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Ayurveda Drugs for Management of Respiratory Allergic Disorders: A Short Review

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Abstract:
Allergy of respiratory system, termed as respiratory allergies are the major cause of morbidity in both children and adult. The disorder contributes to headaches and fatigue, limit day to day activities, interferes with sleep and therefore leads to school absenteeism in children and poor work performance in adults. The increasing prevalence of these disorders in present era is related to modern stressful life style, artificially of our food, super clean living conditions and irrelevant use of antibiotics leading to immune dysfunction and hypersensitivity of airways. According to the Modern medicine, its management includes antibiotics, antipyretic, anti-inflammatory, antihistamines, bronchodilators, mast cell stabilizers, decongestants and corticosteroids. But, these are associated with many adverse effects and lack long-term sustained effect. Ayurveda explains the pathology of respiratory allergies as immune dysfunction which is due to formation of (undigested intermediate product) Ama, and Kapha dosha. Ayurveda has potent drugs possessing immunomodulatory, anti-allergic, anti-inflammatory and mucolytic effect which can be used for breaking the pathology of the respiratory allergy at various levels, and giving prompt symptomatic relief to the patient. The Ayurveda approach of management of Respiratory allergies is to potentiate the immune system of the individual in order to reduce the susceptibility towards the allergens and at the same time providing symptomatic relief to the patient. Thus, it is supposed that these drugs can prove beneficial and provide effective and long term solution to allergic disorders and thereby may improve the quality of life and work performance. Paper reviews clinical and experimental studies published in various journals to provide evidences regarding the efficacy of various Ayurveda drugs in the management of respiratory allergies. Review of studies indicates that Ayurveda drugs have potential to reduce the morbidity and therefore can be successfully used for the management of respiratory allergies.

Keywords: *Ayurveda, Respiratory allergy, Ama, Kapha, immunomodulatory*

1. Introduction

Respiratory allergies are the major cause of morbidity in both children and adult. The disorder contributes to headaches and fatigue, limit day to day activities, interferes with sleep and therefore leads to school absenteeism in children and poor work performance in adults. The increasing prevalence of these disorders in present era is related to modern stressful life style, artificially of our food, super clean living conditions and irrelevant use of antibiotics leading to immune dysfunction and hypersensitivity of airways. According to the Modern medicine, its management includes antibiotics, antipyretic, anti-inflammatory, antihistamines, bronchodilators, mast cell stabilizers, decongestants and corticosteroids. But, these are associated with many adverse effects and lack long-term sustained effect.
Ayurveda explains the pathology of respiratory allergies as immune dysfunction which is due to formation of (undigested intermediate product) *Ama*, and *Kapha dosha*. Ayurveda has potent drugs possessing immunomodulatory, anti-allergic, anti-inflammatory and mucolytic effect which can be used for breaking the pathology of the respiratory allergy at various levels, and giving prompt symptomatic relief to the patient. The Ayurveda approach of management of respiratory allergies is to potentiate the immune system of the individual in order to reduce the susceptibility towards the allergens and at the same time providing symptomatic relief to the patient. Thus, it is supposed that these drugs can prove beneficial and provide effective and long term solution to allergic disorders and thereby may improve the quality of life and work performance. Present paper reviews the evidences regarding the efficacy of various Ayurveda drugs in the management of respiratory allergies.

2. Material and Methods

Classical texts of *Ayurveda* as well as PUBMED, MEDLINE database were used for the search of relevant literature and research papers. Papers published between Jan 1960 to Oct 2014 were only considered. The key words used for the search was respiratory allergy, asthma, rhinitis, shwas etc. Only research articles published in English language were considered. Papers in other languages were approved when there was an English abstract containing data essential for the study. Ayurvedic drugs mentioned in reference to *shwas* and *pratishyaya* and diseases of respiratory system in the classics are being reviewed here with their scientific evidences.

2.1. Shirish (Albizia lebbeck)

A study evaluated the anti-allergic activity of the standardized extract of Albizia lebbeck with respect to the catechin, a polyphenolic phytomarker. Albizia lebbeck (50-300 mg/kg) and 50 mg/kg of catechin were administered to mice to evaluate the mast cell stabilization and estimation of histamine elevation in the plasma. Findings suggest that Albizia lebbeck at different concentrations has got potent mast cell stabilizing property and the IC(50) value of Albizia lebbeck was found to be 85 microg/ml.[1] In a study, successive chloroform, methanol and water extracts of bark and leaves of Albizzia lebbeck were tested for its in vitro mast cell stabilizing effect against compound 48/80. Methanolic extract of leaf and methanolic and water extracts of bark have shown maximum activity comparable to that of disodium chromoglycate. The effect of A. lebbeck was studied on the degranulation rate of sensitized peritoneal mast cells of albino rats when challenged with antigen (horse serum). Triple vaccine was used as adjuvant. Disodium cromoglycate (DCG) and prednisolone were used for comparison. Drugs were given during the first or second week of sensitization and the mast cells studied at the end of the second or third week. Serum from these rats was used to passively sensitize recipient rats whose peritoneal mast cells were then studied. The in vitro effects of A. lebbeck and DCG on the degranulation rate of the sensitized mast cells were also studied. The results indicated that A. lebbeck has a significant cromoglycate-like action on the mast cells. In addition, it inhibits the early processes of sensitization and synthesis of reaginic-type antibodies. If A. lebbeck is given during the first week of sensitization it markedly inhibits the early sensitizing processes, while if given during the second week it suppresses antibody production during the period of drug administration.[2] Another study investigated the effect of the extract from the bark of Albizia lebbeck (AL), one of the ingredients of Ayruvedic medicines, on H1R and HDC gene expression using toluene-2,4-diisocyanate (TDI) sensitized allergy model rats and HeLa cells expressing endogenous H1R. Administration of the AL extract significantly decreased the numbers of sneezing and nasal rubbing. Pretreatment with the AL extract suppressed TDI-induced H1R and HDC mRNA elevations as well as [(3)H]mepyramine binding, HDC activity, and histamine content in the nasal mucosa. AL extract also suppressed TDI-induced up-regulation of IL-4, IL-5, and IL-13 mRNA. In HeLa cells, AL extract suppressed phorbol-12-myristate-13-acetate- or histamine-induced up-regulation of H1R mRNA. The results suggest that AL alleviated nasal symptoms by inhibiting histamine signaling in TDI-sensitized rats through suppression of H1R and HDC gene transcriptions. Suppression of Th2-cytokine signaling by AL also suggests that it could affect the histamine-cytokine network.[3] A preparation of Shirish (Shirishavaleha-confection of Shirisha) showed significant increase in Hb and considerable decrease in total eosinophil count, AEC and ESR when studied in cases of bronchial asthma.[4] The decoction of *Shirish* (*Albizzia lebbeck*) stem bark was found to be effective against bronchospasm induced by histaminic acid phosphate and shown to exert di-sodium cromoglycate like action on mast cells. A considerable fall of TLC ($p>0.01$), Eosinophil count ($p>0.001$), ESR ($p>0.01$) and increase in the level of PEFR ($p<0.001$) were observed. The effects of treatment based on the subjective parameters were highly significant.[5] The hot aqueous decoction (DO81) and its butanolic fraction (FO82) were used to study the anti allergenic activity in various models like anti PCA and mast cell stabilizing activity. There was 74 ± 1.5% and 66.1+ 4.2% inhibition of PCA protection or mast cell against degranulation was 54.33 + 2.52 and 69.9+4.56 respectivity for D081 and F082. These fractions were also studied for inhibition of Schutz date phenomenon, where 80.50-1.17 and 75.33 ± 0.99% inhibition of antigen-induced contraction was noticed.[6]

2.2. Guduchi (Tinospora cordifolia)

Adjuvant treatment with *T. cordifolia* helps to maintain adequate pulmonary functioning in chronic asthmatics and maintain quality of life, which is an important aspect of economic disease management of bronchial asthma especially of long-standing, chronic recurrent and elderly asthmatics.[7] In a study, seventy-five patients of allergic rhinitis were randomly given either Tinospora cordifolia (TC) extract or placebo for 8 weeks. They were clinically examined and Hb %, TLC, DLC and nasal smear was done. At the end of trial baseline investigations were repeated, drug decoded and results analyzed. With TC treatment 100% relief from sneezing was reported in 83% patients, in 69% from nasal discharge, in 61% from nasal obstruction and in 71% from nasal pruritis. The difference between TC and placebo groups was highly significant. After TC administration, eosinophil and neutrophil count decreased and goblet cells were absent in nasal smear. Further, TC also significantly decreased all symptoms of allergic rhinitis.[8] Tinospora cordifolia significantly decreased bronchospasm induced by 5% histamine aerosol in guinea pigs, capillary permeability, in mice and reduced number of disrupted mast cells in rats. [9-10] Aqueous extract of *Tinospora cordifolia* (Willd.) stem was evaluated on mast cell mediated allergic reactions *in vivo* and *in vitro. T. cordifolia* (125 to 1000 mg/kg) dose-dependently inhibited compound 48/80 induced lethality in rats, histamine induced paw edema in mice and histamine induced bronchial asthma in guinea pigs. *T. cordifolia* significantly ($p < 0.001$) inhibited the cutaneous anaphylaxis reaction activated by histamine in a rat model and compound 48/80 induced ear swelling response in mice. *T. cordifolia* (2.5-160 µg/mL) also showed significant ($p < 0.001$) inhibition of histamine induced contraction of guinea-pig ileum *in vitro* implying the H_1 antihistamine activity. *T. cordifolia* (0.01 to 10 mg/mL) significantly ($p < 0.001$) inhibited the histamine release from rat peritoneal mast cells activated by compound 48/80. In addition, *T. cordifolia* (0.01 to 10 mg/mL) significantly ($p < 0.001$) inhibited the secretion of tumor necrosis factor-α (TNF-α) in antidinitrophenyl (DNP) IgE-

stimulated rat peritoneal mast cells. The level of cAMP in RPMC transiently and significantly increased compared with that of control cells when *T. cordifolia* was incubated with mast cells. *T. cordifolia* (0.01 to 10 mg/mL) showed concentration-dependent inhibition in compound 48/80 induced reactive oxygen species (ROS) generation. In addition, *T. cordifolia* decreased intracellular calcium levels of activated mast cells. These results show that *T. cordifolia* may be beneficial in the treatment of acute and chronic allergic disorders. [11]

2.3. Pippali (Piper longum)

The fruits of *P. longum* are used in the treatment of bronchitis, cold, cough, paralysis; rheumatism and stomach ache in the states of Sikkim, Bengal, Bihar and Orissa. The fruits effectively reduced the passive cutaneous anaphylaxis in rats and protect guinea pigs against antigen induced bronchospasm; a 30% protection was observed in an in vitro study.[12-13] The effect of petroleum ether, alcoholic and decoction of the fruits of *P. longum* was studied for antihistaminic activity using Guinea pig ileum preparation (*in vitro*), histamine induced bronchospasm in Guinea pigs and haloperidol induced catalepsy in mice (*in vivo*). Its anti-allergic activity was evaluated using milk induced leukocytosis in mice and passive paw anaphylaxis in rats (*in vivo*). The extracts (100 µg mL^{-1}) significantly ($p<0.01$) inhibited the histamine induced contraction of isolated Guinea-pig ileum preparation. The extracts (50, 100, 200 mg kg^{-1}) showed the significant ($p<0.01$) activity and increase in dose of extract increased the % protection in histamine induced bronchospasm and also showed significant ($p<0.01$) activity in haloperidol induced catalepsy and passive paw anaphylaxis. In milk-induced leukocytes, petroleum ether and decoction extract (200 mg kg^{-1}) showed significant ($p<0.05$) decrease in number of leukocytes and alcoholic extract didn't show any significant effect.[14] Shati (Hedychium spicatum)In a clinical study conducted on children suffering from tropical pulmonary eosinophilia, *H. spicatum* was found effective in relieving signs and symptoms and reducing the blood eosinophil level in a dose of 70mg / kg of body weight. Most of the symptoms were relieved within one to three weeks period; radiological findings and lymphadenopathy were normalized after a considerably prolonged period.[15] Another study reported that, powder of *H.spicatum* when administered in patients of tropical pulmonary eosinophilia in the dose of 6 gm twice daily for 4 weeks, the eosionophil count was reduced by 60.54%.[16] The powdered rhizome when given in divided doses of 10gm to 25 patients with recurrent paroxysmal attacks of dyspnoea for 4 weeks (Bronchial asthma), completely relieved dyspnoea, cough and restlessness in all patients. The ronchi completely disappeared in 36% of the patients. The mean respiratory rate was reduced by 25% and the vital capacity increased by 20%. The mean absolute count also decreased by 55.6%. [17]

2.4. Bharangi (Clerodendron serratum)

The anti inflammatory and anti allergic activity and effect on bronchial hyper reactivity of both stem and root of Clerodendron serratum was evaluated. Result indicated that Low Dose (LD) of Bharangi root and High Dose (HD) of stem shows anti-inflammatory (23%) and anti-allergic activity (21%) equivalent to Dexamethasone (21%). But the high dose of Bharangi root has promising anti-inflammatory (44%) and anti-allergic activity (35%). Anti-allergic activity is minimal (8.6%) for LD of stem. Bharangi Root is more effective than Stem. [18] In a study aimed to evaluate the anti-asthmatic activity of an indigenous polyherbal compound Bharangyadi , containing, Bharangi (Clerodendrum serratum), Sati (Hedychium spicatum) and Pushkarmoola (Inula racemosa) through various in-vitro & in-vivo experimental models, the results demonstrate that drug has potent histamine antagonism property with significant mast cell stabilizing and spasmolytic activity in the experimental animals. Pre-treatment with Bharangyadi extract showed 80% & 86% protection from histamine induced bronchoconstriction in guinea pigs with 27.8% and 36.1% increase in pre convulsion time (equal to standard drug). Screening of Histamine antagonism activity on guinea pig ileum showed that drug reduces the smooth muscle contraction in dose dependent manner. Increasing concentration of Bharangyadi extract with maximum dose of histamine (1.6µg) showed maximum inhibition at the dose of 50mg (99.78%). Inhibition of smooth muscle contraction by addition of drug in organ bath before adding histamine showed that drug has preventive type antagonism. [19]

2.5. Kantakari (Solanum xanthocarpum)

The plant has been reported effective in the treatment of asthma and chronic bronchitis.[20] In a pilot study undertaken to investigate the clinical efficacy and safety of a single dose of Solanum xanthocarpum and Solanum trilobatum in mild to moderate bronchial asthma. The respiratory functions (FVC, FEV1, PEFR and FEF25-75%) were assessed by using a spirometer prior to and 2 h after oral administration of 300 mg powder of whole plant of either S. xanthocarpum or S. trilobatum. Standard bronchodilator drugs, salbutamol (4 mg) and deriphylline (200 mg) were used for comparison. Treatment with either S. xanthocarpum or S. trilobatum significantly improved the various parameters of pulmonary function in asthmatic subjects. However, the effect was less when compared to that of deriphylline or salbutamol.[21] Further the study was extended and the clinical efficacy of two herbs S. xanthocarpum and S. trilobatum in a dose of 300 mg tds for 3 days was investigated in mild to moderate bronchial asthma. Their effect was compared with standard bronchodilator drugs, salbutamol (4 mg) and deriphylline (200 mg). The respiratory function was assessed by measuring the peak expiratory flow rate (PEFR) using a mini peak flow meter. Improvement in lung function was assessed by physical examination (rhonchi and crepitation) and other symptoms such as cough, breathlessness and sputum. S. xanthocarpum and S. trilobatum produced a progressive improvement in the ventilatory function of asthmatic individuals over 3 days. The scores for rhonchi, cough, breathlessness and sputum were reduced by these drug treatments. The improvement in PEFR and the reduction in other symptom scores indicate a bronchodilator effect, a decrease of oedema and secretions in the airway lumen. The response was found to be equivalent to that of deriphylline but less than salbutamol.[22]

2.6. Pushkaramula (Inula racemosa Linn.)

The alcoholic extract of root of Inula racemosa, was studied for its antiallergic effect in experimental models of type I hypersensitivity, (egg albumin induced passive cutaneous anaphylaxis (PCA) and mast cell degranulation in albino rats). Assessment of protection against egg albumin induced passive cutaneous anaphylaxis by different doses of Inula racemosa was done by giving drug intraperitoneally or orally for seven days or once only. Inula racemosa (i.p. as well as p.o.) showed significant protection against egg albumin induced PCA. Protection against compound 48/80 induced mast cell degranulation by alcoholic extract of Inula racemosa (single dose) was similar to that of disodium cromoglycate. Drug treatment for seven days schedule showed greater protection than disodium cromoglycate intraperitoneally. Findings indicate that Inula racemosa possesses potent antiallergic properties in rats.[23] Another study reported that Inula racemosa extract at concentration 5,10,20 and 40 mcg/ml produced dose related inhibition of mast cell degranulation.[24]

2.7. Karkatshringi (Pistacia integerrima stew. Ex. Brandis)

Galls of Pistacia integerrima are valued in traditional medicine used in India for the treatment of asthma, chronic bronchitis, phthisis, diarrhea, fever, other ailments for the respiratory tract, and as antispasmodic, carminative, antiamoebic and anthelmintic. Essential oil of Pistacia integerrima J.L. Stewart ex Brandis galls (EOPI) was tested using in vitro studies such as antioxidant activity, mast cell degranulation, angiogenesis, isolated guinea pig ileum preparation and soyabean lipoxidase enzyme activity. In vivo studies included lipopolysaccharide-induced bronchial inflammation in rats and airway hyperresponsiveness in ovalbumin in sensitized guinea pigs using spirometry. EOPI (5-30 µg/ml) inhibits 5-lipoxidase enzyme activity with IC50 of 19.71 µg/ml and DPPH scavenging activity up to 100 µg/ml with maximum inhibition of 44.93 ± 2.53% at 100 µg/ml. Pre-treatment with EOPI inhibited erythropoietin-induced angiogenesis. It showed dose dependent (10, 30 and 100 µg/ml) anti-allergic activity by inhibiting compound 48/80 induced mast cell degranulation to an extent 19.08 ± 0.47%. The finding that essential oil induced inhibition of transient contraction of acetylcholine in calcium free medium, and relaxation of S-(-)-Bay 8644-precontracted isolated guinea pig ileum jointly suggests that the L-subtype Cav channel is involved in spasmolytic action of EOPI. Treatment with EOPI dose dependently (7.5, 15 and 30mg/kg i.p.) inhibited lipopolysaccharide-induced increase in total cell count, neutrophil count, nitrate-nitrite, total protein, albumin levels in bronchoalveolar fluid and myeloperoxidase levels in lung homogenates. Roflumilast was used as a standard. EOPI reduced the respiratory flow due to gasping in ovalbumin sensitized guinea pigs.[25] Further, in another study, Pistacia integerrima leaves extracts showed significant response against chemically induced pain ($P<0.001$) whereas galls extracts had highly significant protection ($P<0.0001$) in a dose dependent manner. In thermally induced algesia, Pistacia integerrima galls extracts 200 mg/kg (p.o.), showed significant ($P<0.05$) response but less than pentazocine and diclofenac, positive references. The extracts of Pistacia integerrima 50-200 mg/kg (p.o.) had modest activity against hind paw acute and chronic inflammation induced by formalin ($P<0.01$).[26]

2.8. Madhuyashti (Glycyrrhiza glabra)

Glycyrrhizin (GRZ), a major constituent of a plant Glycyrrhiza glabra, GRZ alleviates asthmatic features in mice. A study evaluated its efficacy on asthmatic features in a mouse model of asthma. BALB/c mice were sensitized and challenged with ovalbumin (OVA) to develop the asthmatic features such as airway hyperresponsiveness: allergen induced airway constriction and airway hyperreactivity (AHR) to methacholine (MCh), and pulmonary inflammation. The mice were orally treated with GRZ (2.5, 5, 10 and 20 mg/kg) during or after OVA-sensitization and OVA-challenge to evaluate its protective or reversal effect, respectively on the above asthmatic features. The status of airway hyper responsiveness was measured by monitoring specific airway conductance (SGaw) using a non-invasive method and the pulmonary inflammation was assessed by haematoxylin and eosin staining of lung sections. Several other parameters associated with asthma such as interleukin (IL)-4, IL-5 interferon-gamma (IFN-gamma), OVA-specific IgE, total IgG(2a) and cortisol were measured by ELISA. GRZ (5 mg/kg) markedly inhibited OVA-induced immediate airway constriction, AHR to MCh ($p<0.01$), lung inflammation, and infiltration of eosinophils in the peribronchial and perivascular areas. It prevented the reduction of IFN-gamma ($p<0.02$), and decreased IL-4 ($p<0.05$), IL-5 ($p<0.05$) and eosinophils ($p<0.0002$) in the BAL fluid. Also, it reduced OVA-specific IgE levels ($p<0.01$) and prevented the reduction of total IgG(2a) ($p<0.01$) in serum.[27] Further, *Glycrrhiza* exhibits expectorant action.[28]

2.9. VASA (Adhatoda vasica)

A polyherbal combination DCBT4567-Astha-15 with vasa as the main ingredient was found as effective as salbutamol (12mg/day) or salbutamol (12 mg/day) in combination with theophylline (200 mg/day) in the treatment of reversible asthmatics. The plant has also shown credible antitussive activity as comparable to codeine, bronchodilator activity in both *in vivo* and *in vitro* studies, anti-hyperglycemic activity, antiviral activity, antitumor activity and immune-stimulant activity in various studies.[29] A study investigated a mode of action profile of RLX (6, 7, 8, 9, 10, 12-hexahydro-azepino-[2, 1-b]-quinazoline-12-one) a bronchodilator obtained by the chemical modification in the molecule of alkaloid vasicine (Ex: Adhatoda vesica). The effect of RLX (p.o.) was observed on: (a) mast cell degranulation, (b) release of histamine and prostaglandin E (PGE), (c) 45Ca uptake and (d) activities of cAMP phosphodiesterase (PDEase) and lipoxygenase enzymes in mesenteries/peritoneal mast cells/lung tissue homogenates in rats under systemic anaphylaxis. RLX (10 and 20 mg/kg) inhibited antigen-induced mast cell degranulation and released of histamine from target tissues. An increased outflow of PGE (lungs) and an inhibited 45Ca uptake (peritoneal mast cells) were noted. Lung PDEase and lipoxygenase activities were decreased. Results suggest that RLX could be acting like disodium cromoglycate and aminophyline with additional attributes its oral efficacy and long duration of action.[30] Further in another study, the antitussive activity of Adhatoda vasica (AV) extract was

evaluated in anaesthetized guinea pigs and rabbits and in unanaesthetized guinea pigs and was found to have a good antitussive activity. Intravenously, it was 1/20-1/40 as effective as codeine on mechanically and electrically induced coughing in rabbits and guinea-pigs. On oral administration to the guinea-pig the antitussive activity of AV was similar to codeine against coughing induced by irritant aerosols.[31]

2.10. Haridra (Curcuma longa)

Anti asthmatic property of curcumin, a natural product from the rhizomes of *Curcuma longa* has been tested in the guinea pig models of airway hyper responsiveness. Guinea pigs were treated with curcumin during sensitization (to examine preventive effect) and after developing impaired airway features (to examine therapeutic effect). The study demonstrate that curcumin is effective in improving the impaired airways features in OVA sensitized guinea pigs. [32] A study investigated the effects of intranasal curcumin in chronic asthma where animals were exposed to allergen for longer time. Balb/c mice were sensitized by an intraperitoneal injection of ovalbumin (OVA) and subsequently challenged with 2%nd OVA in aerosol twice a week for five consecutive weeks. Intranasal curcumin (5mg/kg) was administered from days 21 to 55, an hour before every nebulization and inflammatory cells recruitment, levels of IgE, EPO, IL-4 and IL-5 were found suppressed in bronchoalveolar lavage fluid (BALF). Intranasal curcumin administration prevented accumulation of inflammatory cells to the airways, structural alterations and remodeling associated with chronic asthma like perifebronchial and airway smooth muscle thickening, sloughing off of the epithelial lining and mucus secretion in ovalbumin induced murine model of chronic asthma.[33] In another study, intranasal curcumin has been detected in plasma after 15 min to 3 h at pharmacological dose (5 mg/kg, i.n.), which has shown anti-asthmatic potential by inhibiting bronchoconstriction and inflammatory cell recruitment to the lungs. At considerably lower doses has proved better than standard drug disodium cromoglycate (DSCG 50 mg/kg, i.p.) by affecting inflammatory cell infiltration and histamine release in mouse model of asthma. HPLC detection revealed that curcumin absorption in lungs has started after 30 min following intranasal administration and retained till 3h then declines. Results suggest that intranasal curcumin (5.0 mg/kg, i.n.) has effectively being absorbed and detected in plasma and lungs both and suppressed airway inflammations at lower doses than the earlier doses used for detection (100-200 mg/kg, i.p.) for pharmacological studies (10-20 mg/kg, i.p.) in mouse model of asthma.[34] Curcumin also attenuates allergic airway inflammation by regulation of CD4+CD25+ regulatory T cells (Tregs)/Th17 balance in ovalbumin-sensitized mice. Study aimed to determine the protective effects and the underlying mechanisms of curcumin on ovalbumin (OVA)-induced allergic inflammation in a mouse model of allergic asthma. A total of 60 mice were randomly assigned to six experimental groups: control, model, dexamethasone (2 mg/kg), and curcumin (50 mg/kg, 100 mg/kg, and 200 mg/kg). Study demonstrated that curcumin inhibited OVA-induced increases in eosinophil count; interleukin (IL)-17A level were recovered in bronchoalveolar lavage fluid. Histological studies demonstrated that curcumin substantially inhibited OVA-induced eosinophilia in lung tissue. Flow cytometry (FCM) studies demonstrated that curcumin remarkably inhibited Th17 cells and significantly increased Treg cells. The results in vivo showed that curcumin treatments markedly attenuated the inflammatory in asthma model by regulating Treg/Th17 balance.[35] The effect of curcumin on NF-κB transcriptional activity was investigated using a cell-based luciferase reporter assay in A549 cells and by measuring inhibitory κBα (IκBα), p65, and p50 levels after exposure of Raw264.7 cells to lipopolysaccharide (LPS). BALB/c mice were sensitized to ovalbumin (OVA) by intraperitoneal injection, and challenged with repeated exposure to aerosolized OVA. The effects of daily administered curcumin (200mg/kg body weight, i.p.) on airway hyper-responsiveness (AHR), inflammatory cell number, and IgE levels in bronchoalveolar lavage (BAL) fluid were analyzed. NF-κB activation in lung tissue was also assessed by Western blot analyses. Curcumin inhibited NF-κB-dependent transcription in reporter assays in A549 cells with an IC(50) of 21.50±1.25μM. Curcumin stabilized IκBα and inhibited nuclear translocation of p65 and p50 in LPS-activated Raw264.7 cells, and curcumin-treated mice showed reduced nuclear translocation of p65 in lung tissue. Treatment with curcumin significantly attenuated AHR and reduced the numbers of total leukocytes and eosinophils in BAL fluid. Infiltration of inflammatory cells and mucus occlusions in lung tissue were significantly ameliorated by treatment with curcumin, which also markedly decreased the level of IgE in BAL fluid. [36]

3. Compound Drugs

A botanical formulation (Aller-7) was evaluated for the treatment of allergic rhinitis using a combination of extracts from seven medicinal plants, including Phyllanthus emblica, Terminalia chebula, Terminalia bellerica, Albizia lebbeck, Piper nigrum, Zingiber officinale and Piper longum. The effect of Aller-7 on rat mesenteric mast cell degranulation was studied by incubating different concentrations of Aller-7 and challenging them with a degranulating agent, compound 48/80. The inhibitory activity of Aller-7 was determined against lipoxygenase and hyaluronidase, the key enzymes involved in the initiation and maintenance of inflammatory responses. Furthermore, most of these manifestations are due to histamine, which causes vasodilatation, increasing capillary permeability and leading to bronchoconstriction. Hence, the antihistaminic activity of Aller-7 was determined is isolated guinea pig ileum substrate using cetirizine as a positive control. The antispasmodic effect of Aller-7 on contractions of guinea pig tracheal chain was determined using papaverine and cetirizine as controls. Aller-7 exhibited potent activity in all these in vitro models tested, thus demonstrating the novel anti-allergic potential of Aller-7.[37]

The effect of "Pentapala-04" (prepared from five medicinal plants namely, Adhatoda vasica Need, Ocimum sanctum Linn, Coleus aromaticus Benth, Glycyrrhiza glabra Linn and Alpiania galangal Sw) on ova albumin and aluminium hydroxide induced lung damage in albino wistar rats was investigated. The rats were divided into three groups of four animals each. Group I, II and III served as control, toxic and post treatment group respectively. Results showed that there was increased level of lipid peroxidation and decreased level of antioxidants in toxic group animals. But the levels of antioxidant enzymes were restored in post-treated groups of animals.[38]

4. Conclusion

The review of the ayurvedic drugs indicate that these drugs possess potent anti-allergic and anti inflammatory activity and can be successfully used for the management of respiratory allergies like allergic asthma and allergic rhinitis.

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