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Review

Review on Antiasthamatic Herbs

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Abstract

Asthma is a disease of the airways which is chronic in nature. The inflammation of the airways results in increased contractibility of the smooth muscles which are surrounding the airways. As a result of this, the airways are narrowed and finally it results in wheezing. The causes of asthma are both environmental and genetic. Epigenetic as well as the changes occurring in the environment cause asthma. Allergens, air pollution, high ozone levels, traffic pollution, cockroaches, dust mites, animal dander, mould and smoking are the factors that result in asthma. Asthma is essentially characterized by the restriction of obstruction tracheal muscle. Herbs are used as a natural remedy for the management of asthma. The treatment of asthma is mainly focused on the strengthening of the health of the lungs, nervous and immune systems. This generally requires long time therapy and more over the people has been realized serious adverse effects of the synthetic drugs which are used in the management of asthma. As a result, the world has started exploring the herbs as an agent of asthma therapy. Plants which are comparatively economical, easily available, and relatively free from the hazardous side effects are usually selected.

From ancient times, Ayurvedic science has explored, analysed and documented the medicinally important plants through assessment of their multiple modes of therapeutic action. Natural products have been an important resource for maintaining life for ages, as evident from Indian Ayurvedic literatures like Charak and Sushruta Samhita. Current synthetic drugs hold no promise incomplete healing of these disorders. In contrast to them, many target specific herbal alternatives have been recognized due to properties like bronchodilator, mast cell stabilization, anti-inflammatory, anti-allergic, immunomodulatory as well as inhibitory action on mediators of inflammation (leukotriene's, cyclooxygenase, cytokines etc.)

Keywords: Asthma, Medicinal plants, Antiasthamatic drugs, Herbal drugs.

INTRODUCTION

Asthma is a common chronic disorder of the airways that involves a complex interaction of air flow obstruction, bronchial hyper responsiveness and an underlying inflammation. This interaction can be highly variable among patients and within patients over time. This section presents a definition of asthma, a description of the processes on which that definition is based the pathophysiology and pathogenesis of asthma, and the natural history of asthma.

The World Health Organization recognizes asthma as a major health problem[1]. Bronchial Asthma is one of the major respiratory disorders in clinical practice which is caused by a combination of complex and incompletely understood environmental and genetic interactions. It is characterized by chronic airway inflammation and increased hyper- responsiveness leading to cough, wheeze, chest tightness and dyspnoea[2].

The overall Burden of asthma in India is estimated at more than 15 Million patients[3]. However, India is a vast country with immense geographical, economical, racial, religious and Socio-political diversity. In a survey of more than 2000 individuals, asthma prevalence was 2.0% in women and about 3.65% in men[4].

India is known as the "Emporium of Medicinal plants" due to availability of several thousands of medicinal plants in the different bioclimatic zones Medicinal plants continue to provide valuable therapeutic agents, both in modern medicine and in traditional systems of medicine. It has fewer side effects than modern medicine. Medicinal plants are being used largely for the treatment of various respiratory disorders including Bronchial Asthma. Plants are the only economic source of a number of well-established and important drugs. Numbers of Siddha formulations are offered for the treatment of Bronchial Asthma.it has more anti–asthmatic herbs.[5]

Definition of Asthma

Asthma is a chronic inflammatory disorder of the airways. The inflammation of the airways results in increased contractibility of the smooth muscles which are surrounding the airways.

PATHOPHYSIOLOGY AND PATHOGENESIS OF ASTHAMA:

These include

Bronchoconstriction

In asthma, the dominant physiological event leading to clinical symptoms is airway narrowing and a subsequent interference with airflow. In acute exacerbations of asthma, bronchial smooth muscle contraction (bronchoconstriction) occurs quickly to narrow the airways in response to exposure to a variety of stimuli including allergens or irritants. Allergen-induced acute bronchoconstriction results from an IgE-dependent release of mediators from mast cells that includes histamine, tryptase, leukotrienes, and prostaglandins that directly contract airway smooth muscle [6].Aspirin and other non-steroidal anti-inflammatory drugs can also cause acute airflow obstruction in some patients, and evidence indicates that this non-IgE-dependent response also involves mediator release from airways cells [7].

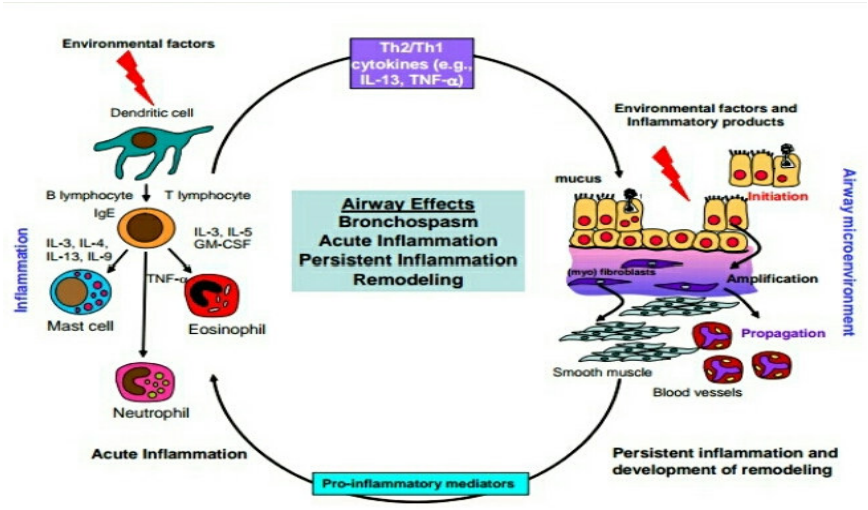


Fig 01: Factor Limiting Airflow in Acute and Chronic Asthma

PATHOPHYSIOLOGICAL MECHANISMS IN THE DEVELOPMENT OF AIRWAY INFLAMMATION

Inflammation has a central role in the pathophysiology of asthma. As noted in the definition of asthma, airway inflammation involves an interaction of many cell types and multiple mediators with the airways that eventually results in the characteristic pathophysiological features of the disease: bronchial inflammation and airflow limitation that result in recurrent episodes of cough, wheeze, and shortness of breath. The processes by which these interactive events occur and lead to clinical asthma are still under investigation.

Moreover, although distinct phenotypes of asthma exist (e.g. Intermittent, persistent, exercise-associated, aspirin-sensitive, or severe asthma), airway inflammation remains a consistent pattern. The pattern of airway inflammation in asthma, however, does not necessarily vary depending upon disease severity, persistence, and duration of disease. The cellular profile and the response of the structural cells in asthma are quite consistent.

Inflammatory Cells

Lymphocytes

An increased understanding of the development and regulation of airway inflammation in asthma followed the discovery and description of lymphocytes, T helper 1 cells and T helper 2 cells (Th1 and Th2), with distinct inflammatory mediator profiles and effects on airway function (figure no.2). After the discovery of these distinct lymphocyte subpopulations in animal models of allergic inflammation, evidence emerged that, in human asthma, a shift, or predilection, toward the Th2-cytokine profile resulted in the eosinophilic inflammation characteristic of asthma [9].

Mast cells

Activation of mucosal mast cells releases bronchoconstriction mediators (histamine, cysteinyl - leukotriene, prostaglandin D2)[11]. Although allergen activation occurs through high-affinity IgE receptors and is likely the most relevant reactions sensitized mast cells also may be activated by osmotic stimuli to account for exercise-induced bronchospasm (EIB). Increased numbers of mast cells in airway smooth muscle may be linked to airway hyper responsiveness.

Eosinophil

Increased numbers of eosinophil exist in the airways of most, but not all, persons who have asthma [13]. These cells contain inflammatory enzymes, generate leukotriene, and express a wide variety of pro-inflammatory cytokines. Increases in eosinophil's often correlate with greater asthma severity[14].

Neutrophils

Are increased in the airways and sputum of persons who have severe asthma, during acute exacerbations, and in the presence of smoking. Their pathophysiological role remains uncertain; they may be a determinant of a lack of response to corticosteroid treatment [15].

Dendritic cells

These cells function as key antigen-presenting cells that interact with allergens from the airway surface and then migrate to regional lymph nodes to interact with regulatory cells and ultimately to stimulate Th2 cell production from naïve T cells [17]

Macrophages

Macrophages are the most numerous cells in the airways and also can be activated by allergens through low-affinity IgE receptors to release inflammatory mediators and cytokines that amplify the inflammatory response [18].

Inflammatory Mediators

Chemokine: are important in recruitment of inflammatory cells into the airways and are mainly expressed in airway epithelial cells [19]. Exotoxin is relatively selective for eosinophil, whereas thymus and activation-regulated chemokine's (TARCs) and macrophage-derived chemokine (MDCs) recruit Th2 cells. There is an increasing appreciation for the role this family of mediators has in orchestrating injury, repair, and many aspects of asthma[19].

Cytokines: direct and modify the inflammatory response in asthma and likely determine its severity. Th2-derived cytokines include IL-5, which is needed for eosinophil differentiation and survival, and IL-4 which is important for Th2 cell differentiation and with IL-13 is important for IgE formation[20].

Cysteinyl-leukotrienes: are potent Broncho constrictors derived mainly from mast cells. They are the only mediator whose inhibition has been specifically associated with an improvement in lung function and asthma

symptoms [20]. Recent studies have also shown leukotriene B4 can contribute to the inflammatory process by recruitment of neutrophils [21].

Nitric oxide (NO): is produced predominantly from the action of inducible NO synthase in airway epithelial cells; it is a potent vasodilator [22]. Measurements of fractional exhaled NO (FeNO) may be useful for monitoring response to asthma treatment because of the purported association between FeNO and the presence of inflammation in asthma [23].

Immunoglobulin E

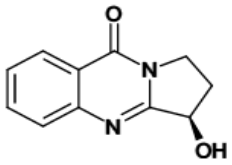
IgE is the antibody responsible for activation of allergic reactions and is important to the pathogenesis of allergic diseases and the development and persistence of inflammation. IgE attaches to cell surfaces via a specific high-affinity receptor[24].The development of monoclonal antibodies against IgE has shown that the reduction of IgE is effective in asthma treatment. These clinical observations further support the importance of IgE to asthma[2]**.**

ANTIASTHAMATIC HERBS

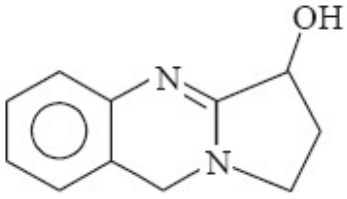
1) Adulsa

Fig 02: Adulsa

Synonym: Adulsa, Vasaka.
Vernacular Name: Adulsa
Biological source: It consists of dried, as well as fresh leaves of the plant ***Adhatoda vasica.***
Family: Acanthaceae
Part Used: Leaves.
Chemistry: Leaves contain quinazoline derivatives such as vasicine 2.0 to 2.5%, vasicinone and 6-hydroxy vaccine. The drug also contain volatile oil, betain and vasakin.[28]



Vasicinone



Vasicine

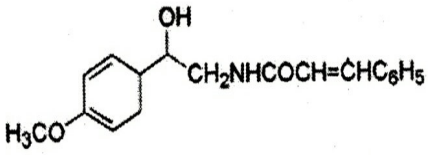
PHARMACOLOGICAL ACTIONS

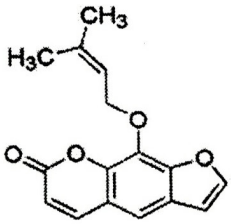
The traditional healers are using this herb for the treatment of chronic Asthma. Adusa is known as Vasa or Vasak in Sanskrit and is a reputed drug for Asthma mentioned in Ayurveda. *Adhatoda vasica*is considered in the east to be the best possible treatment for all chest diseases and used in India as an expectorant, antitussive and in other respiratory disease. It is also used widely to relieve asthma. Adhatoda vasica has been bronchial asthma. Research performed over the last three decades revealed that the alkaloids present in the leaves, vasicine and vasicinone, possess powerful respiratory stimulant activity. Its essential oil exhibited antitussive (cats), expectorant (rats and rabbit), and antiasthmatic (guinea pig) activity in *in-vivo* experiments.[29]

02] Bael

Fig 03: Bael

Synonym: - Bel, Indian Bael.
Vernacular Name:-Bel.
Biological Source: It consists of unripe or half ripe fruits and leaves obtained from ***Aegle marmelos***.
Family: - Rutaceae.
Parts used: Fruit & leaves.
Chemistry: Tannins, active principle (marmelosin), alkaloids (aegelin & aegelinin) and coumarin (marmesin).The drug also contain carbohydrates (11-17%), protein, Vitamin C, Vitamin A and volatile oil.[28]





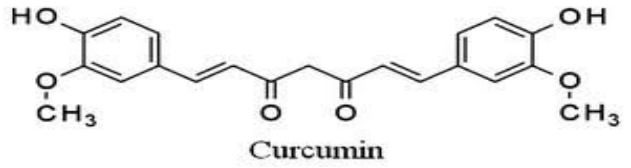
PHARMACOLOGICAL ACTIONS
Its leaf extract is being used in Indian system of medicine as an Antidiabetic agent and traditional text of India prescribe it in the management of asthma. Therefore the effect of the alcoholic extract of the leaves of *Aegle marmelos*. On guinea pig isolated ileum and tracheal chain was investigated using the isolated organ bath method. 1mg/ml and 2mg/ml doses of the alcoholic extract of this plant produced a positive relaxant effect in isolated guinea pig ileum and tracheal chain, respectively. In addition, they antagonized the contractions, which are produced by histamine. Because the alcoholic extracts elicited the antagonistic effect against histamine and also relaxed the histamine-induced contractions, it can be concluded that relaxations induced by *A. marmelosin* both guinea pig ileum and tracheal chain were due to the depression of H1-receptors. This study shows that Aegle marmeloscan be used effective in the treatment of asthmatic disorder.

03] Turmeric

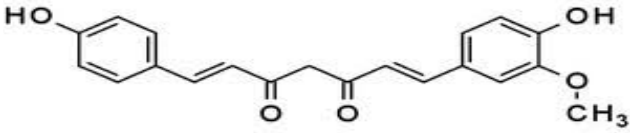
Fig 04: Turmeric

Synonym: Haldi.
Vernacular Name:-Halad

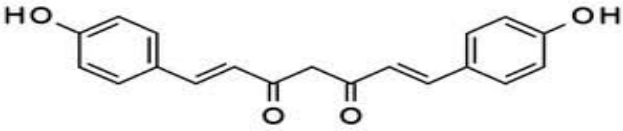
Biological Source: It consist of dried rhizomes of the plant ***Curcuma longa.***
Family: - Zingiberaceae
Parts used:-Rhizoms and bulb
Chemistry:-Turmeric rhizomes contain about 5% curcuminoids consisting of a mixture of compound and its derivatives. The standerdiesed extracts of curcumin generally consist of curcumin, desmethoxycurcumin and bisdesmethoxycurcumin Curcumin, Turmeric Extract, Food Color E100, diferuloylmethane, 1,7- Bis(4-hydroxy-3-methoxyphenyl)-1,6- heptadiene-3,5-dione Chemical Formula: $C_{21}H_{20}O_6$ [31].



Curcumin



Demethoxycurcumin



Bis-demethoxycurcumin

PHARMACOLOGICAL ACTIONS

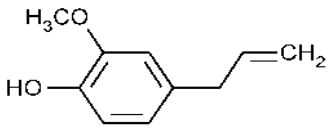
Curcuma longa has been known to Indians since centuries. It has been purported to have anti-inflammatory actions Anti-asthmatic property of Curcuma longa has been tested in experimental animal model of airway hyper responsiveness and has been documented to be effective in improving the impaired airways features. A study from Journal of Alternative and Complementary Medicine confirms that Curcumin is safe in several human trials and inhibits a number of pro-inflammatory mediators that play an important role in asthma [32].

04] Tulsi

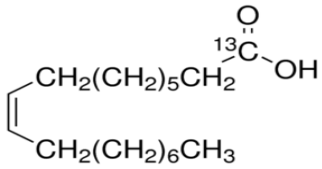
Fig 05: Tulsi

Synonym:-Holy basil, Sacred basil.
Vernacular Name:-Tulsi.
Biological Source: Tulsi consist fresh and dried leaves of ***Ocimum sanctum.***
Family: - Labiatae.
Parts used:-Whole plant.

Chemistry: - The plant is contain alkaloids, glycosides, saponin, tannins, vitamin C, and maleic, citric, and tartaric acid. The leaves contain a high content of essential oils which include Toluene, Camphene, Octane, Benzene, Citronellel, Sabinene, Limocene, Ledol, Dimethyl benzene, Ethyl-2- methyl butyrate, Eugenol, Terpiniolene.
It contain eugenol, carvacrol, caryophyllin, and eugenol-methyl-ether.Seedsof this plant are chief source of fixed oils such as Oleic acid, Stearic acid, Hexourenic acid, Palmitic acid, Linodilinolin and Linolenic acid.[28]



Eugenol



Oleic Acid

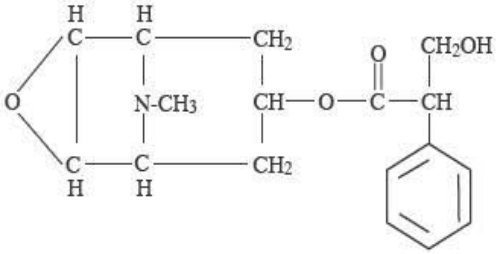
PHARMACOLOGICAL ACTIONS

The anti-asthmatic activity of a 50% aqueous ethanol extract of dried and fresh leaves, and the volatile and fixed oils of *Ocimum sanctum* was evaluated against histamine and acetylcholine induced pre-convulsive dyspnea (PCD) in guinea pigs. The 50% ethanol extract of fresh leaves, volatile oil extracted from fresh leaves and fixed oil from the seeds significantly protected the guinea pigs against histamine- and acetylcholine-induced PCD.

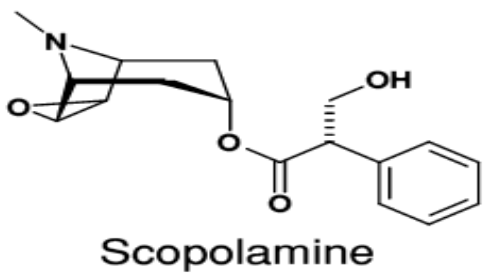
05] Belladonna

Fig 06: Belladonna

Synonyms: belladonna leaf.
Vernacular Name: Beladado.
Biological Source: Belladona herb consists of dried leaves or the leaves and other aerial parts of ***Atropa belladona.***
Family-Solanaceae.
Part Used: Whole Plant.
Chemistry: The total alkaloidal content of drug is 0.4-1. Root (0.6 per cent), stem (0.05 per cent), leaves (0.4 per cent), unripe berries (0.19-0.21 percent), The main alkaloids are hyoscamine, atropine, hyoscine, pyridine n-methyl pyrroline and homotropine.[28]



Atropine



Scopolamine

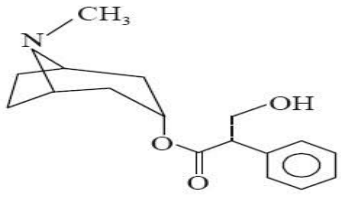
PHARMACOLOGICAL ACTIONS

It is a powerful antispasmodic intestinal colic and spasmodic asthma. Occasionally the leaves are employed as an ingredient of cigarettes for relieving asthma [34]

06] Datura

Fig 07: Datura

Synonyms: Datura herb.
Vernacular Name: Dhatura.
Biological Source: Datura consists of dried leaves and flowering tops of ***Datura metel.***
Family: Solanaceae.
Plant part: Whole plant
Chemistry:-It contains up to 0.5 per cent of total alkaloids, among hyoscine (scopolamine) is the main alkaloids, while hyoscyamine and atropine are present in very less quantities.[28]



Hyoscyamine

PHARMACOLOGICAL ACTIONS

The whole plant, but especially the leaves and seed, is, antiasthmatic, antispasmodic, antitussive, and bronchodilator. In China, the plant is used in the treatment of asthma. In Vietnam, the dried flowers and leaves are cut into small chips and used in antiasthmatic cigarettes. Total alkaloid content of the leaves is 0.426%, which is mainly atropine. The seeds contain 0.426% alkaloids, which is mainly hyoscyamine. The roots contain 0.35% hyoscyamine [3]

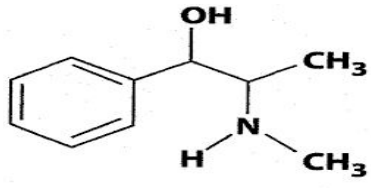
07] Ephedra

Fig 08: Ephedra

Synonyms: Ma Huang.
Vernacular Name: Ephedra.
Biological Source: It consists of dried young stems of Ephedra gerardiana.
Family: Ephedraceae
Plant part: Young Stem.
Chemistry: It contains the amino alkaloids. They are Ephedrine, noe-ephedrine, n-methyl ephedrine, Pseudo-ephedrine etc. Along with the amino alkaloids, macrocyclic alkaloids called ephdradine are present in roots.[28]

PHARMACOLOGICAL ACTIONS

This is the most widely known Chinese herb used to treat asthma. Ephedra plants contain about 2 to 3% naturally occurring ephedra alkaloids, mostly ephedrine and pseudoephedrine both alkaloids stimulate the alpha and beta adrenergic receptors, and in general act similarly to norepinephrine (adrenaline). This in turn will act to dilate the Bronchial tubes (for asthma, hay fever etc.) as well as increase CNS and cardiac activity. The only safe recommended use of ephedra is for short-term bronchodilation[36].



ephedrine

CONCLUSION

Plants are always an important source of drugs in fact many of the currently available drugs were derived either directly or indirectly from them. In the past decade, research has been focused on scientific evaluation of traditional drugs of plant origin for the treatment of various diseases. In developing countries 80% of population is using traditional medicine in primary medical problems. In addition to prescription and non-prescription drugs, there are an increasing number of herbs that can be used to treat many of the precursor or chronic conditions of asthma. Precautions should be taken when combining herbs with prescription or non-prescription drugs, as there is always the possibility of drug – drug interaction and adverse drug reaction. Herbs for asthma should not be used in the case of a moderate or severe asthma attack but they are often very effective in controlling the chronic symptoms of asthma. Herbs for asthma can be used in conjunction with prescribed medications but they should not replace prescription medications unless the patient is under the care of a physician.

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