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Herbal Therapies for Asthma: A Review of Traditional and Modern Perspectives

Sunil Kardani*, Ghanshyam Parmar, Jay Chudasama, Nirmal Shah, Dipti Gohil and Rajesh Maheshwari

Department of Pharmacy, Sumandeep Vidyapeeth Deemed to be University, Vadodara - 391760, Gujarat, India; sunilkardani@yahoo.co.in

Abstract

This review explores the potential of nine herbal plants - Turmeric, Ginger, Black Seed, Holy Basil, Licorice, Garlic, *Boswellia*, *Adhatoda vasica*, and Ginseng in preventing and alleviating asthma symptoms. Asthma, a chronic inflammatory airway disease, often benefits from conventional treatments, but interest in natural alternatives is growing. Traditional herbal medicines show promise as alternative treatments and management strategies for asthma. Research highlights that many of these herbs exhibit anti-inflammatory, antioxidant, bronchodilatory, and immunomodulatory effects, which are crucial for addressing asthma's underlying mechanisms. For instance, compounds like curcumin from Turmeric and thymoquinone from Black Seed have demonstrated anti-inflammatory and bronchodilatory properties. Ginger and Holy Basil have shown immunomodulatory effects that can help control airway inflammation. While current evidence often stems from *in vitro*, animal, or preliminary human studies, suggesting a role in symptomatic relief and potentially inhibiting disease progression, further rigorous clinical trials are needed to confirm their preventive efficacy and establish clear guidelines for their use as natural alternatives to conventional drugs, ultimately aiming to improve the quality of life for asthmatic patients.

Major Finding: The review concludes that Turmeric, Ginger, Black Seed, Holy Basil, Licorice, Garlic, *Boswellia*, *Adhatoda vasica*, and Ginseng show strong potential in alleviating asthma and evidence from laboratory, animal, and limited human studies indicates they may improve airway function and reduce inflammation with therapeutic efficacy in asthma management.

Keywords: Asthma, Anti-inflammatory, Bronchodilatory, Herbal Plants

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1. Introduction

Asthma is a chronic inflammatory disease of the airways characterized by reversible airflow obstruction, bronchial hyperresponsiveness, and underlying inflammation. While conventional treatments are effective in managing symptoms, there is growing interest in complementary and alternative medicine, including the use of herbal plants, for both the management and potential prevention of asthma. This comprehensive review explores the scientific evidence behind nine herbal plants mention in Figure 1-Turmeric (*Curcuma longa*), Ginger (*Zingiber officinale*), Black Seed (*Nigella sativa*), Holy Basil (*Ocimum sanctum*), Licorice (*Glycyrrhiza glabra*), Garlic (*Allium sativum*), *Boswellia* (*Boswellia serrata*), *Adhatoda vasica* (Malabar Nut), and Ginseng (*Panax* species) and their potential role in preventing or alleviating asthma symptoms.

2. Turmeric (*Curcuma longa*)

Turmeric, a spice commonly used in South Asian cuisine, is derived from the rhizomes of the *Curcuma longa* plant. Its primary active compound, curcumin mentioned in Figure 2, has been extensively studied for its potent anti-inflammatory and antioxidant properties.

*Author for correspondence

Asthma is characterized by chronic inflammation of the airways, making anti-inflammatory agents potentially beneficial in its management and prevention.

A study shown the efficacy of curcumin as an add-on therapy in patients with bronchial asthma. The study involved adult patients with asthma who were already receiving standard asthma treatment. One group received 500 mg of curcumin capsules daily for 30 days in addition to their standard treatment, while the control group received only the standard treatment.

The results of this study showed significant improvements in the mean Forced Expiratory Volume in 1 second (FEV1) values in the curcumin group compared to the control group, indicating an improvement in airway obstruction. Additionally, the curcumin group exhibited significant improvements in hematological parameters such as total leukocyte count, erythrocyte sedimentation rate (ESR), and white blood cell count, suggesting a reduction in inflammation. No clinically significant adverse events were reported, indicating that curcumin was safe as an add-on therapy. The authors concluded that curcumin is effective and safe for the treatment of bronchial asthma[1]. Another research mentioned that curcumin, the main active compound in turmeric, is more effective at reducing inflammation than ibuprofen and aspirin. This anti-inflammatory action may help lower airway inflammation in asthma patients.

While the above studies primarily focused on the therapeutic effects of turmeric in individuals with existing asthma, its potent anti-inflammatory properties suggest a potential role in preventing the development or progression of the disease. Chronic inflammation is a key factor in the pathogenesis of asthma, and regular consumption of turmeric or curcumin may help to mitigate this inflammation in susceptible individuals. However, further long-term studies are needed to specifically evaluate the preventive effects of turmeric on asthma development.

3. Ginger (*Zingiber officinale*)

Ginger, a widely used spice with a long history in traditional medicine, contains various bioactive compounds, including gingerols and shogaols, which possess anti-inflammatory and antioxidant properties. These properties may be beneficial in the context of asthma, a condition characterized by airway inflammation and oxidative stress.

The effect of ginger extract on the expression of key T-helper cell transcription factors in patients with allergic asthma. The study involved examining the hydroalcoholic extract of ginger on peripheral blood mononuclear cells (PBMCs) of asthmatic patients. The researchers found that the ginger extract significantly reduced the expression of



Figure 1. Herbal plants used in Asthma.

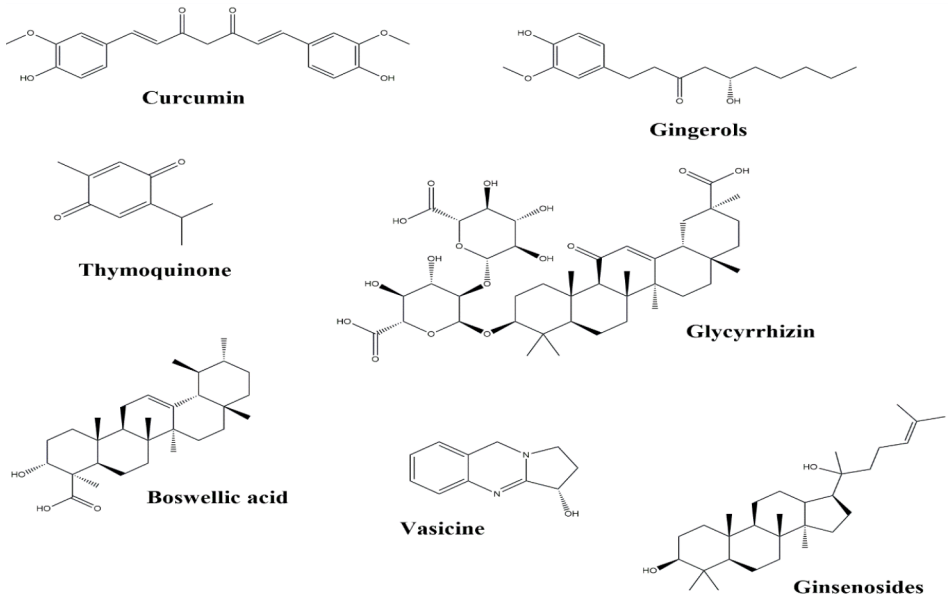


Figure 2. Phytoconstituents with anti-asthmatic property found in herbal plants.

GATA-3, ROR-γt, and T-bet, which are transcription factors involved in the differentiation of Th2, Th17, and Th1 cells, respectively. These T-helper cell subtypes play crucial roles in the inflammatory processes associated with asthma. The study concluded that ginger extract could help control asthma and decrease its severity by affecting the main cells involved in airway inflammation[2].

Another study evaluated the effects of ginger on the improvement of asthma symptoms. Patients in the test group received ginger along with their regular asthma medication for two months. The results showed that a significant percentage of patients in the ginger-treated group experienced relief from wheezing and chest tightness. Additionally, there was a reduction in nocturnal coughs, usage of inhaler sprays, and the frequency of dyspneic attacks. While the study observed improvements in symptoms, it noted that ginger did not significantly change the stage of the disease or spirometric results[3].

The anti-inflammatory and immunomodulatory effects of ginger suggest a potential role in preventing the onset or severity of asthma. By modulating the inflammatory response and potentially affecting airway hyperresponsiveness, regular consumption of ginger may contribute to better respiratory health. However, more research is needed to specifically determine its preventive efficacy in asthma.

4. Black Seed (*Nigella sativa*)

Black seed, also known as black cumin, comes from the *Nigella sativa* plant. Its seeds and oil have been used for centuries in traditional medicine for various ailments, including respiratory disorders. The main active compound in black seed is thymoquinone, which exhibits anti-inflammatory, antioxidant, and bronchodilatory effects. A review of studies on black seed found a small study indicating that inhaled boiled black seed extract has a potential bronchodilatory effect on people with asthma, improving all markers of lung function and respiratory rate[4]. This suggests that black seed may help in relaxing the airways and improving breathing in asthmatic individuals.

A meta-analysis of four randomized controlled studies also found that black seed supplements may help manage asthma through the seed's anti-inflammatory effects. This aligns with the understanding that inflammation plays a central role in asthma pathophysiology. Another study demonstrated that a small group of people who took 500 mg of black seed oil twice a day for four weeks experienced improvements in their Asthma Control Test (ACT) scores. The ACT assesses symptoms such as shortness of breath and other effects of asthma[5].

Research has also examined the direct bronchodilatory effects of black seed. One study

investigated the antiasthmatic effect of boiled extract of *N. sativa* on asthmatic patients. The results showed that *N. sativa* had a relatively potent antiasthmatic effect on asthmatic airways, although its effects on most measured pulmonary function tests were less than those of theophylline at the concentrations used[6].

The combination of anti-inflammatory and bronchodilatory properties of black seed suggests a potential role in preventing asthma attacks and possibly the progression of the disease. By reducing inflammation in the airways and potentially improving lung function, regular use of black seed might help in maintaining respiratory health. However, more extensive clinical trials are needed to confirm these potential preventive benefits.

5. Holy Basil (*Ocimum sanctum*)

Holy Basil, also known as Tulsi, is a revered herb in Ayurvedic medicine known for its adaptogenic, anti-inflammatory, and immunomodulatory properties. Traditionally, it has been used for various respiratory conditions, including asthma. Animal studies have found that extracts of holy basil help keep the bronchial airway passages clear[7]. This suggests a potential bronchodilatory effect that could be beneficial in asthma. Two preliminary clinical trials treated asthma patients with 500 mg of holy basil three times daily for one month. These trials reported improvements in breathing function and a reduction in the frequency of asthma attacks in patients taking holy basil. However, one review noted that these studies lacked a comparison group not taking holy basil, making it difficult to definitively attribute the improvements solely to the herb[8].

A single-blind crossover study compared the bronchodilator activity of *O. sanctum* with salbutamol in patients with mild and moderate asthma. The study found that *O. sanctum* (200 mg twice daily) produced significant improvements in FEV1 and Peak Expiratory Flow Rate (PEFR) values and also led to an improvement in asthma symptoms. However, the bronchodilator activity of *O. sanctum* was less efficacious compared to salbutamol (2 mg twice daily), which produced very highly significant improvements in FEV1 and PEFR values. The study concluded that *O. sanctum* possesses significant bronchodilator activity in mild and moderate bronchial asthma, but its effect is less potent than salbutamol[9].

The anti-inflammatory and potential bronchodilatory effects of holy basil, along with its adaptogenic properties, which can help manage stress (a known asthma trigger for some), suggest a possible role in asthma prevention. Regular consumption of holy basil might help in reducing the frequency and severity of asthma symptoms in susceptible individuals. However, more rigorous, placebo-controlled studies are needed to further validate these potential preventive benefits.

6. Licorice (*Glycyrrhiza glabra*)

Licorice root has been used in traditional medicine for its expectorant, antitussive, and anti-inflammatory properties, which may be beneficial for respiratory conditions like asthma. The main active compound in licorice root is glycyrrhizin. A review suggested that glycyrrhizin extract from licorice root may help relieve asthma due to its anti-inflammatory properties[10]. The authors also proposed that it might be the asthma treatment with the fewest potential side effects. However, the review noted that research in this area is limited and primarily based on *in vitro* and animal studies, emphasizing the need for more human clinical trials. Another study found that licorice root tea and extract may offer protection against strep throat, indicating its potential for respiratory health. While specific studies on licorice directly preventing asthma are limited, its known anti-inflammatory and mucolytic effects could indirectly contribute to maintaining healthy airways.

The anti-inflammatory and expectorant properties of licorice suggest it might help in preventing respiratory issues that could exacerbate or contribute to asthma development. By potentially reducing inflammation in the airways and promoting mucus clearance, licorice may support overall respiratory health. However, more research is needed to specifically investigate its role in asthma prevention. It is also important to note that high consumption of licorice can lead to side effects like high blood pressure in some individuals, so moderation is crucial.

7. Garlic (*Allium sativum*)

Garlic is a widely recognized herb with numerous health benefits, including anti-inflammatory, antioxidant, and immunomodulatory properties. These properties have led to investigations into its potential role in managing respiratory conditions like asthma.

A study found that garlic extracts significantly reduced the number of inflammatory cells and white blood cells called eosinophils in laboratory mice. This reduction seemed to decrease bronchial inflammation, a key feature of asthma[11]. Research has also shown that the water fraction of garlic extracts has a marked anti-inflammatory effect on allergen-induced allergic asthma in mice, suggesting it could be a promising protective agent for allergic asthma patients[12]. Another study investigated the effect of aged garlic extract on allergic airway inflammation in mice. The results indicated that multiple intraperitoneal injections of aged garlic extract caused a significant decrease in the hallmark criteria of allergic airway inflammation, including eosinophil percentage in lung lavage, peri bronchial lung eosinophils, and inflammation[13].

The anti-inflammatory and immunomodulatory effects of garlic suggest a potential role in preventing the onset or severity of asthma, particularly allergic asthma where inflammation plays a critical role. Regular consumption of garlic might help in modulating the immune response and reducing airway inflammation. However, more human studies are needed to confirm these findings and establish specific preventive recommendations.

8. *Boswellia* (*Boswellia serrata*)

Boswellia, also known as Indian frankincense, is a resin extract from the *Boswellia serrata* tree. It contains boswellic acids, which have been shown to possess significant anti-inflammatory properties by inhibiting the production of leukotrienes, inflammatory mediators that can cause bronchial muscle contraction. A study on the effect of *Boswellia* on bronchial asthma found that people who took *Boswellia* experienced decreased asthma symptoms and indicators. This suggests that the herb could play an important role in treating bronchial asthma. Research has shown that the positive immune-balancing properties of *Boswellia* can help with the overreaction to environmental allergens that occurs in asthma.

A double-blind, placebo-controlled clinical study investigated the effects of *B. serrata* gum resin in patients with bronchial asthma. Forty patients were treated with 300 mg of *Boswellia* gum resin thrice daily for 6 weeks. The results showed that 70% of patients in the *Boswellia* group experienced improvement in disease symptoms, including a reduction in dyspnea, rhonchi, and the number of asthma attacks, as well as an increase in FEV1, FVC (Forced Vital Capacity), and PEFR. There was also a decrease in eosinophil count and ESR. In contrast, only 27% of patients in the placebo group showed improvement. The study concluded that *B. serrata* gum resin plays a definite role in the treatment of bronchial asthma[14].

Another study suggested that treatment with a bioavailable delivery form of *B. serrata* extract (Casperome®) as complementary therapy could help reduce the need for inhalation therapy with inhaled corticosteroids and long-acting beta-agonists in asthmatic patients[15].

Given its potent anti-inflammatory properties, *Boswellia* may have a role in preventing the development or exacerbation of asthma. By inhibiting leukotriene production and reducing airway inflammation, regular use of *Boswellia* might contribute to better asthma control and potentially prevent severe attacks. The positive findings in clinical trials support its therapeutic use, and further research could explore its preventive potential in at-risk individuals.

9. *Adhatoda vasica* (Malabar Nut)

Adhatoda vasica, commonly known as Malabar Nut or Vasa, is an herb traditionally used in Ayurveda for respiratory disorders, including asthma, bronchitis, and cough. It contains alkaloids like vasicine and vasicinone, which have been shown to possess bronchodilatory and anti-inflammatory effects. A study investigated the effect of an aqueous extract of *Adhatoda vasica* on ovalbumin-induced allergic asthma in mice. The researchers found that oral administration of the *A. vasica* extract reduced the cardinal features of asthma at both phenotypic and molecular levels. The treatment inhibited the increased hypoxic response in asthmatic mice by downregulating HIF-1α (hypoxia-inducible

factor 1-alpha), which in turn improved mitochondrial morpho function. The study provided evidence for *A. vasica*'s mechanism of action in asthma through the modulation of the cellular hypoxic response[16].

Phytochemical studies have shown that vasicine, at low concentrations, induces relaxation of tracheal muscles, and at higher concentrations, offers significant protection against histamine-induced bronchospasm. Vasicinone, an auto-oxidation product of vasicine, has also been reported to cause bronchodilatory effects both *in vitro* and *in vivo*[17]. Research has also indicated that vasicinone exhibits potent anti-allergic activity in animal models[18].

Given its bronchodilatory, anti-inflammatory, and anti-allergic properties, *Adhatoda vasica* holds promise for both the treatment and potential prevention of asthma. By helping to relax the airways, reduce inflammation, and inhibit allergic reactions, regular use of this herb may contribute to better respiratory health and potentially prevent asthma exacerbations. Its traditional use for respiratory conditions and the supporting scientific evidence warrants further investigation into its preventive potential in humans.

10. Ginseng (*Panax* species)

Ginseng, particularly Korean Red Ginseng and Korean White Ginseng derived from *Panax ginseng*, has been traditionally used for its energizing and immunomodulatory effects. Research has begun to explore its potential role in respiratory health, including asthma. A review of current studies on ginseng as an anti-asthmatic agent in murine models analyzed eight full-text articles. The findings of this review demonstrated that Korean red ginseng, Korean white ginseng, and ginsenosides (the active compounds in ginseng) exert an anti-asthmatic effect primarily through the reduction in mucus cell hypersecretion, inflammatory cell infiltration, Th2 cytokines, and inhibition of inflammatory NF-κB and COX2 pathways. The review concluded that ginseng has therapeutic potential for the treatment of asthma, although further laboratory studies and clinical trials in humans are needed to support these findings from animal models[19]. Another study evaluated the therapeutic effects of Korean Red Ginseng (KRG) against ovalbumin-induced allergic asthma in mice. The researchers found that KRG effectively suppressed the inflammatory response by inhibiting reactive oxygen species (ROS) production. Their results suggested that KRG may have the potential to alleviate asthma[20].

Black Ginseng, which is processed from the whole ginseng root via repetitive steaming and drying, has also shown potential anti-asthmatic activity by inhibiting the Protein Kinase CO-mediated IL-4/STAT6 signaling pathway, which is involved in allergic inflammation[21]. The evidence from animal studies suggests that ginseng and its components may have anti-inflammatory and immunomodulatory effects that could be beneficial in preventing or mitigating asthma symptoms. By potentially reducing inflammation, modulating the immune response, and affecting mucus production, regular use of ginseng might contribute to better respiratory health. However, the current evidence is primarily from animal models, and more research, particularly well-designed clinical trials in humans, is necessary to confirm its preventive efficacy in asthma.

11. Conclusion

The herbal plants discussed in this Review - Turmeric, Ginger, Black Seed, Holy Basil, Licorice, Garlic, *Boswellia*, *Adhatoda vasica*, and Ginseng - have demonstrated potential in mitigating asthma symptoms through various mechanisms, primarily their anti-inflammatory, bronchodilatory, and immunomodulatory properties. Scientific studies, including *in vitro*, *in vivo*, and some clinical trials, provide evidence for these effects. While many of these studies focus on the therapeutic role of these herbs in managing existing asthma, their underlying mechanisms of action suggest a potential role in preventing the onset or progression of the disease.

However, it is important to note that the current body of evidence, particularly regarding asthma prevention in humans, is still evolving. Further well-designed, large-scale clinical trials are needed to definitively establish the preventive efficacy of these herbal plants for asthma. Additionally, the quality and standardization of herbal preparations can vary, and potential interactions with conventional medications should be carefully considered.

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Author Contribution

SK and GP were responsible for the study design and manuscript drafting. JC and DG performed the literature review and data extraction. NS and RM, reviewed and edited the manuscript for intellectual content. All authors have read and agreed to the published version of the manuscript.