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RESEARCH ARTICLE
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"A COMPREHENSIVE REVIEW: ON ROLE OF AROMATIC PHYTOCHEMICALS FROM HERBS LIKE *JASMIN GRANDIFLORA*, *AZADIRACHTA INDICA* AND *EUCALYPTUS* LEAVE IN THE TREATMENT OF COMMON COLD"

Mo. Faisal H. Gotajiwala[1*], Kuntupalli Sandhya Rani[2], Dr. Pragnesh Patani[3]

[1*]Student, Khyati College of Pharmacy, Palodia, Ahmedabad.
[2]Assistant Professor, Khyati College of Pharmacy, Palodia, Ahmedabad
[3] Principal and Professor, Khyati College of Pharmacy, Palodia, Ahmedabad

[*]**Corresponding Author:** Mo. Faisal H. Gotajiwala
[*]Student, Khyati College of Pharmacy, Palodia, Ahmedabad. Email: faisalchhipa03@gmail.com

Abstract:
Phytochemicals are natural compounds found in plants that hold immense significance for human health. These bioactive substances encompass a diverse array of compounds, such as flavonoids, polyphenols, and alkaloids, which contribute to the vibrant colors, flavors, and protective mechanisms of various plant species. Beyond their potential in managing common cold symptoms. These compounds include flavonoids, polyphenols, and alkaloids, among others. Research suggests that phytochemical-rich foods like garlic, ginger, and echinacea may possess antiviral and immune-boosting properties, which could help alleviate common cold symptoms.

Keywords: Jasmine, Neem Leaves and Harit Pan

INTRODUCTION:

Common colds can be defined as upper respiratory tract infections that affect the predominantly nasal part of the respiratory mucosa. Because upper respiratory tract infections can affect any part of the mucosa, it is often arbitrary whereas an upper respiratory tract infection is called a "cold" or "sore throat".[1]

The common cold is the most frequent acute illness in the United States and throughout the industrialized world. About half the population gets at least one cold every year.[2] Colds account for 40% of all time lost from jobs among employed people (23 million days of work per year) and about 30% of absenteeism from schools (26 million school days per year).[3]

Seasonal patterns of infection can be identified for some of the various types of viruses that are responsible for the common cold such as parainfluenza viruses, rhinoviruses is one of the most virus affected on human health, and Adenoviruses and coronaviruses tend to produce epidemics during the winter and spring.

The pathophysiology of common cold, especially on the aspect of cellular migration and defense. Most upper respiratory tract infections are caused by rhinoviruses. The rhinovirus is a non-enveloped 30nm RNA-virus with over 100 serotypes and only replicates in primates.[4] It belongs to the

Picornaviridae family, consisting of small RNA-viruses ('PicoRNA Viruses') also including enteroviruses, aphto- and cardioviruses and hepatitis A virus.[5]

Rhinoviruses are transmitted mainly via direct- or indirect contact with infected secretions and invade their host by binding to the ICAM-1 receptor on the nasal epithelium[6,7]. Typical for rhinovirus upper respiratory tract infections are isolated scattered foci of infected epithelium, not showing any striking damage or cytopathic alterations, between large areas of normal epithelium.[8,9]

A rhinovirus is spread from person to person by virus contaminated respiratory secretions, partially through inhalation of small-, or large-particle aerosols, but mainly via direct-or indirect contact with infected secretions.[10] In 40% up to 90% of common cold patients, a rhinovirus could be detected on the hands presumably due to frequent contact with the virus-shedding nose.[11] Hendley and Gwaltney supported the importance of hand-to-hand transmission by demonstrating that treatment of the hands with a virucidal compound significantly reduced transmission of rhinovirus inf ection.[12] Since rhinoviruses retain their virulence up to 3 days on plastic surfaces, transmission is very easy.[12]

SYMPTOMS:

When a person has a cold virus, their immune system tries to fight it off. This causes the symptoms that we recognize as a cold.[13]

- a sore throat
- a cough
- sneezing
- a blocked or runny nose
- a headache

Rarer symptoms include:

- muscle aches
- shivering
- pinkeye
- weakness
- low appetite
- fatigue

CAUSES:

The majority of the over 200 Trusted Source viruses that can induce cold symptoms are rhinoviruses. The immune system strives to combat viruses when they enter the body. In someone with a robust immune system, symptoms might not materialize However, signs of infection will show up if the immune system is unable to combat the virus.[13]

INTRODUCTION OF PHYTOCHEMICALS:

Phytochemicals are non-nutrient plant compounds that are biologically active and produced by the primary and secondary metabolism of plants.[14] Phytochemicals are natural functional ingredients widely present in fruits, vegetables, seeds and nuts, whole grain products, legumes, dark chocolate, and tea, whose regular dietary intake was suggested to reduce the occurrence of many chronic illnesses.[15]

Phytochemicals are protective for plants against ultraviolet light, predators, insects, and disease.[16 - 18]

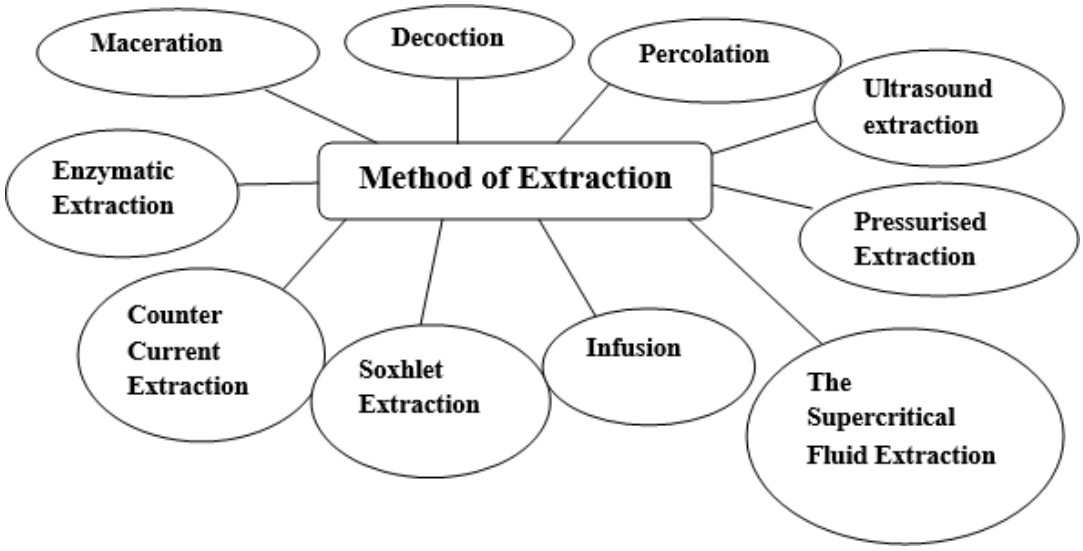
ROLE OF PHYTOCHEMICALS IN HEALTH AND DISEASES :

Phytochemicals play an important role in human health as antioxidants, antibacterial, antifungal, antiinflammatory, anti-allergic, antispasmodic, chemopreventive, hepatoprotective, hypolipidemic, neuroprotective, hypotensive, prevent aging, diabetes, osteoporosis, cancer and heart diseases, induce apoptosis, diuretic, CNS stimulant, analgesic, protects from UVB-induced carcinogenesis, immuno-

modulator and carminative.[19] In humans, curcuminoids, the polyphenolic phytochemicals, acts as an anti-inflammatory and cancer preventive drug.
Genistein (5,7,4'-trihydroxyisoflavone) is one of two major isoflavonoids in soy. Soy isoflavonoid conjugates have chemopreventive activity in carcinogen induced rat models of breast cancer.[20]

EXTRACTION METHOD FOR STUDYING PHYTOCHEMICALS :

Extraction method is the crucial in the first step of isolation of phytochemicals. Because it's necessary for the desired chemical constituent of phytochemicals for further separation and characterized of phytochemicals. It has been reported that the size of the plant material, properties of the solvent solid to solvent ratio extraction temperature, and extraction time will affect the extraction efficiency.[21,22] High temperature affects dispersion and solubility. High temperatures may result in solvents being lost and extracts with impurities and the degradation of thermolabile compounds. The extraction efficiency increases with extraction time will not affect the extraction.[23]



1. **Maceration**: In the process of maceration (for fluid extract), whole or coarsely powdered plant-drugs are kept in contact with the solvent in a sealed container for a predetermined amount of time with frequent stirring until soluble materials is dissolved. For use with medicines that are thermolabile, this approach is the most appropriate.[2,25,26,27]
2. **Infusion**: This is a diluted solution of the parts of the crude medicines that are easily soluble. Making fresh infusions involves briefly macerating the contents in either cold or boiling water. [25,26,27,28]
3. **Digestion**: This is a type of maceration where the maceration extraction process is heated gently. When a somewhat high temperature is acceptable, it is employed because it increases the menstrual fluid's ability to dissolve solvents.[25,27,28]
4. **Percolation**: Percolation is a continuous process of extraction which depends on the diffusion that's already a another method of extraction. In diffusion, liquid moves from higher concentration to lower concentration (Zhang et al.,2018). In percolation, the solvent also moves or flow from higher concentration to lower concentration until it absorbs constituents from the container through bottom filtered. It has an advantage that it shows continuous gravity for flow of solvent that is fresh or unsaturated and the soluble constituents are removed by the solvent. Percolation process is continued at room temperature without agitation, until its all the constituents are extracted.[26,27,28]
5. **Soxhlet extraction**: This method is only necessary when the impurity is insoluble in the solvent in which the target chemical has a limited solubility. If the target component is highly soluble in a

solvent, it can be easily separated from the insoluble material via filtration. The benefit of this method is that only one batch of warm solvent is recycled, as opposed to numerous portions being passed through the sample. Because prolonged heating could cause the compounds to degrade, this approach cannot be employed with thermolabile chemicals.[25,26,27,28,29,30]

6. **Ultrasound extraction:** is also known as the sono extraction method. This method involves the use of ultrasound with the different frequencies ranging from the 20mhz because they increase the permeability of the cell walls. This process is used in many cases such as the extraction of the natural roots of the plants. It is used for large scale production due to their high costs. It is most simple method for the disruption of the cell walls.[26,27,31]
7. **Counter current extraction:** In this method, the solvent is present in a large amount and the other one i.e. solute is present in a small amount as compared to the solvents. The liquid-liquid extraction basically takes place at the same time in all tubes of the apparatus which are used for the extraction as electromechanically. The separation of the active components between thewater and organic solvents basically depends upon the hydrophillic groups which are present in the basic molecule.[25,26,27]
8. **Decoction** : In this extraction method, the plant parts are brought to a boil in water followed by cooling, straining, and passing sufficient cold water through the drug to produce the required volume.[32]
9. **Enzymatic Extraction** : In this extraction method, enzymes are used to increase the yields during the extraction. Enzymes are used to soften the tissues of biomass and facilitate the degradation of the cells.[26,27,,33]
10. **The Supercritical Fluid Extraction :** In this extraction method, supercritical fluids at high temperatures and pressures above the critical values are applied to the extraction material. The pressure is adjusted, and the supercritical fluids return to their gas phase and evaporate without leaving solvent residues.[26,27,33]
11. **Pressurised Liquid Extraction :** This extraction method is conducted under high pressures and temperatures that aid in the high solubility of the compounds in the solvent and result in high diffusion of the solvent into the sample array.[33]

JASMINE GRANDIFLORA:[34],[35],[36]

Taxonomical position of *Jasmine grangiflora* :

Kingdom	Plantae – Plants
Subkingdom	Tracheobionts - Vascular Plant
Division	Mangoliophyte - Flowering Plants
Class	Magnoliopsida- Dicotyledons
Order	Scrophulariales
Family	*Oleaceae*- Olive family
Genus	*Jasminum*
Species	*Grandiflorum*

VERNACULAR NAME OF *JASMINE GRANDIFLORA* :[37]

Hindi	Chameli, Jati
Sanskrit	Balihrasa, Chambeli, Chetaki
Gujarati	Chameli
Telugu	Jai puvvu
Urdu	Yasmeen
English	Jasmin
Tamil	Anankam, Jatimalli, Jatimullai
Manipuri	Jati kuppi. [

Flower

Leaves

CHEMICAL COMPOSITION OF *JASMINUM GRANDIFLORUM* [38] :

Anac Olcay, 1986[28]	Feng Huan Wei *et al.*, 2015[29]
1. Linalool	1. Benzyl acetate
2. Benzyl acetate	2. Nerolidol
3. Benzylalcohol	3. Cedrol
4. Nerolidol	4. Methyl myristate
5. p-cresol	5. 7-Tetradecene
6. Lactones	6. Benzyl benzoate
7. Indole	7. Neophytadiene
8. Benzoic acid	8. Perhydrofarnesyl Acetone
9. Methyl linoleate + vanilin	9. Phytol acetate
10. Benzyl benzoate	10. Nonadecane
11. Phytol (isomers)	11. Geranyl linalool
12. High paraffins	12. Methyl palmitate
	13. 3,7,11,15- tetramethyl -1-Hexadecen-3-ol
	14. Hexadecanoic acid
	15. 3,7,11-trimethyl-1,6,10-dodecatrien-3-ol
	16. 3,7,11,15-tetramethylhexadecanoic acid methyl ester
	17. 9,12,15-octadecatrienoic acid methyl ester
	18. Heneicosane
	19. Phytol
	20. Octadecanoic acid methyl ester
	21. 9,12,15-Octadecatrienoic acid
	22. Docosane
	23. Tricosane
	24. Tetracosane
	25. Pentacosane
	26. Hexacosane
	27. Heptacosane
	28. Octacosane
	29. Squalene
	30. Nonacosane

PHARMACOLOGICAL ACTIVITY :

a) Spasmolytic activity: In vitro, jasmine has spasmolytic activity on the uterus of rats and the post synaptic ileum of guinea pigs, which is not atropine-like. It was most likely cAMP, not cGMP, that caused the spasmolytic action of jasmine absolute. It has been suggested that the contradictory effects observed in vitro and in vivo are likely caused by the fact that jasmine absolute solely has physiological effects in vitro (producing a relaxation) as opposed to psychological effects in vivo (producing a stimulant effect in humans and enhanced movement in animals)[39].

b) Anti-inflammatory activity: Jasminum officinale, Azadirachta indica, Berberis aristata, Curcuma longa, Picrorrhiza kurroa, Rubia cordifolia, Trichosanthues dioica, Aristolochia indica, Hemidesmus indicus, Randiaspinosa, and Glycyrrhiza glabra have all been included in the polyherbal formulation Jatyadi ghrita. When compared to Diclofenac sodium, which demonstrated 33 percent inhibition, the preparation demonstrated nearly 50 percent inhibition of croton oil-induced ear edema[40].

c) Anti-acne activity: Using the broth dilution method, researchers have investigated the anti-acne activity of 10 natural medicines that are utilized as traditional medicine in diverse skin problems. These products target Propionibacterium acnes. It was discovered that the J. grandiflorum extract's minimal inhibitory concentrations (MIC) were less than 800 µg/ml41.[41]

d) Breast cancer activity: Flowers of J. grandiflorum are useful to women when brewed as a tonic as it aids in preventing breast cancer and stopping uterine bleeding.[42]

e) Anticholinesterase Activity: The aqueous and hydroethanolic extracts of the flower buds have the potential to inhibit CNS enzymes.[43]

f) Anthelmintic activity: Anthelmintic activity of the various extracts of flowers of Jasminum grandiflorum was investigated with Indian adult earthworms. The ethanolic extract showed significant anthelmintic activity.[44]

g) Analgesic Activity: The various solvent extracts of leaves of Jasminum grandiflorum were investigated for analgesic activity in albino rats and mice by formalin test and hot plate method. The aqueous extract of leaves expressed high analgesic activity at a dose of 200 mg/kg.[45]

Traditional Uses [46] :

They are useful in stomatopathy, cephalopathy, odontopathy, ophthalmopathy, leprosy, skin diseases, pruritis, strangury, dysmenorrhoea, ulcers, as refrigerant, ophthalmic and vitiated conditions of pitta.

AZADIRACHTA INDICA [NEEM LEAVES] [47,48] :

Taxonomical position of *Azadirachta indica* (neem):

Family	*Meliaceae*
Subfamily	Melioideae
Order	Rutales
Suborder	Rutinae
Genus	*Azadirachta*
Species	*Indica*

VERNACULAR NAME OF *AZADIRACHTA INDICA* [49] :

Hindi	Neem

Gujarati	Dhanujhada
Tamil	Veppai, Sengumaru
Sansakrit	Pakvakrita, Nimbaka
Marathi	Nimbay
Telugu	Vepa

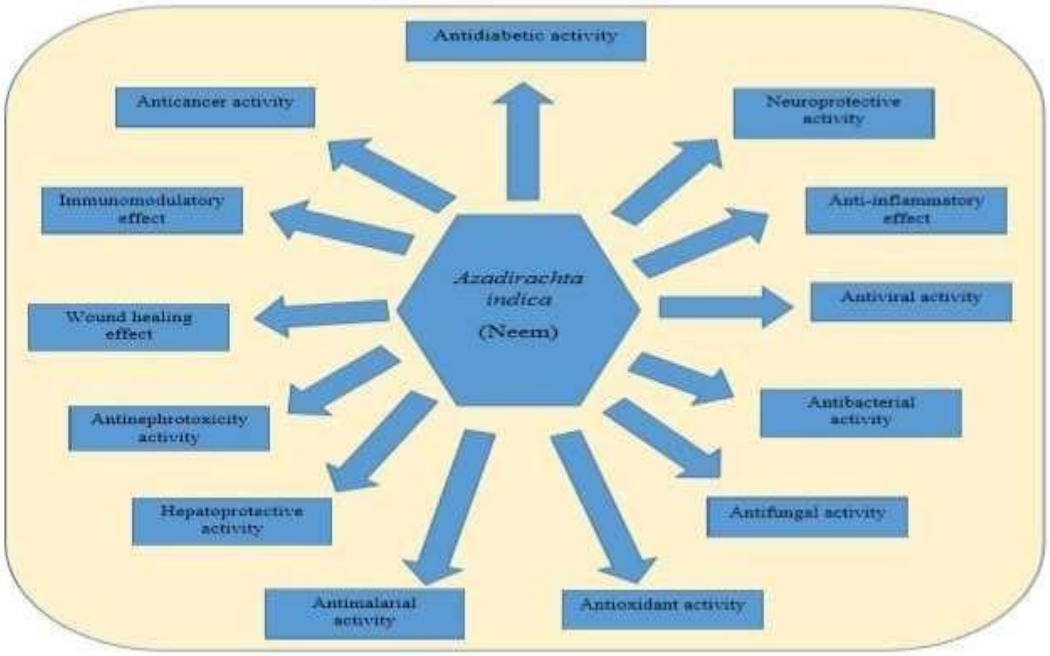
Neem Leaves

Neem Fruits

CHEMICAL COMPOSITION OF *AZADIRACHTA INDIC* [50]:

Sr. No	Source	Chemical Constituents	Uses
1	Seed Oil	Nimbidin	Anti-inflammatory, Anti-arthritics, Hypoglycemic, Antipyretic, Spermicidal, Antifungal, Antibacterial, Diuretic.
2	Seed Oil	Azadirachtin	Antimalarial
3	Seed Oil	Nimbin	Spermicidal
4	Seed Oil	Nimbolide	Antimalarial, Antibacterial
5	Seed Oil	Gedunin	Antimalarial, Antifungal
6	Seed Oil	Mahmoodin	Antibacterial
7	Bark	Gallic Acid and Catechin	Antibacterial
	Bark	Margolone, Margolonone and isomargolonone	Antibacterial
9	Leaf	Cyclic Trisulphide and Cyclic tetrasulphide	Antifungal
10	Leaf	Polysaccharides	Anti-inflammatory
11	Bark	Polysaccharides G1A, G1B	Antitumour
12	Bark	Polysaccharides G2A	Anti- inflammatory
13	Bark	NB-2 Peptidoglucon	Immunomodulatory

PHARMACOLOGICAL ACTIVITY:



a) Anti-inflammatory effect : Anti-inflammatory effect of neem plants has been reported by various studies. In an experimental study based on rat models, nimbidin from neem trees was used orally to

evaluate its anti-inflammatory response. It was confirmed that the phagocytosis was inhibited, and further, the migration of macrophages to their peritoneal cavities was significantly inhibited in response to inflammatory stimuli.[51]

b) Wound-healing effect : As a folk medicine, wound-healing properties of the neem leaves are known since ancient times. In one study, the effects of neem oil in the treatment of chronic, nonhealing wounds were performed, and the results showed that after 8 weeks of treatment, 50% wound healing was observed in almost 44% patients. In another study, the aqueous extract of neem leaves was used to check the wound-healing activities, and a significant reduction in the longest diameter wounds has been observed.[52]

c) Immunomodulatory effect : Neem oil is also used as a nonspecific immunostimulant as it plays a role in the activation of cell-mediated immune mechanisms to elicit an enhanced response to subsequent mitogens. Besides this, neem infusion has been found to successfully improve the antibody titer growth performance when used at the level of 50 ml/l of fresh drinking water.[53]

d) Cardioprotective effect : As a folk medicine, the neem tree extract is well known for its cardioprotective properties as well. In this regard, A. indica extract at a dose of 250–1000 mg/kg significantly restores most of the hemodynamic, biochemical, and histopathological parameters. The study further concluded that neem extract shows equipotent cardioprotective activities as compared to Vitamin E.[54]

e) Antimicrobial activity : Neem extracts are rich in antimicrobial compounds as some studies have clearly shown that neem extracts can be potentially useful to control some foodborne pathogens and other spoilage organisms. Antiviral activity of neem bark extract confirmed that bark extract extensively blocked HSV-1 entry into cells at 50–100 µg/ml concentration. Antifungal activity of extracts of seed on Candida spp. has also been evaluated, and the finding of the study has concluded that neem seed extract appears to be hopeful anticandidal agents.[55]

f) Antidiabetic effect : The neem tree extract has also been evaluated for its antidiabetic activities. Earlier finding confirmed that diabetic rats treated with neem extract (250 mg/kg b. w.) exhibited glucose levels significantly less as compared to the control group. Neem root bark extract showed reduction in blood sugar level at dose of 200 and 400 mg/kg b. w. Higher dose of this extract (800 mg/kg b. w.) showed significant reduction in blood sugar level and it reduced blood sugar level by 54% as comparison to control.[56]

TRADITIONAL USES [57]:

Traditionally, neem leaves, blossoms, seeds, fruits, roots, and bark have all been used to cure fever, infections, inflammation, skin conditions, and dental issues. The therapeutic benefits of neem leaf in particular have been documented. Immunomodulatory, anti-inflammatory, antihyperglycemic, antiulcer, antimalarial, antifungal, antibacterial, antiviral, antioxidant, antimutagenic, and anticarcinogenic qualities have all been shown for neem leaf and its compounds. The extensive variety of pharmacological actions of neem leaf is summarized in this paper.

***EUCALYPTUS* LEAVE [58] :**

Taxonomical Classification of *Eucalyptus* Leave :

Kingdom	Plantae
Phylum	Spermatophyta
Class	Dicotyledonae
Order	Myrtales
Family	Myrtaceae

Genus	Eucalytu

VERNACULAR NAME OF EUCALYPTUS [59] :

Hindi	Neelgir
English	Gum Eucalyptus
Sanskrit	Tail Pan
Gujarati	Harit Pan

Eucalyptus Leave

Eucalyptus Flower

CHEMICAL COMPOSITION OF EUCALYPTUS [60]:

RI	Compound	Percent Composition
931	α-Pinene	28.74
1033	1,8-Cineole	27.18
1078	Linalool oxide	0.40
1094	Linalool	1.17
1109	β-Fenchol	1.10
1138	*trans*-Pinocarveol	3.27
1167	Borneol	3.00
1179	Terpinen-4-ol	1.18
1196	Myrtenol	0.19
1208	ρ-Menth-1-en-8-ol	5.24
1226	*cis*-Carveol	0.23
1432	β-Gurjunene	0.95
1426	β-Caryophyllene	2.99
1437	Aromadendrene	1.58
1454	α-Humulene	0.56
1458	*allo*-Aromadendrene	1.12
1489	Eremophilene	0.59
1575	Spathulenol	6.63
1581	Globulol	6.53
1585	*epi*-Globulol	0.77
1592	Viridiflorol	3.00
1640	α-Cadinol	0.70
	Total identified	97.61
	Monoterpenoids	71.70
	Sesquiterpenoids	25.91

PHARMACOLOGICAL ACTIVITY:

a) Antibacterial and Antiseptic Activity : Traditional uses of eucalyptus plants included antiseptic properties and the management of respiratory tract diseases.[61] The herb is also effective against

colds, the flu, sore throats, and chest infections, such as pneumonia and bronchitis.[62] EO from E. globulus has been shown in several studies to exhibit moderate antimicrobial activity against both Gram-positive and Gram-negative bacteria, including Staphylococcus aureus, Enterococcus faecium, Listeria monocytogenes 4b, and Listeria monocytogenes EGD-e, as well as bacteriostatic activity against all strains tested, with the exception of Pseudomonas aeruginosa.[63]

b) Anti-inflammatory Activity: Analgesic, anti-inflammatory, and antipyretic medications are made from the aromatic components of EO. The effects of eucalyptol on the synthesis and production of leukotriene B4, thromboxane B2, interleukin-1β (IL-1β), and tumor necrosis factor-α (TNF-α) in human blood monocytes were studied by Juergens et al. Their findings suggest that eucalyptol is a potent cytokine inhibitor that may be used to treat bronchial asthma and other steroid-sensitive conditions over the long term.[64]

c) Antioxidants Activity: The process of infection often results in inflammation, which controls the phagocytes' production of free radicals. Reactive oxygen species, often known as free radicals, can be scavenged by antioxidant molecules, shielding cells from harm and eventual death. These free radicals are physiologically significant for the synthesis of certain biomolecules, the production of energy, phagocytosis, and cell development in living systems.[65]

d) Cytotoxic and Toxic Effects: Aspects Certain Eucalyptus species' extracted extracts and constituents exhibited cytotoxic properties. The cytotoxicity of the eucalyptus-derived chemicals was assessed in the two experiments included in this section by calculating the sample concentration that inhibited 50% of cell growth (IC50). Using a myeloid leukemia cell line as a model, the first study was done on the formylated triterpene called "Cladocalol," which was extracted from the leaves of E. cladocalyx. HL-60.[66]

TRADIIONAL USES [67,68]:

In Zimbabwe, eucalyptus species have been utilized to clean up mine tailings dams. However, eucalyptus leaves are used as a traditional medical remedy (TMR) for the treatment of minor acute respiratory illnesses, such as the flu and the common cold.

Approximately 900 species make up the genus Eucalyptus L'Heritier, and more than 300 of those species have volatile essential oil in their leaves. Among them, about 20 species have a significant percentage of 1,8-cineole (more than 70%), which is commercially exploited to produce essential oils for the cosmetic and medicinal industries, including antimicrobial, antiseptic, antioxidant, and gastrointestinal disorder treatment, wound healing, and insecticidal/insect repellent, herbicidal, acaricidal, nematicidal, and perfumes, soap making and grease remover

CONCLUSION:

phytochemicals found in various plants have shown promise in the management of common cold symptoms. Compounds such as flavonoids, polyphenols, and alkaloids found in herbs like echinacea, ginger, garlic, and others may possess antiviral and immune-boosting properties. While there is some evidence to support their effectiveness in reducing the duration and severity of cold symptoms, more rigorous clinical studies are needed to establish their efficacy and determine optimal dosages. Additionally, it's essential to use herbal remedies under the guidance of a healthcare professional, especially if you have underlying health conditions or are taking medications, to ensure safety and effectiveness. Overall, phytochemicals offer a natural and complementary approach to managing the common cold, but further research is required for a comprehensive understanding of their role in cold prevention and treatment.

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