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Patterns of Zinc, Calcium, And Membrane Potential in Serum Among Owerri Asthmatics

Nwanyaka Henry Ifeanyi[1], Nwokeji Calistus Muodebe[2], Nnodim Johnkennedy[3*]

[1]*Department of Public Health, Faculty of Health Science, Imo State University Owerri*
[2]*Department of Medical Microbiology, Madonna University, Elele Rivers, Nigeria*
[3]*Department of Medical Laboratory Science, Faculty of Health Science, Imo State University Owerri, Imo State, Nigeria*

***Corresponding Author**: Nnodim Johnkennedy, Department of Medical Laboratory Science, Faculty of Health Science, Imo State University Owerri, Imo State, Nigeria.

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Abstract

The lining of your airways becomes inflamed and produces mucus, which causes asthma. Along with other symptoms, this inflammation during an attack produces a wheezing or whistling sound as you breathe. The purpose of this study was to measure the serum zinc, calcium, and membrane potential in Owerri's asthmatic individuals. a case control study with 36 asthmatic patients who were receiving care at the General Hospital in Owerri. Serum zinc and serum calcium were measured in fasting venous blood, and the Nernst equation was used to determine membrane potential. The serum zinc was measured by atomic absorption spectrophotometry, while the serum calcium was assessed using the Randox Kit. For statistical analysis, the Independent Student t test was employed.The findings showed that, in comparison to the controls, asthmatic individuals had considerably lower membrane potential, serum zinc, and serum calcium ($p<0.05$). This study showed that a decline in serum zinc, calcium, and membrane potential may be a key factor in the pathophysiology of asthma. To prevent asthma in Owerri, pregnant women may need to consume higher amounts of these vital trace metals through their diet.

Keywords: *Membrane potential, zinc, calcium, asthmatic*

Introduction

Asthma is a prevalent long-term illness that impacts a significant number of people in Nigeria. With an estimated 6 million children in the US affected, it is the most prevalent chronic illness in children. Asthma has a complicated etiology that includes bronchial hyperresponsiveness, intermittent airflow restriction, and airway inflammation [1]. Inflammation of the bronchial tubes and an abundance of sticky secretions inside the tubes are symptoms of asthma. The symptoms of asthma include tightness, inflammation, and mucus buildup in the airways [2]. The three main symptoms of asthma are inflammation, irritated airways, and blocked airways. Normal breathing causes the muscles surrounding the airways to relax, allowing air to pass through freely. However, asthma causes the muscles to stiffen. The air finds it more difficult to flow through [3].

Red, swollen bronchial tubes are a symptom of asthma. The lungs may be harmed by this inflammation [4]. Long-term asthma management depends on treating this. When asthmatics come into contact with even minute triggers, their sensitive airways have a tendency to overreact and restrict [5]. Symptoms of these issues could include: Coughing, particularly in the morning or at night, The whistling sound made when breathing, or wheezing, breathing difficulty, chest tightness, soreness, or pressure Breathing issues preventing you from sleeping [6].

Not every asthmatic has the same symptoms in the same manner. It's possible to experience some of these symptoms but not all of them, or to have other symptoms occasionally.

Additionally, the symptoms could differ from one asthma attack to the next, being milder or worse [7].

Some asthmatics may experience prolonged periods of time without experiencing any symptoms. Others

may experience issues on a daily basis. And some people could only get asthma when they exercise or when they have viral illnesses like colds [8].

In fact, asthma has an impact on antioxidants, particularly zinc (Zn), which exhibits antioxidant activity, while other micronutrients like calcium (Ca) are vital. Asthmatic illness and other conditions may arise as a result of disruptions in the metabolism of these components [9].

Calcium might also have an indirect effect on smooth muscle function by increasing magnesium levels. However, the role of calcium and zinc in asthmatic patients is still signicant [10]

Globally, the prevalence of asthma has been rising recently, although there have been conflicting studies regarding the interaction between zinc and calcium in asthmatic patients. While some studies have demonstrated that variations in blood trace element levels in asthmatic patients may be linked to the disease's development, other research has not found a correlation between blood zinc and calcium levels and the prevalence of asthmatic patients. This study assessed the membrane potential, serum calcium, and serum zinc levels of asthmatic participants in Owerri, Imo State, Nigeria, to provide insight into their condition.

Material and Methods

Subjects: This study included thirty-six asthma patients, aged 10 to 30, who were admitted to General Hospital Owerri (20 men and 16 females). Based on their history of recurrent or persistent wheezing episodes with or without dyspnea and improvement with β-agonist use, they were identified based on a clinical background. Thirty-six seemingly healthy individuals between the ages of 10 and 30

Blood collection

Four milliliters of fasting venous blood were drawn from each person and placed in EDTA and plain bottles. The whole blood was centrifuged at 5,000g for 10 minutes in a Westerfuge (model 684) centrifuge in order to separate the serum. Red blood cells were isolated from the plasma by centrifugation, and they were then lysed with 1.0 milliliter of distilled, deionized water and rinsed three times with physiological saline. Red cell haemolysates were frozen and kept for examination.

Biochemical Assay: zinc levels were determined by atomic absorption spectrophotometer technique.

serum calcium was estimated using Randox Kit CA590. While membrane potential was determined by calculation using the Nernst equation.

Statistical analysis

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

Ethical clearance

Consent as well as ethical approval was obtained from the ethical committee of the General Hospital Owerri**.**

Results

Table 1: Membrane potential, calcium and zinc level in asthmatic subjects and controls

Parameter	Control	asthmatic	p
Serum zinc(mgdl)	89.03 ± 4.72	81.85 ± 4.20	p<0.05
Serum calcium (mmol/L)	2.43 ± 0.09	1.62 ± 0.18	p<0.05
Membrane potential (J)	250.39 ± 44.69	191.14 ± 50.68	p<0.05

The levels of membrane potential, serum zinc and calcium were decreased in asthmatic pateints when compared with the controls ($p<0.05$).

Discussion

An ongoing respiratory condition that causes chest tightness, shortness of breath, coughing, or wheezing at some time in life is asthma. Increased antioxidant consumption is associated with asthma. Toxins and volatile free radicals, also known as atoms or groups of atoms with an unpaired electron, are neutralized by antioxidants. Relatively speaking, these include reactive oxygen species (ROS) that generate free radicals and set off a chain reaction in biological systems [11].

In this investigation, the membrane potential in asthmatic women was considerably lower than in normal pregnant women. This is in line with research that shown a substantial reduction in mitochondrial membrane potential in asthmatic participants' plasma as compared to normal pregnant samples. This indicates that asthmatic patients have relatively little energy, which is related to their elevated levels of bronchial distress [12].

The asthmatic group's serum calcium level was significantly lower in our investigation, which is in line with the findings of [13]. A study conducted in India

yielded essentially similar results, demonstrating that the asthmatic group's plasma calcium levels were considerably lower than those of the control group [14]. Similar to this, there was no discernible difference in the serum calcium levels between the asthmatic group and the non-asthmatic group in this investigation.

Additionally, our investigation revealed that asthmatics had considerably lower serum zinc levels than the control group.

This study found that while zinc was considerably lower in asthmatic patients than in apparently healthy persons without asthma, it was still necessary for the immune system to function at its best [15]. The study of [16], who documented zinc deficiency in sickle cell disease, is consistent with the notable decrease in zinc levels. An additional cause of zinc deficiency in asthmatics may be the rise in allergic illnesses. A zinc shortage in asthmatics may be linked to a decrease in interleukin-2 production, a reduction in cell-mediated immunity, a decrease in T-helper functions, and an increase in bacterial infections. Additionally, asthmatics had much higher copper levels. This aligns with the research conducted by [17].

The observed decreases in calcium and zinc levels in asthmatic individuals could be related to compromised bronchiole airways.

Conclusion

This study shown that, in comparison to normal, asthmatics had significantly lower membrane potential, blood calcium, and zinc levels. This highlights the significance of tracking blood zinc and calcium concentrations in asthmatic patients in order to lower the occurrence of asthma.

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