

A GENERAL REVIEW ARTICLE ON THERAPEUTIC POTENTIAL OF GINGER IN RESPIRATORY DISORDER

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ABSTRACT

Ginger, which is known as *Zingiber officinale*, has certain active compounds called bioactive phenolics, especially 6-gingerol, 8-gingerol, and 6-shogaol. These compounds have properties that help reduce inflammation, fight oxidative stress, stop viruses, and help open up the airways, which can be helpful for people with breathing problems. Studies done in the lab show that extracts from ginger and its individual parts can lower inflammation in the airways by blocking substances like TNF- α , IL-1 β , and NF- κ B. They also help reduce the amount of harmful chemicals that are produced in the body. These compounds in ginger also help relax the muscles around the airways by managing the levels of calcium inside cells, making the effects of bronchodilators stronger, and improving the ability of airways to open up. In animal studies, when ginger or 6-shogaol is given, it helps reduce the number of eosinophils, lowers levels of inflammatory proteins, and improves the structure of the lungs in cases of allergic airway inflammation and sudden lung injury. Tests done in the lab also show that fresh ginger has the ability to fight some respiratory viruses, which could be useful during viral infections like the common cold or flu. Although there is not much human study yet, some early reports suggest that taking ginger by mouth can improve symptoms of asthma and change the levels of certain proteins related to asthma in a better way. Ginger is usually safe to take in amounts that are part of normal food or in supplement form, but more research is needed to find out the best way to take it, how much is safe, and what specific breathing conditions it could help with. Taken all together, these findings suggest that ginger could be a helpful addition to treatments for breathing problems, and more highquality studies are needed to confirm this.

Keywords: Ginger; *Zingiber officinale*; bioactive phenolics; 6-gingerol; 8-gingerol; 6-shogaol; anti-inflammatory activity; antioxidant effects; antiviral activity; bronchodilation; airway inflammation; TNF- α inhibition; IL-1 β suppression; NF- κ B pathway; oxidative stress; calcium regulation; eosinophil reduction; allergic airway inflammation; acute lung injury; respiratory viruses; asthma symptom improvement; respiratory disorders; therapeutic potential.

1. INTRODUCTION

Respiratory conditions like asthma, chronic obstructive pulmonary disease (COPD), allergic airway inflammation, acute lung injury, and viral respiratory infections continue to be significant global health problems because they often last a long time and current treatment options have their shortcomings [1]. While corticosteroids and bronchodilators are commonly used, problems such as side effects, resistance to steroids, and inadequate control of symptoms have led to more interest in safer, plant-based treatments that can be used alongside existing therapies [2]. Among the plantbased options, *Zingiber officinale*, or ginger, has gained attention because of its long use in traditional medicine and the variety of bioactive chemicals it contains. Ginger has more than 100 biologically active components, with gingerols, shogaols, and paradols being the most important for its medicinal effects [1]. These compounds have various therapeutic actions, including anti-inflammatory, antioxidant, immune-modulating, antiviral, and bronchodilating properties, which make ginger a good choice for treating complex respiratory diseases [3]. Studies in animals and cells show that ginger can reduce airway inflammation by lowering cytokines like TNF- α and IL-1 β , changing NF- κ B pathways, and decreasing oxidative stress in lung tissues [3]. Also, certain components of ginger, such as 6-gingerol and 6-shogaol, help relax airway muscles by controlling calcium levels and boosting the effectiveness of bronchodilators that are triggered by β -agonists [2]. There is increasing evidence from animal and cell-based studies that ginger can help with allergic airway inflammation, stop viruses from attaching to respiratory cells, and decrease airway sensitivity [5]. Although there is not much clinical data from human studies yet, recent small-scale trials show that taking ginger can improve asthma symptoms and affect markers of inflammation [4]. Overall, these results suggest that ginger could be a helpful addition in treating respiratory disorders, and more clinical research is needed to explore its full potential [1].



Figure 1: Ginger (*Zingiber officinale*)

1.1 MORPHOLOGY OF GINGER: (*Zingiber officinale*)

Zingiber officinale is a plant that lives for more than one year. It grows from an underground, thick, fleshy part called a rhizome. This rhizome acts as a storage organ and also helps the plant reproduce without seeds. From the rhizome, shoots grow upward, forming a structure that looks like a stem. This stem-like structure is made of tightly wrapped leaf sheaths. There are no real, hard wood stems. This kind of growth helps the plant survive tough conditions by staying underground and quickly regrowing when the environment improves.[7]

(a) Rhizome – External Morphology and Macroscopic Characters

Size and shapes: Each part of the rhizome, called a “finger,” can vary in size depending on the type of ginger, its age, and growing conditions.

Surface & Color: The outer layer is dry and has a brown or beige color. When peeled, the inside is light yellow or cream. The rhizome has a strong smell because of oils inside it.

(b) Rhizome Anatomy (Transverse/Longitudinal Features – Macroscopic to Microscopic

Cortex and Vascular System: Inside the rhizome, there is a layer of soft cells that contain starch grains. There are small groups of vascular tissue, but not a full ring. In some growth stages, there is a central part called the pith.

Secretory Structures: The rhizome has special cells that produce oils and chemicals, such as 6-gingerol, 8-gingerol, and 6-shogaol. These compounds give ginger its distinctive smell and taste. These features can be seen in samples and are used to identify ginger in studies.

Storage Products: There are many starch grains in the soft tissues, which are key features used to identify ginger in medicine. These features explain why ginger is used in medicine and how it is tested for quality [6].

(c) Pseudostems (Aerial Shoots)

Structure: The rhizome doesn't have real stems. Instead, the structure that looks like a stem is made of tightly rolled leaf sheaths. Each pseudostem grows from a point on the rhizome.

Height & Habit: Plants usually grow pseudostems that are around 60 to 100 cm tall. The height depends on the type of ginger and growing conditions. The pseudostem supports the leaves and, in flowering plants, the flower cluster [6].

Adaptive Significance: The rolled sheaths protect the inner parts and help keep moisture in. They also allow the plant to grow quickly when conditions are good.

(d) Leaves – Morphology and Arrangement

Phyllotaxy: Leaves grow one by one on opposite sides of the stem (distichous), which is a common feature in the ginger family.

Shape & Dimensions: The leaves are long and narrow, about 15 to 30 cm long and 2 to 3 cm wide. They taper to a point at the tip. The surface is smooth with parallel veins and a central vein.

Sheath & Ligule: The base of each leaf forms a long sheath that wraps around the pseudostem. Some varieties have a small stalk-like part called a pseudopetiole. **Surface Characteristics:** The top surface is darker green and smooth. The leaves help the plant make its own food, which supports the rhizome. [7]

(e) Inflorescence and Flowering Shoots

Origin: Flower clusters grow from small shoots that develop directly from the rhizome, not from the pseudostem. Flowering shoots can appear in the same season as leafy shoots or under specific environmental conditions.

Type & Structure: The flowering cluster is a tight, cone-shaped or cylinder-shaped structure on a short stalk. It has overlapping leaf-like parts (bracts) that cover the individual flowers. The bracts can be green, yellow, or have a purple tint.

Significance: Many types of ginger don't flower well or produce few seeds. So, the flower clusters are more important for identifying the plant than for growing new plants in cultivation. [6]

(f) Flowers — detailed and floral structure

Symmetry and parts: The flowers have a kind of symmetry called zygomorphic, which means they look the same on both sides if you split them down the middle. This is typical in the ginger family. The corolla, which is the part that looks like petals, is shaped like a tube and has three lobes. The labellum is a special part of the flower and is made from modified stamens called staminodes. It is often very noticeable and has colors like purple or red with yellow patterns, which helps attract pollinators. Androecium and gynoecium: Usually, there is one stamen that produces pollen, and the other stamens are transformed into staminodes that help form the labellum. The single pistil is made up of an ovary, a style, and a stigma. Reproduction notes: In many types of ginger grown for commercial use, natural seed formation is very rare. If seeds are produced, they are often not viable or are sterile, so the main way to grow ginger is by using vegetative methods. [6]

(g) Root system

Type and function: The roots are thin and fibrous, growing from the nodes of the rhizome. They help hold the plant in place and absorb water and nutrients. Unlike the rhizome, they don't store food. [7]

(h) Reproduction and propagation

Vegetative propagation: This is the main method used. By planting pieces of the rhizome that have at least one bud or eye, new plants are grown that are genetically the same as the parent plant. This is useful for keeping the plant's chemical makeup and farming traits consistent.

Sexual reproduction: Flowering and seed production are not common in cultivated ginger, so sexual reproduction isn't a major part of growing ginger. [6]

(f) Diagnostic and pharmacognostic features (why shape matters for review)

Morphological signs for identification: A fleshy, fragrant rhizome, lateral branches, a pale yellow outer layer, and the presence of starch grains and oil cells when viewed under a microscope are used to confirm the identity of raw medicinal material and to spot fake products.

Anatomical signs for quality control: Microscopic traits like starch grains, oil cells, and the arrangement of vascular bundles, along with visible signs like rhizome color, scent, and texture, are part of official descriptions. These help ensure medicinal qualities remain consistent. [6]

(g) 11. Differences between plant varieties and environmental effects

Variety differences: The size of the rhizome, how it branches, the strength of the aroma, and the levels of gingerols and shogaols can vary between plant varieties and local types. These differences in form are connected to the chemical profiles used in research and business.

Environmental influence: Soil type, temperature, rainfall, and farming methods affect the growth of the rhizome (like size and fiber content) and the production of chemical compounds. So, the shape of the plant is influenced by both genes and the environment. [7]



Figure 2: Morphology of Crude Drug Ginger

1.2 HISTORICAL AND TRADITIONAL USE:

Ginger (*Zingiber officinale*) has been used for thousands of years as one of the most valued medicinal and culinary plants in Asian, Middle Eastern, and Mediterranean cultures.

Historical records show that ginger was grown in South and Southeast Asia as far back as 3000 years ago, making it one of the oldest known herbal remedies in traditional medicine systems [8].

(a) Use in Ancient Indian (Ayurvedic) Medicine

In Ayurveda, ginger is known as “Vishwa Bheshaja,” which means “universal medicine” because of its wide range of health benefits. Classical Ayurvedic texts talk about how ginger helps with breathing issues, digestion, inflammation, and blood circulation. It was used to treat cough, cold, asthma, sore throat, and stuffy nose, often in the form of teas, pastes, and steam inhalations [8].

Ginger was also used as a digestion booster to improve the digestive fire called agni. It was prescribed for nausea, motion sickness, and stomach discomfort.

(b) Use in Traditional Chinese Medicine (TCM)

In Chinese medicine, ginger (Sheng Jiang) is mentioned in the ancient medicine book “Shen Nong Ben Cao Jing” (around 200–300 AD). It was classified as a warming herb used to fight cold, treat cough, clear mucus, and warm the lungs and stomach [8,9].

Fresh ginger was used for cold-related breathing problems, while dried ginger (Gan Jiang) was used for long-term breathing issues, lung congestion, and weak digestion. TCM doctors used ginger a lot in treatments for fever, flu, and symptoms similar to asthma.

(c) Use in Middle Eastern and Greco-Arab Medicine (Unani System)

In Unani medicine, ginger (Zanjabil) has been used for a long time to treat respiratory infections, throat issues, digestion problems, and sexual health [9].

Famous Persian and Arab doctors like Ibn Sina (Avicenna) described ginger as a warming, mucus-clearing, and anti-inflammatory herb that helps with conditions like catarrh, cough, and lung congestion. Ginger was commonly included in herbal powders, syrups, and medicinal mixtures.

(d) Traditional Uses in Southeast Asia

Southeast Asian cultures like Indonesia, Malaysia, and Thailand used ginger in their traditional healing systems like jamu.

Ginger was used for:

- Relief from colds, flu, and sore throat
- Recovery after childbirth
- Improving digestion
- Reducing inflammation and pain

These regions used ginger in poultices, teas, and steam therapy to clear the respiratory system [9].

(e) Use in African and Caribbean Traditional Medicine

In African herbal practices, ginger has been used for a long time to treat cold symptoms, chest congestion, sore throat, and infections. Ginger tea or honey mixtures were seen as good for clearing mucus. In the Caribbean, ginger tea was used to treat upper respiratory infections, fever, and cough, as well as for digestion and reducing inflammation [8].

(f) Introduction to Europe and Western Traditional Use

Ginger reached Europe through the spice trade during the Roman Empire and became highly valued after black pepper. Medieval European doctors used ginger to treat respiratory problems, digestion issues, weakness, and circulation problems [8,9].

By the 16th century, ginger was included in Western herbal medicine books for:

- Cough and cold relief
- Warming the body
- Improving blood flow
- Soothing sore throat and chest congestion

1.3 MECHANISMS OF ACTION:

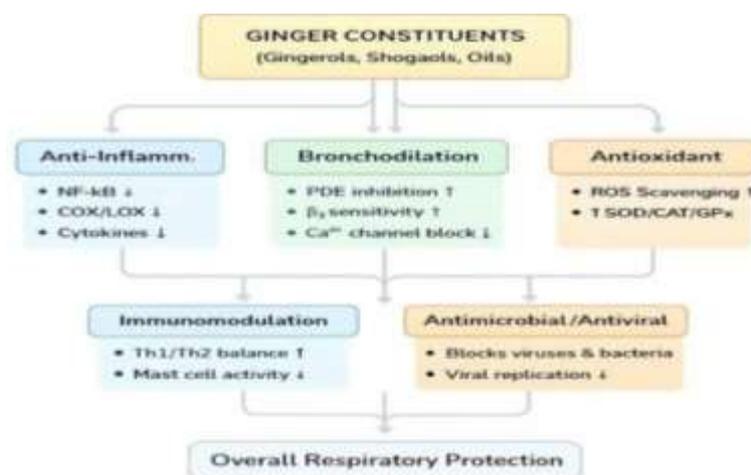


Figure 3: Mechanism of Action of Ginger In Respiratory Disorder.

Ginger has shown promise in treating respiratory problems because it contains special chemicals. The main active ingredients, gingerols and shogaols, work by reducing inflammation. They do this by stopping certain proteins and enzymes, such as cyclooxygenase (COX) and lipoxygenase (LOX), which are involved in causing inflammation. This helps lower the body's inflammatory response, which is often connected to conditions like asthma, bronchitis, and other breathing issues [10].

Additionally, ginger also has antioxidant properties that help fight oxidative stress, which is common in long-term lung diseases. It works by removing harmful free radicals and improving the body's natural ability to protect itself from damage. This supports lung health and helps prevent tissue damage [10,11].

1.4 CLINICAL APPLICATIONS:

Ginger (*Zingiber officinale*) has been increasingly studied in clinical trials and human studies for its benefits in various respiratory conditions. It is used for its anti-inflammatory, anti-allergic, bronchodilator, antimicrobial, and antioxidant properties. **(a) Asthma Management**

Clinical studies suggest that ginger can help improve symptoms and airway function in people with asthma.

- **Reduction of Airway Inflammation**

Taking ginger has been shown to significantly lower levels of inflammatory markers like IL-4, IL-5, and TNF- α in asthma patients, which helps improve airway patency.

- **Improvement of Lung Function (FEV1, FVC)**

A randomized clinical trial found that ginger extract improved forced expiratory volume (FEV1) and forced vital capacity (FVC) in people with mild to moderate asthma.

- **Enhancement of Response to β 2-Agonists**

Research indicates that ginger can enhance the bronchodilatory effect of albuterol, helping relax the muscles in the airways.[12]

(b) Allergic Rhinitis (Seasonal Allergy)

- **Reduction of Nasal Congestion & Sneezing**

A clinical trial comparing ginger to loratadine showed that ginger was just as effective in reducing nasal congestion, sneezing, and itching.

- **Control of IgE-Mediated Symptoms**

Ginger treatment led to lower levels of IgE in the blood, which helps reduce allergic respiratory symptoms.[13]

(c) Acute Respiratory Infections (Common Cold, Flu)

- **Relief of Cough, Sore Throat & Congestion**

Studies show that ginger tea or extracts can help relieve symptoms of upper respiratory infections by reducing throat irritation and coughing.

- **Antiviral Activity Against Respiratory Viruses**

Fresh ginger has been found to have antiviral effects against the human respiratory syncytial virus (HRSV) in human airway cells.

- **Reduction of Symptom Duration**

Using ginger along with honey or lemon has been shown to shorten the duration of common cold symptoms in clinical settings.[14]

(c) Chronic Obstructive Pulmonary Disease (COPD)

- **Improvement in Breathing & Reduced Exacerbations**

Clinical evidence suggests that ginger can help reduce breathlessness and improve quality of life for COPD patients by decreasing airway inflammation. □ **Antioxidant Support**

Ginger supplementation has been found to improve oxidative stress markers, such as increased SOD and decreased MDA, which are linked to the progression of COPD.[13]

(d) Bronchitis (Acute & Chronic)

- **Soothing of Inflamed Airways**

Studies indicate that ginger can reduce bronchial inflammation and mucus production, providing relief for people with chronic bronchitis. □ **Expectorant Activity**

It supports the body's natural ability to clear mucus from the airways, allowing patients to cough up mucus more easily.[12]

(e) Anti-Tussive (Cough-Suppressant) Activity

- **Reduction in Cough Frequency**

Clinical trials have found that ginger can significantly reduce the sensitivity of the cough reflex in people with upper respiratory tract infections.

- **Improved Throat Comfort**

Ginger lozenges have been found to decrease throat irritation and promote smoother airway movement.[14]

(f) Post-Viral Respiratory Inflammation (Including Post-COVID Symptoms)

- **Relief of Persistent Cough & Fatigue**

Clinical observations suggest that ginger can help relieve persistent cough, inflammation, and breathing difficulties in people recovering from viral infections, including those who had COVID-19.

- **Lung Recovery Support**

Ginger enhances the body's antioxidant response and reduces inflammation, which helps in the recovery of lung tissue.[13]

1.5 RESPIRATORY DISORDERS:

Respiratory disorders affect both the upper and lower respiratory tracts, compromising breathing, gas exchange, or airway function. Ginger has the potential to offer therapeutic benefits for several of these conditions due to its antiinflammatory, bronchodilating, antioxidant, and immunomodulatory effects.

1. Asthma

A chronic inflammatory condition of the airways, characterized by bronchoconstriction, airway hyperresponsiveness, and excess mucus production. Symptoms include wheezing, coughing, chest tightness, and shortness of breath. It involves a Th2 immune response, with increased eosinophils and high IgE levels.[15]

2. Chronic Obstructive Pulmonary Disease (COPD)

A progressive lung disease that includes chronic bronchitis and emphysema. It is primarily caused by smoking, pollution, and oxidative stress. Features include irreversible airflow limitation, chronic cough, mucus production, and damage to the air sacs in the lungs.[15]

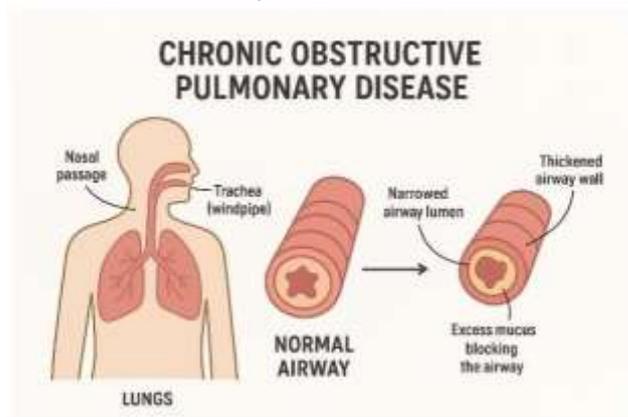


Figure 4: Chronic Obstructive Pulmonary Disease

3. Acute and Chronic Bronchitis

Inflammation of the bronchial tubes, leading to increased mucus production and persistent coughing. Acute bronchitis is often caused by viral infections, while chronic bronchitis is a component of COPD and is defined by a productive cough lasting more than three months for two consecutive years.[16]

4. Upper Respiratory Tract Infections (URTIs)

Includes conditions like the common cold, pharyngitis, sinusitis, and laryngitis. These infections are usually viral in origin, such as rhinovirus or influenza. Symptoms may include sore throat, nasal congestion, and coughing.[16]

5. Allergic Rhinitis

An inflammatory response of the nasal lining to allergens like pollen or dust mites, mediated by IgE antibodies. Symptoms include sneezing, nasal itching, runny nose, and watery eyes. It is often linked to asthma.[15]

6. Pneumonia

An infection of the lung tissue caused by bacteria, viruses, or fungi. Symptoms include fever, cough with mucus, chest pain, and difficulty breathing. It involves inflammation and fluid buildup in the alveoli.[16]

7. Pulmonary Fibrosis

A chronic lung disease characterized by the buildup of excess collagen and stiffening of lung tissue. This leads to progressive shortness of breath and problems with oxygen exchange.[15]

8. Acute Respiratory Distress Syndrome (ARDS)

A severe form of respiratory failure caused by lung injury, infection, trauma, or sepsis. Features include widespread damage to the lung air sacs, fluid accumulation, and severe low oxygen levels.[16]

9. Respiratory Viral Infections

Includes infections like influenza, respiratory syncytial virus (RSV), and SARS-CoV-2 (the virus that causes COVID-19). These infections lead to inflammation, fever, coughing, and airway congestion.[15]

10. Whooping Cough (Pertussis)

Caused by the bacterium *Bordetella pertussis*, this condition is marked by severe coughing fits followed by a highpitched “whoop” sound. It is common in children but can also affect adults.[16]

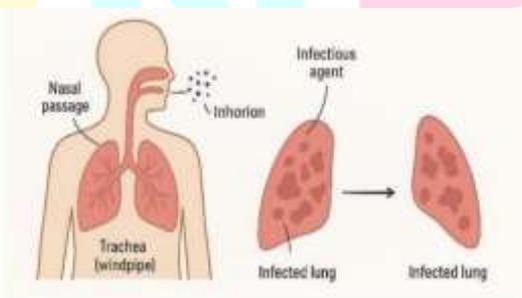


Figure 5: Infection respiratory Disease

1.6 TRADITIONAL METHOD OF TREATMENT :

Ginger has been used for a long time in Ayurveda, Traditional Chinese Medicine (TCM), Unani, and other traditional systems to treat various breathing problems such as cough, cold, asthma, bronchitis, sore throat, stuffy nose, and flu.

1. Traditional Ayurvedic Uses

1.1 Sonth (Dry Ginger) Decoction

This is made by boiling dry ginger powder with water, black pepper, and tulsī. It helps with cough, cold, bronchitis, sore throat, and chest congestion. [17]

1.2 Ginger Tea (Adrakh Kadha)

Fresh ginger is boiled with spices like clove, cinnamon, and honey to clear mucus, reduce inflammation, and ease coughing.[17]

1.3 Ginger-Honey Paste

Fresh ginger juice is mixed with honey and taken to help with dry cough, allergy-related cough, and sore throat.[17]

1.4 Steam Inhalation with Ginger

Sliced ginger is added to boiling water, and the steam is inhaled to relieve stuffy nose, sinus issues, and chest tightness.[17]

2. Traditional Chinese Medicine (TCM) Uses

2.1 Gan Jiang (Dry Ginger) Herbal Formula

In TCM, this is used to “warm the lungs,” improve blood flow, and treat coughs, asthma, and wheezing caused by cold.[18]

2.2 Sheng Jiang (Fresh Ginger) Decoctions

Fresh ginger is combined with jujube and other herbs to treat sudden respiratory infections, flu, chills, and mucus buildup.[17]

2.3 Ginger-Water Vapor Therapy

This is a traditional way of inhaling vapors infused with ginger to ease sinus blockage and irritation in the bronchial tubes.[17]

3. Unani and Middle Eastern Traditional Practices

3.1 Zanjabil Herbal Syrup

This is made with ginger extract, honey, and lemon and is used to treat productive cough and asthma symptoms.[17]

3.2 Ginger with Black Seed (Nigella) Mixture

A combination of ginger and black seed is used to treat bronchitis, wheezing, and long-term cough.[18]

3.3 Ginger Warm Compress

A warm paste made from ginger is applied to the chest to ease breathing and reduce congestion.[17]

4. Folk and Home Remedies (Global Traditional Use)

4.1 Ginger Milk

This is often consumed at night to soothe sore throat and cough.[18]

4.2 Chewing Raw Ginger

Eating raw ginger helps reduce throat irritation and inflammation.[18]

4.3 Ginger Oil Chest Massage

This is a traditional therapy used in Southeast Asia to relieve bronchial congestion.[18]

1.7 EFFECTS OF GINGER IN TREATING RESPIRATORY DISORDERS:

Ginger (*Zingiber officinale*) has been found to be very helpful in managing several respiratory conditions like asthma, bronchitis, COPD, allergic rhinitis, cough, cold, and respiratory infections. The main active components in ginger, such as gingerols, shogaols, zingiberene, and essential oils, are responsible for its health benefits.

1.Effect of Ginger in Asthma

1.1 Reduction in Airway Inflammation

Ginger helps lower the presence of certain inflammatory cells and substances in the airways of people with asthma, which can improve how well their lungs work.

1.2 Bronchodilation

Some ingredients in ginger, like 6-gingerol and 6-shogaol, help relax the muscles around the airways.

They do this by preventing calcium from entering the muscle cells and by making the β 2-adrenergic receptors more active.

1.3 Improvement in Airway Hyperresponsiveness (AHR)

Studies on animals and in laboratory settings show that ginger can reduce airway hyperresponsiveness, making it easier to breathe in people with asthma.[19]

2.Effect of Ginger in Bronchitis

2.1 Reduction of Bronchial Swelling

Ginger can reduce inflammation in the bronchial lining by inhibiting enzymes like COX-2 and 5-LOX.

2.2 Expectorant Effect

Ginger can help the body produce and clear mucus more effectively, making it useful for people with bronchitis.

2.3 Reduction in Cough Frequency

The volatile oils in ginger, such as zingiberene and citral, can soothe irritated airways and reduce coughing.[19]

3. Effect of Ginger in COPD

3.1 Antioxidant Protection

Ginger helps reduce oxidative stress in the lungs, which can cause further damage in people with COPD. It does this by increasing levels of enzymes like SOD, catalase, and glutathione.

3.2 Anti-inflammatory Benefit

Ginger can lower levels of inflammatory markers like TNF- α and IL-8 in the lungs, which helps improve airflow.

3.3 Improvement in Bronchial Constriction

Ginger can help relax the bronchial muscles, making it easier to breathe for people with COPD.[20]

4. Effect of Ginger in Allergic Rhinitis

4.1 Reduction in Nasal Congestion

Ginger can reduce the allergic reactions that cause nasal blockage by decreasing IgE levels and preventing mast cells from releasing substances that cause inflammation.

4.2 Decrease in Sneezing and Rhinorrhea

Ginger can lower the release of histamine and leukotrienes, which are responsible for symptoms like sneezing and runny nose.

4.3 Immune Modulation

Ginger helps balance the immune system by supporting the Th1/Th2 response, which can reduce the overreaction seen in allergic rhinitis.[19]

5. Effect of Ginger in Common Cold & Upper Respiratory Tract Infection (URTI)

5.1 Antiviral Action

Ginger can block how certain viruses, like rhinovirus and respiratory syncytial virus, attach to and multiply in the body.

5.2 Symptomatic Relief

Drinking hot ginger tea or using ginger extracts can help ease throat irritation, cough, and nasal congestion.

5.3 Antibacterial Activity

Ginger can inhibit the growth of harmful bacteria like *Streptococcus pneumoniae* and *Staphylococcus aureus*, which can lead to secondary infections.[19]

6. Effect of Ginger in Cough

6.1 Antitussive Activity

The compounds in ginger, such as gingerols and shogaols, can soothe the airway lining and help reduce the urge to cough.

6.2 Anti-inflammatory Benefit

Reducing swelling in the airways can help decrease both the frequency and severity of coughing.[19]

7. Effect on Respiratory Inflammation & Oxidative Stress

7.1 Decrease in ROS and Free Radicals

Ginger can lower harmful substances like reactive oxygen species in the lungs, which protect against oxidative damage.

7.2 Reduction in Chronic Inflammation

Ginger helps reduce long-term inflammation in the respiratory system by lowering the activity of the NF- κ B pathway.[20]

8. Clinical Evidence of Ginger in Respiratory Diseases

8.1 Improved Lung Function

Studies have shown that taking ginger can improve lung function, including measures like FEV1, FVC, and peak expiratory flow in people with asthma.

8.2 Reduced Asthma Symptoms

Ginger extracts have been found to reduce wheezing, shortness of breath, and chest tightness in patients with asthma.

8.3 Reduction in Cough & Mucus

People who drink ginger tea or take ginger supplements often report less coughing and better ability to expel mucus.[20]

1.8 MEDICINAL USE OF GINGER:

1. Relief from Nausea and Vomiting

Ginger can help ease nausea that comes from being pregnant, feeling sick from moving around, or from chemotherapy [21].

2. **Anti-Inflammatory Action**

Ginger lowers levels of certain inflammatory markers like CRP, hs-CRP, and TNF- α [21].

3. **Antioxidant Effects**

It boosts the body's antioxidant levels by increasing GPx and TAC, while also lowering MDA [22].

4. **Digestive Health Support**

Ginger helps with digestion, reduces bloating, and has protective effects on the stomach [21].

5. **Blood Sugar & Metabolic Regulation**

Ginger can help lower fasting blood sugar and HbA1c levels in people with type 2 diabetes [22].

6. **Pain-Relieving Effects**

It can help with muscle pain, menstrual cramps, and pain caused by inflammation [21].

7. **Respiratory Health Support**

Ginger may help open up airways and reduce inflammation in the respiratory system [22].

8. **Antimicrobial & Immunomodulatory Effects**

Ginger has antimicrobial properties against bacteria and viruses, and it also helps regulate the immune system [21,22].

1.9 HERBAL PREPARATIONS OF GINGER FOR RESPIRATORY DISORDERS:

Ginger (*Zingiber officinale*) has been used for a long time in different herbal treatments to help with breathing problems like cough, cold, asthma, bronchitis, sore throat, mucus buildup, and airway inflammation.

1. **Ginger Decoction (Ginger Kashayam / Ginger Tea) How to Make:**

Take 5 to 10 grams of fresh ginger root, crush it, and boil it in 150 to 200 mL of water for 10 to 15 minutes.

Optional Additions: Black pepper, tulsi leaves, clove, or honey can be used. **Usage:**

This helps with cold, cough, throat blockage, bronchial irritation, and mild asthma. **How It Works:**

It warms the body, helps clear mucus from the airways, and reduces inflammation. [23,24]

2. **Ginger Honey Syrup How to Make:**

Extract 10 to 20 mL of juice from fresh ginger.

Mix it with an equal amount of honey.

Usage:

This is good for dry cough, sore throat, and irritation of the airways.

How It Works:

Honey soothes the throat, while gingerols help reduce coughing and airway inflammation.

[23]

3. **Ginger Steam Inhalation (Herbal Steam Therapy) How to Make:**

Crush fresh ginger and boil it in water. Inhale the steam for 5 to 10 minutes.

Optional Addition: Add eucalyptus or tulsi for better respiratory benefits.

Usage:

This is effective for nasal blockage, sinusitis, cough, and respiratory infections.

How It Works:

The oils from ginger clear mucus and help stop harmful bacteria in the airways. [24]

4. **Dry Ginger Powder (Sonth / Shunthi Churna) How to Make:**

Take 2 to 3 grams of dried ginger powder with warm water or honey.

Usage:

This is commonly used for asthma, bronchitis, productive cough, and chest congestion.

How It Works:

It contains shogaols and other strong compounds that help open airways and reduce inflammation.[24]

5. Ginger & Black Pepper Herbal Mix (Trikatu)**Ingredients:**

Dry ginger, black pepper, and long pepper (Pippali).

Usage in Ayurveda:

This is a well-known formula for asthma, chronic cough, and weak lungs.

How It Works:

It increases how well other respiratory medicines work.

It also helps improve breathing and reduces airway sensitivity. [23]

6. Ginger Herbal Kadha (Ayurvedic Immunity Drink)**How to Make:**

Boil ginger, tulsi, cinnamon, and black pepper together for 10 to 15 minutes.

Usage:

This is popular for viral cough, allergic rhinitis, cold, flu, and airway inflammation.

How It Works:

The combination of herbs reduces mucus, inflammation, and stress on the airways.[24]

7. Ginger Lozenges (Traditional homemade) How to Make:

Mix boiled ginger extract with jaggery or sugar until it turns into a syrup and forms lozenges. **Usage:**

This is helpful for sore throat, hoarseness, and to stop coughing.

How It Works:

Gingerols soothe the airway lining and stop inflammation.[23]

8. Ginger Oil Chest Massage (Traditional Use) How to Make:

Mix ginger essential oil with coconut or sesame oil (1 to 2%).

Usage:

Apply it on your chest or back for relief.

How It Works:

The oils speed up blood flow and have a mild effect on opening up the airways.[24]

9. Ginger Turmeric Milk (Haldi-Adrak Doodh) How to Make:

Boil fresh ginger and turmeric in milk.

Usage:

This helps with cough, cold, throat pain, and general breathing discomfort.

How It Works:

It has a strong combination of anti-inflammatory and antioxidant benefits.[24]

10. Ginger Herbal Nasal Decongestant (Folk Remedy) How to Make:

Mix ginger juice with warm water and use a few drops on the nose.

Usage:

It helps with sinus pressure and blockage.

How It Works:

It works by creating a mild irritation that improves blood flow in the sinuses.[24]

1.10 THERAPEUTIC EFFECTS OF GINGER IN RESPIRATORY DISORDERS

Ginger (*Zingiber officinale*) offers several health benefits that can be helpful for conditions such as asthma, bronchitis, cough, COPD, allergic rhinitis, and respiratory infections. These benefits come from various compounds found in ginger, like gingerols, shogaols, zingiberene, and essential oils.

1. **Anti-inflammatory Effect**

1.1 **Reduction of Airway Inflammation**

Ginger helps reduce the production of certain chemicals such as TNF- α , IL-1 β , IL-6, and IL-8, which can cause swelling and sensitivity in the airways.

1.2 **Inhibition of COX-2 and 5-LOX**

The compounds in ginger can stop enzymes that cause inflammation.

This reduces substances like prostaglandins and leukotrienes in the respiratory system.

1.3 **Suppression of NF- κ B and MAPK Pathways**

These pathways play a role in controlling inflammation seen in conditions like asthma and COPD.

Ginger can help prevent these pathways from becoming active.[25,26]

2. **Bronchodilatory Effect**

2.1 **Relaxation of Airway Smooth Muscle**

Compounds such as 6-gingerol and 8-gingerol help relax the muscles in the bronchial tubes, making it easier to breathe.

2.2 **Calcium Channel Blocking Activity**

Ginger stops calcium from entering the muscle cells in the airways, which can help prevent bronchoconstriction.

2.3 **Enhancement of β 2-Adrenergic Response**

Ginger can make the body more responsive to β 2-agonists, which is helpful in opening the airways for people with asthma.[25,26]

3. **Antioxidant Effect**

3.1 **Reduction of Oxidative Stress in Airways**

Ginger helps remove harmful free radicals that can cause inflammation and damage in the airways, especially in conditions like asthma and COPD. 3.2 **Boosting Antioxidant Enzymes**

It increases the activity of enzymes such as SOD, catalase, and glutathione peroxidase, which protect the lungs from damage due to oxidative stress.[25,26]

4. **Anti-allergic Effect**

4.1 **Reduction of IgE-Mediated Allergic Reactions**

Ginger can prevent mast cells from releasing histamine, which helps reduce symptoms of allergic rhinitis and asthma.

4.2 **Decrease in Eosinophilic Inflammation**

It lowers the presence of eosinophils in the lining of the airways, which helps with breathing and reduces mucus production.[25,26]

5. **Antitussive (Cough-Relieving) Effect**

5.1 **Soothing Effect on Respiratory Mucosa**

The essential oils in ginger can reduce irritation of cough receptors and help ease inflammation in the respiratory tract. 5.2

Reduction of Cough Frequency

Studies show that ginger extracts can reduce the sensitivity of the cough reflex, especially in cases of cough caused by colds.[25,26]

6. **Expectorant and Mucolytic Effect**

6.1 **Enhancement of Mucociliary Clearance**

Ginger helps the body produce more mucus and improves the movement of cilia, which helps clear the airways.

6.2 **Breakdown of Thick Mucus**

Gingerols make mucus less sticky, making it easier to expel in conditions like bronchitis and COPD.[25,26]

7. **Antimicrobial Effect**

7.1 **Activity Against Respiratory Pathogens**

Ginger is effective against bacteria like Staphylococcus aureus, Streptococcus pneumoniae, Haemophilus influenzae, and respiratory viruses.

7.2 **Inhibition of Viral Replication**

It stops viruses that cause colds and flu from reproducing, which can reduce the severity of symptoms.[25,26]

8. **Immunomodulatory Effect**

8.1 **Balancing Th1/Th2 Responses**

Ginger helps regulate the body's immune system, especially in allergic asthma where Th2 responses are overactive.

8.2 **Enhancement of Innate Immunity**

It boosts the activity of immune cells like macrophages and natural killer cells, which help fight respiratory infections.[25,26]

1.11SIDE EFFECTS OF GINGER:

1. Gastrointestinal Effects

Some people may experience heartburn, stomach upset, diarrhea, bloating, or irritation in the mouth, especially if they take more than 2 grams of ginger each day.[27,28]

2. Increased Bleeding Risk

Ginger can slightly slow how blood clots, which might make it easier to bleed, particularly for those who are already on medications that prevent blood clots.[29]

3. Hypoglycemia (Low Blood Sugar)

Taking large amounts of ginger can lower blood sugar levels and make insulin work more effectively.[28]

4. Allergic Reactions (Rare)

A small number of people may have an allergic reaction, which can lead to skin rashes, itching, or swelling in the lips and mouth.[28,29]

5. Gallbladder Effects

Ginger can increase bile production, so it's something to be cautious about if someone has gallstones.[29]



6. Pregnancy-Related Cautions

Taking up to 1 gram per day is usually safe for nausea during pregnancy, but higher doses might cause heartburn or increase the risk of contractions.[28]

7. Drug Interactions

Ginger may interact with medicines used to prevent blood clots, manage blood sugar, or lower blood pressure.[28]

CONCLUSION

Ginger, which is also called *Zingiber officinale*, is becoming a popular choice for treating different breathing issues because of its many health benefits. It contains powerful compounds like gingerols, shogaols, zingerone, and essential oils. These help reduce inflammation, open up the airways, fight harmful free radicals, lower allergic responses, and support the immune system. Ginger works by changing how the body handles inflammation, stopping the release of certain chemicals, and reducing the amount of substances that cause swelling. This makes it useful for long-term breathing conditions like asthma and COPD.[30]. Ginger can also help relax the muscles in the airways, prevent calcium from moving into these muscles, and improve the body's response to hormones that help open up the airways. This makes it helpful for sudden airway narrowing and breathing trouble. Its ability to fight oxidative stress helps protect the lungs from damage, and its antimicrobial properties make it useful for treating infections, coughs, and bronchitis. In traditional medicine systems like Ayurveda, Unani, and Traditional Chinese Medicine, ginger has been used for a long time to treat coughs, sore throats, congestion, and breathing problems. Recent scientific studies are supporting these traditional uses. Although more large-scale research is needed to find the best ways to use ginger, current studies show that it is safe, easy to find, and effective as a helpful treatment for breathing issues. Overall, ginger is a useful natural option that can be used together with standard treatments to improve breathing, reduce symptoms, and help the lungs work better.[31].

FUTURE PERSPECTIVE

Ginger, also known as *Zingiber officinale*, has a lot of promise when it comes to helping with different respiratory problems, but there are still some scientific questions that need to be answered. To make sure ginger is reliable and works the same way every time, it's important to create extracts that have the right levels of active ingredients like gingerols, shogaols, and zingiberene. Using modern methods such as chromatography and metabolomics can help with making sure these extracts are consistent in quality [32].

However, right now there isn't enough strong clinical evidence to fully support how effective ginger is for conditions like asthma, chronic obstructive pulmonary disease (COPD), allergic rhinitis, bronchitis, and viral respiratory infections. More organized research is needed to determine how well ginger works, the best doses to use, its safety, and how long it should be taken. New drug delivery methods, such as nanoparticles, liposomes, nanoemulsions, phytosomes, or inhaled forms, may improve the stability, absorption, targeting of the lungs, and effectiveness of ginger. Future studies should also look into how ginger might work better along with common respiratory medications like beta-2 agonists and corticosteroids, which could mean lower medication use and fewer side effects [33]. Understanding how ginger affects key biological pathways, including NF- κ B, MAPK, Nrf2, cytokine regulation, and smooth muscle ion channels, could help in making more effective plant-based medicines. Because ginger has antiviral qualities, more research is needed to study its role in fighting new respiratory viruses like new flu strains, RSV, and coronaviruses, as well as exploring how it can be combined with other herbs in antiviral formulas [33]. Also, using personalized medicine based on a person's genetic profile could help make ginger treatments more effective and reduce interactions with other drugs. It's important to carry out detailed safety and toxicity studies to find out safe dosages and to check long-term safety, especially in groups like children, pregnant women, and the elderly. [33]

REFERENCES

1. **Mao QQ, Xu XY, Cao SY, et al.** Bioactive Compounds and Bioactivities of Ginger (*Zingiber officinale*). *Foods*. 2019;8(6):185.
2. **Townsend EA, Emala CW, et al.** Effects of Ginger and Its Constituents on Airway Smooth Muscle Relaxation and Calcium Regulation. *Pulmonary Pharmacology & Therapeutics*. 2013/2014.

3. **Yocum GT, et al.** Ginger and 6-Shogaol Mitigate Features of Allergic Airway Disease in Preclinical Models. 2019.
4. **Emala CW, et al.** Low-Dose Oral Ginger Improves Daily Symptom Scores in Asthmatics: A Pilot Clinical Study. 2024.
5. **Bischoff-Kont I, et al.** Benefits of Ginger and Its Constituent 6-Shogaol in Respiratory Inflammation. *Nutrients*. 2021.
6. **Mao QQ, Xu XY, Cao SY, et al.** Bioactive Compounds and Bioactivities of Ginger (*Zingiber officinale*). *Foods*. 2019;8(6):185.
7. **Bischoff-Kont I, et al.** Benefits of Ginger and Its Constituent 6-Shogaol in Respiratory Inflammation. *Nutrients*. 2021.
8. **Mao QQ, Xu XY, Cao SY, et al.** Bioactive Compounds and Bioactivities of Ginger (*Zingiber officinale*). *Foods*. 2019;8(6):185.
11. **Ballester P, et al.** Effect of Ginger on Inflammatory Diseases: Molecular Pathways and Clinical Implications. *Molecules*. 2022.
12. **Rahmani AH, Shabrmi FM, Aly SM.** Active ingredients of ginger as potential candidates in the prevention and treatment of diseases via modulation of biological activities. *International Journal of Physiology, Pathophysiology and Pharmacology*. 2014;6(2):125–136.
13. **Ali BH, Blunden G, Tanira MO, Nemmar A.** Some phytochemical, pharmacological and toxicological properties of ginger (*Zingiber officinale* Roscoe): A review. *Food and Chemical Toxicology*. 2008;46(2):409–420.
14. **Gholamnezhad Z et al.** Effect of Ginger Extract on Lung Function and Inflammation in Asthmatic Patients. *Phytotherapy Research*. 2015.
15. **Townsend EA et al.** Ginger Enhances β 2-Agonist-Induced Relaxation of Airway Smooth Muscle. *Am J Respir Cell Mol Biol*. 2013.
16. **Rahim N et al.** Clinical Effects of Ginger in Allergic Rhinitis Compared to Loratadine. *Phytomedicine*. 2020.
17. **Global Initiative for Asthma (GINA).** Global Strategy for Asthma Management and Prevention. 2023.
18. **Global Initiative for Chronic Obstructive Lung Disease (GOLD).** Global Strategy for the Diagnosis, Management, and Prevention of COPD. 2024.
19. **Ayurvedic Formulary of India (AFI), Govt. Of India** – Ginger-honey and steam inhalation practices for respiratory relief.
20. **Bensky D., Chinese Herbal Medicine: Materia Medica** – Uses of Gan Jiang and Sheng Jiang in TCM for respiratory disorders.
21. **Ballester P, et al.** Effect of Ginger on Inflammatory Diseases: Molecular Pathways and Clinical Implications. *Molecules*. 2022.
22. **Rahmani AH, Shabrmi FM, Aly SM.** Active ingredients of ginger as potential candidates in the prevention and treatment of diseases via modulation of biological activities. *International Journal of Physiology, Pathophysiology and Pharmacology*. 2014;6(2):125–136

23. **Ali BH, Blunden G, Tanira MO, Nemmar A.** Some phytochemical, pharmacological and toxicological properties of ginger (*Zingiber officinale* Roscoe): A review. *Food and Chemical Toxicology*. 2008;46(2):409–420.
24. **Gholamnezhad Z et al.** Effect of Ginger Extract on Lung Function and Inflammation in Asthmatic Patients. *Phytotherapy Research*. 2015.
25. **Townsend EA et al.** Ginger Enhances β 2-Agonist-Induced Relaxation of Airway Smooth Muscle. *Am J Respir Cell Mol Biol*. 2013.
26. **Rahim N et al.** Clinical Effects of Ginger in Allergic Rhinitis Compared to Loratadine. *Phytomedicine*. 2020.
27. **Global Initiative for Asthma (GINA).** Global Strategy for Asthma Management and Prevention. 2023.
28. **Global Initiative for Chronic Obstructive Lung Disease (GOLD).** Global Strategy for the Diagnosis, Management, and Prevention of COPD. 2024.
29. **Ayurvedic Formulary of India (AFI), Govt. Of India** – Ginger-honey and steam inhalation practices for respiratory relief.
30. **Bensky D., Chinese Herbal Medicine: Materia Medica** – Uses of Gan Jiang and Sheng Jiang in TCM for respiratory disorders.
31. **Gholamnezhad Z., et al. (2019).** Therapeutic effects of ginger (*Zingiber officinale*) in respiratory diseases: A review. *Avicenna Journal of Phytomedicine*. – Anti-inflammatory effects, reduction of Th2 cytokines, NF- κ B suppression, effects in asthma and allergic rhinitis.
32. **Gholamnezhad, Z., Havakhah, S., & Boskabady, M. H. (2016).** Clinical and experimental evidence on the respiratory effects of ginger (*Zingiber officinale* Roscoe). *Iranian Journal of Basic Medical Sciences*, 19(2), 125–138.
33. **Mao, Q., Xu, X., Cao, S., Gan, R.-Y., Corke, H., Beta, T., & Li, H.-B. (2019).** Bioactive compounds and bioactivities of ginger (*Zingiber officinale* Roscoe). *Foods*, 8(6), 185.
34. **Nile, S. H., & Park, S. W. (2015).** Ginger's bioactive compounds and modulation of NF- κ B, MAPK, and antioxidant pathways. *Food & Function*, 6(3), 1063–1072.

