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The Key Issues Related to Features and Perspectives of Antioxidants in Asthma and Allergy Pharmacotherapy

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ABSTRACT

The review aims to highlight the anti-allergenic and anti-inflammatory potential of some antioxidants in the pharmacological treatment of asthma and allergies. Under various physiological and pathological conditions, oxidative stress is both a result of and a contributor to redox metabolism. To effectively manage existing issues, it may be essential to understand the molecular mechanisms of basal oxidative stress and the role of antioxidants. It has been demonstrated that antioxidants can change the biomarkers of allergic inflammation and other consequences of allergy. Antioxidants can neutralize free radicals and control the level of cholesterol and other lipids in the blood. Antioxidants have anti-cancer activity due to prevention and inhibition of cancer cell growth. Antioxidants stimulate and activate the regeneration of normal, healthy cells. The complexity of each response and the multiple physiological effects complicate clinical studies of antioxidant therapy. Based on the existing evidence, we believe that antioxidants like zeolin-containing Geomin Forte have promising perspectives as adjunctive pharmacotherapy for asthma and allergic diseases.

INTRODUCTION

The incidence and prevalence of allergic diseases are increasing worldwide. The most common types of allergy include anaphylactic shock, allergic dermatoses, allergic enteropathy, and respiratory or airway allergies. Oxidative stress, which plays a crucial role in the pathogenesis of allergic diseases, is a result of an imbalance between free radicals (reactive oxygen species or ROS, for example) and the antioxidative potential of the body. While oxidative stress takes place, cells try to antagonize the oxidative impacts and recover redox equilibrium by acting or downregulating encoding genes of protecting enzymes, structural proteins, and transcription factors.[1]

An increase in ROS generation in the body can alter the DNA, cause changes in lipids and proteins, activate various transcription factors, and produce both pro- and anti-inflammatory cytokines.[2]

The ovalbumin-sensitized (OVA) mouse model of allergic rhinitis has been used in studies to examine the role of the nuclear factor-kappa B (NF-B) signaling pathway in allergies. The study demonstrated elevated oxidative stress markers such as methylenedioxyamphetamine (MDA) and nuclear factor erythroid 2-related factor 2 (Nrf2) in positive correlation with inflammatory cytokines and histological findings, besides an activation in NF-kB signaling pathways. All the changes mentioned were alleviated with continued treatment with the antioxidant mangiferin.[3]

Dietary antioxidants have been suggested as prospective pharmacotherapeutic agents targeted to the oxidative signaling pathways in allergic diseases.[4]

We conducted extensive literature searches in Tomson Reuters, Google Scholar, PubMed, Cochrane Library, Web of Science, Clinical Key, and Elsevier Foundations to assess the evidence that is currently available on the use of antioxidants in the pharmacological treatment of allergic diseases and asthma. In addition to grey literature, national and international policies, and recommendations were examined. National and international policies and guidelines were also reviewed.

REVIEW

There is strong evidence that oxidative stress plays a key role in the pathogenesis of asthma and chronic obstructive pulmonary disease (COPD) via inflammatory response, including activation of transcription factors such as protein-1 (AP-1), proinflammatory gene expression mediators, and nuclear factor-kB (NF-kB) pathway. Therefore, available antioxidants may modify the inflammatory process in case of many respiratory disorders and protect against the direct detrimental effects of oxidative stress.[5-8]

Constantly produced free radicals can cause damage to healthy cells without protective antioxidative defense. At the same time, free radicals are necessary to maintain health. For instance, human immune cells need free radicals to combat infections. Therefore the body must maintain a specific balance between antioxidants and free radicals. Otherwise, oxidative stress can cause damage to DNA and other cellular structures.[9-15]

An allergy, as an immune response to harmful exposure to an antigen, can cause tissue damage leading to severe illness with inflammation, swelling, itching, pain, mental disturbances, etc. It has a dramatic impact on the quality of life (QOL).[16,17]

Currently, a biological network of distinct but related inflammatory processes replaced a unified model of asthma. The revised definition of asthma includes a broad spectrum of disorders with various clinical presentations (phenotypes) and endotypes (signaling mechanisms). Because of their fundamental prognostic and therapeutic significance, the identification of these disorders is essential in the therapy of allergic diseases, especially asthma.[18-26]

The stratification of endotypes of asthma is important for its management. There are two endotypes of asthma: type 2 (T2) high or T2-low. The treatment of advanced T2 asthma with biologics or other therapies focused on related molecular mechanisms is generally accepted. These developments have shifted the paradigm of asthma management, with a focus on new treatments, including antioxidants.[27-34]

The recent identification of important markers of inflammation and oxidative stress has allowed a broader approach to asthma research.

Therefore, dietary supplements containing antioxidants can be used in combination with the core pharmacotherapy of allergic diseases, including asthma.

There is some evidence of a significant role of the enzymatic antioxidant arginase in the pathogenesis of asthma. A decrease in arginase-1 concentration and activity (ARG1) amplifies airway inflammation in asthma patients. There is a correlation between arginase expression in bronchial tissue, L-arginine plasma concentration and activity, and airway inflammatory processes. The polymorphism of arginase isoforms (ARG1 and ARG2) correlates with asthma severity and a decrease in B2 agonist and glucocorticoid effectiveness.[35-38]

Although curcumin is considered to have anti-inflammatory and antioxidant properties, its exact mode of action is completely understood. Curcumin inhibits the expression of several cytokines, including interleukins (IL-2, IL-3, IL-5) and granulocyte-macrophage colony-stimulating factor (GM-CSF), and increases the activity of histamine in lung tissue, as well as lowers the levels of Interferon-gamma (IFN-γ)-induced Nitric oxide (No) synthase in bronchial tissue. Exposure to curcumin reduces eosinophil recruitment, airway hyperreactivity, and asthma symptoms. Existing evidence suggests that curcumin may be used as a second-line and/or adjunctive treatment for asthma.[39-41]

One of the flavonoids, quercetin, is a potent antioxidant that is commonly found in foods like black tea, wild berries, wine apples, broccoli, and oilseeds like walnuts. It is typically present in yellow and red onions. Besides antioxidative properties, quercetin has antiallergic and antiviral activity. It inhibits the release of histamine release, the production of pro-inflammatory cytokines, interleukin-4 (IL-4), and leukotrienes. According to studies, the anti-immunomodulatory and inflammatory properties of quercetin may be effective in treating allergic rhinitis, severe bronchial asthma, and anaphylactic reactions to peanuts.[41-44]

The use of zeolites in complex antioxidant therapy has shown positive results, according to existing evidence. Zeolites are hydrated aluminosilicates (SiO_4 and AlO_4) of alkaline and alkaline-earth metals with high absorption properties. They are excellent detoxifiers and have antioxidant and anti-inflammatory properties.[45-46]

One of the zeolites, Geomin forte 500 mg, in addition to its direct antioxidant activity, can boost the induction of natural antioxidants by acting as an electron-donating surfactant. Geomin Forte has 200-250 times more potent antioxidative properties than vitamins E and C. It can also be used as an adjunctive treatment for pathologies with the persistent engagement of the immune system, such as allergic diseases.[36,43,45,47]

CONCLUSIONS

Understanding the molecular mechanism of oxidative stress and the nature and features of antioxidants may be critical for treating diseases in whose pathogenesis oxidative stress plays a crucial role.

A literature search led us to the conclusion that antioxidants, like Geomin Forte, have outstanding potential as supplementary therapeutic agents in the treatment of asthma and allergic diseases.

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