

Echinacea Purpurea: A Review On Bioactive Constituents And The Pharmacological Activity(*Purple Cone Flower*)

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ABSTRACT: *Echinacea purpurea* is a herbal medicinal plant native to the North America. It is a perennial herbaceous plant commonly known as purple coneflower, red sun flower and rudbekia. Purple coneflower is a flowering plant of genus *Echinacea* and belongs to the family Asteraceae. This species of plant is spread along the wild of eastern, south eastern and Midwest of United States.

The Indian origin of *Echinacea purpurea* is called *Andrographis paniculate* commonly known as kalmegh. This is commonly used for common cold in India. The *Echinacea purpurea* contains various chemical constituents mainly the polysaccharide, alkylamides, phenolic compounds such as caffeic derivatives like chicoric acid which is more abundant, caftaric acid, caffeic acid and flavonoids, glycoproteins. Different sections of the plant contains different chemical constituents and its presence varies. The *Echinacea purpurea* constituents are extracted by alcohol and is analyzed by various analytical methods such as UV spectrophotometry, HPLC and coulometric electrochemical and electrospray ionization mass spectrometry.

The *Echinacea purpurea* shows various pharmacological activities such as anti-oxidant, anti-bacterial, antiviral, anti-immunosuppressant and anti-inflammatory and this activity is shown by various constituents of the plant present. The efficacy of *Echinacea purpurea* is not completely revealed and from the data available it is identified that the *Echinacea* is well tolerated. This article reviewed the brief introduction about *Echinacea purpurea*, its bioactive compounds present and pharmacological activity with the toxicology.

KEYWORDS: alkylamides, polysaccharides, phenolic compounds, caffeic acid, chicoric acid, *Echinacea purpurea*

I. INTRODUCTION



Fig1. *Echinacea purpurea*

Echinacea purpurea belonging to the family of Asteraceae (Compositae) is commonly also know by the name of purple cone flower. It is a perennial medicinal herb which is native and largely found in the central grasslands of North America. The purple cone flower is mainly characterized by erect main stems which measure up to 2 meters in height, coarse hairs, alternate leaves on long stalks, solitary spiny, coarse hairs and reddish orange flowers surrounded by purplish bracts. Unlike other species of *Echinacea*, *Echinacea purpurea* has a fibrous root system. The majority of the taxa are diploid (n=11). Among different species of *Echinacea* the *Echinacea purpurea* is the plant that is widely cultivated that has medicinal uses. [1]

Table 1 Major constituents of *Echinacea* species (adapted from Barnes 2002)

Species	Plant part	Constituents	Comment
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<i>Echinacea pallida</i>	Roots	Polysaccharides, polyacetylenes, caffeic acid esters.	Alkylamides are not present
<i>Echinacea angustifolia</i>	Roots	Alkylamides; caffeic acid esters, particularly Echinaside, cynarin; polysaccharides; polyacetylenes	Cynarin is characteristic of <i>Echinacea angustifolia</i>
<i>Echinacea purpurea</i>	Aerial parts	Caffeic acid esters mainly chichoric acid, polyacetylenes polysaccharides	Echinaside is not present

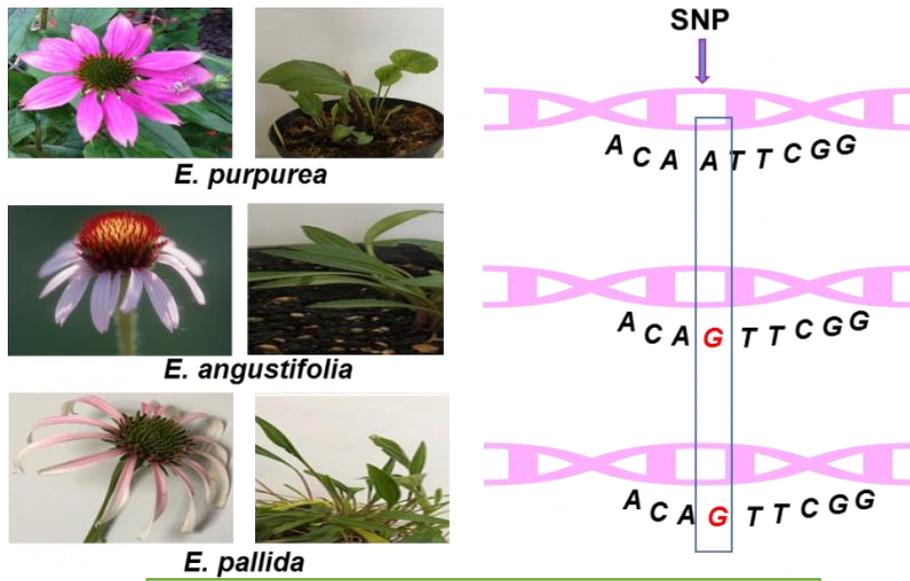


Fig2. Species of Echinacea

II. MEDICINAL APPLICATIONS

This medicinal plant is commonly used for prevention and treatment of common cold, influenza, bowel pain, toothache, snake bite, skin disorders, cancer, seizure, chronic arthritis, and upper respiratory tract infection. Mainly the aerial parts of *Echinacea purpurea* show medicinal properties. The researchers carried out the isolation and the structural elucidation of its phytoconstituents and found out that there were no resulting evidence about its mechanism of action. Alkylamides, Glycoproteins, polysaccharides and caffeic acid derivatives such as cichoric acid are the main constituents which are responsible for activity. The roots of *Echinacea purpurea* are rich in cichoric acid. Among them glycoproteins, polysaccharides and caffeic acid derivatives show immunomodulatory effects. Some species that contain caffeic acid derivatives have an application in the process of quality control and authentication of the plant extracts. Anandamide which is an endogenous ligand of cannabinoid receptors has a structural similarity with alkylamides and also bind to cannabinoid receptors and trigger effects on cytokines. [2 ,8]

History

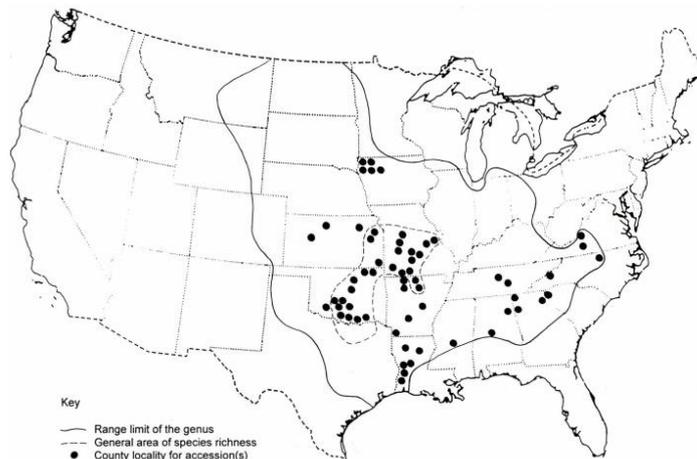


Fig 3. The natural range of the Genus Echinacea in the US.

The plants of Echinacea species have been used since the 16th century by the native Americans for a large variety of medical problems like bowel trouble, sore gums and snake bites. Among the Echinacea species, *Echinacea purpurea* is one of the most popular medicinal plant cultivated in North America. Before colonization of Europe, a number of native American nations, including the Blackfoot, Cheyenne, Choctaw, Dakota, Delaware and Comanche used various preparations of echinacea for a variety of medicinal purposes. In the after days the European settlers learned from their indigenous teachers about these native biological species and thus brought Echinacea into colonial pharmacopoeia. The other name of Echinacea is "echinos" which is a Greek word and also named as comb flower, hedgehog and Indianhead. Echinacea is closely related to Asteraceae family which consist of members like sunflower, ragweed and daisies. The general treatment using echinacea was not practiced until the 18th century. *Echinacea purpurea* was very popular in the early part of the 19th century till the mid 19th century. Primarily the root extract was used as blood purifier and was also marketed as anti-infective agents. Recently studies related to *Echinacea purpurea* have been focused more on treatment of problems like chronic wounds, UTI's, snake and mosquito bites [1]

III. BIOACTIVE CONSTITUENTS

Different species of Echinacea contains several chemical constituents which show pharmacological activities. Mainly the *Echinacea purpurea* contains bioactive constituents such as alkylamides, polysaccharides, glycoproteins, flavonoids and phenolic compounds which include derivatives of caffeic acid like chicoric acid, caftaric acid, caffeic acid, chlorogenic acid and echinocides whose amounts vary on the part of the plant's section. In addition to this, it also contains phylloxanthobilins, acetaldehyde, dimethyl sulphide, hexanal, Limonene, beta-phellandrene, camphene and alpha-pinene are present regardless of the species used. Fatty acids, aldehydes and terpenoids constituents are present in the plants whose presence depends on the section of parts used.[11]

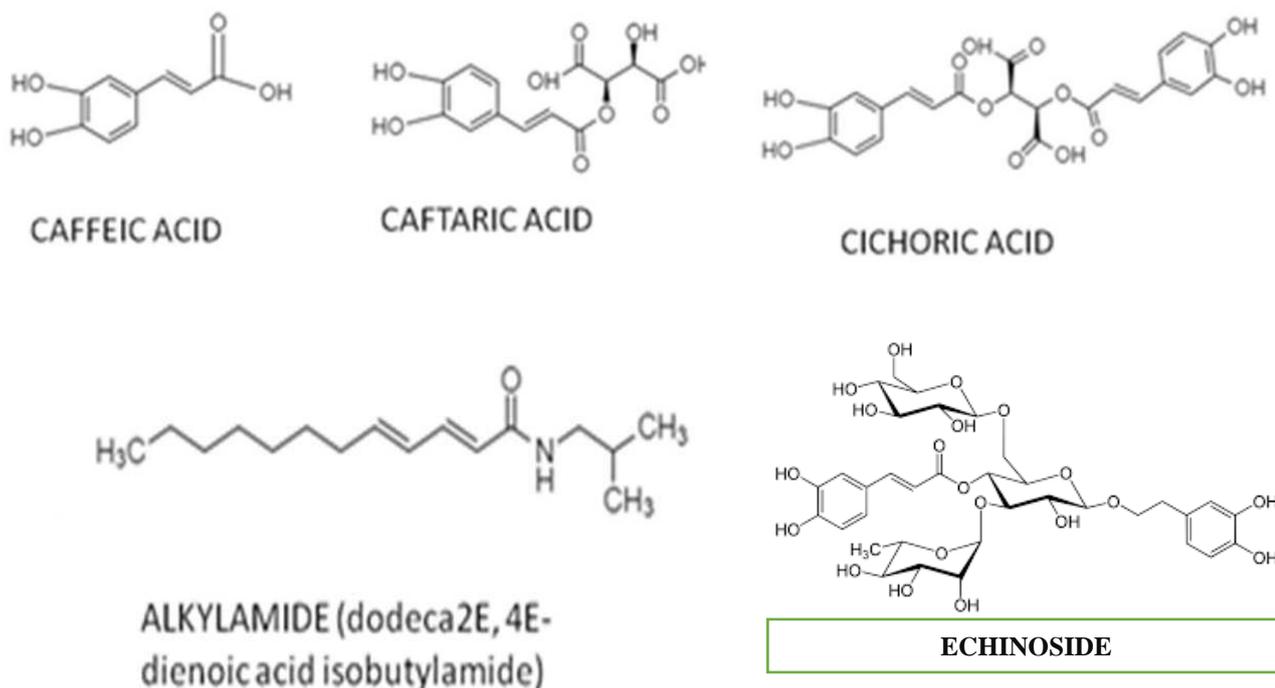


Fig 4. Structures of bioactive constituents

Glycoproteins, alkyl amides and polysaccharides are chemical components responsible for the immunomodulatory activity. The phenolic component chicoric acid is responsible for antioxidant and antibacterial activity which support the immunological system of the body. Polysaccharides are complex carbohydrates made up of more than two monosaccharide units.[11] The *Echinacea purpurea* contains two immunostimulatory polysaccharide mainly the PS I and PS II in the aerial part of the plant that can be isolated. The PS I to be a 4-O-methyl glucurono arabinoxylan that's is mainly composed of glucuronic acid and sugars arabinose and xylose and PS II to be an acidic arabinorhamnagalactan mainly composed of sugars arabinose, rhamnose and galactose. Xyloglucan is also isolated from the leaves and stem which is xylose and glucose polymer.[5]

Alkylamides are aliphatic chain of polyunsaturated fatty acids connected to short chain amine, these are isolated from aerial and root part of the plant. Phenolic compounds the caffeic acid derivative chicoric acid is the most abundant constituent present in the roots and petiole. Echinocides which is also a caffeic derivative is particularly a neuroprotective and cardiovascular effective. Above part of the plant contains small amount of volatile oils and pyrrolizid alkaloids such as tusssilagin and isotusssilagin.[10,11]

IV. METHODS OF EXTRACTION OF PHYTOCONSTITUENTS

Adventitious root samples and extraction solvents:

The natural roots of *Echinacea purpurea* which were used to induce the adventitious roots cultivated in cultures like suspension cultures (5L capacity 5L airlift bioreactors) and the method of Wu et al. (2007a) was followed. The moisture content was reduced to about 10% by subjecting the adventitious roots harvested from the bioreactor cultures by drying at 40°C in hot air oven. The roots were later stored at a temperature of -20°C after the process of drying to protect it from humidity and light until analysis is done. Immediately before the process of extraction the roots were dried and ground in an IKA M20 grinder. HPLC grade ethanol, acetonitrile, and methanol were used. Millipore Q system was used for the purification of water.[15]

Extraction of caffeic acid derivatives:

A cooling condenser was used for the process of extraction which was carried out using a 100ml RBF. 40ml of solvents like distilled water, methanol (20, 40, 60, 80 and 100%) were used for extraction of doses of 2g of powdered roots which were put into RBF carried out at $80 \pm 1^\circ\text{C}$ for 1h and a suitable solvent was selected for extraction of caffeic acid derivatives. To select the suitable temperature the extraction was also carried out at 40,60 and 80°C for 1h for the samples consisting of 2g of dried powdered roots using 40ml of 60% ethanol. Whatman No.1 filter paper was used in both the experiments for filtering of the cooled extract through the double layers of the filter paper. The washing of the condenser was done with 20ml of solvent and later the washings were added to the extract. The phytoconstituents such as caffeic acid derivatives, phenolics, flavonoids, and polysaccharides were quantified using the combined extract (100 ml). [23]

Determination of total phenolic contents:

A modified version of Folin-Ciocalteu colorimetric method was used for the analysis of the content of total phenolic content in the plant methanolic extracts according to the method of Wu et al. (2007b). 2.5 ml deionized water was mixed with 100 μl of methanolic extracts which was followed by the addition of 0.1ml (2N) Folin-Ciocalteu reagent. The mixtures were well stirred and allowed to stand for 6 min before 0.5 ml of a 20% sodium carbonate solution was added. The colour developed after 30 min at room temperature and the absorbance was measured at 760 nm using a UV visible spectrophotometer (UV-1650PC, Shimadzu, Japan). Before the addition of 0.5ml of a 20% sodium carbonate solution, the mixtures were stirred and allowed to stand for 6min. The absorbance was measured at 760 nm by using a UV visible spectrophotometer and the colour developed after 30 min was measured. Comparison of the measurements obtained to the standard curve of gallic acid solution was done and was expressed in terms of mean mg of gallic acid equivalent/g of the plant material dry weight for the extracts obtained in triplicate.[23]

Determination of flavonoid contents:

Colorimetric method was used for the determination of total flavonoid content. 1.25ml of distilled water was mixed with 0.25 ml of methanolic plant extract or (+)-catechin standard solution which was followed by the addition of 5% sodium nitrate solution (0.75 ml). The mixture was made up to 2.5ml with distilled water after the addition of 0.15ml of 10% aluminium chloride after 6min. Spectrophotometer was used for measuring the absorbance at 510nm. Finally the results obtained were expressed in terms of mean mg of (+)-catechin equivalents/g of the dry weight of the plant material for the extracts in triplicate. [17]

Determination of polysaccharide content:

Sediment was collected after the process of extraction, and subjected to desiccation at 60°C . From the sediment, 0.2 g was resuspended in 5 ml of 5% sulphuric acid and kept in boiling water for 2 hours. The liquid-solid mixture was diluted to 50 ml with distilled water after the acidic hydrolysis. Through sedimentation, the supernatant was demarcated and the polysaccharide assay in the supernatant was according to the carbazole reaction method as follows: From the above supernatant, a sample of 0.2 ml was taken and mixed with 6 ml concentrated sulphuric acid, held in a boiling water bath for 20 min, and cooled. To that 0.2 ml carbazole-absolute ethanol (0–15% v/v) was added and the contents were vigorously mixed. After 2h of the reaction time in darkness at room temperature, the purplish red colour developed and the absorbance was measured at 530 nm. β -Galacturonic acid (0, 50, 100, 200, 400, and 600 mg/ml) was used as the standard.[23]

Determination of content of caffeic acid derivatives:

The analysis of the caffeic acid derivatives was done using HPLC. The HPLC shows peaks that were identified by comparing their retention times with those of the standard, under the same chromatographic condition they were determined. The extraction and analysis of caffeic acid derivatives were done by the method of Pellati et al. (2004). The fractions of caffeic acid were analysed using an HPLC system with XTerra® RP 18 column (particle size 3.0 μm , 150 mm \times 3 mm). The mobile phase was (A) water and (B) acetonitrile. The gradient elution was modified as follows: Initial 10% B for 40 min; 25% B for the next 11 min; 50% B for 1 min; recycling to the initial condition for 8 min with a flow rate of 0.3 ml/min. The caffeic acid derivatives were detected at 330 nm. The standards were obtained from Chroma Dex (Laguna Hills, CA, USA). [23]

Statistical analysis:

Statistical analysis systems software was used for the Statistical analysis. ANOVA procedures were used for the analysis of variance. Duncan's multiple-range test was used that indicated notable differences between the means [23]

V. PHARMACOLOGICAL ACTIVITIES OF ECHINACEA PURPUREA**1.ANTI IMMUNOSUPPRESSANT ACTIVITY**

It is the best known immunostimulant. The different parts of several species of this flower have immunomodulatory properties which was known from various studies and reports. The purified polysaccharides act as an active constituent which shows stimulatory effect on mice which were selected for study, this effect was studied through immune cells either applied in culture or through intraperitoneal injection. The mice were treated with cyclosporin or cyclophosphamide to suppress the immunity and due to Echinacea immunity functions actively increased. Due to these studies, it was suggested that this flower can stimulate immune functions healthy as well as immunosuppressed animals. All the immune cells were not affected especially the B cells neither activated nor produced more antibodies to red blood cells of the sheep. The purified polysaccharides act only on the nonspecific branch of the immunity says Luetig et al. according to recent studies, the transcription of various immune response genes were stimulated by the rhinovirus in different types of cells. The preparations of this purple cone flower can reverse the expressions of cytokine genes and few of their secreted products in the bronchial epithelial cells. Purple cone flower stimulates the neutrophil and macrophage phagocytic function according to the animal and human studies done. It also possesses nonspecific, short term immune system stimulant properties.[6]

2.ANTI VIRAL AGENT ACTIVITY

Through in vitro studies of acyclovir resistant and acyclovir susceptible strains of herpes simplex virus 1 and 2 we have found out that preparation of E. purpurea is active against it. The extraction of hexane collected from the root part of this plant and cichoric acid inhibits HSV-1, but cichoric acid inhibits human immunodeficiency virus type 1 (HIV1) integrase. When the alcoholic root

extracts were incubated into the embryonic fibroblasts of the mouse it showed that they were found to be resistant to Vesicular stomatitis, herpes and influenza A2 herpes virus infection for about 24 hours. Strong inhibition effect was seen against the influenza viruses A/Victoria/75 (H3N2) and A/Puerto Rico/8/1934 (H1N1), avian strains A/Thailand/1(KAN1)/2004 (H5N1) and A/FPV/Dutch/1927 (H7N7) when the standard preparation extract was used. The standard preparation can inhibit the hemagglutination (HA) activity and can block the entry of virus into the treated cells, this was studied during the HA assays results. when the mice were chosen as the animal model and the purified polysaccharide was administered to the mice that were infected with influenza A H1N1 (A/WSN/33) they showed symptoms like weight loss but to the untreated mice similar pulmonary viral titers were observed. The mice that were treated for lower systemic, interleukin 10 (IL10) levels, pulmonary keratinocyte chemoattract (KC) and systemic levels of IFN γ were observed which indicates that *E. purpurea* can modulate the clinical symptoms that were observed in influenza by cytokines alteration. On this basis, the latter studies done we can say that the plant has beneficial effect from the different components on the influenza patients through different mechanisms. [8,11]

3.ANTIBACTERIAL ACTIVITY

When there is initially an interaction of the bacteria with the mucosal lining of the lungs and mucosa it causes bacterial infection, as well as various parts of the lungs, several pathogen bacteria can cause respiratory symptoms. *Streptococcus pyogenes* cause pharyngitis, toxic shock syndrome, and necrotizing fasciitis. Furthermore, many factors have been described which include streptococcal genes and virulence factor which causes several infections and here there is the dual action of *Echinacea purpurea* in killing the bacteria by inhibiting their inflammatory activities which could be a significant help in combating such information. **Dosing:** A major limitation reported is the lack of meta-analysis of available trial data and the lack of standardization of *Echinacea*. Use for longer than 10 days in otherwise healthy individuals is not recommended, and parenteral use is not recommended. Rinse the *Echinacea*, roughly chop the entire *Echinacea* plant, combine the chopped leaf with vodka, and store the tincture in a cool, dark place out of reach of children.[13]

4.ANTIOXIDANT PROPERTY

Here mainly the root extract of *Echinacea purpurea* is used, here the main mechanism of action is that it suppresses the oxidation of human low-density lipoprotein, and this can be determined by the process of electrophoresis to check the mobility by using copper ions. The antioxidant activity of *Echinacea* root extracts was mediated by free radical scavenging and transition metal chelating.

Dosage: 300-400 mg of *Echinacea purpurea* dry powder extract three times daily.

LIQUID EXTRACT TINCTURE: 10 ml per day

Formulation: Powder sample preparation: Here, purple coneflower root extracts are taken, which are dried and converted into powder. The powder is then added to teas or other hot beverages and can be sweetened as desired. The powder makes a nutrition supplement when added to smoothies, juices, or cereals.

Tincture:

1. Rinse the purple coneflower plant.
2. Roughly chop the entire echinacea plant.
3. Place the chopped leaf into the vodka.
4. Let the tincture sit in a cold, dark place out of the reach of kids.[13]

5.ANTI INFLAMMATORY ACTION

Flower root extract

The preparation of purple cone flower is used because it has reversed the inflammation caused by several bacteria. The determination of the anti-inflammatory action of purple cone flower is mainly done by using several experiments on animals. Here dried roots are used to reverse the inflammation and the evaluation of the drug is mainly done on mice which inhibited Carrageen induced paw edema in the same way as that of Indomethacin. The mechanism of action is the inhibition of COX 1 and COX 2 by the alkylamide. Also, it was found that the alcoholic extract of the root and aerial parts of the plant can inhibit the fibroblast induced collagen concentration. The presence or absence of stimulation by Lipopolysaccharide and phorbol 12-myristate can be assessed by the effect of *Echinacea* and its compounds on NF-Kb expression by jurkat cells. The expression of some genes, such as the key factor for inflammation depends on NF-Kb which is a nuclear transcription factor. When there are no stimulants, the root extract will not show much action on inflammation. To increase NF-Kb levels the 2,4diene is used but 2ene alkylamide decrease the NF-Kb levels, thereby causes inhibition which shows the considerable diversity in the bioactivity of this plant.

Dosing: 3 times daily, 300-500 mg *Echinacea purpurea* dry powder

LIQUID EXTRACT TINCTURE: Upto 10 ml daily [2.5ml for three times]

Formulation: DRY POWDER: Here, the purple coneflower root extracts are taken, which are dried and converted into powder. The powder makes the nutrition supplement when added to smoothies, juices, or cereals.[14]

6. ANTIOSTEOPOROTIC ACTIVITY:

The studies show the presence of active constituent in purple cone flower which is used to treat osteoporosis. *Echinacea* species contain echinoside, which is a phenylpropanoid glycoside that was isolated from *Cistanche tubulosa*. The scientist found that echinoside obtained from the purple coneflower leads to improved bone mineral density and biomedical properties. Purple coneflower's main antiosteoporotic mechanism is echinoside, which increase the bone density and promote cell signaling pathways. The main way through which the drug acts is by mineralization by modulating the stimulus of osteoprotegerin and the cell differentiation and cell signaling. Thus, echinacea is an herbal medicine for osteoporosis treatment and prevention. However, more research is needed to determine the clinical trials for the same. **Dosing:** Mainly prepared in the form of capsules that contain *Echinacea* spp. Along with *Gentiana* sp., which is available in the market and can be prescribed to treat osteoporosis.[12]

7.ANTIPSYCHOTIC ACTIVITY

The anxiolytic activity of Echinacea drugs was determined in an experimental animal at a lower dose than those used in traditional indications. Mainly, the purple coneflower contains alkyl amides, which have been reported to have cannabimimetic activity on both receptors, which depends on the structural similarity with the receptor. The activation of these cannabimimetic receptors leads to a considerable decrease in anxiety and has antidepressant properties.[14]

8. ANTIFUNGAL ACTIVITY

Through in vitro testing activity experiments the *Echinacea purpurea* extraction has shown antifungal effect on various fungal species like *Saccharomyces cerevisiae* and *Candida albicans* (the most common fungal cause of human skin disease). The extraction of herb and roots part of this plant have been observed with antimicrobial action. Due to the *E. purpurea* extraction the human macrophages and natural killer cells undergo phagocytosis of candida in vivo. The activity of macrophages in mouse against *Candida* has also been observed that there is stimulation due to *E. purpurea* polysaccharide exposure. So basically the *E. purpurea* extract rich in polysaccharide decreases the infection and death rates of immunosuppressed mice with candida infection. Human clinical trial testing was conducted by Coeugnet and Kuhnast which shows that the extracted juice of *E. purpurea* has an ability to effect recurrent vaginal yeast infections. The group with Echinacea treated mice showed that increased reactivity of the skin and decreased recurrence of vaginal candidiasis over monitoring period of about 6 months while 60% of control group got new infections and 5-17% of the women were diagnosed with recurrent vaginal infections in the treatment groups.[6]

9. MOSQUITOCIDAL ACTIVITY

Aedes aegypti larvae was affected by mosquitocidal activity of the purified alkamide present as one of the bioactive component in *Echinacea purpurea*. In general isobutyl group has a significant role in the mosquitocidal property of alkamides. The alkamides having isobutyl amide moiety in the structure have a stronger effect when compared to those alkamides having 2-methylbutyl amide moiety in their structure.[8]

VI. VETERINARY APPLICATIONS

There is a need for treatment of most of the domestic animals including pets, livestock, Pisces etc. as they might have viral or microbial infections at any point in their lives and these causative organisms are analogous to corresponding human counterparts' example, animal herpes viruses, avian influenza viruses, various respiratory viruses and bacteria, and many fungal and parasitic infections. Hence some of them should be responsive to the Echinacea purpurea treatment which may act as anti-inflammatory, antiviral or as an antifungal substance. It can also act as antibacterial and fight against bacteria like *Salmonella* which are sources of contamination of food. In regions like North America and Europe Echinacea has a modern tradition of veterinary application. Certain herbs, including *E. purpurea*, have modern tradition in the application of veterinary domain. Few reports have stated that the basic studies that is analogous to the ones described for diseases in humans and animal-controlled trials. The treatment was concluded to be safe and free of significant side effect. The *E. purpurea* root extract was able to treat the protozoan parasite *Coccidia* infected chicks, the lesion scores decreased and also improved the health of the animals but it was not shown whether the effect of the root extract was directed towards the parasite itself or immune system as the immune parameters was not measured. The herbal preparation of Echinacea has variable functions like controlling infections, stimulating the immune system, promoting the growth and enhancing the performance in animals. Fishes are more prone to viral and microbial infections unlike other farm animals hence instead of synthetic antimicrobials usage Echinacea preparations could be useful. [25]

VII. TOXICOLOGICAL STUDIES

Preclinical data obtained from the analysis of laboratory animals with isolated aerial or root parts of *Echinacea purpurea* administered orally shows very low reproductive or developmental toxicology. A lethal dose for unadulterated *E. purpurea* is not found in in vivo studies, making it safe (23). But plant juice administered through the oral and intravenous routes indicates LD50 to be over 30 g/kg and 10 g/kg in mice.[9]

VIII. MUTAGENICITY

Diminishment of sperm was seen when *Echinacea purpurea* was introduced into the sperm with a dose of 0.6 mg/mL (24). At a higher concentration of 8 mg/mL, decreased sperm mobility and penetration in hamster oocytes caused sperm denaturation. There is no sign of tumour growth due to the exposure of *Echinacea purpurea* to the body (20). Some of the phytochemicals in *E. purpurea* indicate a potential reduction in tumours and even viral infections.[23]

IX. ADVERSE EFFECTS/ SIDE EFFECTS

Echinacea purpurea shows adverse effects in the intensity range of mild to moderate. Headache is a prevalent and undesirable effect, but it cannot be used as a diagnosis concluding the causative agent to be *E. purpurea* since the common cold can also be diagnosed under this.[13]

X. ALLERGIC REACTIONS

There are a handful of these kinds of reactions, which include rare cases of anaphylaxis and effects such as asthma, urticaria, angioedema, itchy and watery eyes, gastrointestinal upset, and respiratory obstructions that may reach severe levels. Other less prominently known effects include thrombocytopenia, erythema nodosum, exanthema, acute cholestatic disease, and, with long-term use, leucopenia and eosinophilia. [13,9]

XI. CONTRAINDICATIONS

Echinacea purpurea is contraindicated in patients having autoimmune conditions or Human Immunodeficiency Virus (HIV) infection. The German Commission E monograph with the consensus of experts. There is an indication that since there is a prevalent risk that the immune-stimulating effect could lead to the worsening of these autoimmune illnesses or intensification of HIV. [13]

XII. CONCLUSION

Different article survey is done and is found that *Echinacea purpurea* has a long history of traditional medicinal use for wide variety of diseases. It is the most important species of Echinacea that has much medicinal value. The studies suggest that the whole plant parts have different pharmacological activities which contains various chemical constituents like polysaccharides, alkylamides, phenolic compounds. This review study possessed that *Echinacea purpurea* has anti-oxidant, anti-bacterial, anti-

immunosuppressant, anti-viral and anti-inflammatory activities. The mechanism of action of most of the chemical constituents is not known. The safety testing of Echinacea is done and is found out it does not cause much of toxicity and the dose is well tolerated. Existing articles suggest that Echinacea should be used for treatment of diseases and not as the prevention of disease. The further studies related to efficacy of Echinacea is still going on, however the present review article confirms the pharmacological activities and medicinal use of *Echinacea purpurea*.

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