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A Review on Anti-Asthmatic Potential of Various Medicinal Plants

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ABSTRACT

Asthma is a serious allergic disorder of the respiratory system, marked by inflammation and narrowing of airways. It affects about 300 million people worldwide. This has a great burden on medical treatment. Several medicines are available, but they have many serious side effects. Therefore, there is a need to search for a new therapeutic agent with no or minimal side effects while most economical for patients. In folk medicine, anti-asthmatics herbal medicine has been used and showed potential therapeutic and anti-asthmatic efficacy due to the presence of potentially active compounds. Bronchial asthma is a paroxysmal attack of situations such as breathlessness, chest tightness, and wheezing resulting from paroxysmal narrowing of the bronchial airways. Asthma is characterized by inflammation, obstruction, and hyper-responsiveness of the airway. Ayurveda is mentioned in the use of herbal formulations in the treatment of various human diseases and disorders. Some plants and their extracts mentioned in the above review have shown anti-asthmatic, Anti-histaminic, and anti-allergic activity.

KEYWORDS: Asthma, bronchospasm, obstruction per-responsiveness, anti-asthmatic plants, Ayurveda, antiallergic activity.

I. INTRODUCTION

The term “asthma” comes from the Greek meaning, “to breathe hard”.Asthma is an airway disorder caused due to various intrinsic as well as extrinsic factors such as cold, exercise, medications, genetics and house dust, animal fur, or various foods respectively. It causes the narrowing of the airway by the changes in the levels of mast cells, eosinophils, cytokines, and other various inflammatory mediators[1].

Nowadays, most of the cases of asthma were considered similar but differ only based on disease severity. Therefore, the treatment of patients with asthma requires differences in dose, route of intake, or frequency of taking the ß2-adrenoceptor agonist, and corticosteroids that are essential to managing asthma disease. However, asthma sub-phenotypes identification has challenged this view in the modern medicinal system. Forthe past two decades, research has identified the fundamental source of asthma is the allergic pathways.

The National Institute of Health defines asthma as a chronic inflammatory disorder of the airways in which cellular elements play a major role, particularly mast cells, T-lymphocytes, eosinophils, epithelial cells, and neutrophils. Asthma is an inflammatory disease that targets the airway’s narrowing and thereby resulting in the change of eosinophils, mast cells, lymphocytes, and cytokine levels[2]. The exacerbation of coughing, dyspnoea, wheezing, and chest tightness characterizes it. The individual with asthma is well known to have a high level of IgE that binds to the receptor of a most cell and inflammatory products. The interaction between antigen and antibody IgE results in the activation of inflammatory cellular reactions. Thereby releasing mediators such as histamine, and prostaglandins that ultimately lead to the contraction of airway smooth muscles.

Mast cell plays a key role in the pathophysiology of asthma and is abundant in the airways of asthmatic patients. They are orchestrated by several interacting cytokines, one of which is stem cell factor released by the epithelial cell upon encounter with inhaled allergens. Inhaled allergens activate sensitized mast cells by crosslinking surface-bound IgE molecules to release various bronchoconstrictor mediators. The allergens are also

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processed by dendritic cells, which are conditioned by thymic stromal lymphopoietin (TSLP) secreted by epithelial and mast cells to release several chemokines that attract T helper 2 cells, these cells in turn, induce B cells to produce and secrete IgE antibodies that sensitize mast cells, induce eosinophil mediated inflammation and stimulate mast cell proliferation[3].

The concept of Herbalism through complementary and alternative medicine has emerged as a tool to explore potent pharmacological interventions for asthmatic reactions with nil or

1.1. Glycyrrhiza glabra Linn. (Fabaceae)

Glycyrrhiza glabrais commonlycalled'Mulethi'[4]and is popularly known for its use in cough, cold, and other respiratory ailments in various regions of India. This medicinal plant isfound in Asia and various parts of southern Europe. Ethanolic or aqueous extract of aerial parts of G.glabra at100mg/kg body weight in mast cell degranulation in sensitized albino rats possess anti-asthmatic activity[5].The anti-inflammatory, Anti-asthmatic, and anti-oxidant are dueto glycyrrhizin decreasing leukotriene and cytokine levels significantly[6].

Fig No.1

1.2. Ficus racemose (Moraceae)

Ficus racemose is commonly called 'Udumbara' in Marathi and other names such as Ficus glomerata, Ficus lucescens, and Ficus racemose var. elongate[7]. Different aerial and non-aerial parts of this plant namely bark, leaf, fruits, and roots used as anti-asthmatic, hepatoprotective, diabetes, carminative, astringent, antioxidant, anti-dysentery, etc. Ethanolic extract of Ficus racemose plant bark at the dose of 100mg/kg, p.o. in clonidine-induced catalepsy in mice and mast cell fewer side effects. Rigveda, of India, and Hippocrates, the Greek physician of Western medicine believed that diseases have natural causes and used various herbal remedies for treatments. Herbalism defines the role of medicinal herbs to prevent, and treat diseases and to promote well-being (maintaining health and healing).

II. SOME MEDICINAL PLANTS WITH ANTI-ASTHMATIC POTENTIAL

degranulation possessa significant anti-asthmatic effect[8]. The barkcontainsvarious types of sterols like β-sitosterol, lupeol, and stigmasterol[9].

Fig No. 2

1.3. Alternanthera Sessilis Linn. (Amaranthaceae)

Alternanthera Sessilisis commonly called 'Kanchari' in Marathi[10]. Young shoots are used as a vegetable in shri Lanka and also used as a medicinal plant in China and India. Traditionally the plant is used to treat diseases such as asthma, liver illness, skin diseases, and ulcers[11].It contains β-carotene, α and β- spina sterol, and β-sitosterol[12]. Ethanolic extract of aerial part (leaves) of a plant at the dose of 500mg/kg p.o. in Histamine induced bronchospasm in guinea pig and studied on BALF in egg albumin-sensitized guinea pigs possesses an anti-asthmatic effect by significantly increasing PCT and percent protection against standard drug Mepyramine[13].

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Fig No. 3

1.4. Trigonella Foenum Graceum (Fabaceae)

Alternanthera Sessilis Linn. is commonly called 'Methi'[14] in Hindi also known as 'fenugreek', and is used as a vegetable throughout Sri Lanka, India, and many tropical countries. The plant consists of many chemical constituents such as steroids, saponins, β-sitosterol, terpenoids, alkaloids, and flavonoids such as flavone glycosides like luteolin, quercetin, and apigenin. Traditionally people use the decoction of seeds or whole plantsfor asthma as well as allergic bronchitis[15]. Methanolic extract of the plant at different doses of 200, 300, and 400 mg/kg p.o.[16]inhistamine-induced bronchospasm prolonged PCT and in compound 48/80 induced mast cell degranulation showed dose-dependentprotection.

Fig No. 4

1.5. Syzygium cumini (Myrtaceae)

Syzygium cumini also known as 'Jamun' in Hindi[20], widely distributed medicinal plant which is used in treating various diseases such as asthma, diabetes, inflammation, etc. Ayurvedic medicinal formulations are found to be clinically useful in several diseases and disorders with the advantage of patient compliance and less cost. Ethanolic extract of Syzygium cumini plant bark atthe dose of 400 mg/kg p.o.[21]in histamine-induced bronchospasm significantly increased PCT and percent protection and inhistamine-induced mast cell degranulation significantly decrease in degradation of mast cells at 500 µg/ml.Syzygium cumini containstannins which are responsible for anti-asthmatic, anti-inflammatory, anti-diabetes[22], etc.

Fig No. 5

1.6. Nasturtium officinale (Brassicaceae)

Nasturtium officinale commonly called 'watercress' and also known as 'chhuch' in Hindi[24], possesses various pharmacological effects such as antioxidant and anti-inflammatory effects. Oxidative stress involves regulating inflammation or different chronic inflammatory disease such as asthma. Inflammation plays a key role in regulating the pathophysiology of asthma[25]. The treatment with pulverized ethanolic extract of plant material at the dose of 500 mg/kg orally administered in an ovalbumin-induced rat model of asthma significantly reduced the tissue FRAP(Fluorescence Recovery After Photobleaching) level.

Fig No. 6

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1.7. Portulaca Oleracea(Portulacaceae)

Portulaca Oleraceaalso called 'Purslane'contains anti-oxidants, omega-3 fatty acids, alpha-linolenic acid, eicosapentaenoic acid (EPA) which are mostly found in fish and some species of algae, vitamins, alkaloids, terpenoids, and flavonoids[26]. The ethanolic extract of Portulaca Oleraceaat the dose of 50, 100, and 200 µg/ ml inhibited the production of inflammatory mediators like NO and pro-inflammatory cytokines by decreasing TNF-α, IL-1β, and IL-6 levels.

Fig No. 7

1.8. Argemone Mexicana (Papaveraceae)

Argemone Mexicana is commonly called 'Kateri dhotra' in Marathi[27], it finds the roadside and many fields in India. This plant mainly contains alkaloids, flavonoids, tannins, sterols, and terpenes, traditionally it is used in the treatment of asthma. When ethanolic extract of the plant at the dose of 350 mg /kg orally given to animals in histamine and Ach-induced bronchospasm then it possesses significant anti-asthmatic activity as compared to the standard drug ketotifen fumarate (1mg/kg)[28].

Fig No. 8

1.9. Crocus sativus L.(Iridaceae)

Crocus sativus L.is commonly known as 'Saffron' or 'Keshar' in Marathi, it mainly consists of safranal (SFN) and crocin (CRO). Safranal is a potent anti-inflammatory agent and crocin is responsible for its anti-oxidant properties in epithelial cells of the bronchi. Experimentally induced inflammation by increased airway hyper-responsiveness, and epithelial cell injury, and after treatment with safranal itpossesses a decrease in hyper-responsiveness, and cell injury and also reduces Th2 type cytokine production in the lungs[29].

Fig No. 9

1.10. Fumaria officinalis (Papaveraceae)

Fumaria officinalisis commonly called Fumaria angustifolia, Fumaria diffuse, Fumaria media, etc. Methanolic extract of Fumaria officinalisat a dose of200, 400 mg/kg p.o. significantly restore lung oxidative markers such as LPO, GSH, and SOD by using Ovalbumin-Induced Airway Inflammation in rat animal models[30].

Fig No. 10

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III. CONCLUSION

Asthma is a chronic inflammatory airway disorder, caused due to the narrowing of the airway, and leads to difficulty in breathing. This may be caused due to various internal and external factors such as cytokines, histamine release, stimulation of IgE antibodies, and due to pollutants, xenobiotics, dust particles, pet furs, etc. IgE antibody binds with the receptors present on the mast cell which is responsible for the releasing of various inflammatory mediators which results in the cause of asthma.The WHO recognizes asthma as a disease of major health importance and plays a role in the coordination of international efforts against the disease.current therapy for asthma treatment has serious side effects including corticosteroids cause hyperglycemia, Cushing's syndrome, and fragile skin, salbutamol cause palpitation, throat irritation, and muscle tremors, anticholinergics cause dry mouth, difficulty in swallowing, photophobia, blurring of vision, and many more. The drugs used in asthma are mostly steroidal in nature.

About 60-70% of medicines are either prescription or OTC medicines derived from plant or herbal origin.The difference is only that molecules undergo various chemical modifications to make them able to be marketed. In the present scenario, the demand for plant products is growing exponentially throughout the world and major pharmaceutical companies are currently conducting extensive research on plant materials as the need of the day.

This work will be useful to find anti-asthmatic drugs with help of in vitro and in vivo models, The result of the investigation showed that experimentally induced asthma produces dyspnoea and leads to convulsions by stimulating and releasing of H_1 receptor and histamine respectively. Plant extracts using ethanol, methanol, and other solvents significantly exert their effect by their anti-asthmatic and anti-inflammatory as well as antioxidant activity.These plants and their chemical components have also been shown to have a relaxant effect on tracheal smooth muscle by stimulatory effects on β-adrenoceptor as well as inhibitory effects on muscarinic receptors in tracheal smooth muscles.

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