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Herbal Treatment of Pneumonia (Treatment of Pneumonia from Medicinal Plants): A Review

Sanjana Mishra[1*], Navneet Kumar Verma[2], Tarun Kumar[1]

[1]Students of B. Pharmacy, Buddha Institute of Pharmacy, GIDA, Gorakhpur (U.P.), India-273209
[2]Associate Professor, Buddha Institute of Pharmacy, GIDA, Gorakhpur (U.P.), India-273209

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***Corresponding author:** Sanjana Mishra
Students of B. Pharmacy, Buddha Institute of Pharmacy, GIDA, Gorakhpur (U.P.), India-273209

Abstract **Review Article**

Infectious diseases are caused by pathogenic microorganisms such as bacteria; fungus, influenza, and parasites. Illnesses have the ability to transmit between people through direct or indirect means. The world's second most common cause of death is infectious diseases. Roughly 25% of the medications humans require come from plants found in rainforests. Only a little amount of scientific research has been done on therapeutic plants. Due of bacteria's resistance to the antibiotics that are now in use, new antibacterial medicines have to be developed. In rural and underdeveloped parts of India, a variety of plants are commonly utilized as herbal medicines to cure infectious ailments. This chapter reviews the literature on the use of medicinal plants to treat illnesses like pneumonia and malaria. Traditional medicine is preferred primary health care system in many rural areas for variety of reasons, including its affordability and efficacy. The current study focused on existing medicinal plant literature, with ethnobotany, phytochemistry and pharmacology details being highlighted. All of examined plants showed potent action, supporting their conventional uses as well as their ability to cure common diseases. Curcuma longa L., Punica granatum L. and Justicia adhatoda L. were most widely used plant families for pneumonia therapy in research area (each with seven plants); of these, Curcumalonga L., Punica granatum L. and Justicia adhatoda L. had most inhibiting ability against Staphylococcusaureus and Streptococcus pneumoniae. Ascorbic acid, curcumin, vasicine, piperine, quercetin, myricetin and gallic acid have all been derived from these plants and are said to have antibacterial properties. Although Himalayan region has wide range of ethnomedicinal plants used to treat pneumonia, research on in-vivo activity, toxicology, and mechanism of action is minimal. As result, in order to produce novel antibacterial drugs from studied plant species, thorough study of these aspects is needed.

Keywords: Pneumonia, Infectious diseases, Medicinal Plants.

INTRODUCTION

The primary respiratory organs, the lungs, carry out gaseous exchange, or the exchange of oxygen and carbon dioxide, which is how breathing is accomplished. Exposure to harmful substances such as bleomycin, nitric oxide, oleic acid, cigarette smoke, and bacterial, viral, or fungal infections is the primary cause of lung damage or dysfunction. Numerous lung conditions, including asthma, bronchitis, pneumonia, TB, whooping cough, lung cancer, chronic obstructive pulmonary disease (COPD), pulmonary edema, acute respiratory distress syndrome, etc., were brought on by these chemicals [1]. Inflammation is the primary cause of lung problems and is primarily brought on by inhaled dust and heavy cigarette smoking, which damages lung tissue and can be fatal. Among the several lung ailments, pneumonia is one of the most prevalent infectious infections. This is a serious health problem that contributes significantly to global death and morbidity. Acute respiratory infections such as pneumonia are characterized by lung inflammation and a build-up of pus in the bronchioles or alveoli. Alveoli normally fill with air in healthy people, but when someone has pneumonia, their alveoli fill with pus or fluid, which makes breathing difficult and reduces oxygen intake. Pneumonia infection, also known as nosocomial infection, can be hospital acquired or community acquired and is generally categorized as the result of pathogenic bacteria invading the lower respiratory tract [2]. Pseudomonas aeruginosa, Legionella pneumophila, Mycoplasma pneumoniae, Chlamydophila pneumoniae, Chlamydophila psittaci, Coxiella burnetii, viruses (Influenza virus A & B, Respiratory syncytial virus, Severe Acute Respiratory Syndrome Coronavirus 2), fungi (Aspergillus fumigatus, Mucor mycosis), aspiration, and other agents are among

the pathogens that contribute to the development of pneumonia. Gram negative bacteria are recognized as the primary source of nosocomial pneumonia infections, while Streptococcus pneumoniae is the culprit that causes community-acquired pneumonia infections globally [3]. Despite bacterial, fungal or viral pneumonia there are various other kinds of pneumonias which include:

Acute air gap pneumonia, sometimes referred to as lobar pneumonia, is a disorder caused by injury to the alveoli that causes edema to extend into the terminal airways, including the pores of Kohn, a section of the lung parenchyma, and a complete lobe.

The symptoms of lobular pneumonia—bronchitis, bronchiolitis, and necrosis—distinguish it from lobar pneumonia. The causing organism here attacked the adjacent lung parenchyma or the walls of the bronchioles directly, resulting in patches that manifested.

Interstitial alterations and adjacent alveolar disorders are the hallmarks of interstitial pneumonia. There are several reasons why the supporting tissue surrounding the air sac thickens.

Nodular lesions are defined by the presence of one or more nodules that have been infiltrated and are primarily caused by mycobacterial species like Nocardia asteroids or fungi like Aspergillus fumigatus and Mucor mycosis [4]. Lipoid When fat builds up in the alveoli and inflames the lungs, it results in pneumonia [5].

Early detection of pneumonia is beneficial for illness management and can be achieved by a variety of methods, including physical examination, sputum examination, chest X-ray, biochemical identification, and serological testing. Conventionally, antibiotics with a restricted or broad spectrum of activity are used to treat pneumonia. Despite their effectiveness, they have major adverse effects that make them poisonous for the human body. Because they are safe and effective, the use of medicinal herbs as a potential cure for pneumonia is growing in popularity as an alternative treatment method [6]. This review's primary goal is to draw attention to research on medicinal plants that have been traditionally utilized and are biologically useful in treating pneumonia. We have gathered family-level data on over 150 traditionally used medicinal plants that are effective against pneumonia for this review, and the results are tabulated. A description of a few medicinal herbs that have been shown to have significant potential for reducing the chance of contracting pneumonia as well as being useful in managing the illness has also been provided.

Antibacterial Function of Medicinal Plants Used to Cure Pneumonia

Recently, the antibacterial activity of 54 medicinal plants against S. aureus and 12 plants against S. pneumoniae was evaluated. The most often utilized plant portions in the manufacture of extracts utilizing solvents like MeOH, EtOH, and water were leaves, nuts, entire plants, stem bark, and rhizomes. Ethanol and methanol are the ideal solvents for plant extraction because of their polar origins and the large range of bioactive chemicals they release. The most widely used methods for identifying bacterial inhibition were agar well diffusion and disc diffusion. The disc diffusion technique is most frequently applied to studies of antibiotic susceptibility [7]. Moreover, the disc diffusion test and the agar well method are quick, inexpensive, and simple to read and interpret. The highest antibacterial activity (25 mm inhibition zones) against S. pneumoniae was found in the aqueous extract of Cassia fistula L. at 0.32 mg/ml concentration, while the highest antibacterial activity (13.3 mm inhibition zones) against S. aureus was found in the methanolic extract of Ampelocissus latifolia (Roxb.) Planch at 0.5 mg/ml concentration. Plant extracts were officially tested in concentrations ranging from 0.005 to 10,000 mg/ml and were found to have clear inhibition zones ranging from 1 to 100 mm against bacterial pathogens that cause pneumonia. S. Aureus and S. pneumoniae were discovered to have Minimum Inhibitory Concentration (MIC) values ranging from 0.0078 to 200 mg/ml in antibacterial sample on different extracts of medicinal plants that are often used to treat pneumonia. Many methods, including as serial tube dilution, agar dilution, broth micro dilution, and tube dilution, were used to determine the minimum inhibitory concentration (MIC). The MIC values of plant extracts and compounds are equal to the amounts of conventional medications/antibiotics used as a control to assess antibacterial efficacy. Research on medicinal plants in clinical settings is crucial to the development of novel anti-pneumonia medications with minimal adverse effects. A wide range of chemical components found in herbal treatments are a useful place to start when creating new anti-pneumonia medications. It has been confirmed that the following compounds were isolated from A. J. latifolia, J. latifolia, J. latifolia, Adhatoda, Curcuma longa L., Bauhinia variegata Linn., Piper nigrum L., Adhato Punica granatum L., and Punica granatum L.: gallic acid, myricetin, quercetin, vasicine, piperine, ascorbic acid, 1,4-dioxan, pelargonidin-3-galactose, cyanidin-3-glucose, curcumin, bisdemethoxycurcumin, curcumin diglucoside, hexahydrocurcumin, and tetrahydrocurcumin. They were said to exhibit antibacterial behavior [8]. S. aureus was suppressed by curcumin monoglucoside, a derivative of curcumin. The majority of pneumoniae are bacteria. It has been demonstrated that curcumin and its derivatives have stronger antibacterial activity against strains of S. pneumoniae. Gallic acid exhibits the strongest antibacterial effect against S. aureus due to its structural similarity to alkanols and strength as a surfactant. Similarly, the structures of phenolic compounds dictate their optimal antibacterial activity. Phenolic toxicity to bacterial pathogens was thought to be caused by inhibition of enzymes, maybe by a reaction with

sulfhydryl groups, or non-specific interactions with proteins, which help to inactivate protein activity. Potential targets in bacterial cells include adhesions that are exposed to the surface, membrane-bound enzymes, and cell wall polypeptides. Additionally, phenols can provide bacterial diseases access to substrates that they are unable to use. The most important component of Curcuma longa, a member of the Zingiberaceae family that is frequently used in Asian cooking, is curcumin. At comparatively low doses, it exhibits a broad variety of pharmacological characteristics [9].

There are twenty distinct antibiotic components that make up curcumin. It can eventually be developed into an antibiotic and has been found to be effective against S. aureus. Vasicinone and vasicine are said to be the most active phytochemical substances that were extracted from J. adhatoda vine leaves. The plant's potent antibacterial activity against S. aureus in alcoholic extracts may be attributed to the presence of these active chemicals. When coupled with ciprofloxacin, a substance called piperine (Piper nigrum) shown antibacterial efficacy against Staphylococcus aureus, possibly by acting as an efflux pump inhibitor. Leucas aspera was shown to have secondary metabolites. Because the plant extracts are in their natural form and have a higher concentration of bioactive chemicals, they may have strong pharmacological activity against S. aureus [10].

Medicinal Plant Toxicity in Treatment of Pneumonia

In this investigation, only seven plants were shown to be hazardous to both humans and animals. Although it's a frequent misconception that using ethnomedical plants is safe, there are negative side effects linked to using herbal remedies. There are toxic effects, although they are often mild and only a small percentage of people experience them [11]. Studies have demonstrated that glycyrrhizin increases the adrenal cortex's ability to excrete hormones. One of G. glabra's main constituents, glycyrrhizinic acid, has been demonstrated to have considerable toxicity when taken at larger dosages, making it risky for people who have heart disease, renal failure, or high blood pressure. Prolonged use might also cause hypertension and oedema. Among the many active compounds found in C. longa is curcumin, which possesses antibacterial qualities against S. aureus and S. pneumoniaa [12]. The Hydro-Alcoholic Extract (HAE) of C. longa produced mild toxicity at 1000 mg/kg, which included depression, initial excitation, decreased breathing, and dullness. The therapeutic dose of C. longa HAE can be lowered to 500 mg/kg. Additionally, the highest concentration (0.1 lg/ml) of C. When added to culture medium, longa root extract harms the developing embryo. It stops the rabbit embryo's growth at the morula stage. Papaver somniferum extract is now seen to be a good source of treatment for many ailments, as it produces necrosis in cells at a concentration of 150 g/ml [13].

A Synopsis and Quick Annotation of Certain Medical Herbs that are Active Against Pneumoria

- **Acalypha indica -** A. indica, sometimes referred to as Indian nettle, is a member of the Euphorbiaceae family. The herb has historically been used to treat asthma, bronchitis, pneumonia, and cough. Using the disc diffusion test method, the antimicrobial screening of A. indica extracts against the bacterial strains Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, and Staphylococcus aureus was carried out using various solvents (petroleum ether, chloroform, acetone, and methanol). When it came to Klebsiella pneumoniae, the acetone and methanol extracts showed the maximum zone of inhibition, whereas the other bacterial strains showed notable action. The study presents the empirical support for its traditional use in the management of pneumonia [14].
- **Beta vulgaris -** B. vulgaris, also known as sugar beet, is a member of the Amaranthaceae family. This plant produces sugar and has some bioactive ingredients that effectively combat a variety of microorganisms that are the main source of infectious diseases. Using the disc diffusion method, the antibacterial activity of beetroot leaves was examined against five pathogenic microbes: Salmonella typhi, Escherichia coli, Staphylococcus aureus, and Bacillus subtilus. After making a crude leaf extract, it was fractionated using progressively more polar solvents. The standard medication employed was ciprofloxacin, and the diameter of the formed zone of inhibition was used to calculate the results. It was discovered that the crude extract and its fractions—n-hexane and chloroform—were highly effective against Klebsiella pneumonia [15].
- **Carum carvi -** Caraway, or C. carvi, is a member of the Apiaceae family. The plant's main uses are as a carminative, antimicrobial, antispasmodic, and culinary condiment. Escherichia coli, Klebsiella pneumoniae, Proteus vulagaris, and Pseudomenas aeruginas were the four bacterial strains against which a study was done to determine the antibacterial properties of caraway. The hydro distillation process was utilized to extract the essential oil from caraway seeds, and Kirby Bauer's disc diffusion method was employed to test the antibacterial activity. After the extract discs were ready, they were put on a nutrient agar slant, seeded with bacterial strains, and left to generate the zone of inhibition during incubation. Using a ruler, the activity was evaluated by calculating the zone of inhibition's diameter. The findings indicated that the oil is related because of the richness of carvone and that it is effective against all of the screened species [16].
- **Citrus aurantifoliam -** Key lime, or C. aurantifolia, is a member of the Rutaceae family. Traditionally, this plant has been used to treat a variety of illnesses, including stomach issues and colds. Using the agar well diffusion method, the antibacterial efficacy of

Citrus aurantifolia hydro alcoholic leaf extract was assessed against various bacterial species, including Escherichia coli, Staphylococcus aureus, Klebsiella pneumoniae, and Pseudomonas species. As a standard, 10 mg/ml of gentamicin was utilized. Significant antibacterial activity against Klebsiella pneumoniae, Staphylococcus aureus, and Pseudomonas species was observed in the hydro alcoholic leaf extract [17].

- **Cuminum cyminum -** Cumin, also known as C. cyminum, is a well-liked spice in the Apiaceae family. Using the cup plate agar diffusion method, the antibacterial activity of cumin seed essential oil was evaluated against the following bacterial strains: Proteus vulgaris, Klebsiella pneumoniae, Enterococcus feacalis, Staphylococcus aureus, E. coli, and S. typhi. Zone of inhibition was utilized to determine the results, with gentamicin at a standard value of 10µg/ml. The oil proved to be efficient against every tested strain of bacteria, according to the study's findings. A zone of inhibition ranging from moderate to high was seen against Klebsiella pneumoniae, which may contribute to cumin's anti-pneumonia properties [18].
- **Echinops adenocaulos -** Globe thistle, or E. adenocaulos, is a member of the Asteraceae family. Numerous medical conditions, including diarrhea, intestinal worms, migraines, hemorrhoids, and other bacterial infections, are treated with this herb. The minimum inhibitory concentration (MIC) of the zamzam water extract of Echinops adenocaulos was measured in order to assess its in-vitro antibacterial activity against Streptococcus pneumoniae. With the lowest MIC of 0.781 mg/ml, the zamzam water extract was found to have stronger antibacterial activity [19].
- **Erythrina senegalensis -** E. senegalensis, also referred to as flame tree, is a member of the Fabaceae family. This plant is used to treat liver disease, stomach problems, malaria, and body aches, among other conditions. Using the agar dilution method, the in-vitro antibacterial activity of Erythrina senegalensis leaf and stem bark extract was evaluated against four microbiological strains: Escherichia coli, Staphylococcus aureus, Candida albicans, and Klebsiella pneumoniae. Using ethyl acetate as a solvent, separate extracts of the leaf and stem bark were made. The extracted materials were further refined by column chromatography, and the separated fractions (F1 for hexane, F2 for ethyl acetate, and F3 for ethanol) were scrutinized. The purified extract was diluted using the serial dilution procedure in order to determine the MIC value. Pour each diluted extract into a sterile petri plate, mix it with agar media, and let it solidify. The plate was separated into four compartments, each of which was injected with a different strain of bacteria. After that, the plate was incubated, and the MIC was noted. According to the findings, stem bark extract and leaf extract with fractions F2 and F3 exhibited the best antibacterial activity against Klebsiella pneumonia [20].
- **Euclea crispa -** E. crispa, also referred to as blue guarri, is a member of the Ebenaceae family. It is applied to the treatment of many infectious illnesses. P. aeruginosa, H. influenzae, K. pneumoniae, S. aureus, S. epidermidis, S. pneumoniae, and S. pyogenes were the microorganisms against which the antibacterial screening of five flavonoid compounds (catechin, epicatechin, gallocatechin, hyperoside, and quercitrin) isolated from E. crispa leaf extract was assessed using the disc diffusion method. Epicatechin and hyperoside were the two flavonoids that showed the greatest activity against B. subtilis, H. influenza, K. pneumoniae, and S. pneumonia out of the five [21].
- **Foeniculum vulgare -** F. vulgare, a member of the Apiaceae family, is most widely recognized as fennel. The herb is used extensively, mostly as an expectorant, galactagogue, antibacterial, and anti-inflammatory. Using the disc diffusion method, the antibacterial activity of the aqueous and methanolic seed extracts of Foeniculum vulgare was assessed. Staphylococcus aureus, S. Albus, E. Coli, Pseudomonas species, Bacillus species, Shigella species, Salmonella typhi, Micrococcus lutus, Streptococcus haemolyticus, and Agrobacterium tumefaciens were the strains of bacteria employed in the study. The antibacterial activity of the extract against test organisms is shown by the presence or absence of a zone of inhibition. The outcomes demonstrated that while the methanolic extract was successful in combating a limited number of species, such as Staphylococcus aureus, Klebsiella pneumoniae and Escherichia coli, however the aqueous extract exhibits good efficacy against all test species. For this reason, fennel's alcoholic and aqueous extracts both have anti-pneumonial properties [22].
- **Houttuynia cordata -** H. cordata, a member of the Saururaceae family, is more commonly referred to as fish mint. The herb has historically been used to treat respiratory conditions like COPD, bronchitis, and pneumonia, among others. An investigation on the H. cordata plant's ability to treat H1N1-induced viral pneumonia was carried out on animals. First, column chromatography was used to extract the flavonoids (rutin, hyperin, quercitrin, and isoquercitrin) from the aerial sections of the H. cordata plant. HPLC was then used to quantify the flavonoids. The H1N1 influenza virus was introduced intraperitoneally into the mice. The usual medication was 100 mg/kg of ribavirin. Measurements were made of lung index, survival rate, life span, weight fluctuation, inflammatory infiltration, and histological changes as well as other lung functional assessment measures.Mice infected with H1N1 and treated with flavonoids had longer life spans, reduced pulmonary indices, and decreased weight loss. Out of all the extracted

flavonoids, hyperin and quercitrin were found to be important in the treatment of viral pneumonia caused by H1N1 [23].

- **Linum usitatissimum -** L. usitatissimum is a member of the Linaceae family and is also referred to as flax seed or linseed. The plant that is high in phytoconstituents with antiviral, antifungal, and antibacterial properties, such as lignans. By adopting the disc diffusion method, an antibacterial research of flax seed extract was carried out against Salmonella paratyphi, Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus, Proteus vulgaris, and Lactobacillus sporogens. A series of extraction techniques were utilized to prepare the flax seed extract, with streptomycin serving as the control. Selected microbial strains were injected into prepared nutrient media or broth. Discs containing flax seed extract were made, inserted in culture media that had been infected, and then incubated for a specific amount of time. By measuring the developed zone of inhibition surrounding the discs, the findings were computed and compared to the control group. The produced extracts with the highest activity against the organisms that were screened included aqueous extract, which was followed by ether, methanol, chloroform, ethyl acetate, and butanol [24].
- **Parietaria judaica -** P. judaica, also referred to as pellitory plant, is a member of the Urticaceae family. This herb is used to heal burns, cuts, wounds, and chronic cough in addition to its hypnotic and diuretic properties. The broth micro-dilution method was used to assess the antibacterial activity of P. judaica leaf extract using various solvents (methanol, acetone, hexane, and water) against seven bacterial strains: Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, Proteus vulgaris, Enterococcus faecium, and Staphylococcus aureus. The broth in the micro-wells was varied in its concentration of plant extract, and the lowest concentration at which no microbial growth was seen was designated as the minimum inhibitory concentration, or MIC. Hexane extract, out of all the fractions, inhibits the growth of every bacterial strain thathas been screened. The hexane fraction's anti-pneumonial efficacy against Klebsiella pneumoniae was demonstrated by its MIC of 12.5 mg/ml [25].
- **Urtica urens -** U. urens, a member of the Urticaceae family, is used medicinally to treat lung conditions. It is sometimes referred to as dwarf nettle or annual nettle. Saleh Fares et al. discovered a minimum inhibitory concentration (MIC) of 6.25 mg/mL for the plant's aqueous extract's ability to inhibit multidrug-resistant clinical isolates of S. pneumoniae by the use of the micro-broth dilution method. This indicates that it may be used as medicine to treat S. pneumonia that is resistant to many drugs [26].
- **Verbascum fruticulosum -** V. fruticulosum, also referred to as mullein, is a member of the Scrophulariaceae family and has long been used to treat lung conditions. The aqueous extract of V. fruticulosum demonstrated the best antibacterial activity with the lowest minimum inhibitory concentration of 0.195 mg/ml when tested in vitro against Streptococcus pneumoniae [19].
- **Waltheria indica -** W. indica is a member of the Sterculiaceae family and is sometimes referred to as sleepy morning. Infections of the upper respiratory tract are the principal usage of this herb. Using the agar diffusion method, an in vitro investigation was carried out to assess the antibacterial properties of W. indica leaves extract against the following bacterial species: Streptococcus aureus, Streptococcus pneumonia, Streptococcus pyrogens, and Klebsiella pneumoniae. To get acidic, basic, polar, and non-polar fractions, the extract of W. indica leaves was produced and subjected to bioactivity guided fractionation. Samples of bacteria were used to inoculate the agar medium. Using a borer, wells were made on infected media, filled with the appropriate sample fractions, and then left to incubate. A clear ruler was used to measure the zone of inhibition that emerged after the incubation period. The control group was given 10µg/ml of ciprofloxacin. According to the study's findings, the plant exhibits potent antimicrobial activity against a few different types of bacteria [27].
- **Zingiber officinale -** Z. officinale is a member of the Zingiberaceae family and is a rhizome that is generally known as ginger. It serves as a spice in addition to a medication. Using the agar well diffusion method, an in vitro antibacterial investigation was carried out on a methanolic extract of Zingiber officinale. Pseudomonas aeruginosa, Salmonella typhi, Klebsiella pneumoniae, Staphylococcus aureus, and Escherichia coli were the species used in the study. Out of all the selected species, the extract demonstrated the highest level of effectiveness against Klebsiella pneumoniae, according to the data. Its ethnopharmacological value in the treatment of pneumonia was demonstrated by the aforementioned scientific study [28].

Ethnopharmacology of Medicinal Herbs Effective against Pneumonia

There are billions of different plant species in the surrounding environment in nature, and each one has inherited magical abilities to treat various illnesses. The traditional usage of medicinal herbs by tribal peoples to treat illness-like situations is widespread and provides valuable information for scientists and future generations seeking to identify lead compounds. The practice of discovering novel medicines through the application of traditional knowledge dates back thousands of years [29].

The collected ethno-pharmacological information about medicinal plants is tallied and arranged in accordance with plant families. The ethno-medical literature that is now available states that tribal peoples employed all of the herbs listed in Tables 1 through 8 to treat pneumonia by decocting an effective portion of the plant.

Fig. 1: Pneumonia / Radiology Case / Radiopedia.Org

Table 1: List of Traditional Medicinal Plants under Families. Apiaceae, Apocynaceae & Asteraceae

APIACEAE				
Botanical Name	**Common Name**	**Part use**	**Ethnopharmacological use**	**Ref.**
Angelica atropurpurea	Common Angelica	Whole plant	pneumonia, tuberculosis, cold, sore throats, flu, fever, stomach disorders, rheumatism, abortifacient, emetic, febrifuge, tonic	[30]
Angelica breweri	Brewer's Angelica	Roots	pneumonia, influenza, tuberculosis, colds, cough, sore throats, bronchitis, wounds, antirheumatic, headache	[30]
Angelica lineariloba	Poison Angelica	Whole plant	pneumonia, analgesic antihemorrhagic	[30]
Carum carvi	Caraway	Fruit	pneumonia, carminative, appetizer, galactogogue	[31]
Centella asiatica	Brahmi	Leaves	pneumonia, toothache, indigestion, dysentery, stimulate nervous system	[32]
Eryngium foetidium	Mexican Coriander	Whole plant	pneumonia, constipation, ulcer, piles, fever, anthelminthic, malaria, diabetes	[33]
Hydrocotyle himalaica	Golpatta	Whole plant	pneumonia and throat infection	[34]
Osmorhiza occidentalis	Western Sweetroot	Roots	pneumonia, whooping cough, cold, influenza, pulmonary disorders, chills venereal sores	[35]
APOCYNACEAE				
Aclepias crispa	witvergreet	Whole plant	bacterial pneumonia	[35]
Alstonia scholaris	Devil's tree	Bark & Leaves	pneumonia, bronchitis, influenza, arthritis, fever, headache, diarrhea, dysentery	[36]
Asclepias curassavica	Topical milkweed	Whole plant	pneumonia, tonsillitis, bronchitis, cardiac tonic, urethritis and external and internal bleeding	[37]
Picralima nitida	Akuamma seeds	Seeds	pneumonia and stomachache	[38]
Rauvolfia caffra	quinine tree	Leaves & Stem bark	pneumonia, body swelling and rheumatism	[30]
Rauvolfia serpentina	Sarpagandha	Shoots	pneumonia	[39]
Tabernaemontana stapfiana	Mabondet	Roots & Bark	pneumonia, chest problems	[40]
ASTERACEAE				
Adenostemma viscosum	Dung weed	Fresh Juice	pneumonia, edema, inflammation lung congestion and ear infections	[30]
Ambrosia artemisiifolia	Common Ragweed	Leaves	pneumonia, anti-inflammatory, antidiarrheal, antiemetic, insect sting	[30]
Ambrosia trifida	Giant Ragweed	Leaves	pneumonia, fever astringent, emetic, disinfectant, febrifuge, antidiarrheal	[41]
Artemisia capillaris	Khamtso	inflorescence	pneumonia, joint pain	[42]
Artemisia tridentata	big sagebrush	Leaves	pneumonia and cold	[30]
Aspilia	Wild sunflower	Leaves &	pneumonia, stomach ache, coughs and	[43]

Table 2: List of Traditional Herbs Under Families: Capparaceae, Carophyllaceae, Chenopodiaceae, Cleomaceae, Clusiaceae, Combretaceae

CAPPARACEAE					
Botanical Name	**Common Name**	**Part use**	**Ethnopharmacological use**		**Ref.**
Boscia angustifolia	rough-leaved shepherd's tree	Leaves & Roots	pneumonia, boils, chest pain, wound infection, urinary infection and typhoid fever, diarrhea, burns and headache		[44]
Maerua subcordata	Ashkulebya	Leaves	pneumonia, ophthalmic diseases		[45]
Stixis suaveolens	Fragrant Caper Vine	Fruits	Pneumonia and cough		[30]
CAROPHYLLACEAE					
Ayapana triplinervis	white snakeroot	Leaves	pneumonia, bronchitis, asthma, cold, influenza, fever, mouth sores, ulcers, UTI, GI disorders, emetic, anticancer, cardotonic		[30]
Drymaria villosa	Abijalo	Shoots	pneumonia, sinusitis		[46]
CHENOPODIACEAE					
Chenopodium ambrosioides	American wormseed	Leaves	bacterial pneumonia		[47]
CLEOMACEAE					
Cleome amblyocarpa		Spider flowers	Fruits	pneumonia, cough, chest pain,	[30]
CLUSIACEAE					
Garcinia afzelii		Bitter kola	Roots & Leaves	pneumonia, cough, fever	[48]
COMBRETACEAE					
Combretum platpetalum		Red wings	Root	bacterial pneumonia	[49]
Combretum schumannii		sand bushwillow	Leaves	pneumonia, headache, epilepsy	[30]
Terminalia ivorensis		Ivory Coast almond	Whole plant	pneumonia, cold, sore throat, coughs, bacterial infections cutaneous infections, buccal infections, nose bleeding, diarrhea and skin diseases	[50]
Terminalia sericea		Silver cluster leaf	Roots & Leaves	bacterial pneumonia	[51]

Table 3: List of Traditional Herbs Under Family: Fabaceae

FABACEAE				
Botanical Name	**Common Name**	**Part use**	**Ethnopharmacological use**	**Ref.**
Abrus precatorius	Indian liquorice	Aerial parts	pneumonia, tonsil and abortion	[52]
Abrus schimperi	Jacquirity	Roots	pneumonia	[53]
Acacia amythethophylla	Large-leaved acacia	Roots	pneumonia, fever	[30]
Acacia ataxacantha	Flame thorn	Leaves & Roots	pneumonia, cough	[54]
Acacia eriloba	Camel thorn	Leaves	bacterial pneumonia,	[55]
Acacia mellifera	Black thorn	Bark	pneumonia, fever, stomach problems, sterility, malaria, and syphilis,	[56]
Acacia nilotica	Gum Arabic tree	Leaves	pneumonia, chest pain, diarrhea and dysentery	[30]
Albizia amara	Oil cake tree	Roots	pneumonia, tuberculosis, warts, infertility of women and aphrodisiac	[30]
Albizia antunesiana	purple-leaved false thorn	Roots	pneumonia, cold, sore throat, tonsillitis, tuberculosis, gonorrhea, abdominal pains, cuts, ulcers, painful and swollen legs	[30]
Albizia schimperiana	forest long-podded albizia	Stem bark	pneumonia and malaria	[57]
Andira inermis	Cabbage bark	Leaves	pneumonia, fever	[48]

FABACEAE				
Botanical Name	**Common Name**	**Part use**	**Ethnopharmacological use**	**Ref.**
Caesalpinia crista	Fever nut	Whole plant	pneumonia, pulmonary tuberculosis, fever, malaria, menstrual complaints, skin diseases, swelling, uterine stimulant	[58]
Cassia acutifolia	Senna	Roots	pneumonia, gastrointestinal disorders, stomachache, uterus complaints, heavy menstruation	[38]
Cassia afrofistula	Golden shower	Roots	pneumonia, chest complaints, fever, gastrointestinal disorders, gonorrhea, malaria, snakebites	[30]
Chamaecrista mimosoides	Boesmantee	Whole plant	bacterial pneumonia	[49]
Dalea purpurea	purple prairie clover	Whole plant	pneumonia, diarrhea, heart troubles, measles and poultice	[30]
Dichrostachys cinerea	Chinese lantern tree	Leaves and roots	pneumonia and tuberculosis	[59]
Glycyrrhiza glabra	Liquorice	Roots	pneumonia, cough, asthma	[60]
Piptadeniastrum africanum	African oak	Bark	pneumonia, fever, toothache, skin complaints, wounds	[61]

Table 4: List of Traditional Herbs Under Families: Lamiaceae, Lauraceae, Liliaceae

LAMIACEAE				
Botanical Name	**Common Name**	**Part used**	**Ethnopharmacological use**	**Ref.**
Ajuga bracteosa	Bugle	Leaves	pneumonia, bronchitis, headache, diabetes, gastric pain and typhoid fever.	[62]
Callicarpa longifolia	Long Leaved Beauty Berry	Roots	pneumonia, fever diarrhea and colic	[30]
Leucas indica	Drona pushpam	Leaves	pneumonia and wounds	[63]
Ocimum gratissimum	Clove basil	Whole plant	pneumonia, cough, fever and other upper respiratory tract infections	[50]
Salvia dorrii	Purple sage	Whole plant	pneumonia, chest congestion, sore throat, cold, cough, influenza, fever	[30]
Stachys affinis	Knotroot	Whole plant	pneumonia, cold, cough	[64]
LAURACEAE				
Cinnamomum camphora	Camphor tree	Bark	bacterial pneumonia, gout, high blood pressure, diarrhea	[65]
Cinnamomum glaucescens	Cinnamon berry	Roots & Leaves	pneumonia, bronchitis, cough and cold.	[66]
LILIACEAE				
Aletris pauciflora	Few flowered colic root	Aerial parts	pneumonia, bronchitis and other respiratory diseases	[30]
Allium cepa	Onion	Bulb	pneumonia, cough, Diuretic, appetizer, antimicrobial, jaundice, scabies, cancer	[67]

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