



HERBS FOR PREVENTING AND MANAGING ACUTE AND CHRONIC RESPIRATORY DISORDERS

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<https://doi.org/10.46607/iamj06p6062022>

(Published Online: September 2022)

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Article Received: 20/08/2022 - Peer Reviewed: 16/09/2022 - Accepted for Publication: 26/09/2022



ABSTRACT

Urbanization has increased the risk of respiratory diseases in adults and children. Various medicines help deal with the symptoms associated with common respiratory conditions like the common cold, cough, sore throat, sinusitis, asthma, bronchitis, COPD, and a few more. However, many herbs are used traditionally to manage these conditions, such as Tulsi, Mulethi, Ginger, Motha, Talispatra, Peppermint, Ashwagandha, Pippali, Rudravanti, Bhumi amla, Fennel, Adulsa, Vacha, Thyme and a lot more due to their safety profile and preferences. A decoction of honey and herbs is well known for managing respiratory conditions.

Key words: Respiratory health, Honey, *Ocimum sanctum*, *Zingiber officinale*, *Adhatoda vasica*, *Glycyrrhiza glabra*, *Coleus aromaticus*, *Phyllanthus niruri*, *Piper longum*, *Cressa cretica*, *Abies webbiana*, *Cyperus rotundus*, *Acorus calamus*, *Foeniculum vulgare*, *Withania somnifera*, *Mentha piperita*.

INTRODUCTION

Due to the healing properties of plants, allopathic medicines contain various plant compounds (or phytochemicals) in their formulations. Many natural

compounds are used in allopathic medicines, a few of which include, digoxin (as a cardiac tonic agent), artemisinin (in the treatment of malaria), quinine (for

malaria and babesiosis), ephedrine (as an antihistaminic agent), codeine (an analgesic and anti-tussive), cocaine (as a local anesthetic), caffeine (as CNS stimulant and cough suppressor), paclitaxel from *Taxus brevifolia* (as a chemotherapy agent), et al. Some natural compounds are now being synthesized^[1]. Lifestyle changes and urbanization may cause many conditions that can compromise health. Respiratory diseases are one of the most prominent among them. Despite their predominance, they are generally ignored or given minimal importance. Among all the conditions, the leading cause of morbidity and mortality is lower respiratory tract diseases such as asthma, pneumonia, bronchitis, COPD, emphysema, tuberculosis, and some flu infections^[2]. Generally, there is a balance between the oxidants and antioxidants in the cells. During oxidative stress, there is an imbalance between oxidants and antioxidants, favouring the oxidants. Oxidative stress is due to the generation of free radicals and reactive oxygen species, which are the major causes of cellular damage that may contribute to the development of many chronic health conditions. Tobacco smoking may cause excessive production of free radicals and reactive oxygen species, which may also lead to inflammation in the lungs. Many herbs possess antioxidant properties that can reduce oxidative stress, which can slow and prevent chronic health conditions. The concept of healthy aging is well accepted and herbal medicines play important role in alleviating the sign and symptoms of the age-related disorder.

A Concoction of Honey and Herbs for Respiratory Health

Honey

Honey is used since ancient times for both nutritional and medicinal benefits. Honey mainly comprises carbohydrates (95-97% of its dry weight). Other compounds present in honey are proteins, vitamins, minerals, amino acids, and organic acids. The major phytochemicals of honey include flavonoids, polyphenols, glycosides, alkaloids, anthraquinones, and volatile compounds. Monosaccharides such as glucose and fructose are the major sugars present in honey which contribute to the maximum nutritional and

physical characteristics (such as viscosity, hygroscopicity, and granulation) of honey. The main organic acid present in honey is gluconic acid, with minor quantities of acetic, formic, and citric acid. The acidic (pH 3.2 - 4.5) property of honey is due to the presence of these acids. Honey also comprises all the nine essential amino acids and all non-essential amino acids except asparagine and glutamine. Among all the amino acids, proline is the major amino acid in honey (50-85%) obtained primarily from the salivary secretions of honeybees. Proteins are present in minor quantities, especially in the form of enzymes (invertase, diastase, glucose oxidase, catalase, and acid phosphatase) and free amino acids. The common minerals found in honey are potassium, calcium, copper, iron, magnesium, sodium, zinc, manganese, phosphorous, and selenium. Vitamins such as ascorbic acid (vitamin C), thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), pantothenic acid (vitamin B5), and pyridoxine (vitamin B6) are present in minor quantities. The major phytochemicals present in honey include flavonoids and polyphenols, which act as antioxidants. These include gallic acid, benzoic acid, syringic acid, caffeic acid, cinnamic acid, coumaric acid, quercetin, kaempferol, catechin, luteolin, galangin, etc. Honey is shown to have antimicrobial, antioxidant, anti-inflammatory, anti-proliferative, anti-metastatic, and anticancer properties^[3]. Various studies have shown honey to be effective against cough. It reduces the frequency and severity of cough and improves the sleep quality of children having cough^[4].

Sunthi

Zingiber officinale belongs to the family *Zingiberaceae*. It is commonly known as ginger or sunthi. The phytochemicals present in ginger include phenolic compounds, terpenes, polysaccharides, lipids, organic acids, and raw fibres. The medicinal benefits of ginger are mainly due to the presence of phenolic compounds such as gingerols, paradols, and shogaols and their derivatives such as dihydroparadols, acetyl derivatives of gingerols, gingerdiols, mono and diacetyl derivatives of gingerdiols, and a few more. The major pharmacological activities shown by ginger include

antioxidant [5], antimicrobial, anti-inflammatory [6], bronchodilator [7], and anticancer. The rhizomes of ginger help to prevent and manage respiratory, neurodegenerative, and cardiovascular disorders, diabetes mellitus, chemotherapy-induced nausea, and vomiting, and obesity. Numerous studies have shown the antioxidant properties of ginger. The antioxidant properties of different gingers are as follows: dried ginger > stir-fried ginger > carbonized ginger > and fresh ginger [8]. A study revealed 6-shogaol in ginger to show potent antioxidant and anti-inflammatory activity, which is due to the presence of α , and β -unsaturated ketone moiety [9]. The ginger rhizome contains potent anti-allergic compounds, which may be useful in the treatment and prevention of allergic diseases.

Adulsa



Adhatoda vasica (now known as *Justicia adhatoda*) belongs to the *Acanthaceae* family. It is commonly

known as Adulsa, Vasa, and Malabar nut. The various pharmacological activities of *A. vasica* include anti-inflammatory, bronchodilator, antitussive, antioxidant, anti-diabetic, antibacterial, respiratory stimulant, antimicrobial, antidepressant, and a few more [10]. Adulsa has medicinal importance and is used in conditions like cold, cough, bronchitis, asthma, whooping cough, thirst, fever, loss of memory, jaundice, etc. It is used in the treatment of various respiratory conditions such as bronchitis, asthma, tuberculosis, etc. It has a soothing effect on the throat, which helps to reduce sore throat and cough with expectorant properties that help to loosen the phlegm in the airways. Adulsa is known to show unfailing results in acute asthma and bronchitis, wherein the sputum is thick and sticky [11]. The leaves of adulsa contain vasicine, vasicol, ashatonine, vasicinone, peganine, baraine, steroids, alkanes, saponins, flavonoids, fatty

acids, essential oils, and vitamin C. The essential oils of adulsa comprise ketones, terpenes, and phenolic ether. The major alkaloids of adulsa include vasicine and vasicinone which are well known for their pharmacologically important activities. Adulsa leaves are rich in vitamin C, carotene, and essential oil [10,11]. Both *in vitro* and *in vivo* studies reveal the bronchodilatory effects of vasicine and vasicinone. Studies have shown the bronchodilatory effect of vasicine to be comparable to theophylline [12,13].

Mulethi



Glycyrrhiza glabra is commonly known as Mulethi or Licorice. It belongs to the family *Legumi-*

nosae/ Fabaceae. The phytochemicals present in licorice include triterpenoid saponins, flavonoids, and phenolic compounds. Licorice also contains amino acids, proteins, simple sugars, polysaccharides, mineral salts, pectin, starch, gums, sterols, and resins. The major triterpenoids of licorice include glycyrrhizin and glycyrrhetic acid. The most abundant isoflavone of licorice is glabridin which accounts for 0.08 to 0.35% of the dry weight of the roots. Glycyrrhizin (also known as glycyrrhizinic acid) is the major ingredient of licorice. It is nearly 50 times sweeter than sucrose, which makes it a natural sweetener for herbal medicines. It shows various pharmacological actions such as anti-inflammatory, antioxidant, antimicrobial, anti-asthmatic, anti-diabetic, anti-atherogenic, anti-cancer, antispasmodic, etc. World Health Organization has recognized licorice as a demulcent and expectorant to manage sore throat, bronchial catarrh, and coughs [14]. Various studies have shown licorice to be effective in managing respiratory conditions. It helps to manage both acute and chronic respiratory conditions. Studies show licorice to be effective in managing chronic coughs, asthma, bronchitis, tuberculosis, and many other respiratory

conditions ^[14]. Studies have shown 18 β -glycyrrhetic acid to possess anti-tubercular effects ^[15]. Isoliquiritigenin, a flavonoid derived from the roots of licorice has shown various properties such as anti-inflammatory, anti-diabetic, antioxidant, and anticancer. Glycyrrhizic acid and other flavonoids show anti-inflammatory and anti-asthmatic effects. Many studies have shown *G. glabra* to inhibit airway constriction, hyper-reactivity, and eosinophil infiltration, and reduce airway inflammation ^[16]. A study showed superior bronchodilator properties of *G. glabra* than *Boswellia carterii* (Olibanum) in managing chronic bronchial asthma ^[17].

Tulsi

Tulsi (*Ocimum sanctum*) belongs to the family *Lamiaceae*. It is known as "The Queen of Herbs" or "Mother Medicine of nature". Tulsi is effective against anxiety, cough, asthma, fever, diarrhoea, and arthritis. In the Indian Materia Medica, the tulsi leaf extracts can effectively manage bronchitis, rheumatism, and pyrexia. Other therapeutic uses of tulsi include the treatment of asthma or dyspnea, epilepsy, hiccups, cough, inflammation, wounds, skin, and haematological diseases. Various *in-vitro*, animal, and human experiments have proved antimicrobial (including antibacterial, antiviral, antifungal, antiprotozoal, antimalarial, and anthelmintic), analgesic, anti-inflammatory, antioxidant, chemopreventive, hepato-protective, neuro-protective, mosquito repellent, cardio-protective, analgesic, antipyretic, anti-allergic, immunomodulatory, anti-asthmatic, anti-tussive and anti-ulcer properties ^[18,19]. The leaves and stems of this herb contain various phytochemicals such as carbohydrates (xylose and polysaccharides), saponins, flavonoids, triterpenoids, tannins, glycosides, and phenolic compounds. The phenolic compounds include rosmarinic acid, apigenin, cirsimartinin, isothymusin, and isothymonin, which exhibit antioxidant and anti-inflammatory activities. The volatile oils present in the leaves of tulsi include eugenol, euginal, urosolic acid, carvacrol, linalool, limatrol, caryophyllene, and methyl carvicol. A study reported that the anti-inflammatory and antibacterial proper-

ties of different species of tulsi could be due to the presence of linoleic acid ^[20].

Thyme



Thyme is scientifically known as *Coleus aromaticus* or *Coleus amboinicus* and belongs to the family *Lamiaceae* (*Labiatae*).

The phytochemicals derived from *C. aromaticus* include terpinolene, α -pinene, β -pinene, β -caryophyllene, methyl eugenol, thymol, 1,8-cineole (eucalyptol), eugenol, carvacrol, and β -phellandrene ^[21]. The essential oils of *C. aromaticus* include carvacrol, thymol, eugenol, chavicol, and ethyl salicylate ^[22]. It is a traditional medicinal plant used in the treatment of cold, cough, chronic asthma, hiccoughs, bronchitis, malarial fever, hepatopathy, renal calculi, convulsions, epilepsy, respiratory infections, etc. A decoction of Thyme with other herbs is useful in common colds and coughs with phlegm ^[21]. Various phytochemical analysis studies reveal the presence of carvacrol and γ -terpinene, which shows anti-inflammatory and antiviral properties. These properties make it an important herb in managing conditions like cold, sore throat, bronchitis, asthma, whooping cough, pharyngitis, and other respiratory tract infections. Various studies have reported the antimicrobial activity of thyme, including antibacterial, antiviral, and antifungal activities ^[23]. Studies have reported the mast cell stabilizing property of Thyme. These mast cells play a major role in rhinitis and asthma ^[24].

Bhumi amla



Phyllanthus niruri belongs to the *Euphorbiaceae* family. It is commonly known as Bhumi amla. The various

pharmacological activities shown by *P. niruri* include anti-inflammatory, antifungal, hypotensive, antibacterial, antiviral, antioxidant, hepatoprotective, analgesic, and many more. *P. niruri* is known to be effective in the treatment of cough, asthma, bronchitis, tuberculosis, diabetes, jaundice, kidney stones, blood and liver disorders like anaemia and hepatitis, and improves digestion, and appetite stimulant. The major phytochemicals present in *P. niruri* include niruriside (which shows antiviral properties), lignans, phyllanthin, hypophyllanthin, flavonoids, triterpenes, glycosides, tannins, alkaloids, ellagitannins, triterpenes, niruriside and a few more [25]. Various studies have shown the antiviral, antibacterial, antioxidant, and anticancer properties of *P. niruri* [26].

Pippali



Pippali is scientifically known as *Piper longum*. It belongs to the family *Piperaceae*. It is commonly

known as long pepper or pippali. It has various pharmacological properties including antioxidant, antimicrobial, anti-inflammatory, anticancer, immunomodulatory, analgesic, antiplatelet, cardioprotective, and many more. The major constituents derived from *P. longum* include piperine, piperlongumine, sesamin, piperlonguminine, pipermonaline, piperundecalidine, and sylvatin. Pippali fruit contains alkaloids, of which piperine is the most abundant and most important, followed by methyl piperine, pipermonaline, piperettine, asarinine, pellitorine, piperundecalidine, etc. Pippali is commonly used in the treatment of cough, chronic bronchitis, asthma, diarrhoea, cholera, viral hepatitis, malaria, respiratory tract infections, and others. The lignans found in pippali include sesamin, fargesin and pulviatilol. It also contains esters, organic acids (palmitic acid and tetrahydropiperic acid), and volatile oils (piperine, caryophyllene, enta-

decane, bisabolene, terpinolene, etc.) [27]. Studies have revealed the anti-inflammatory and anti-asthmatic properties of pippali [28,29]. A study showed that the choti variety of pippali showed better anti-inflammatory action than the standard diclofenac sodium [30].

Rudravanti



Cressa cretica, commonly known as Rudanti or Rudravanti, belongs to the family *Convolvulaceae*. It is a traditional medicine used in the treatment of cough, dia-

betes, asthma, ulcers, stomatitis, constipation, respiratory infections, etc. It shows antibacterial, antifungal, anti-inflammatory, antitussive, expectorant, and anticancer properties. The major chemical constituents present in *C. cretica* include quercetin, quercetin-3-O-glucoside, lampferol, rutin, syringaresinol-h-d-glucoside, cretican, and a few more. Various studies have shown the anti-inflammatory and antipyretic properties of *C. cretica* [31]. A study showed antitussive activity of *C. cretica* significant to codeine phosphate [32].

Talispatra



Abies webbiana belongs to the family *Pinaceae*. It is commonly known as Talispatra. Traditionally this herb is used in the treatment of

cough, phthisis, bronchitis, asthma, hiccups, vomiting, helminthiasis, mouth disorders, respiratory infections, and a lot more. The leaves of Talispatra have carminative, expectorant, mast cell stabilizing, anti-inflammatory, antitussive, bronchodilator, antioxidant, antimicrobial, decongestant, antiseptic, astringent, anti-spasmodic, and anti-hyperglycemic proper-

ties. A decoction of the leaves of *A. webbiana* is used to manage cough, asthma, chronic bronchitis, hoarseness, and other pulmonary infections. Various studies have shown the antibacterial and anti-inflammatory properties of this herb [33,34]. The phytochemicals derived from *A. webbiana* include flavonoids, saponins, amino acids, tannins, alkaloids, lipids, triterpenoids, and steroids. It also contains monoterpenes, biflavonoid glycosides, and phytosterols. A study showed the antitussive activity of *A. webbiana* comparable to codeine phosphate [35].

Motha

Cyperus rotundus belongs to the family *Cyperaceae*. It is traditionally used as an analgesic, aromatic, astringent, diaphoretic, diuretic, antispasmodic, carminative, antitussive, sedative, stimulant, antibacterial, anti-allergic, anti-carcinogenic, antiemetic, antihistamine, antimalarial, antioxidant, antiplatelet, antipyretic, antiviral, and few more [36]. It shows the presence of alkaloids, flavonoids, tannins, glycosides, furfenchromones, starch, and sesquiterpenoids. It is widely used in the treatment of nausea, vomiting, dyspepsia, diarrhoea, fever, malaria, cough, and bronchitis. The major phytochemicals derived from the rhizomes are α -cyperone, α -rotunol, β -cyperone, β -rotunol, β -pinene, camphene, cyperene, cyperol, cyperenone, monoterpenes, sitosterol, fatty oil, and a few more [83]. Various studies reveal the anti-inflammatory and analgesic properties of this herb [37]. A study revealed the antibacterial potential of the root extracts of *C. rotundus* against *H. influenza*, *P. aeruginosa*, *S. pneumonia*, *S. aureus*, and *S. pyrogens* which commonly affect the respiratory system [38].

Vacha



Acorus calamus (Vacha) belongs to the family *Araceae*. It is traditionally used in different medicinal preparations for the treatment of asthma, sinusitis, bronchitis, fever, arthritis,

diarrhoea, dyspepsia, eczema, kidney and liver problems, and a lot more. The phytochemicals present in Vacha include glucoside (such as acorine, eugenol, pinene, camphene), alkaloid, volatile oil (such as calamen, clamenol), asarone, and sesquiterpenes. It shows antimicrobial, tranquillizing, antidiarrhoeal, antioxidant, spasmolytic, neuroprotective, antihistaminic, mast-cell stabilizing, bronchodilator, and many other medicinal properties [39]. Various studies have shown antibacterial, a bronchodilator, antihistaminic, and mast-cell stabilizing properties of this herb making it a useful herb in managing respiratory conditions like asthma and bronchitis [40]. Studies have shown α -asarone to possess anti-inflammatory properties that can alleviate asthma by inhibiting mast cell activation [41].

Saunf

Foeniculum vulgare is commonly known as fennel or saunf. It belongs to the family *Umbelliferae*. The phytochemicals derived from fennel include volatile compounds, flavonoids, phenolic compounds, fatty acids, and amino acids. Phenolic compounds contain neochlorogenic acid, chlorogenic acid, gallic acid, caffeic acid, p-coumaric acid, ferulic acid-7-O-glucoside, ferulic acid, hesperidin, cinnamic acid, rosmarinic acid, quercetin, apigenin, etc. It possesses pharmacologically important actions such as anti-ageing, anti-allergic, anti-inflammatory, antimicrobial, antiviral, anti-mutagenic, antioxidant, antipyretic, anti-nociceptive, expectorant, galactogenic, antispasmodic, antithrombotic, antitumor, hepatoprotective, and memory enhancing properties. It is used in the treatment of cough, cold, cuts, abdominal pain, vomiting, constipation, conjunctivitis, gastritis, fever, flatulence, mouth ulcers, kidney diseases, cancer, and a lot more [42]. Various studies have shown the anti-inflammatory, antioxidant, antimicrobial, and analgesic properties of this herb [43].

Ashwagandha

Withania somnifera belongs to the family *Solanaceae*. It is commonly known as Ashwagandha. The roots of ashwagandha smell like a horse (ashwa), the reason behind its name (the power of a horse). The phytochemicals derived from ashwagandha include

alkaloids, steroidal lactones, and saponins. Among alkaloids isopelletierine, cuseohygrine, Anaferine, and anahygrine are important. Major lactones include withanolides and withaferin, which are of medicinal importance. The various pharmacological properties of Ashwagandha include anti-inflammatory, immunomodulatory, antioxidant, anticancer, anxiolytic, antidepressant, stress-reliever, neuro-protective, analgesic, and a lot more^[44]. Various studies have shown immunomodulatory and anticancer properties of the roots of *W. somnifera*^[45,46]. A study shows the anti-inflammatory properties of *W. somnifera* on ovalbumin-induced airway inflammation^[47].

Menthol

Mentha piperita (peppermint) belongs to the family *Lamiaceae*, which is one of the most aromatic plant species. Phytochemicals derived from the mint family show anticancer properties against different cancers such as cervix, lung, breast, and much more in humans. The species of *Mentha* are rich in polyphenols and contain caffeic acid and its derivatives like caftaric acid, cinnamic acid, ferulic acid, and oleanolic acid. Flavonoids like luteolin and its derivatives apigenin, acacetin, thymonin, diosmin, and salvigenin are present in these plants. Of all the phytochemicals present, the essential oils of these species play an important role. *M. piperita* shows other pharmacologically essential activities such as antifungal, antiviral, anticancer, anti-inflammatory, and anti-allergic. Peppermint leaves act as a remedy for the common cold and inflammation of the mouth and respiratory tract^[48]. Various in vitro studies show smooth muscle relaxant properties of peppermint oil. These species contain high levels of antioxidants, including phenolic compounds, ascorbic acid, and carotenoids. The phenolic compounds show free radical scavenging properties. Several studies have shown the cooling effect of menthol, which can alleviate dyspnea. It also reduces physical and mental breathing effort, breathing discomfort, anxiety, and fear during inspiratory resistive loaded breathing^[49]. A study on *M. piperita* L. leaf extracts revealed strong antibacterial action against Gram-positive bacteria like *Staphylococcus*

aureus and *Bacillus subtilis* than Gram-negative *Escherichia coli*^[50].

CONCLUSION

A decoction of herbs with honey is an effective remedy for managing mild to severe symptoms of respiratory disorders. The multiple actions such as anti-allergic, anti-inflammatory, anti-microbial, immunomodulatory, expectorant, decongestant, antitussive, and antioxidant properties of these ingredients may provide synergistic effects in preventing and managing acute and chronic respiratory conditions.

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Source of Support: Nil

Conflict of Interest: None Declared

How to cite this URL:Kanchan B Jangid et al: Herbs for Preventing and Managing Acute and Chronic Respiratory Disorders. *International Ayurvedic Medical Journal* {online} 2022 {cited September 2022} Available from: http://www.iamj.in/posts/images/upload/3667_3675.pdf