ASSESSMENT OF CARDIOVASCULAR RISK FACTORS IN OBESE INDIVIDUAL IN AWKA, ANAMBRA STATE, NIGERIA.

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ABSTRACT

BACKGROUND: Risk factor modification can reduce clinical events and premature death in people with established cardiovascular disease (CVD) as well as in those who are at high cardiovascular risk due to one or more risk factors. Obesity, a common nutritional disorder in industrialized countries is associated with an increased mortality and morbidity of cardiovascular disease (CVD).

OBJECTIVE: This study evaluated the CV risk factors in obesity and significance of obesity as a risk factor for acute coronary and cerebrovascular conditions which occur frequently in our society.

METHOD: Cardiovascular risk assessment was carried out in 250 subjects, 125 obese and 125 non-obese using the following methods: Framingham risk score, Gamma glutamy1 transferase, (GGT), CK-MB, very high single risk factor (VHSRF) and more than 3 high risk factors (>3HRF)

RESULTS: With the different methods used for the assessment, percentage of individual at high risk tended to be higher in obese individual than in non obese, only Framingham Risk score method shows significant difference in risk percentage ($P < 0.05$). High blood pressure is the most predominant risk factor among the obese assessed (37.6%). The mean value of all the variables (risk factor) except HDL were higher in obese subjects than non obese. Statistically, there were no significant differences between the means of FBG, HDL and GGT ($P>0.05$) whereas there were significant differences between the mean value of total cholesterol, LDL, VLDL, triglyceride, CK-MB and CRP ($P<0.05$).

CONCLUSION: In conclusion, hypertension happens to be the most predominant cardiovascular risk factor observed among obese assessed. Obesity is a serious risk factor for cardiovascular disease because most cardiovascular disease risk factors assessed were more predominant in obese than in normal subjects therefore reduction in weight of an individual is very important to reduce cardiovascular disease.

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INTRODUCTION

Cardiovascular disease (CVD) is a major cause of morbidity and premature death throughout the world. The underlying pathology is atherosclerosis, which develops over many years and is usually advanced by the time symptoms occur, generally in middle age.[1] Acute coronary events (heart attack) and cerebrovascular events (stroke) frequently occur suddenly, and may be fatal before medical care can be given[2]. Risk factor modification can reduce clinical events and premature death in people with established CVD as well as in those who are at high cardiovascular risk due to one or more risk factors.[3-4] To identify high risk patients without cardiovascular disease requires assessment of risk factors.[5-6] Obesity, the most common nutritional disorder in industrialized countries is associated with an increased mortality and morbidity of cardiovascular disease.[7] Obesity is a chronic multifunctional and complex disease resulting from a long term positive energy balance, in which both genetic and environmental factors are involved.[8] Obesity is defined by body mass index (BMI) and further evaluated in terms of fat distribution via the waist–hip ratio and total cardiovascular risk factors.[9-10]

Body mass index is closely related to both percentage body fat and total body fat. The single or multiple risk factors that can predispose the individual to cardiovascular risk will be handled either by modified lifestyle or treatment with drugs, thereby reducing the incidence of cardiovascular disease. By decreasing blood pressure, cholesterol level, level of glycemia,

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proimflammatory cytokines and adhesion molecules, weight loss may prevent the progression of atherosclerosis or the occurrence of acute coronary syndrome event in the obese high risk population. Even after adjusting for risk factors, obesity remains directly associated with CVD. [11]

Aim and objective: The aim of this study is to assess cardiovascular risk in obese individuals and to evaluate existing risk factor indices. The objectives of the study are (i) to measure lipid profile, C reactive protein (CRP), creatine kinase (CK-MB), fasting blood glucose (FBG), gamma glutamyl transferase (GGT); blood pressure (ii) to calculate risk factor indices; Reynold , Framingham risk score, blood pressure, very high single risk factor (VHSRF) and more than 3 high risk factors (>3HRF). (iii) to ascertain the predominant risk factor, sensitivity and specificity of the existing factors. This study aims at evaluating the significance of obesity as a risk factor for acute coronary and cerebrovascular conditions which occur frequently in our society.

Methodology

A cross sectional study which involved a total of 250 subjects, 125 obese and 125 non-obese was carried out in Awka and its environs. Ethical clearance was obtained from Ministry of Health, Anambra State Nigeria. Oral data collection was done using self administered close ended questionnaire with socio-demographic characteristics, lifestyle and dietary habits, medical and family history. Anthropometric measurements weight, height and blood pressure were taken according to WHO procedure.[4] Blood sample was collected from fasting subjects using standard procedure. Serum lipid profile, fasting blood glucose, CK-MB, GGT were estimated by automation using BS-120 Autoanalyser (Mindray), CRP concentration (hs-crp) was assayed by Enzyme-linked Immunosorbent Assay (ELISA) method using microplate reader 96 A (MR-96A) while cardiovascular risk assessment was carried out using the following methods: Framingham risk score, Gamma glutamy1 transferase, CK-MB, very high single risk factor (VHSRF) and more than 3 high risk factors (>3HRF). The risk scores were stratified into low and high risk.

Statistical analyses: Statistical analyses were done using Statistical package for social sciences software (SPSS 17.0.) Students't test was used to compare independent sample means; odd ratio and relative risk were used to access the methods. Statistical significance was set at $p<0.05$.

RESULTS

Cardiovascular risk assessment was carried out biochemically on 125 obese (test) and 125 non obese (control) with different methods shown below. The risk scores were stratified into low and high risk. Percentage of individuals at low risk was higher in both test and control than those at high risk as shown below.

Table 1: Number and percentage (in bracket) of obese individual that are at LOW and HIGH risk of CVD using different methods of assessment

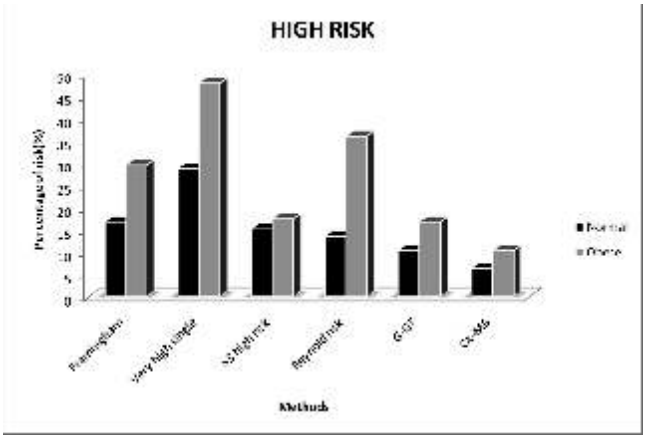
METHOD OF ASSESSMENT	Framingham method	Very high single factor	>3 high risk factors	Reynold risk	G-GT	CK-MB
RISK SCORE						
Low	88 (70.4%)	65(52%)	103(82.4	65(52%)	104(83.2%	112(90%)
Intermediate	26 (20.8%)			15(12%)		
High	11 (8.8%)	60(48%)	22(17.6%	45(36%	21(16.8%)	13(10.4%

Table 2: Number and percentages of non obese individual that are at low and high risk of CVD using different methods for assessment

METHOD OF ASSESSMENT RISK SCORE	Framingham method	Very high single factor	>3 high risk factors	Reynold risk score	G-GT	CK-MB
Low	104 (83.2%)	89(71%)	106 (84.8%)	108(86.4%	112(89.6%	117(93.6%)
Intermediate	6 (4.8%)			0 (0%)		
High	15 (12%)	36 (28.8%)	19 (15.2%)	17 (13.6%)	13 (10.4%)	8 (6.4%)

It was observed that those at high risk tends to be higher in obese subjects than in non obese although only Framingham Risk score method shows significant difference in risk percentage. ($p < 0.05$) as shown in figure 1

Fig 1: Bar chart showing percentage of obese and non obese that are at high risk using different methods.



Reliability of these test method in diagnosing cardiovascular risk was assessed using odd ratio, proportion and relative risk. As proportion, odd ratio (OR) or relative risk (RR) increases, the likelihood of obese individual being more at high risk of CV increases. If OR > 1, then obese individual are more likely to be at high risk of cardiovascular disease using a particular method of assessment. All the methods showed OR, RR and proportion greater than 1. Reynold risk score method gave the highest OR and RR value. (OR = 5.88, RR = 2.60).

Table 3: Reliability of test method in diagnosing cardiovascular risk (Odd ratio, proportion and relative risk)

METHOD	RELATIVE RISK(RR)	ODD RATIO(OR)	PROPORTION(P)
FRAMINHAM RISK SCORE	1.70	2.08	1.40
REYNOLD RISK SCORE	2.60	5.88	2.05
CK-MB	1.67	1.70	1.27
GGT	1.70	1.3	1.74
VERY HIGH RISK FACTOR	1.66	2.28	1.5
>3 HIGH RISK FACTOR	1.20	1.20	1.10

Very High Risk Factor (VHRF) was the most sensitive method whereas Ck-MB was the most specific as shown in table 4

Table 4: Sensitivity and specificity table

METHODS	FRAMINGHAM	REYNOLDS	CK-MB	GGT	VHSRF	>3HRF
SENSITIVITY	29.6%	47%	10.4%	16.8%	48%	17.6%
SPECIFICITY	83.2%	86.4%	93.6%	89.6%	71.2%	84.8%

Statistically, the mean values of all the variables analyzed were higher in obese than in non obese except HDL-C, there was no significant difference between the mean values of fasting blood glucose (FBG), HDL-C and Gamma Glutamyl transferase (GGT) (P> 0.05) whereas there was significant difference between the mean values of total cholesterol, LDL-C,VLDL-C, triglyceride, CK-MB and CRP (P <0.05) in obese and non-obese.

Table 5: Mean (±standard deviation) of risk factors analyzed in obese and control subjects

VARIABLE	OBESITY	CONTROL	P-VALUE
FBG	108(± 48)	103(±51)	P > 0.05
TOTAL CHOL	202(± 39)	185(±49)	P < 0.05
LDL-C	117(±38)	104(±39)	P < 0.05
HDL-C	59.8(± 18)	63.7(±17)	P > 0.05
VLDL	24.5(±14)	17.8 (±10)	P < 0.001
TRIGLYCERIDE	122.7(±74)	88.4 (±50)	P < 0.001
CK-MB	18.4(± 11)	14.1(±8.6)	P < 0.001
GGT	45.5(± 29)	44.9 (±41.7)	P > 0.05
CRP	2.97(± 2.5)	1.89(±2.2)	P < 0.001

p < 0.05 is significant, p < 0.001 is highly significant

The prevalence of CVD risk factors was relatively higher in obese than non obese. High blood pressure happens to be the most prevalent risk factor (37.6%) observed among obese individual assessed. Percentage of obese subject that have FBG >120mg/dl was 19%, total cholesterol > 235mg//dl was 24%, Systolic BP >140mm/Hg was 37.6%, LDL >135mg/dl (21.6%), CRP > 3mg/dl (32%), CK-MB > 24iu/L (17.6%), TG >155mg/dl (11%), GGT > 55 UI/L (19.2%)

DISCUSSION

Obese and non obese individual were assessed for cardiovascular risk, and with the different methods used for the assessment, percentage of individuals at high risk tends to be higher in obese subjects than in non obese although only Framingham Risk score method shows significant difference in risk percentage. (p < 0.05)

Individuals with a very high single risk factor showed highest percentage among both obese (48%) and non obese (28.8%), this shows that it is the most sensitive method. Any major risk factor, if left untreated for many years has the potential to produce CVD. This method is very useful because single risk factor detected will be immediately modified by lifestyle or drug intervention thereby reducing chance of one having CVD. This is in line with report by the American Heart Association (AHA) which says that preventive effort should target each major risk factor.[12] It was found that 18% obese and 15% non obese were at high risk of CVD on using >3HRF method. This is in line with work done by Lambert et al [11] which highlights high prevalence of multiple risk factors in a population based sample of overweight/obese in South Arabia. Considering the significant association between clustering of CVD risk factors and BMI or waist circumference, the study suggests that high prevalence of overweight may have important implications for the health care system, even at lower level of BMI or waist circumference.

In this study, on using FHS risk score method, 8.8% of obese and 4.8% of non obese shows high risk of CV. FHS has shortcomings in that it does not account for other established major risk factors like hypertriglyceridaemia, obesity, family history, inflammatory markers like CRP; there is emerging evidence in potentially using CRP, particularly using the Reynolds Risk score to reclassify intermediate risk into a high risk category for potential intervention.[13] Using Reynolds risk score, intermediate risk subject were reclassified to high risk subject giving 29% obese and 16.8% non- obese to be at high CV risk. Of all the methods used, FHS method showed significant percentage risk difference between obese and non obese individual. This is because Framingham Heart study (FHS) has been in forefront of the development of cardiovascular risk prediction equations for assessment of absolute risk. Development of WHO/International society of Hypertension risk prediction chart have resulted in a paradigm shift in CVD prevention strategies, from a single risk factor to a more cost-effective total CV risk approach, an approach recommended by WHO for CVD prevention worldwide.[14]

There are instances when the tool overestimates risk in low-risk population and underestimates in high risk group. Recent studies have examined the accuracy of FHS in women, different ethnic and social groups.[15] Its limitation is that they are not age specific but they are highly sensitive and specific. Work done by the Scottish MIDS PAN Data suggest that the exclusion of social deprivation and certain risk factors in the estimation of CV risk results in a serious underestimation of absolute risk.[15-16]

High sensitive CRP is a useful tool for early diagnosis of CV risk in obese children and adults. In this study, on using Reynolds risk score, 36% of obese and 13.6% non obese are at high risk of developing CVD and the mean serum hs-CRP level in obese is significantly greater than non obese. Higher BMI is associated with higher CRP concentration, even among young adults aged 17 to 39years.[17] These findings suggest a state of low grade systemic inflammation in overweight and obese persons. Human adipose tissue expresses and releases the proinflammatory cytokine inducing low-grade systemic inflammation in person with excess fat.[18]. Heart patients who have persistent CRP between 4 and 10mg/l, with clinical evidence of low grade inflammation should be considered to be at increased risk of thrombosis.[19]

In a report published in Circulation Journal of the American Heart Association, researchers cited Gamma glutammyl transferase test as one of the simplest ways to determine whether or not individuals are at risk of death from CVD. GGT method assessed 17% obese and 10% non obese individual to be at risk in this study and the mean serum GGT level is higher in obese subject but there was no significant difference. This is in line with other studies which reported that high levels of GGT are associated with fatty liver, insulin resistance, type 2 diabetes stroke, obesity and other metabolic risk factors.[20] Higher levels of GGT have been associated in population with increased risk of atherosclerosis.[20] Another important association between GGT and the metabolic Syndrome is the finding that higher GGT levels occur in obese particularly those with abdominal obesity.[21]

CK_MB is a cardiac marker and can be used in diagnosis of myocardial infarction. High CK-MB is seen in acute myocardial infarction which rises in 4-6hrs and reaches its peak at 18-24hrs after the attack.[22] In this study, 10% of obese and 7% non obese individual have high CK-MB level >24 IU/L but there was no significant difference in their percentage risk. The highest CK-MB level obtained in this study was 72 iu/l which is not so high. . Mean CK-MB level is significantly higher in obese individual than non obese (table 4.7). This method gave the least percentage of individual at CV risk and was most specific (93.6%). Limitation of CK-MB method of assessment is that high CK-MB is seen only after episodes of myocardial infarction which means that the individual has developed CVD (myocardial infarction) already.[23] The pattern of serial CK-MB determination is more informative than a single determination. One CK MB measurement, even when taken at an appropriate time cannot definitely confirm or rule out the occurrence of acute myocardial infarction.[24] CK-MB is higher in obese non diabetic subject and lower in trained

athletes.

Odd ratio (OR) and relative risk (RR) were used to determine reliability of these methods in diagnosing cardiovascular risk. If OR > 1, then obese individual are more likely to be at high risk of cardiovascular disease using a particular method of assessment. As relative risk or odd ratio increases, the likelihood of obese individual being more at high risk of CV increases using the different methods of assessment. Reynold risk score method gave the highest OR and RR value. (OR = 5.88, RR = 2.60).

The prevalence of high CVD risk factors was relatively higher in obese than non obese. High blood pressure happens to be the most predominant risk factor (37.6%) observed among obese individual assessed. This is in line with work done by Ejim et al[9], on prevalence of cardiovascular risk factors in the middle- aged and elderly population of a Nigeria rural community. Statistically, the mean values of all the variables analyzed were higher in obese than in non obese except HDL-C, there was no significant difference between the mean values of fasting blood glucose (FBG), HDL-C and Gamma Glutamyl transferase (GGT) (P> 0.05) whereas there was significant difference between the mean values of total cholesterol, LDL-C/ VLDL-C, triglyceride, CK-MB and CRP (P <0.05) in obese and non-obese.

Similarly, increased delivery of free fatty acids to muscles leads to increased muscle triglyceride which plays a role in the development of insulin resistance in this tissue. Insulin helps to convert glucose into glycogen which is stored in the liver, when the liver becomes too saturated with glycogen; glucose is instead used to create fatty acid that is released into the blood stream.[25]

It was also noticed in this work that total cholesterol, triglyceride and LDL cholesterol were significantly higher in obese as compared to controls while HDL- is significantly lower which is in line with findings of Niranjan et al[21]; 2006, Szczygielska et al [15]. Work done by Bhatti[26] differ a little because all the parameters including FBG, except HDL level showed significant increase in obese, HDL was significantly reduced.

Alteration in the fasting lipid profile indicates proatherogenic dyslipidaemia in obese subject due to increase activity of hepatic lipase on increased fatty cells (both in number and size).[27] As free fatty cells enlarge in size, all the products they produce like free fatty acid, cytokines, lipid metabolites increase in quantity except adiponectin whose secretion is inversely related to the size of the fat cell. This fatty acid is used to produce triglyceride which build up and contribute to body fat.

Limitations of the study

Limitations of this study include the small sample size and generalized study population.

CONCLUSION

High blood pressure was the most prevalent CVD risk factor observed among obese subjects. Obesity is a serious risk factor for CVD because most of the risk factors assessed were more prevalent in obese than in non obese subjects; therefore reduction in weight of an individual is very important to reduce the possibility of cardiovascular disease

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