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RESEARCH ARTICLE

ASSESSMENT OF THE RISK OF MYOCARDIAL INFARCTION AMONG UNDERGRADUATE STUDENTS IN A NIGERIAN TERTIARY INSTITUTION.

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ABSTRACT:

Background;Myocardial Infarction (MI) is a term which is used for defining the necrosis in the heart muscle due to the lack of the oxygen need of myocardium which cannot be supplied by the coronaries.
Aim:This study was carried out to determine the effects of some lifestyle and anthropometric parameters on some cardiac enzymes.Methods: A total of 146 students of sex, age bracket, (16 - 30) were recruited for this study. Enzymatic methods were used in the determination of AST, ALT, CKMB activities. Anthropometric measurements of the participants were taken. The result showed that there was significant increase in systolic blood pressure (SBP), weight and height ($p<0.05$), but there was no significant increase in their diastolic blood pressure (DBP) and body mass index (BMI) ($p>0.05$) in the serum ALT, AST, and CKMB activities. However, there was significant difference in ALT and AST activities ($P<0.05$) but there was no significant difference in serum CKMB activity ($P>0.05$). Statistically the percentage of the participants that had their serum ALT activity above the reference range were 16.6%, those within the reference range were 83.4%,. In serum AST activity, the percentage above the reference range were 19.9%, those within the reference range were 80.1%. Meanwhile, in serum CK-MB activity, those above the reference range were 25.2% while those within the reference range were 74.8%. Conclusion:This could be probably indicate that the leakage of AST and ALT activities may be of hepatic origin.. The non-significant increase in CKMB which is a specific marker of myocardial injury, could suggest that the subjects were not at risk of developing of myocardial infarction as regards their age
Key Words: Myocardial infarction, undergraduate students, Nigerian tertiary Institution

INTRODUCTION

Myocardial infarctions (MI) are diseases that result when blood flow stops to a part of the heart muscle. It is characterised by chest pains or discomfort which may travel into the shoulder, arm,, back, neck or jaw (Beckowski, 2015). Although, myocardial infarction presents mainly in older patients greater than 45, younger men or women can suffer it.

Fortunately, its incidence is not commonly encountered in patients younger than 45 years (Egred *et al*., 2005). Although myocardial infarction is an uncommon entity in young patients, it carries a significant morbidity, psychological effect, and financial challenges for both the person and the family when it manifests at a young age (Egred *et al*., 2005; Chowdhury and Marsh, 1999). When the disease appears at a young age, it also becomes a big problem for the patient and the physician because of the devastating effects on the more active lifestyle of young patients (Chowdhury and Marsh, 1999). A good number of myocardial infarctions are asymptomatic or associated with minor symptoms (Sheifer *et al*., 2001). The prevalence and incidence of myocardial infarction varies depending on the study population, patient's age, and the method of diagnosis (Valensi *et al.*, 2011).

Report has shown that the percentage prevalence of cardiovascular disease (myocardial infarction)due to high blood pressure,(HBP) in 1988 and 1999 was 2.3% and 1%. Report in 2013 youth and cardiovascular disease statistical fact sheet show that incidence of myocardial infarction is higher in the black than in the white, and was higher in boys than girls (Mozafferian *et al.*, 2013). Myocardial infarction among student due to smoking 18.1%, male student were more likely than female student to report current use (Mozafferian *et al*., 2013).The report of Mozafferian *et al.* (2015) showed that prevalence of coronary heart disease by age and sex was less than 1% in the age range 20-39 years in both male and female but 32.2 and 18.8% in age in men and women ≥80 years. The same study also reported 0.3% prevalence of myocardial infarction in age group of 20-39 years in both men and women but the prevalence increased to 3.3 and 1.8% in men and women of 40-59 years respectively (Mozaffarian *et al.*, 2015). Due to the above statistical evidence, it is paramount to assess the prevalence of myocardial infarction among the youth because they are equally disposedto the above mentioned risk. In assessing the risk of myocardial infarction among student, many factors are likely to predispose student and those factors includes, smoking, obesity and lack of exercise. Less common factors include stress-related causes such as (job) academic stress (Kivimakki *et al*., 2012) and chronic high stress levels. Tobacco smoking, including second hand smoke (Smith *et al*., 2006), short-term exposure to air pollution, including carbon monoxide, nitrogen dioxide, and sulphur dioxide, lack of physical activity, psychosocial factors including, low socioeconomic status, social isolation and negative emotions increase the risk of and are associated with worse outcomes after MI. Socioeconomic factors such as a shorter education and lower income (particularly in women), and unmarried co-habitation are also correlated with a higher risk of MI (Nyblom*et al.*, 1989).

Some disease factors also contribute to the risk and they include diabetes mellitus (type1or2), high blood pressure, dyslipidaemia/hypercholesterolemia, particularly high amount of low-density lipoprotein, low amount of high density lipoprotein, high triglycerides, and obesity (Smith *et al*., 2006).

However, there are some cardiac markers that can be used in the diagnosis of myocardial infarction among them include, aspartate transaminase, alanine transaminase, troponin I, creatine kinase, etc. Creatine kinase (isoenzymes CK-MB) is the enzyme used as a definitive serum marker for the diagnosis or exclusion of acute myocardial infarction (Lee, 2006). The determination of CK-MB mass has proven to be more specific for myocardial necrosis than the long-standing CK-MB activity and CK-MB inhibition assays (Wu *et al.*,1992). CK-MB, released after acute myocardial infarction, is detectable in blood as early as 3-4 hours after the onset of symptoms, and remains elevated for approximately sixty-five (65) hours post infarct. CK-MB mass levels are reportedly 50% diagnostic for Acute Myocardial Infarction (AMI) after three (3) hours and > 90% diagnostic at six (6) hours. Such accuracy makes CK-MB mass determinations useful in confirming AMI in patients presenting to the ER with non-diagnostic ECGs > six (6) hours after the onset of symptoms. Elevation of CK is an indication of damage to muscle. It is therefore indicative of injury, rhabdomyolysis, myocardial infarction, myositis and myocarditis. Aspartate transaminase (AST) and alanine transaminase (ALT) are also released though not specific to myocardial infarction, yet can still be raised and is used as a marker for myocardial infarction (Micheal *et al.*, 2004).

Many population based studies have proven that some factors such as abnormal blood level of certain lipids, diabetes, high blood pressure and lack of physical activity are among the risk factors that accelerate the development of myocardial infarction. Other factors that predisposes one to myocardial infarction include sleep deprivation and job-related stress (e.g academic stress). Students are not exempted in the above mentioned risk. Hence, the need to assess the prevalence among student is paramount as little or no publication has been done in this environment. The aim of this study is to assess the risk of myocardial infarction among students in a tertiary Institution South Eastern Nigeria.

Materials and methods.

The work studied 146 students(73 males and 73 females) of the College of Health SciencesNnamdi Azikiwe University Awka, Nnewi campus aged between 16-30 years who were apparently healthy. To encourage consent and allay the anxiety of the participants, the aim of the study was explained to them. The study was conducted in three parts; (a) collection of data on demographic and economic status(sex, age, family status, educational level) and health behaviours (physical activity at school and during leisure time, smoking, alcohol intake, and diet; (b) anthropometric (height, weight) and blood pressure measurements; and (c) blood sample tests. Anthropometric measurements used standardized procedures(Ezeanyika *et al*., 2008) height was measured to the nearest centimetre using a measuring tape. Weight was recorded with a mechanical personal scale (BR 9011, Hana, China) calibrated at the beginning of each working day to the nearest 0.1 kg. Body mass index (BMI) was calculated as weight (in kg) divided by height (in metre squared). A BMI ≥25 kg/m^2 was defined as overweight (Olusi, 2002). Blood pressure (BP) was measured twice using a digital BP meter (Seiwex SE-7000 Seinex electronic Ltd, UK) with the subject seated for at least five minutes, and using left arm (Atman *et al*., 1996). High blood pressure was defined according to the WHO/ISH guildline: a systolic blood pressure (SBP)≥ 140mm/Hg or diastolic blood pressure of (DBP)≥ 90 mm/Hg (WHO/ISH, 2003). Blood samples were collected from the subjects and analysed within two hours. Biochemical cardiac markers were carried out using standard procedures. Serum creatinine kinase (isoenzyme CK-MB), serum aspartate aminotransferase and alanine aminotransferase were determined using standard.

Statistical analysis. The data generated were analysed on SPSS version 20.0. The test of significance was done using t-test statistics. The acceptable level of significance was $P<0.05$.

RESULTS.

Table 1 represents the characteristics of the studied participants. The results show that 15.1% of the subjects showed traces of abnormal blood pressure while 19.8 and 5.5% of the subjects were respectively overweight and obese. The anthropometric parameters of

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the participants are represented in Tables 2 and 3. The systolic blood pressure (SBP,DBP) of the male participants were significantly higher compared to the females (P<0.05). Also, the height and weight of the male participants were significantly higher in the male subjects(P<0.05). However, these did not reflect on the body mass index (BMI) (P>0.05). The SBP and weight of the age group 26-30 was significantly higher to the other age groups (P<0.05). The DBP, height and BMI of this age group(26-30) although higher in values were not significant compared to the other age groups (P>0.05) (Table3). Table 4 and 5 represent the results of the enzyme markers of myocardial infarction. The serum concentrations of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in the male participants were higher compared to the females although statistically insignificant (P>0.05). Also, there was no significant difference on the serum creatinine kinase (isoenzyme CK-MB) between the two genders (P>0.05). The comparison of the serum cardiac markers across different age groups showed no significant differences in their values (P>0.05) (Table5). The Pearson correlation results showed positive relationship between some of the parameters (Table 6) while the percentage prevalence of the cardiac markers that fall within and above the standard reference range was represented in table 7.

DISCUSSION

MI is still one of the most important illnesses in the world that causes mortality and morbidity. MI diagnosis is based on the clinical symptoms, changes of ECG and the increase of cardiac enzymes in serum levels (Saucedo, 2000).The general believe that myocardial infarction or any heart related injury could arise as a result of some factors such as high blood pressure, physical inactivity, unhealthy diet, stressful conditions, and obesity was assessed in this study. From the anthropometric measurements, there was a significant increase in the systolic blood pressure (SBP) of the males when compared with the female participants (P<0.05). This explains the fact that the male counterpart engages in activities that could lead to raised systolic blood pressure when compared to the female and this is in line with reports of Ohnishi*et al.*(1985), where they reported that stressful activities increases blood pressure. Though there was no significant difference in the diastolic blood pressure (DBP), but the mean value of the male was also higher than that of the female participants. Furthermore, there was a significant increase in the mean height and weight of the male students when compared to the females (P<0.05). This was similar to result reported by Igiri *et al.* (2008) which observed that males had higher height and weight but the female had higher BMI which explains the fact that female tends to have higher adipose tissue or fat deposition which can lead to higher BMI when compared with the male subjects. Moreover, the age classification showed that there was a linear increase in age and the anthropometric parameters. Similarly, there was significant increase in the mean serum ALT and AST activities of the male students when compared with the female students(P<0.05). It has been reported that stressful activities increases blood flow in working skeleton while it decreases blood supply to the liver and portal vein, causing damage to the liver with a resultant increase in the leakage of these liver enzymes into the blood stream (Ohnish*et al.*,1985). Conversely, there was no significant difference in the mean serum CK-MB activities of the participants (p>0.05). It is possible that myocardial infarction is more prevalent among the people of old age and CK-MB being a specific enzyme for such heart problem was not raised among the younger age. In the age classification, there was a linear increase in the mean serum ALT activities with respect to age, 16-20 years and 21-25years except in the age group of 26-30years. This rise may be as a result of some other activities that may result in an increase in ALT activities, or it could be as a result of factors such as acute haemolysis, alcoholic liver disease, hepatitis, pancreatitis and acute renal disease (Goldberg and Kish, 1996). The mean serum AST activities of the participants as regards their age classification was not significant but their mean value increases linearly with age, 16-20years and 21-25years, except in age classification of 26-30 years where there was no relationship between age and increased AST activities. This may result from some other hepatocellular disease or some other metabolic syndrome like BMI, dyslipidemia and glucose intolerance that may be prevalent among individuals of this age bracket (Loomba *et al.*, 2008). There was no significant difference in the mean serum CK-MB activities of the participants with respect to their age classification and gender. Advance in age is one of the factors that could predispose one to myocardial injury. This is due to loss of integrity and flexibility of the endothelia lining of the artery with respect to age (Fethi, 2011). There wasa positive correlation between age and SBP ($r=0.621$; $P=0.02$),indicating that increase in age leads to an increase in SBP. Similarly, a significant positive correlation was observed between SBP, and DBP, weight and height. Similarly, an increase in weight led to a corresponding increase in SBP same as weight and BMI.Furthermore, a significant positive correlation was observed between AST activity and ALT activity. This agrees with the findings of Valensi *et al.* (2011) which reported that liver injury could result in the raised activities of both enzymes. Also, an individual having myocardial infarction is likely to have both of the enzyme activities raised and thus ALT and AST are useful in screening for asymptomatic disease such as silent myocardial infarction, liver disease and so on (Valensi *et al.,* 2011). Statistically, the result shows that 80.1% of the participant had their AST activity within the reference range while 19.9% had their AST activities raised above the reference range.This suggests that 19.9% of the participants were at risk of developing any disease that could lead to raised activity of AST of which myocardial infarction was not exempted. We observed that 16.6% of the participants had their ALT activity above the reference range.Conditions such as hepatocellular haemolysis, jaundice, etc could cause the release of ALT into the blood stream. There was no significant increase in the mean serum activities of creatine kinase MB (Ck-MB) of the male and female participant. This is contrary to the findings of Fethi (2011) who reported raised CK-MB activity in the age 30-60 years. This shows that advance in age was one of the major risk factor of myocardial infarction since the mean age of participant for this study was 22.42±2.35 years. Meanwhile, 25.2% of the participant had their Ck-MB activities raised above the reference range. Thismay be as a result of other risk factors such as unhealthy diet, physical inactivity and academic stress (Morris and Crawford, 1958; Delving and Henry, 2008).

CONCLUSION

It could be concluded that, though there are risk factors to myocardial infarction, as mentioned above, individual of age bracket 16-30 who have no history of diabetes or genetic predisposition were unlikely to suffer from myocardial injury.The increased activities of AST and ALT, in some of the subjects may not be of myocardial origin since many other factors can result in their elevated activities of such enzymes.The non-significant increase in CKMB which is a specific marker of myocardial injury, suggests that the subjects were not at risk of developing of myocardial infarction as regards their age.

Table 1. Study population characteristics

Parameter	Frequency (%)
Gender	
Male	73(50)
Female	73(50)
Age Group (Years)	
16-20	43(29.5)
21-25	93(64.4)
26-30	9(6.2)
Hypertension Status	
Normotensive	124(84.9)
Hypertensive	22(15.1)
Body Mass Index	
Underweight	13(8.9)
Normal Weight	96(65.8)
Overweight	29(19.8)
Obese	8(5.5)

Table 2: Anthropometric parameters of the male and female participants.

PARAMETERS	**MALE (n=73)**	**FEMALE (n=73)**	**P-VALUE**
Age (years)	22.42 ± 2.35^{a}	21.79 ± 2.51^{a}	0.119
SBP (mmHg)	118.23 ± 11.58^{a}	110.45 ± 9.76^{b}	0.000
DBP (mmHg)	76.93 ± 8.37^{a}	74.71 ± 8.17^{a}	0.107
Weight (kg)	71.96 ± 12.5^{a}	65.70 ± 1.40^{b}	0.005
Height (m)	1.76 ± 0.85^{a}	1.65 ± 0.86^{a}	0.000
BMI (kg/m^2)	23.39 ± 4.32^{a}	24.08 ± 4.42	0.341

Results are mean ± SD.Values with different superscript in a row are significant ($P<0.05$).

SBP = Systolic blood pressure, DBP = Diastolic blood pressure, BMI = Body Mass Index.

Table 3. Anthropometric parameters of the participants based on age classification.

PARAMETERS	AGE Classification			P-value.
	16 - 20 (n=43)	21 - 25 (n=94)	26 - 30 (n=9)	
SBP(mmHg)	109.98±8.93	115.47±12.09	123.44±3.47^{b}	0.001*
DBP (mmHg)	75.12±6.96	76.03±8.93	77.00±8.20	0.762
WEIGHT (kg)	65.40±1.34	69.60±1.32	77.11±1.39^{b}	0.039
HIGHT (m)	1.69±1.18	1.70±0.09	1.71±1.02	0.768
BMI (kg/m^2)	22.67±3.91	23.10±4.54	26.15±3.40^{b}	0.059

Results are mean ± SD. Values with superscript in a row are significant (P<0.05).

Table 4. Serum Alanine Aminotransferase, Aspartate Aminotransferase and Creatine Kinase mb (isoenzyme) activities of the participants.

PARAMETERS	MALE (n=73)	FEMALE (n=73)	P-VALUE
ALT (IU/L)	21.67±13.35^{b}	16.16±1.13^{b}	0.009
AST (IU/L)	28.54±10.30^{b}	24.57±86.4^{b}	0.014
CKMB (IU/L)	21.75±12.4^{b}	22.581±11.4^{b}	0.683

Results are mean ± SD. Values with different superscript in a row are significant (P<0.05).

ALT = Alanine Aminotransferase; AST = Aspartate Aminotransferase;

CK-MB = Creatine Kinase mb (isoenzyme).

Table 5: The enzymes level of the participants based on age classification.

PARAMETER	AGE RANGE			P-VALUE
	16 - 20 (n=43)	**21 - 25 (n= 94)**	**26 - 30 (n=9)**	
ALT (IU/L)	17.90±13.3	19.70±12.7	13.20±4.90	0.283
AST (IU/L)	25.74±9.90	27.14±9.97	23.10±4.20	0.421
CKMB (IU/L)	22.11±1.42	21.40±1.19	28.65±1.94	0.217

Results are mean ± SD. Values with different superscript in a row are significant ($P<0.05$).ALT = Alanine Aminotransferase; AST = Aspartate Aminotransferase; CK-MB = Creatine Kinase mb (isoenzyme).

Table 6. Pearson correlation between the parameters .

PARAMETERS	CORRELATION	SIGNIFICANCE
AGE VS SBP	0.621	0.002*
SBP VS DPB	0.580	0.000*
WT VS HT	0.345	0.002*
SBP VS WT	0.491	0.000*
BMI VS WT	0.748	0.000*
AST VS ALT	0.297	0.000*
AST VS CKMB	- 0.074	0.454

*significant

Table 7: Prevalence of the cardiac markers in the studied (%)

PARAMETER	WITHIN RANGE	ABOVE RANGE	PERCENTAGE (%)	
			WITHIN	ABOVE
ALT IU/L	121	24	83.4	16.6
AST IU/L	117	29	80.1	19.9
CK-MB IU/L	104	35	74.8	25.2

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