ORIGINAL ARTICLE

Alterations in Some Biochemical Parameters and Trace Elements in Asthmatic Patients in Owerri

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Abstract:

Background: Asthma is a chronic disease characterized by recurrent cough and wheeze. *Aim and Objectives:* To determine the level of some biochemical parameters and trace elements in asthmatic patients attending General Hospital Owerri. *Material and Methods:* Thirty six confirmed asthmatic patients and thirty six apparently healthy subjects (control) between the age of 10 to 30 years were selected in this study. Serum trace elements: Zinc and copper, malondialdehyde, vitamin C, vitamin E, immunoglobulin A and immunoglobulin E were estimated using standard methods. *Results:* There serum levels of copper, IgE, IgA and MDA were significantly increased in asthmatic patients when compared to control ($p<0.05$). While the serum levels of zinc, vitamin C and vitamin E were significantly decreased in asthmatic patients when compared with the control ($P< 0.05$). *Conclusion:* These observations probably indicated that asthmatic patients could be prone to the oxidative stress. Also, foods or diets containing antioxidants could be beneficial to asthmatic patients.

Keywords: Trace Elements, Asthma, Antioxidants, Imunoglobulins

Introduction:

Asthma is a chronic disease characterized by characterized by recurrent cough and wheeze. It is a major health disorder [1]. Asthma is one of the complex disorders which involve endocrine, immunologic, autonomic, infectious and other factors in different degrees in some persons. However, the specific nature of disorder, which could lead to airway narrowing, is not clear. The environmental as well as hereditary factors are contributory in the pathogenesis of asthma. Asthma is a chronic disease involving the airways in the lungs [2]. These airways, or bronchial tubes, allow air to come in and out of the lungs. In asthmatic, the airways are always inflamed. They become even more swollen and the muscles around the airways can tighten when something triggers the symptoms. This makes it difficult for air to move in and out of the lungs, hence causing symptoms such as coughing, wheezing, shortness of breath and or chest tightness [3]. When the airways react, the muscles around them tighten. This leads to narrowing the airways, resulting in less air to flow into the lungs. The swelling also can worsen, making the airways even narrower. This could trigger the cells in the airways to make more mucus than usual. Mucus is a sticky, thick liquid could enhance narrowing of the airways. However, not everybody with asthma has similar symptoms in the same way. One may not have all

of these symptoms, or may have different symptoms at different times. Some asthmatic symptoms may also vary from one asthma attack to the next, being mild during one and severe during another [4, 5]. Similarly, some people with asthma may go for extended periods without having any symptoms, interrupted by periodic worsening of their symptoms. Others could have asthma symptoms every day. In the same way, some individuals could only have asthma during exercise, or asthma with viral infections like colds [6, 7].

Mild asthma attacks are generally more common. Usually, the airways open up within a few minutes to a few hours. Severe attacks are less common but last longer and require immediate medical help. It is important to recognize and treat even mild asthma symptoms to help prevent severe episodes and keep asthma under better control. Some early warning signs are changes that happen just before or at the very beginning of an asthma attack. These signs could start before the well-known symptoms of asthma and are the earliest signs that asthma is worsening [8].

Generally, these signs may not be severe enough to prevent daily activities. But by recognizing these signs, asthma attack could be prevented from getting worse. These early warning signs of asthma are Frequent cough, especially at night, Losing breath easily or shortness of breath, Feeling very tired or weak when exercising, Wheezing or coughing after exercise, Feeling tired, easily upset, grouchy, or moody, decreases or changes in lung function as measured on a peak flow meter, trouble sleeping, Signs of a cold for instance sneezing, runny nose, cough, nasal congestion, sore throat, and headache [1].

Asthma can be caused by genetic and environmental factors. Environmental factors are associated with the exposure to air pollution and allergens. Drugs such as aspirin and beta blockers are other potential triggers. The diagnosis is usually based on the pattern of symptoms, response to therapy over time, and spirometry. It is classified according to the rate of symptoms, forced expiratory volume in one second and peak expiratory flow rate. It may also be classified as atopic or non-atopic where atopy refers to a predisposition toward developing a type 1 hypersensitivity reaction [4].

Asthma could cause some physiological changes in serum antioxidant status, which could be due to increased oxidative stress associated with the disease. Various disorders of antioxidant defense mechanisms have been reported in asthma, as that of the epithelial lining fluid of the lung which contains high concentration of antioxidants providing a first line of defense against inhaled and endogenously oxidant agents [6]. Vitamin C is an important non enzymatic antioxidant and has been shown to regenerate other antioxidants within the body, like vitamin E. The ongoing research is examining if vitamin C, by limiting the damaging effects of free radicals through its antioxidant activity, could help prevent or slow the development of asthmatic disease in which oxidative stress plays a crucial role. Besides its biosynthetic and antioxidant functions, vitamin C plays role in immune function and enhances the absorption of nonheme iron, the form of iron present in plant-based foods. Vitamin E is a fat-soluble antioxidant that prevents the synthesis of Reactive Oxygen Species (ROS) formed when fat undergoes oxidation. By limiting free-radical

production and possibly through other mechanisms, vitamin E might help prevent or delay the oxidative stress associated with asthma [9, 10].

Trace elements are in very low concentrations in the body system. It comprises 0.01% of the total body weight and they show many physiological functions such as immunomodulatory effects. Trace elements especially zinc and copper are essential components of the antioxidant enzymes [11]. While zinc plays an important function in DNA and protein production, copper is needed during oxidant with increase of free radicals production and consequently increase risk of asthma. Zinc and copper are involved in cell and tissue growth [12, 13]. Trace element deficiency could result in alteration of the immune system in asthma [14]. In Owerri Imo State Nigeria, there is scarcity of data on some trace elements and biochemical parameters in asthmatic patients.

This study was embarked upon to evaluate status of some biochemical parameters and trace elements in asthmatic patients. Since monitoring of these biochemical parameters is an important guide to some disease conditions, this study was equally undertaken so that the knowledge gained from the research work may suggest a better understanding diagnosis and management of asthma.

Material and Methods:

Subjects: Thirty six asthma patients (20 males and 16 females) aged 10 to 30 years attending General Hospital Owerri were involved in this study. They were diagnosed on clinical background based on history of recurrent or persistent wheezing episode with or without dyspnoea and improvement on use of β-agonist. Also, thirty six apparently healthy subjects aged 10 to 30 years were used as control. The exclusion criteria for the two groups were a history of: malabsorption, renal disease, cardiac disease, diuretic used and the anaemic subject.

Blood Collection:

In all subjects, 5ml of venous blood was collected into a non- anticoagulated tubes. The sample was spun in a Wisterfuge (model 684), centrifuge at 1000g for 10 minutes and the serum collected into a clean dry bijou bottle. The trace elements and biochemical parameters were estimated.

Biochemical Assay:

Trace elements (copper and zinc) levels were determined by atomic absorption spectrophotometer technique as described by Kaneko [15]. Immunoglobulin A and E levels were determined by use of immunoglobulin AGAPPE kits for IgA, and IgE. These tests are measured by nephelometry technique which is based on measurement of the rate of increase in light scattered from particles suspended in solution as a result of complexes formed during an antigen-antibody reaction [16]. Serum Vitamin C was determined by the 2, 4-dinitrophnyl hydrazine method described by Tietz [17]. Vitamin E was carried out by the method of Tietz [17] in which vitamin E caused the reduction of ferric to ferrous ion which then forms a red complex with alpha dipyridyl while Malondiadehyde (MDA) was determined based on the reaction of MDA with Thiobarbituric Acid (TBA) [18].

Statistical Analysis:

The values were expressed as mean ± standard deviation. The student t-test was used to calculate the significant differences at $P<0.05$.

Results:

Table 1: Trace Elements Levels and Biochemical Parameters in Asthmatic Patients and Control Subjects

Parameters	Control Subjects (N=36)	Asthmatic Patients (N=36)
Zinc (μg/dl)	87.03±21.59	81.62±39.62*
Copper (μg/dl)	111.07±64.51	125.36±27.40*
Vitamin C (mg/dl	1.59 ± 0.38	0.62 ± 0.45*
Vitamin E (mg/dl)	4.74 ± 1.92	1.54 ± 0.81*
MDA (umol/l)	0.18 ± 0.02	0.60 ± 0.20 *
IgA (mg/dl)	191.37±62.55	226.04±93.84*
IgE (μl/ml)	88.37±81.99	231.22±198.39*

**Significantly different from control at P<0.05*

Discussion:

Asthma is a chronic lung disease of the respiratory tract characterized by tight feeling in the chest, shortness of breath, coughing or wheezing at some point in life. In this study, it was observed that some trace elements particularly zinc in asthmatic patients are necessary for optimal activity of the immune system, body growth and development was significantly decreased when compared with apparently healthy subjects without asthma [19]. The significant reduction in the level of zinc is consistent with the work of Nnodim *et al.* [14], who reported zinc deficiency in sickle cell disease. Zinc deficiency can also be the result of the increase allergic disorders in asthmatics. The deficiency of zinc in asthmatic, could probably associated with impaired T-helper functions, cell mediated immunity and reduced interleukin-2 production as well as increase of bacterial infection. Also, the level of copper in asthmatics was significantly increased. This is in agreement with the work of Ghaffari *et al.* [19].

It was observed that the level of malondialdehyde was significantly increased among the asthmatics when compared with the control. This is in line with the work of Opara *et al.* [21]. The increase in MDA could be associated with oxidative stress in asthmatics. Oxidative stress is due to an excessive production of highly reactive oxygen species or their insufficient removal leading to increased free radical production. However, since reactive oxygen species are involved in various cellular mechanisms, ROS may have a positive impact on the body, when they are not in excess. In addition, the increased MDA level could lead to disturbance of the enzymatic activity, which contributes to an increased oxidative stress in asthmatics.

Furthermore, serum immunoglobulin analysis showed that IgA and IgE levels were increased significantly in asthmatics. This is in line with previous studies in which the concentrations of IgA and IgE correlate significantly [21]. The significantly high level of IgA is in agreement

with the work of Olsen *et al.* [22] who related IgA elevation in sickle cell disease to manifestations such as growth retardation and cell mediated immune disorder. It is linked with impaired T-helper functions; cell mediated immunity and reduced interleukin-2 production.

Similarly, the level of ascorbic acid was significantly decreased in asthmatics when compared with the control. This is in line with the report of Okogun *et al*. [13]. Ascorbic acid is one of the important water soluble vitamins. It is essential for collagen, carnitine and neuro-transmitters biosynthesis. Most plants and animals synthesize ascorbic acid for their own requirement. However, apes and humans cannot synthesize ascorbic acid due to lack of an enzyme gulonolactone oxidase. Hence, ascorbic acid has to be supplemented mainly through fruits, vegetables and tablets. The reduction of ascorbic acid in asthmatics could be linked to increase in free radical productions.

Also, the level of vitamin E was significantly decreased in asthmatics when compared with the control. Vitamin E is the major lipid-soluble component in the cell antioxidant defence system and is exclusively obtained from the diet [9, 10]. It has numerous important roles within the body because of its antioxidant activity. Vitamin E is a potent chain-breaking antioxidant which inhibits the synthesis of reactive oxygen species molecules when fat undergoes oxidation and during the propagation of free radical reactions. It is primarily located in the cell and organelle membranes where it can exert its maximum protective effect. It acts as the first line of defence against lipid peroxidation, protecting the cell membranes from free radical attack [24].

Conclusion:

It can be concluded that the levels of trace elements, vitamin C and E are deficient in asthmatics. Hence, supplementing individuals with asthmatics with food or drug containing antioxidants and trace elements can help them to enhance their quality of life.

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