

TRADITIONAL HERBAL MEDICINE AND SCIENTIFIC EVIDENCE IN THE MANAGEMENT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Herbal medicine, based on the use of medicinal plants for disease prevention and treatment, has been practiced for thousands of years in traditional systems such as Ayurveda and Traditional Chinese Medicine. Despite their widespread cultural acceptance and perceived safety, scientific validation of many herbal therapies remains limited. Increasing concerns regarding the cost, adverse effects, and symptomatic approach of allopathic medicines have renewed interest in herbal remedies, which are considered affordable, accessible, and time-tested.

Chronic Obstructive Pulmonary Disease (COPD) is a progressive and heterogeneous respiratory disorder characterized by persistent airflow limitation, chronic inflammation, and respiratory symptoms such as breathlessness and cough. Although COPD is incurable, early intervention and appropriate management can improve patient outcomes. Several medicinal plants traditionally used for respiratory disorders possess bronchodilatory, anti-inflammatory, antioxidant, and mucolytic properties. This review highlights the potential role of herbal medicines in the management of COPD and emphasizes the need for systematic scientific and clinical evaluation to support their safe and effective therapeutic use.

INTRODUCTION:

Herbal medicine is the use of medicinal plants for prevention and treatment of diseases: it ranges from traditional and popular medicines of every country to the use of standardized and triturated herbal extracts. Generally cultural root edness enduring and widespread use in a Traditional Medical System may indicate safety, but not efficacy of treatments,

especially in herbal medicine where tradition is almost completely based on remedies containing active principles at very low and ultra-low concentrations, or relying on magical-energetic principles (Firenzuoli & Gori, 2007).

The first documented records of herbal medicine use date back 5,000 years in China. Similarly, India's Ayurvedic

medicine tradition is thought to be more than 5,000 years old and herbal medicines remain an essential component of its practice. Today, the populations of certain countries still depend on herbal medicines to address their healthcare needs. Additionally an older adult populations are more likely to use both conventional drug therapy and herbal medicines. This population is also more likely to have a higher incidence of chronic disease, which more often than not requires the use of increasingly complex conventional drug therapy. At present, there is a dearth of research evaluating the use of herbal medicines, especially clinical trials (Rivera et al., 2013).

Although allopathy has been the most acceptable system of medicine over the years, people are now shifting back to the utilization of herbal medicine. This is due to the following setbacks of allopathic medicine:

- ✓ Its relief from ailments is only symptomatic
- ✓ It has serious and frustrating side effects
- ✓ It is very costly

Herbal medicine like ayurveda and homeopathy are preferred in these types of settings because of the following characteristic features:

- ✓ Less expensive and more reasonable
- ✓ Directly corresponds to the patient's beliefs
- ✓ More accessible
- ✓ Time tested
- ✓ Considered natural and safer
- ✓ Considered to have less or no side effects (Maniyar A. K, 2020)

Plant-based medicine that are used for the treatment of asthma is *Aleurites moluccana* (Zhang Y, 2015), medicine used for the treatment of COPD is *Glycyrrhiza glabra* (Salvi S, 2010), medicine used for the treatment of Diabetes mellitus is *Bauhinia forficata* (Modak M, 2007).

Chronic Obstructive Pulmonary Disease (COPD) is a type of

progressive lung disease characterized by chronic respiratory symptoms and airflow limitation (Global Initiative, 2021). COPD as a heterogeneous lung condition characterized by chronic respiratory symptoms (shortness of breath, cough, sputum production or exacerbations) due to abnormalities of the airways (bronchitis, bronchiolitis) or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction.

The main symptoms of COPD include shortness of breath and a cough, which may or may not produce mucus (Petty TL, 2006). COPD progressively worsens, with everyday activities such as walking or dressing becoming difficult (Raherison C, 2009). While COPD is incurable, it is preventable and treatable. The two most common types of COPD are emphysema and chronic bronchitis, and have been the two classic COPD phenotypes. However, this basic dogma has been challenged as varying degrees of co-existing emphysema, chronic bronchitis, and potentially significant vascular diseases have all been acknowledged in those with COPD, giving rise to the classification of other phenotypes or subtypes (Viegi G, 2010).

There are four grades based on spirometer testing:

- **Grade 1:** mild
- **Grade 2:** moderate
- **Grade 3:** severe
- **Grade 4:** very severe (Petty TL, 2002)

In addition to cigarette smoke, cigar smoke, pipe smoke, and secondhand smoke can cause COPD (Barberà JA., 2016)

REVIEW OF COPD:

Chronic Obstructive Pulmonary Disease (COPD) is a heterogeneous disease. Historically, two COPD phenotypes have been described: chronic bronchitis and emphysema. Chronic obstructive pulmonary disease (COPD) is a common

preventable and treatable disease, characterized by persistent airflow limitation, which is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases (Agusti A, 2024). COPD is expected to be the third leading cause of death. Although the prognosis of affected patients is improving with new treatment modalities, the mortality in these patients is still high (Barnes PJ, 2000).

COPD comprises both emphysema and chronic bronchitis. The majority of patients with COPD have both. Emphysema is when your alveoli become inflamed and damaged. The most common symptom is shortness of breath (dyspnea). Chronic bronchitis is inflaming your large airways. It makes your airways smaller which is shown in figure-1 and a lot of mucus is produced. The most common symptom is cough (Viegi G, 2001).

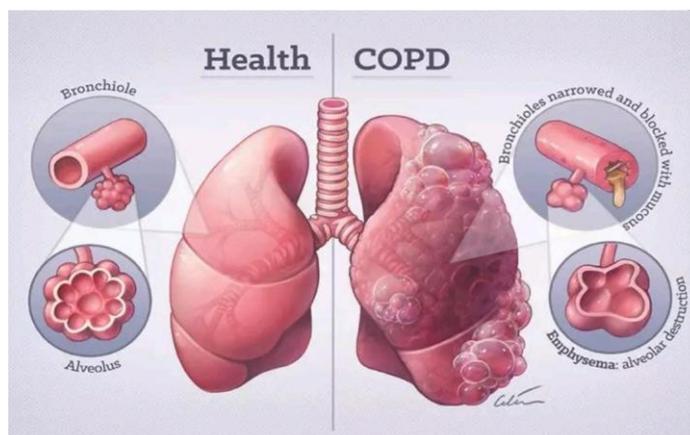


Figure-1 Healthy and affected lungs

Symptoms of COPD:

COPD symptoms don't typically happen until a lot of lung damage is done. COPD symptoms will gradually get worse, especially if exposure to smoke or other irritants goes on.

- ✓ Having trouble catching your breath, especially with exertion.
- ✓ Wheezing or whistling sound while breathing.
- ✓ Long-standing cough that may produce great amounts of mucus.
- ✓ The mucus is likely to be clear, white, yellow or greenish.
- ✓ Tightness or heaviness in the chest.
- ✓ Fatigue or severe tiredness.
- ✓ Frequent infections of the lung.
- ✓ Spontaneous loss of weight. This is achievable as the disease progresses.
- ✓ Swelling of ankles, feet or legs (Hillas G., 2015)

What causes COPD?

The main cause of COPD in developed countries is tobacco smoking. In the developing world, COPD often occurs in people exposed to fumes from burning fuel for cooking and heating in homes that don't have good airflow. Long-term exposure to chemical fumes, vapors and dusts in the workplace is another cause of COPD (Wouters EF, 2002).

These are the prime offenders of COPD:

1. **Tobacco Smoke:** This is by far the most prevalent cause. Smokers—particularly over decades—have far greater probabilities of getting COPD. Yet, not all smokers will get detectable symptoms, but nonetheless, lung damage can quietly happen over time.
2. **Indoor Air Pollution:** Most people in developing nations are exposed to biomass fuel smoke from burning wood, coal, or animal dung for heating

and cooking. These vapors bring about much irritation and with time destroy the lungs in poorly ventilated homes.

3. **Occupational Exposure:** In addition, exposure to dusty environments, chemical fumes, vapors, or smoke (e.g., construction site, factory, or mines) leads to chronic lung inflammation and raises COPD risk—particularly without safety equipment.
4. **Secondhand Smoke & Other Irritants:** Secondhand smoke, pipe smoke, cigar smoke, or tainted air exposure on a daily basis also leads to lung injury and raises other risk factors.
5. **Genetic Causes – Alpha-1 Antitrypsin (AAT) Deficiency:** Approximately 1% of COPD is caused by a genetic condition known as alpha-1 antitrypsin deficiency. Individuals who carry this condition are missing a protective protein, which protects the lungs from harm. Therefore, they can develop COPD or emphysema at an early age—even if they have never smoked. In certain instances, the condition also causes liver damage.
6. **Puzzlingly, not all smokers develop COPD:** That indicates that genetics and other personal characteristics—such as exposure to pollution in early life or childhood infections of the respiratory system—may affect who develops the disease. But even those with no symptoms at all can have compromised lung function and hidden damage from years of smoking (Fletcher C, 2023).

Systemic effects of COPD:

1. Weight loss and nutritional abnormalities:

Unexplained weight loss is one of the most often recognized systemic effects of COPD. It occurs in about 50% of patients with severe COPD, but it can be seen also in about 10–15% of patients with mild to moderate disease, and this is mostly due to loss of skeletal muscle mass. Weight loss

occurs whenever caloric intake and consumption are not matched (Sin DD., 2003)

2. Cardiovascular disease:

Atherosclerosis of coronary arteries is characterized by endothelial dysfunction and an inflammatory process in the atherome plaque with presence of macrophages, T cells and increased pro inflammatory cytokines and C reactive protein. It is remarkable to observe the similarities of cardiac inflammation with lung inflammation (Mannino DM, 2004).

3. Diabetes and glucose intolerance:

The risk of developing type-2 diabetes is increased 1.8 times in women with COPD as compared with those without (Barnes PJ, 1999). On the other hand, hyperglycaemia is associated with poor outcomes in patients admitted to hospital with exacerbations of the disease (Celli BR., 2004).

4. Osteoporosis and fractures:

Osteoporosis with subsequent fractures is a significant problem in patients with advanced COPD. Compared to controls without COPD, patients with COPD seen in primary care were at increased risk for osteoporosis and fractures (Tashkin DP., 2008).

5. Depression:

Depression in COPD patients leads to a lower quality of life, greater objective impairment in function, and decreased adherence to therapeutic interventions (Molfino NA, 2004).

Treatment of COPD:

Treatment plan for COPD includes a combination of prescription medication, pulmonary therapies, and healthy lifestyle changes to help relieve symptoms and slow disease progression.

COPD treatments include:

1. Medication:

Many people with COPD use a variety of prescription medications to help manage the disease, treat associated complications, or target specific

symptoms. Commonly prescribed medication for COPD like Bronchodilators, Corticosteroids (Inhaler, Nebulizer, Tablet and Injection), Antibiotics, Anti-anxiety drugs, Opioids etc.

2. Oxygen therapy:

Medical devices are available that can deliver oxygen to your lungs because COPD interferes with your ability to breathe so you cannot inhaling enough oxygen.

3. Surgery:

Surgery may be beneficial for a small percentage of people with COPD and is usually only an option in severe cases. Surgical procedures for severe COPD are bullectomy, Lung volume reduction surgery (LVRS), Lung transplants, and bronchial rheoplasty.

4. Healthy lifestyle changes:

- ✓ Cut back or quit smoking tobacco products
- ✓ Minimize exposure to air pollution
- ✓ Ensure adequate nutrition
- ✓ Develop a movement practice(Exercise) (Kamboj VP, 2000)

REVIEW OF HERBAL PLANT:

Medicinal plants have been used from the Vedic era. For thousands of years, they have been used to treat and prevent many types of diseases along with epidemics (Sharma A, 2017) . Medicinal plants have been playing an essential role in the development of human culture. As a source of medicine, Medicinal plants have always been at forefront virtually all cultures of civilizations. Medicinal plants are regarded as rich resources of traditional medicines and from these plants many of the modern medicines are produced. The secondary metabolites produced by the plants are usually responsible for the biological characteristics of plant species used throughout the world. The microbial growth in diverse situations is controlled by

plant derived products (Sandelowsky H, 2021).

Plant used to treat COPD:

Ginger, echinacea, and curcumin are some of the herbs that you may hear about when looking into natural remedies for chronic obstructive pulmonary disease (COPD). There is no cure for COPD, but its progression can be slowed with proven treatments like prescription medications, lung therapy, surgery, and lifestyle changes (Nair V, 2011).

1. Licorice root:

Liquorice is an herbaceous perennial plant. Licorice root [figure-2] also comes in pill form or as a liquid extract, and it can be found with glycyrrhizin (the main, sweet-tasting compound in licorice) removed. Some research suggests that glycyrrhizin may improve the benefit of beta-2 agonist bronchodilators (for example, albuterol) in people with COPD (Shah S, 2017). In terms of side effects, large amounts of licorice root containing glycyrrhizin may cause high blood pressure, sodium and water retention, and low potassium levels, which may lead to heart and muscle problems. Pregnant women should avoid excessive licorice intake, according to one observational study that reported association with future health problems in children (Akram M, 2017).



Figure-2 Licorice root

Botanical Name: *Glycyrrhiza glabra* Linn.

Biological Source: The drug consists of the dried, peeled or unpeeled roots and stolons of the plant.

Family: Leguminosae (also known as Fabaceae).

Habit: It is an herbaceous perennial plant that grows up to 1 meter (40 inches) in height, with a robust, extensive, and highly developed subterranean root and stolon system.

Plant Property (Medicinal): It possesses demulcent, expectorant, anti-inflammatory, anti-ulcer, and antiviral properties. The main active constituent is glycyrrhizin, which is 30–50 times sweeter than sugar and gives the root its characteristic sweet taste.

2. Thyme:

Thymus vulgaris is an effective decongestant and antioxidant and is often used in treating respiratory conditions (Tsuda T, 2009). Thyme extract increased the cilia beating frequency (CBF) in an in vitro model of a human COPD airway. Cilia are microscopic filaments that line the respiratory tract and help clear mucus from the airway, and they are often damaged in cases of COPD. Thyme leaves [figure-3] are useful to treat COPD.



Figure-3 Thyme plant

Botanical name: *Thymus vulgaris*

Biological Source: Thyme comes from the genus *Thymus*, a group of aromatic herbs in the mint family (Lamiaceae), with *Thymus vulgaris* (common thyme) being the most widely used culinary and medicinal species, native to the Mediterranean region

Family: Lamiaceae

Habit: Perennial aromatic herb / small shrub

Plant property: Expectorant, Antispasmodic, Antimicrobial, Carminative

3. Curcumin:

The primary active ingredient in turmeric [figure-4] (*Curcuma longa*), curcumin is a highly potent anti-inflammatory compound that may reduce airway inflammation (Dodd JW, 2010). COPD patients who took curcumin as part of their diet had greatly reduced instances of a specific type of colonizing bacteria, non-typeable *Haemophilus influenzae* (NTHi), which they believe causes the inflamed airways commonly seen in the disease (Cochrane, 2005).



Figure 4: Curcumin rhizomes

Botanical Name: *Curcuma longa* Linn. (syn. *Curcuma domestica* Valetton)

Biological Source: The dried or fresh rhizome (underground stem) of the *Curcuma longa* plant

Family: Zingiberaceae (the ginger family)

Habit: A rhizomatous, herbaceous perennial plant that grows up to 1 meter (3 feet) in height with long, oblong leaves and a short false stem formed by the leaf sheaths.

Plant Property: Known for significant anti-inflammatory, antioxidant, and antimicrobial properties, largely due to the active compound curcumin. It is widely used in culinary and traditional medicine as a spice, coloring agent, and therapeutic herb.

4. Echinacea:

Echinacea [Figure-5] has traditionally been used to help prevent upper respiratory infections related to the flu and the

common cold (Yarnell E, 2010). *Echinacea purpurea* (along with vitamin D, selenium, and zinc) could relieve COPD exacerbations triggered by upper respiratory infections (Li X, 2014).



Figure-5
Echinacea

Botanical name: *Echinacea purpurea* (L.) Moench (Other medicinal species: *Echinacea angustifolia*, *Echinacea pallida*)
Biological source: It consists of the dried roots and aerial parts of *Echinacea purpurea* or related species.
Family: Asteraceae (Compositae)
Habit: Perennial herb Erect plant with rough, hairy stems. Produces purple, cone-shaped flowers
Plant properties: Immunostimulant, Anti-inflammatory, Antimicrobial (antibacterial & antiviral), Antioxidant, Wound healing property.

5. Ginseng:

Traditional Chinese medicine believes that ginseng has unique healing powers related to its anti-inflammatory and antioxidant effects (Bauer R, 2010). Asian ginseng may affect blood sugar and blood pressure. Asian ginseng may also interact with certain medications, like blood thinners (Dog TL, 2010). Ginseng root [Figure-6] used for the treatment of COPD.



Figure-6 Ginseng root

Botanical name: *Panax ginseng*
Biological source: Ginseng consists of the dried roots and rhizomes of *Panax ginseng*
Family: Araliaceae
Habit: Perennial herb
Plant property : Adaptogen, Tonic, Immunomodulator, Anti-stress, Mild CNS stimulant

6. Ginger:

This spicy herb is also thought to be extremely beneficial to lung health, as many believe it contains powerful antioxidants and natural antibiotics to help our bodies fight off infection. Ginger [Figure-7] may also help eliminate congestion, as well as ease sore throats. Few mild side effects have been reported including abdominal discomfort, heartburn, diarrhea, and gas. Furthermore, there is a concern that ginger may interact with blood thinners. Some experts also recommend that people with gallstone disease avoid or limit ginger use because it can increase bile flow (Bhatia J, 2021).



Figure-7 Ginger

Botanical name: *Zingiber officinale*
Roscoe

Biological source: Ginger consists of the fresh or dried rhizomes of *Zingiber officinale* Roscoe.

Family: Zingiberaceae

Habit: Perennial herb

Plant properties: Antioxidant, Anti-inflammatory, Antiemetic (anti-nausea and anti-vomiting), Antimicrobial, Carminative (reduces gas) and stimulant properties

7. Ivy leaf:

Ivy leaf (*Hedera helix*) [Figure-8] extract preparations are widely used over-the-counter, non-antibiotic cough remedies authorized by the European Medicines Agency. Ivy leaf extract contains saponins which are believed to have expectorant properties. In vitro studies of ivy mono-preparations show evidence of potential antispasmodic and bronchodilating activity, anti-inflammatory effects, and antitussive properties (Ligade S, 2018).



Figure-8 Ivy leaf

Botanical Name: *Hedera helix* L.

Biological Source: The leaves of the plant *Hedera helix*, commonly known as common ivy or English ivy.

Family: Araliaceae (ginseng family)

Habit: An evergreen, perennial, woody climbing vine or ground cover that clings to surfaces using small aerial rootlets.

Plant Property: The leaves contain saponins and flavonoids which have expectorant, mucolytic, antispasmodic, anti-inflammatory, and bronchodilatory

properties. It is primarily used to treat coughs, acute bronchitis, and other respiratory problems associated with intense mucus formation.

8. Tulsi:

Tulsi is commonly identified as the "Queen of Herbs". Tulsi has been traditionally employed to alleviate conditions such as asthma, bronchitis, influenza, cough, and the common cold. Tulsi leaves [Figure-9] are very useful to treat COPD. The herb is known for its unique physiologically active compounds like eugenol, unsolid acid and camphor, which hold anti-inflammatory, antimicrobial, antiviral, and immunomodulatory qualities, making it highly effective in managing respiratory disorders (Ahmad S, 2014).

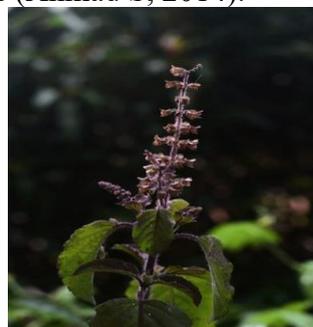


Figure-9 Tulsi

Botanical Name: *Ocimum sanctum* (Holy Basil)

Biological source: Tulsi consists of the fresh and dried leaves of *Ocimum sanctum* Linn.

Family: Lamiaceae

Habit: Erect, aromatic, perennial herb or undershrub

Plant property: Adaptogenic, Immunomodulatory, Antimicrobial, Anti-inflammatory, Antioxidant, Antipyretic, Expectorant, Antistress, Carminative

Traditional medicinal plants used in the treatment of COPD:

S.No	Botanical Name	Common Name	Family	Part use	Plant Properties
1	<i>Glycyrrhiza glabra</i>	Liquorice	Leguminosae	Root	Demulcent, expectorant, anti-inflammatory, anti-ulcer, antiviral and pharmacological management of COPD; contains glycyrrhizin, 30–50× sweeter than sugar.
2	<i>Thymus vulgaris</i>	Thyme	Lamiaceae	aerial parts	Expectorant, c , Antispasmodic, Antimicrobial, Carminative
3	<i>Curcuma longa</i> Linn	Turmeric	Zingiberaceae	Underground stem	Has strong anti-inflammatory, COPD care, antioxidant, and antimicrobial effects due to curcumin; widely used as a spice, coloring agent, and medicinal herb.
4	<i>Echinacea purpurea</i>	Coneflower	Asteraceae	leaves, flowers, stems	Chronic breathing disorder controller, Immunostimulant, Anti-inflammatory, Antimicrobial (antibacterial & antiviral), Antioxidant, Wound healing property
5	<i>Panax ginseng</i>	Ginseng	Araliaceae	Root and stem	Adaptogen, Tonic, Immunomodulator, Anti-stress, pharmacological management of COPD Mild CNS stimulant
6	<i>Zingiber officinale</i> Roscoe	Ginger	Zingiberaceae	underground stem	Antioxidant, Anti-inflammatory, COPD treatment, Antiemetic (anti-nausea and anti-vomiting), Antimicrobial, Carminative (reduces gas) and stimulant properties
7	<i>Hedera helix</i> L.	Ivy leaf	Araliaceae	leaves	Leaves contain saponins and flavonoids with expectorant, mucolytic, antispasmodic, anti-inflammatory, and bronchodilatory effects; used for COPD, cough, bronchitis, and mucus-related respiratory disorders.

8	<i>Ocimum sanctum</i>	Tulsi	Lamiaceae	leaves	Adaptogenic, Immunomodulatory, Chronic breathing disorder controller, Antimicrobial, Anti-inflammatory, Antioxidant, Antipyretic, Expectorant, Antistress, Carminative
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CONCLUSION:

Chronic Obstructive Pulmonary Disease (COPD) is a progressive, preventable, and treatable respiratory disorder marked by persistent airflow limitation, chronic inflammation, and systemic complications that significantly reduce quality of life. Although conventional allopathic treatments such as bronchodilators, corticosteroids, oxygen therapy, and surgical interventions remain the mainstay of COPD management, they often provide only symptomatic relief and may be associated with high cost and adverse effects. This has renewed interest in herbal medicine, which has been an integral part of traditional healthcare systems like Ayurveda and traditional Chinese medicine for thousands of years. Medicinal plants offer supportive benefits due to their anti-inflammatory, antioxidant, expectorant, bronchodilatory, antimicrobial, and immunomodulatory properties. Herbs such as *Glycyrrhiza glabra* (licorice), *Thymus vulgaris* (thyme), *Curcuma longa* (turmeric), *Echinacea purpurea*, *Panax ginseng*, *Zingiber officinale* (ginger), *Hedera helix* (ivy leaf), and *Ocimum sanctum* (tulsi) have demonstrated potential in reducing airway inflammation, enhancing mucus clearance, strengthening immune function, and alleviating respiratory symptoms. Herbal medicines are generally considered safer, more affordable, and culturally acceptable, making them valuable as complementary therapies in COPD management. However, despite their long-standing traditional use, scientific evidence from well-designed clinical trials remains limited. Therefore, further research is essential to standardize

herbal formulations, establish appropriate dosages, evaluate long-term safety, and validate their therapeutic efficacy, enabling their rational integration into modern COPD treatment strategies.

REFERENCES:

1. Agustí A, et al. Precision medicine and treatable traits in COPD. *Front Med.* 2024;11:1375457.
2. Ahmad S, et al. Phytotherapy in chronic respiratory disorders. *Int J Pharm Sci Rev Res.* 2014;25(2):180–189.
3. Akram M, et al. Medicinal plants for respiratory diseases. *J Ethnopharmacol.* 2017;202:1–15.
4. Barberà JA, Blanco I. Chronic obstructive pulmonary disease (COPD). In: Pulmonary circulation. Boca Raton: CRC Press; 2016. p. 497–508.
5. Barnes PJ. Chronic obstructive pulmonary disease. *N Engl J Med.* 1999;343(4):269–280.
6. Barnes PJ. Mechanisms in COPD. *Am J Respir Crit Care Med.* 2000;161(2 Suppl):S70–S76.
7. Bauer R, Woelkart K. Echinacea species. In: Coates PM, Betz JM, Blackman MR, et al., editors. *Encyclopedia of Dietary Supplements.* 2nd ed. New York: Informa Healthcare; 2010. p. 226–234.
8. Bhatia J, et al. Role of herbal medicines in inflammatory lung diseases. *J Tradit Complement Med.* 2021;11(3):250–260.

9. Celli BR, MacNee W. Standards for the diagnosis and treatment of patients with COPD. *Eur Respir J*. 2004;23(6):932–946.
10. Cochrane Airways Group. Bronchodilators for COPD. *Cochrane Database Syst Rev*. 2005;(2):CD000530.
11. Dodd JW, Getov SV, Jones PW. Cognitive function in COPD. *Eur Respir J*. 2010;35(4):913–922.
12. Dog TL. Ginger. In: Coates PM, Betz JM, Blackman MR, et al., editors. *Encyclopedia of Dietary Supplements*. 2nd ed. New York: Informa Healthcare; 2010. p. 325–331.
13. Fletcher C, Peto R. The natural history of chronic airflow obstruction. *Br Med J*. 1977;1(6077):1645–1648.
14. Firenzuoli F, Gori L. Herbal medicine today: Clinical and research issues. *Evid Based Complement Alternat Med*. 2007;4:594728.
15. Global Initiative for Chronic Obstructive Lung Disease (GOLD). *Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease*. 2021 report.
16. Hillas G, Perlikos F, Tsiligianni I, Tzanakis N. Managing comorbidities in COPD. *Int J Chron Obstruct Pulmon Dis*. 2015;10:95–109.
17. Kamboj VP. Herbal medicine. *Curr Sci*. 2000;78(1):35–39.
18. Li X, et al. Herbal medicine for chronic respiratory disease. *Chin Med*. 2014;9:20.
19. Ligade S, et al. Herbal formulations in pulmonary diseases: A review. *Int J Pharm Res Dev*. 2018;10(8):3988–3999.
20. Mannino DM, et al. COPD and asthma in patients with diabetes mellitus. *Diabetes Care*. 2004;27(10):2478–2483.
21. Maniyar AK. European Journal of Molecular & Clinical Medicine. 2020;7(7).
22. Modak M, et al. Herbal medicines for diabetes mellitus: A review. *J Ethnopharmacol*. 2007;109(1):1–15.
23. Molfino NA. Genetics of COPD. *Chest*. 2004;125(5):1929–1940.
24. Nair V, et al. Anti-inflammatory activity of medicinal plants. *Biol Pharm Bull*. 2011;34(5):609–614.
25. Petty TL. COPD in perspective. *Chest*. 2002;121(5 Suppl):116S–120S.
26. Petty TL. The history of COPD. *Int J Chron Obstruct Pulmon Dis*. 2006;1(1):3–14.
27. Raheison C, Girodet PO. Epidemiology of COPD. *Eur Respir Rev*. 2009;18(114):213–221.
28. Rivera JO, Loya AM, Ceballos R. Use of herbal medicines and implications for conventional drug therapy. *Altern Integr Med*. 2013;2:130.
29. Salvi S, Barnes PJ. Is exposure to biomass smoke the biggest risk factor for COPD globally? *Chest*. 2010;138(1):3–6.
30. Sandelowsky H, et al. COPD—do the right thing. *BMC Fam Pract*. 2021;22(1):244.
31. Shah S, et al. Herbal medicines and oxidative stress. *Am J Epidemiol*. 2017;185(5):317–326.
32. Sharma A, et al. Traditional medicinal plants used in respiratory disorders. *Phytotherapies*. 2017;6(6):326–332.
33. Sin DD, Man SF. Why are patients with COPD at increased risk of cardiovascular diseases? *Circulation*. 2003;107(11):1514–1519.
34. Tashkin DP, et al. Long-term management of COPD. *COPD*. 2008;5(4):215–228.
35. Tsuda T, et al. Antioxidant mechanisms of plant flavonoids.

- Carcinogenesis*.
2009;30(11):1949–1955.
36. Viegi G, Pistelli F, Sherrill DL, Maio S, Baldacci S, Carrozzi L. Definition, epidemiology and natural history of COPD. *Eur Respir J*. 2007;30(5):993–1013.
 37. Viegi G, Scognamiglio A, Baldacci S, Pistelli F, Carrozzi L. Epidemiology of chronic obstructive pulmonary disease (COPD). *Respiration*. 2001;68(1):4–19.
 38. Wouters EF, Creutzberg EC, Schols AM. Systemic effects in COPD. *Chest*. 2002;121(5 Suppl):127S–130S.
 39. Yarnell E, Abascal K. Botanical treatments for respiratory diseases. *Phytother Res*. 2010;24(1):1–12.
 40. Zhang Y, et al. Global epidemiology and burden of COPD. *BMC Pulm Med*. 2015;15:5.