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Evaluation of Antioxidant Vitamins and Inflammatory Markers in Patients with Acute Myocardial Infarction

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Authors' contributions

This work was carried out in collaboration between both authors. Author NC designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author OAN managed the analyses of the study. Both authors managed the literature searches, read and approved the final manuscript.

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ABSTRACT

This study evaluated the antioxidant vitamins, inflammatory markers, and marker molecule of oxidative stress in patients with acute myocardial infarction. A total of 90 patients from Federal Medical Centre and Imo Specialist Hospital were used for this study. Results obtained revealed significant reduction in levels of antioxidant vitamins of test subjects when compared to the control subjects. Observed levels of adenosine deaminase and fibrinogen revealed inflammation of myocardial issues that were stressed in test subjects against the control subjects. These observations could be associated markers in patients with acute myocardial infarction. This study has evaluated the antioxidant vitamins in patients with acute myocardial infarction.

Keywords: Antioxidants; inflammatory markers; myocardial infarction; patients.

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1. INTRODUCTION

Acute myocardial infarction (AMI) popularly known as heart attack, is one of the major diseases of the heart. It is a condition that arises when the blood flow to muscles of the heart is cut off, bring about tissue damage [1-2]. Philip [2], attributed acute myocardial infarction to complete occlusion of a coronary artery with thrombus. The same author further noted that the thrombus occurs at the site of plague which has raptured, and then exposes the inner core. Plague is the resultant effect of arterial blockage by fat deposits [2-3]. It has been noted that most of the deaths as a result of acute myocardial infarction are due to ventricular fibrillation via onset of ischaemia [2]. As a cardiovascular disease, AMI is considered to be among the leading cause of death worldwide [2-4]. In 2008 ischemic heart disease accounted for 7.25 million deaths worldwide (12.8%), according to the WHO [5]. The report put up by the global burden disease study in 2017, noted that cardiovascular diseases were responsible for 31.8% of all deaths worldwide [6].

The pathogenesis of many disease conditions are attributed to free radicals [7]. Free radicals bring about damage to body tissues, which utmostly manifest as clinical disorders [8]. All biomolecules including proteins, lipoproteins, connective tissues macromolecules, carbohydrates, lipids and nucleic acids are damaged by oxidative free radicals [7-8]. Free radicals as well as oxidants are both beneficial and toxic compounds. They could come from metabolic activities or environmental factors such as cigarette smoke, pollution, and radiation. When there is overload of un-scavenged free radicals, oxidative stress sets in into the body [9]. By definition, oxidative stress occurs when free radical formation exceeds the ability of protection against them. This process has been linked to so many chronic and degenerative disease conditions, among which are cardiovascular diseases [8-9]. Antioxidants are molecules that offer the needed protection against damaging effects of free radicals [9].

Some vitamins are known to have potent antioxidant effects with well documented bioactivity profiles [9-10]. Among these vitamins are vitamins A, C (ascorbic acid), D and E (tocopherol) [10]. According to Palace et al. [11], vitamin A is the first vitamin to be discovered however, the full range of biological activities of the vitamin remains undefined. The authors further noted that vitamin A and a structurally similar structure; carotenoids can be effective antioxidants for inhibiting the development of heart diseases. Vitamin C is among the first line of antioxidants and a powerful reducing agent, with scavenging ability against free radicals in biological system [12]. It provides antioxidant defense, protecting proteins and lipid membranes from being damaged oxidatively [12-13]. It donates electrons to free radicals and neutralise their activity [13]. Vitamin D is a membrane antioxidant [14]. Chun-Yen et al. [15] reported that vitamin D3 reduces tissue damage and oxidative stress caused by exhaustive exercise. Vitamin E works with vitamin C through effective regeneration of its antioxidant form by reducing tocopheroxyl radicals. This process protects membranes and other compartments of the cell from free radical-induced damage [16-17].

Acute myocardial infarction (AMI) has been described as a dynamic event associated with oxidative stress as well inflammation. There is need to ascertain the status of antioxidant vitamins and inflammatory markers in such clinical disorder. The present study looked into this area and evaluated the antioxidant vitamins in patients with acute myocardial infarction.

2. MATERIALS AND METHODS

2.1 Study Area

The present study was carried out in Owerri, the capital of Imo State, southeast geopolitical zone of Nigeria. Owerri covers about 100 square kilometers (40 square meter) and falls within tropical rain forest zone. It lies within the latitude 5°25´-5°29´N and longitude 6°59´-6°30´E. Owerri houses majorly the Igbo speaking tribe of Nigeria, though few people from other tribes found in Nigeria also reside within. The inhabitants of Owerri are predominantly Christians with very few pagans and Muslims.

2.2 Study Population

The Federal Medical Centre and Imo Specialist Hospital were used for this study. A cohort of patients who were confirmed with myocardial infarction, who attended or were admitted in wards of both hospitals were selected from September 2018 to January 2019... A total of 90 subjects 45 each from both hospitals between the ages of 40 to 65 years were examined as test subjects. Subjects who were apparently health and not suffering from AMI, those whose ages were outside 40 to 65 years, subjects with history

of high blood pressure, HIV, hepatitis, diabetes, and other malignancies as well as subjects who failed to consent to the study were criteria of exclusion. 45 apparently healthy adults (40-65 years), without myocardial infarction or its history were used as control subjects. AMI diagnosis was done by a cardiologist using clinical criteria such as prolonged ischaemic chest pain (angina), characteristic ECG changes, elevated creatin kinase isoenzyme MB (CKMB) and troponin, within 8 hours after onset of chest pain.

2.3 Blood Sample Collection

With help of hypodermic needle, 5 mL of fasting blood sample was collected from each of the subjects through the antecubital vein using the standard clean puncture technique. The venous blood was dispensed into plain container and allowed to clot to separate the serum with the help of a centrifuge (at 3000 revolution per minute (rpm) for 5 mins). The serum was stored at 20˚C until need for analysis.

2.4 Determination of Vitamins

The antioxidant vitamins analysed in this study were vitamins A, C, D and E. Vitamins A and D were determined using the instructions inscribed on their kits (Elisa kits). Vitamin C was carried out using the method reported by Roe and Kuether [18]. Vitamin E was determined using the method as described by Barker and Frank [19].

2.5 Statistical Analysis

Results were present as mean and standard deviations. Data were analysed using students` t-test at 5% significant levels.

3. RESULTS AND DISCUSSION

The potent antioxidant activities of vitamins have been reported by different authors [20]. The antioxidant vitamins of subjects as presented in Table 1 revealed that vitamins A ranged from 0.74 to 1.31 (mg/dL); C ranged from 18.38 to 44.48 (mg/dL); D ranged from 14.86 to 32.04 (mg/dL); and E ranged from 0.44 to1.46 (mg/dL). Debreceni and Debreceni [21] noted that the antioxidant potency of vitamins may play a role in the prevention and therapy of cardiovascular diseases. The same authors noted that antioxidant vitamins such as C, E and carotenoids decrease the rate of oxidative stress and may have a strategic role in the pathogenesis of atherosclerosis and cardiovascular disease. Vitamins A, C, D and E reduced significantly ($p<0.05$) in test subjects when compared to the control subjects.

Willibald et al. [22] noted that inflammation has been associated with acute myocardial infarction (AMI), though the same authors noted that it is still unclear if the inflammation originates from the rapture plaque or is part of the system. Inflammation is known to occupy a central position in all stages but must smolder for years before resulting in a clinical event such as acute myocardial infarction. Inflammation has associated protein makers which include adenosine deaminase and fibrinogen. Adenosine deaminase is considered an inflammatory molecule in myocardial infarction [23]. Fibrinogen is a glycoprotein that are in circulation and acts at the last step in the coagulation response to tissue and vascular injury [20]. Fibrinogen is increased in inflammatory states, and can increase up to 4 folds during infection and inflammation [20]. Adenosine deaminase and fibrinogen levels increased significantly ($p<0.05$) in test subjects against the control subjects. The observed increase in their levels could be linked to the inflammation associated with acute myocardial infarction of test subjects.

Malondialdehyde is among the organic molecules that are products of harmful reactive oxygen species and a marker of oxidative stress [20-23]. The important role of malondialdehyde in the pathophysiology of acute Myocardial infarctions cannot be overstated. Malondialdehyde ranged from 2.16- 5.17 µM/L. Malondialdehyde increased significantly ($p<0.05$) test subjects when compared to the control subjects. The increased could be indication of stress in acute myocardial infarctions situations.

Table 1. Antioxidant vitamins of subjects

Vitamins (mg/dL)	Control subjects	Test subjects	$T_{Cal.}$	p-value
A	1.31±0.27	0.74±0.15	3.2022	p<0.05
C	44.48±8.15	18.38±4.65	4.818	P<0.05
D	32.04±2.50	14.86±1.86	9.5497	P<0.05
E	1.46±0.22	0.44 ±0.09	7.4453	P<0.05

Results are presented as mean and standard deviations of triplicate determinations. T_{cal}= Tcalculated

Table 2. Inflammatory markers of subjects

Markers	Control Subjects	Test Subjects	T_{Cal}	p-value
Adenosine deaminase(U/L)	1.15 ± 0.13	5.21 ± 0.57	-12.0296	P<0.05
Fibrinogen (mg/dL)	204.16 ± 4.78	419.10 ±3.18	-61.5308	P<0.05

Results are presented as mean and standard deviations of triplicate determinations. T_{cal}= Tcalculated.

Table 3. Marker molecule of oxidative stress of subjects

Molecule	Control Subjects	Test Subjects	T_{Cal}	p-value
Malondialdehyde (μM/L)	2.16± 0.13	5.17± 0.26	-17.9380	p<0.05

Results are presented as mean and standard deviations of triplicate determinations. T_{cal}= Tcalculated

4. CONCLUSION

This study revealed increased levels of antioxidants vitamins, inflammatory markers as well as oxidative stress marker in patients with acute myocardial infarction (test subjects). These observations may have portrayed the diseased state of the myocardial tissue. This study evaluated the of antioxidant vitamins in patients with acute myocardial infarction.

CONSENT

Each participant signed an informed consent form after the procedure and implications were explained using a language the subject would understand.

ETHICAL APPROVAL

Research and Ethics Committee of both hospitals used granted ethical approval for the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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