluations of *Krameria pauciflora* methanol extract. *Molecules,* **2012**; 17: 861-872.
75. Sarada K, Margret RJ, Mohan VR. Anti-inflammatory activity of ethanol extracts of leaf and bark of *Naringi crenulata* (Roxb.) Nicolson. *Int. J. Pharm. Sci. Res.,* 3(11): 4540-4544.
76. Kakoti BB, Pradhan P, Borah S, Mahato K, Kumar M. Analgesic and anti-inflammatory activities of the methanolic stem bark extract of *Nyctanthes arbor-tristis* Linn. *BioMed. Res. Int.,* **2013**; 1-6.
77. Rajavel R, Mallika P, Rajesh V, Kumar PK, Moorthy KS, Sivakumar T. Antinociceptive and anti-inflammatory effects of the methanolic extract of *Oscillatoria annae. Res. J. Chem. Sci.,* **2012**; 2(7): 53-61.
78. Vijaya PP, Wilson D, Ali AMA, Yogananth N,. Ali MS, Anuradha V, Kalitha PP. evaluation of in-vitro anti-inflammatory and antimicrobial properties of *Pergularia daemia and Solanum xanthocarpum. Int. J. Curr. Microbiol. App. Sci.,* **2013**; 2(1): 94-99.
79. Pandey K, SHARMA PK, Rupesh D. Antioxidant and anti-inflammatory activity of ethanolic extract of *Parthenium hysterophorus* Linn. *Asian J. Pharm. Clin. Res.,* **2012**; 5(4): 28-31.
80. Sheikh S, Sikder S, Paul SK, Hasan AMR, Rahaman MM and Kundu SP: hypoglycemic, anti-inflammatory and analgesic activity of *Peperomea pellucida* (L.) Hbk (Piperaceae). *Int. J. Pharm. Sci. Res.,* **2013**; 4(1): 458-463.
81. Lin SY, Teng HL, Tseng SH, Chen LG, Wang CC. The antinociceptive and anti-inflammatory activities of *Petasites formosanus* Kitamura extract. *Bot. Stud.,* **2012**; 53: 431-438.
82. Oseni LA, Amiteye D, Antwi S, Tandoh M, Aryitey GM. Preliminary *in vivo* evaluation of anti-inflammatory activities of aqueous and ethanolic whole plant extracts of *Phyllanthus fraternus* on carrageenan-induced paw oedema in sprague dawley rats. *J, App, Pharm, Sci.,* **2013**; 3 (3): 62-65.
83. Alam B, Fahima A, Nahida P, Pia RS, Sharmin A *et al*. Antioxidant, analgesic and anti-inflammatory activities of the methanolic extract of *Piper betle* leaves. *Avicenna J, Phytomed.,* **2013**; 3(2): 112-125.
84. Das B, Ferdous T, Qazi AM, Hannan JMA, Bhattacharjee R, Das BK. Antinociceptive and anti-inflammatory activity of the bark extract of *Plumeria rubra* of laboratory animals. *European J. Medi. Plants,* **2013**; 3(1): 114-126.
85. Alagammal M, Paulpriya K, Mohan VR. Evaluation of anti-inflammatory activity of ethanolic extract of *Polygala javana* DC. whole plant. *Int. Res. J. Pharm.,* **2012**; 3(8): 212-213.
86. Debnath T, Park SR, Kim DH, Jeong EJ, Lim BO. Antioxidant and anti-inflammatory activity of *Polygonatum sibiricum* rhizome extracts. *Asian Pac. J. Trop. Dis.,* **2013**; 3(4): 308-313.
87. Bera E, Bhattacharya S, Biswas M. Evaluation of acute anti-inflammatory activity of *Psidium guajava* leaf extracts in wistar albino rats. *J. Ad. Pharm. Edu. Res.,* **2013** 3(1): 23-26.
88. Thanga SKK, Lincy MP, Muthukumarasamy S, Mohan VR. Anti-inflammatory activity of *Sarcostemma secamone* (L) Bennet whole plant against carrageenan induced paw oedema. *Biosci, Discov.,* **2012**; 3(3): 288-291.
89. Zhou ZH, Q. Zhou WJ, Zhou JH. Anti-inflammatory and anti-nociceptive activities of the extracts of *Sargentodoxa cunteata* and its effects on the model rats with pelvic inflammation. *The J, Animal & Plant Sci.,* **2012**; 22(1): 44-50.
90. Elango V, Carolin O, Raghu PS. Anti-inflammatory activity of the flower extracts of *Solanum nigrum* in rats. *Hygeia J. D. Med.,* **2012**; 4(1): 59-62.
91. Rezazadeh S, ABBAS Aeezadeh K, Hamedani MP, Shafiee A, Isefahani SG. Anti-inflammatory and analgesic activity of methanolic extracts of aerial parts of *Stachys schtschegleevii Sosn. and Stachys balansae* Boiss. and Kotschy Ex Boiss in rats. *Daru.,* **2005**; 13(4): 165-169.
92. Siju EN, Rajalekshmi GR, Saritha KN, Kuttoor DS, Anusha KV, Fairuza MKC. Anti inflammatory activity of the whole plant of *Stachytarpheta cayennensis. Int. J. Pharm. Life Sci.,* **2012**; 3(6): 1777-1779.
93. Hossain MK, Prodhan MA, Even ASMIH, Morshed H, Hossain MM. Anti-inflammatory and antidiabetic activity of ethanolic extracts of *Sterculia villosa* barks on albino wistar rats. *J. Appl. Pharm. Sci.,* **2012**; 2(8): 96-100.
94. Vijayakumar V, Hindumathy CK. In vitro anti-inflammatory activity of *Strychnos potatorum* Linn. Seed by HRBC membrane stabilization. *Indian J. Res. Pharm. Biotechnol.,* **2013**; 1(3): 410-412.
95. Das SC , Bhadra S, Roy S, Saha SK, Islam MS, Bachar SC. Analgesic and anti-inflammatory activities of ethanolic root extract of *Swertia chirata* (Gentianaceae). Jordan J. Biol. Sci., **2012**; 5(1): 31-36.
96. Haque A, Zahan R, Nahar L, Mosaddik A, Haque E. Anti-inflammatory and insecticidal activities of *Synedrella nodiflora. Mole. Clin. Pharmacol.,* **2012**; 2(2): 60-67.
97. Ior LD, Otimenyin SO, Umar M. Anti-inflammatory and analgesic activities of the ethanolic extract of the leaf of *Syzygium Guineense* in rats and mice. *IOSR J. Pharm.,* **2012**; 2(4): 33-36.
98. Jothi ET, Nithya PD, Venkata lakshmi NV, Chand GP, Babu S. In vitro anti inflammatory activity of *Tecomaria Capensis (Thunb)* leaves of different extracts. *Curr. Pharma. Res.,* **2012**; 2(3): 524-526.
99. Nayeem N, Karvekar MD. Effect of plant stages on analgesic and anti inflammatory activity of the leaves of *Tectona grandis. European J. Exp. Bio.,* **2012**; 2(2): 396-399.
100. Sharififar F, Khazaeli P, Alli N, Talebian E, Zarehshahi R, Amiri S. Study of antinociceptive and anti-inflammatory activities of certain Iranian medicinal plants. *J. Intercult. Ethnopharmacol.,* **2012**; 1(1): 19-24.
101. Ali K, Ashraf A, Biswas NN. Analgesic, anti-inflammatory and anti-diarrheal activities of ethanolic leaf extract of *Typhonium trilobatum* L. Schott. *Asian Pac. J. Trop. Biomed.,* **2012**; 2(9): 722-726
102. Naveed M, Muhammad S, Khan H. Antipyretic, analgesic and anti-inflammatory activity of *Viola betonicifolia* whole plant. *Compl. Alter. Med.,* **2012**; 12(59): 1-8.
103. Althaf FD, Sudaroli M, Mohammed SI. In vitro anti-inflammatory activity of *Vitex leucoxylon* Linn. leaves by HRBC membrane stabilization. *Int. J. Pharm. Life Sci.,* **2013**; 4(1): 2278-2281.
104. Dutt V, Dutt R, Kuma S, Dhar V. Evaluation of analgesic activity of *Solanum platanifolium* Sims. fruits. *Indian drugs,* **2007**; 44: 405-407.
105. Park EK. Anti-inflammatory effect of an ethanolic extract from *Clematis mandshurica* Rupr. *J. Ethnopharmacol.,* **2006**; 108: 142-147.
106. Sparg S, Light M, Van staden J. Biological activities and distribution of plant saponins. *J. Ethnopharmacol.,* **2004**; 94: 219-243.

107. Wan D, Liu Y, Li W, Liu H. Separation methods for antibacterial and antirheumatismal agents in plant medicines. *J. Chromatogr. B,* **2004**; 812: 101-117.
108. Chi Y, Jong H, Son K, Chang H, Kang S, Kim H. Effects of naturally occurring prenylated flavnoids on enzymes metabolizing arachdonic acid: cyclooxygenases and lipooxygenases. *Biochemical. Pharmacol.,* **2001**; 62: 1185-1191.
109. Jang D, Cuendet M, Hawthorne M, Kardono L, Kawanishi K, Fong H. Prenylated flavnoids of the leaves of *Mucaranga conifera* with inhibitory activity against cyclooxygenase-2. *Phytomedicine,* **2002**; 61: 867-872.
110. Kupeli E, Kosar M, Yesilada E, Baser K. A comparative study on the antiinflammatory, antinociceptive and antipyretic effects of isoquinoline alkaloids from roots of *Turkish Berberis* species. *Life Sci.,* **2002**; 72: 645-652.
111. Changa C, Wena Z, Wangc S, Duha C. New anti-inflammatory steroids from the formosan soft coral *Clavularia viridis*. *Steroids,* **2008**; 73: 562-567.

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