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A pharmacological evaluation for the ethanolic extract of *Alpinia Calcarata* rhizome for it's anti - asthmatic, antioxidant and anti -inflammatory activities

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Abstract
The study of investigation showed that the ethanolic extract of *Alpinia Calcarata* rhizomes possess anti asthmatic activity. The antioxidant and anti- inflammatory property of the plant also supports its anti-asthmatic property. Drugs effective in asthma are mostly steroidal in nature. Phytochemical analysis showed presence of flavonoid and steroids. The anti-asthmatic property showed by the plant may be because of these chemical moieties. The results obtained in the study supports the traditional and also demands further research and to isolate and characterize active principles responsible for anti-asthmatic activity.

Keywords: Phytochemical, antioxidant, anti-inflammatory, *Alpinia Calcarata* rhizomes

Introduction

Asthma

Asthma is a chronic inflammatory lung disease that can cause repeated episodes of cough, wheezing and breathing difficulty. During an acute asthma episode, the airway lining in the lungs becomes inflamed and swollen. In addition, mucus production occurs in the airway and muscles surrounding the airway spasm. Combined, these cause a reduction in air flow [1].

Asthma is characterized by

- **Airway inflammation:** The airway lining becomes red, swollen, and narrow.
- **Airway obstruction:** The muscles encircling the airway tighten causing the airway to narrow making it difficult to get air in and out of the lungs.

Airway hyper-responsiveness: The muscles encircling the airway respond more quickly and vigorously to small amounts of allergens and irritants.

Common signs and symptoms of an acute asthma episode include

- Coughing
- Wheezing
- Breathlessness
- Respiratory rate increased
- Chest tightness
- Chest or abdominal pain
- Fatigue, feeling out of breath
- Agitation
- Increased pulse rate

Causes

- Allergens from nature, typically inhaled, which include waste from common household pests.
- Indoor air pollution from volatile organic compounds.
- Medications, aspirin, β-adrenergic antagonists (beta blockers), and penicillin.
- Food allergies such as milk, peanuts, and eggs.

Pathophysiology and pathogenesis of asthma

Airflow limitation in asthma is recurrent and caused by a variety of changes in the airway.

- 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 Ig E-dependent release of mediators from mast cells that includes histamine, tryptase, leukotrienes and prostaglandins that directly contract airway smooth muscle.

Airway edema

As the disease becomes more persistent and inflammation more progressive, other factors further limit airflow. These include edema, inflammation, mucus hyper secretion and the formation of inspissated mucus plugs, as well as structural changes including hypertrophy and hyperplasia of the airway smooth muscle. These latter changes may not respond to usual treatment.

Airway remodeling

In some persons who have asthma, airflow limitation may be only partially reversible. Permanent structural changes can occur in the airway; these are associated with a progressive loss of lung function that is not prevented by or fully reversible by current therapy. Airway remodeling involves an activation of many ofthe structural cells, with consequent permanent changes in the airway that increase airflow obstruction and airway responsiveness and render the patient less responsive to therapy [2].

Pathophysiologic mechanism in the development of air way 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 characteristics pathophysiologic features of the disease, bronchial inflammation and airflow limitation that result in current episodes of cough, wheeze, and shortness of breath. The process by which these interactive events occur and leads to asthma are still under investigation. The pattern of airway inflammation in asthma, however does not necessarily vary depending upon the disease severity, persistence and duration of disease. The cellular profile and the response of the structural cells in asthma are quite consistent [3].

Inflammatory Cells: Lymphocytes

An increased understanding of the development and regulation of airway inflammation in asthma followed the discovery and description of subpopulations of lymphocytes, T helper1 cells and T helper2 cells with distinct inflammatory mediator profiles and asthma as a Th2 disease, recognizing the importance of number of families of cytokines and chemokines has advanced our understanding of the development of airway inflammation effects on airway function. 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. In addition, generation of Th2 cytokines (e.g., interleukin- 4 (IL-4), IL-5 and IL-3) could also explain the overproduction of IgE, presence of eosinophils, and development of airway hyper-responsiveness. There also may be a reduction in a subgroup of lymphocytes, regulatory T cells, which normally inhibit Th2 cells, as well as an increase in natural killer (NK) cells that release large amounts of Th1 and Th2 cytokines. T lymphocytes, along with other airway resident cells, also can determine the development and degree of airway remodeling.

Mast cells

Activation of mucosal mast cells releases bronchoconstrictor mediators (histamine, cysteinyl-leukotrienes, prostaglandin D2). Although allergen activation occurs through high affinity IgE receptors and is likely the most relevant reaction, sensitized mast cells also may be activated by osmotic stimuli to account for exercise induced bronchospasm (EIB). Increased number of mast cells in airway smooth muscle may be linked to airway hyper-responsiveness. Mast cells also can release a large number of cytokines to change the airway environment and promote inflammation even though exposure to allergens is limited.

Eosinophils

Increased numbers of eosinophils exist in the airways of most, but not all, persons who have asthma. These cells contain inflammatory enzymes, generate leukotrienes, and express a wide variety of pro-inflammatory cytokines. Increases in eosinophils often correlate with greater asthma severity. In addition, numerous studies show that treating asthma with effecter cell in asthma, it likely has a distinct role in different phases of the disease. Corticosteroids reduces circulating and airway eosinophils in parallel with clinical improvement. However, the role and contribution of eosinophils to asthma is undergoing a re-evaluation based on studies with an anti-IL-5 treatment that has significantly reduced eosinophils but did not affect asthma control. Therefore, although the eosinophil may not be the only primary

Neutrophils

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. The regulation of neutrophil recruitment, activation, and alteration in lung function is still under study, but leukotriene B4 may contribute to these processes.

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 naive T cells.

Macrophages
Macrophages are the most numerous cells in the airways and also can be activated by allergens through low-affinity Ig E receptors to release inflammatory mediators and cytokines that amplify the inflammatory response [4].

Inflammation
Inflammation is defined as the local response of living mammalian tissue to injury due to any agent. It is a body defence reaction in order to eliminate or limit the spread of injurious agent.

Causes of inflammation
- **Infective agents. E.g.:** Bacteria, viruses and their toxins.
- **Immunological agents. E.g.:** Cell mediated and antigen antibody reaction.
- **Physical agents. E.g.:** Heat, cold, radiation, mechanical trauma.
- **Chemical agents. E.g.:** Organic and inorganic poisons

Signs of inflammation
The main signs of inflammation are
- Redness (Latin rubor)
- Heat (calor)
- Swelling (tumor)
- Pain (dolor)

Inflammation may be classified as
Acute inflammation
Chronic inflammation

Antioxidants
The ability to utilize oxygen has provided humans with the benefit of metabolizing fats, proteins, and carbohydrates for energy; however, it does not come without cost. Oxygen is a highly reactive atom that is capable of becoming part of potentially damaging molecules commonly called "free radicals." Free radicals are capable of attacking the healthy cells of the body, causing them to lose their structure and function [13].
Cell damage caused by free radicals appears to be a major contributor to aging and to degenerative diseases of aging such as cancer, cardiovascular disease, cataracts, immune system decline, and brain dysfunction. Overall, free radicals have been implicated in the pathogenesis of at least 50 diseases. Fortunately, free radical formation is controlled naturally by various beneficial compounds known as antioxidants. It is when the availability of antioxidants is limited that this damage can become cumulative and debilitating [14].
Free radicals are electrically charged molecules, i.e., they have an unpaired electron, which causes them to seek out and capture electrons from other substances in order to neutralize themselves. Although the initial attack causes the free radical to become neutralized, another free radical is formed in the process, causing a chain reaction to occur. And until subsequent free radicals are deactivated, thousands of free radical reactions can occur within seconds of the initial reaction. Antioxidants are capable of stabilizing, or deactivating, free radicals before they attack cells. Antioxidants are absolutely critical for maintaining optimal cellular and systemic health and well-being [15].

Advantages of herbal medication
Herbal medicine exhibit fewer side effects and they are very much safe. Plants are gifts of natural to mankind for treating different types of diseases. Herbal medicines are cheaper and easily available. Also for certain diseases like hepatitis, herbs and herbal drugs are the only remedies. The traditional medicine is largely getting popularity over allopathic medicine because of their cost, availability and free from side effects [29]. The plant *Alpinia Calcarata* has been traditionally used for various diseases. In present study rhizomes of the plant *Alpinia Calcarata* have been used which traditionally indicated in the treatment of asthma [30].

Plant profile

Alpinia calcarata – Plant *Alpinia calcarata* –Rhizome

Plant description
Selected plant: *Alpinia Calcarata*

Classification

Kingdom	Plantae
Division	Mangnoliphyta
Class	Liliopsida
Order	Zingiberales
Family	*Zingiberaceae*
Genus	Alpinia
Species	*Alpinia Calcarata*

Synonyms
Alpinia Calcarata Rosk., Alpinia erecta Lodd. and Steud., Alpinia bracheata Rosk., Alpinia cerrnta Sims., Renealmia calcarata Haw., Globba eracta Retx., Languascalcarata Mem [31].

Selected Vernacular Names
Sinhala- Heen aratta, Aratta English- Galanga, Small galangal Tamil-Amkolinji Sanskrit- Rasna [32].

Distribution
It is native to India. Occurs in Southern Malay Peninsula and Sri Lanka. It is common in village gardens in Sri Lanka [33].

Conclusion
In current study *Alpinia Calcarata* significantly inhibited histamine induced indicating its H1 receptor antagonist activity supports anti asthmatic property of the plant. The antioxidant property was studied by hydrogen peroxide scavenging assay and reducing power assay. Hydrogen peroxide scavenging ability of ethanolic extract of *Alpinia Calcarata* rhizomes revealed that the extract scavenges the hydrogen peroxide. However, the hydrogen peroxide scavenging ability was low comparing to standard (ascorbic acid). Reducing power of ethanolic extract of *Alpinia*

Calcarata rhizomes significantly increased with increasing concentration. The *in vitro* antiinflammatory potential of ethanolic extract of *Alpinia Calcarata* rhizomes had shown concentration dependent inhibition of protein denaturation.

References

1. Abramson MJ, Perret JL, Dharmage SC. Distinguishing adult-onset asthma from COPD: A review and a new approach. International Journal of Chronic Obstructive Pulmonary Disease. 2014;9(9):945-962.
2. Rutkowski K, Sowa P, Rutkowska-Talipska J Allergic diseases: the price of civilisational progress. Postepy Dermatol Alergol. 2014;31(2):77-83.
3. Tripathi KD. Essentials of pharmacology, 6th ed. Jaypee brother‟s medical publishers (P) ltd, New Delhi., 184.
4. Harsh Mohan, Text book of Pathology, 6th ed. Jaypee brother‟s medical publishers (P) ltd, New Delhi 130-148.
5. Charles R. Craig and Robert E. Stitzel, Modern pharmacology with clinical applications 5th ed. United states of America, Library of congress cataloguing publication data. P. 423-441.
6. Rutkowski K. Sowa P, Rutkowska-Talipska J. Allergic diseases: the price of civilisational progress. Postepy Dermatol Alergol. 2014;2(2):77-83.
7. Cookson WO, Moffatt MF. Genetics of asthma and allergic disease. Hum Mol Genet. 2000;9:2359-2364.
8. Barnes KC. Evidence for common genetic elements in allergic disease. J Allergy ClinImmunol. 2000;106:S192-S200.
9. Dunnill MS. The pathology of asthma, with special reference to the changes in the bronchial mucosa. J Clin Pathol. 1960;13:27-33.
10. Akers IA, Parsons M, Hill MR. Mast cell tryptase stimulates human lung fibroblast proliferation via protease-activated receptor-2. Am J Physiol Lung Cell MolPhysiol. 2000;278:L193-L201.
11. Williams CM, Galli SJ. The diverse potential effector and immune regulatory roles of mast cells in allergic disease. J Allergy ClinImmunol. 2000;105:847-859.
12. Fahy JV. Reducing IgE levels as a strategy for the treatment of asthma. ClinExp Allergy. 2000;30(1):16-21.
13. Barnes PJ. Anti-IgE therapy in asthma: rationale and therapeutic potential. Int Arch Allergy Immunol. 2000;123:196-204.
14. Milgrom H, Fick RB Jr, Su JQ, *et al*. Treatment of allergic asthma with monoclonal anti- IgE antibody. New Engl J Med. 1999;341:1966-1973.
15. Zieg G, Lack G, Harbeck RJ, Gelfand EW, Leung DY. *In vivo* effects of glucocorticoids on IgE production. J Allergy ClinImmunol. 1994;94:222-230.
16. Edmonds ML, Camargo Jr CA, Brenner BE, Rowe BH. Replacement of oral corticosteroids with inhaled corticosteroids in the treatment of acute asthma following emergency department discharge: a met analysis. Chest. 2002;121:1798-1805.
17. Rainsford KD. History and development of the salicylates. In: Aspirin and Related Drugs. K.D. Rainsford, ed. London & New York: Taylor & Francis; c2004a. p. 1-23.
18. Phillips T, Leeuwenburgh C. Lifelong aspirin supplementation as a means to extending life span. Rejuvenation Res. 2004;7(4):243-51.
19. Pellegatta F, Bertelli AA, Staels B, Duhem C, Fulgenzi A, Ferrero ME. Different short- and long-term effects of resveratrol on nuclear factor-kappaB phosphorylation and nuclear appearance in human endothelial cells. Am J Clin Nutr. 2003;77:1220-1228.
20. Paulus HE. Clinical trial design for evaluating combination therapies. Br J Rheumatol. 1995;34(2):92-95.
21. Gopaiah KV, B. Shristava, P.K. Sharma and G.S. Rao, Lipid polymer based nano particles for the theropy of ulcerative colitis to improve the therapeutic efficiency. I.Emerg. Technol. Innov. Res. 2004;5:1-12.
22. Hydrotropic Technique: A Promising Method to Enhance Aqueous solubility of Nimesulide and to Reduce Difficulties in Bioavailability k.venkat Gopaiah, Asian journal of pharmaceutics. 12(04):S1-S17.
23. Phyllacanthus C. Antioxidant & protective activity in albino wister rats P Keli, S Kancharla, KV Gopaiah, International Journal of Pharmacognosy and Chemistry, 14-24.
24. Shrivastava B, Gopaiah KV, Rao GS. Lipid-polymer based nanoparticles as a new generation therapeutic delivery platform for ulcerative colitis *in vitro/in vivo* evaluation. Int. J. Innov. Technol. Expl. Eng. Sci. 2019;21:42-46.
25. Shrivastava B, Gopaiah KV, Rao GS. Lipid polymer based nano particles for the treatment of ulcerative colitis-review. Int. I. Res. Anal. Rev. 2019;6:549-568.
26. Gopaiah KVMV. Hydrotropic technique: a promising method to enhance aqueous solubility of nimesulide and to reduce difficulties in bioavailability. Asian J Pharm. 2019;12:S1456-S1472. CrossRef | Direct Link I
27. Gopaiah KV. Validation Methods For The Simultanious Axitinib By A Reverse Phase Hplc. LAP LAMBERT Academic Publishing, Germany, ISBN- 978-620-0-45795-0, 2019, 108.
28. Gopaiah KV. Formulation and Development of Rosuvastatin Fast Dissolving Tablets. LAP Lambert-Publications, Germany, 2019. ISBN: 978-620-0-47301-1.
29. Effect of analgesic activity in crude extract and isolated compounds of Tecomaria capensis kvenkata Gopaiah, International journal of green pharmacy 12 (04-supplymentry), 322-328.
30. Laboratory preparation of fruit, vegetable wine and physicochemical study comparisonS Kancharla, P Kolli, KV Gopaiah, International Journal of Pharmacognosy and Chemistry, 25-34.
31. Goel B, Maurya NK. Memory booster herb (natural cognitive enhancers): An overview. International Journal of Physiology, Nutrition and Physical Education. 2019;4(1):975-979.