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RESEARCH ARTICLE

THE PREVALENCE OF CARDIOVASCULAR RISK FACTORS AMONG PRIMARY SCHOOL CHILDREN IN CALABAR, NIGERIA

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ABSTRACT

Background: Cardiovascular diseases risk factors, develop silently during childhood and adolescence with the manifestation of the disease in adulthood. Hence, identification of individual risk factors in childhood is a good method to assess cardiovascular risk level in apparently healthy children. The objective of this study was to examine the prevalence of cardiovascular disease risk factors among primary school children in Calabar, Nigeria. **Methodology:** This was a cross sectional study conducted among 374 randomly selected primary children aged 6 to 12 years (160 males and 214 females) of different socio-economic background. Physical examination was done, anthropometry taken and body mass index (BMI) percentile calculated. Blood pressure was taken using appropriate cuff sizes and non-fasting lipid profile and blood sugar done. **Results:** Thirty one (8.3%) were overweight, with 3.2% and 5.1% being males and females respectively. Fifteen (4.0%) were obese, with 1.6% males and 2.4% were females. Also, 29(7.8%) of the subjects had waist circumference greater than the 90th percentile. Another 29(7.8%) had elevated systolic blood pressure while 9 (2.4%) had systolic hypertension. Twenty five (6.7%) had hypercholesterolemia, 86(23%) had hypertriglyceridemia. One hundred and twenty one (32.4%) had HDL-cholesterol levels of less than 40mg/dl.. All the participants had normal blood glucose levels. **Conclusion:** This study revealed that cardiovascular risk factors are present in primary school children. It is important that efforts should be made to evaluate and identify these health indices with the aim of instituting appropriate interventions early in life to prevent the development of cardiovascular diseases later.

INTRODUCTION

Cardiovascular diseases (CVDs) are a major public health problem worldwide. They constitute important primary causes of preventable morbidity and mortality, especially in industrialized nations. They are assuming a central place in developing nations in recent times resulting in loss of potential years of life (Paavola *et al*., 2014; Alwan, 2010). Globally CVDs are the first cause of mortality and World Health Organization (WHO)estimates that CVDs are projected to account for 73% of global mortality by the year 2020 (World Health Organization, 2000). Studies, (Alwan *et al*., 2010; Hedlcy *et al*., 2002; Claire, 2012) have documented increasing prevalence of overweight and obesity in children and adolescents in many countries which is attributed to increased consumption of refined foods, snacks and decreased physical activity. These result in a concomitant increase in the prevalence of cardiovascular risk factors. A range of cardiovascular risk factors which include genetic factors, hypertension, dyslipidemia, obesity, metabolic syndrome, an atherogenic diet and physical inactivity are associated with CVDs and prevalence of these factors is increasing among children and adolescents (Alwan, 2010).

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The trend that has probably increased the burden of cardiovascular risk is significant increase in the prevalence of childhood obesity and childhood obesity has reached epidemic proportions in many countries of the world (Hedlcy *et al*., 2002; Claire *et al*., 2012; Berenson, 2002; Beaglehole, 2003). Interestingly in obesity, many risk factors are clustered together (World Health Organization, 2009; Berenson, 2002). In Nigeria, obesity is increasing in children and adolescents (Ansa, 2003; Danladi, 2012). Atherosclerosis resulting from dyslipidemia was uncommon in the low-to-middle income countries. Recently, in most African countries it is the second cause of death, chronic illness and disability (World Health Organization, 1999; Chinn, 2002). Atherosclerosis is known to begin in childhood and is directly associated with the CVD risk factors that are well established in adults (Stephen, 2011). It is suggested that there is a forced pace of globalization resulting in the, "export" of risk factors from the Western world such as tobacco smoking, refined foods and sedentary lifestyle with increased risk of CVDs in Africa (World Health Report, 2001). Identification of individual risk factors in the population has been suggested as a good method to assess cardiovascular risk level in apparently healthy children (Beaglehole, 1992). Therefore, this study was undertaken to identify these risk factors among primary school children so as to enable health care planners intervene.

MATERIALS AND METHODS

This study was carried out between February to July, 2017 among primary schools (public and private) children aged 6 to 12 years in Calabar, Niger delta region of Nigeria. Calabar as earlier described by Adams *et al*. (2019) is the capital city of Cross River State of Nigeria in the Niger delta region. It has several health and educational institutions. The city is tagged the tourism destination of Nigeria, with the yearly Christmas carnival festival. Ethical approval for this study was obtained from the ethics committee of the University of Calabar Teaching Hospital and Cross River State ethical committee. Questionnaires detailing the bio-data of each participant including parental educational levels and occupation were used and written consent obtained from parents/guardians. Anthropometry was done and BMI (weight in Kg/ Height in $m.^2$) was calculated (National Centre for social research, 2010). A BMI of 85^{th} to 94^{th} percentile was taken as overweight, BMI of equal to or greater than the 95^{th} percentile was considered a.s obesity, based on the International Obesity Task Force (IOTF) (Chinn, 2002). Blood pressure (BP) was taken using the first and fifth Korotkoff sounds as recommended by the 4^{th} report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents (The Fourth Report on the Diagnosis, 2004). Three readings were taken per subject at 5 minutes intervals after a good rest and the averages recorded. Systolic or diastolic blood pressure of 90^{th} to 94^{th} percentile was classified as elevated blood pressure while values equal to or greater than the 95^{th} percentile for age, sex and height was classified as hypertension respectively, based on the recommendation of the 4^{th} report (The Fourth Report on the Diagnosis, 2004). Waist circumference (WC) was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest as described by the Nat Cen Protocol (National Centre for social research, 2010). A WC of greater than the 90^{th} percentile was taken as abnormally high based on the guidelines of the International Diabetic Federation (IDF) (Bravo *et al*., 2017). Blood samples were obtained aseptically between 9.0am to 10.0am and analysed for total cholesterol (TC), triglycerides (TG) and high density lipoprotein (HDL)–cholesterol using kits from ACON Laboratory while low density lipoprotein (LDL)-cholesterol was calculated from the Friedwald'sformular (Mora, 2009). Serum glucose was assayed using sidekick blood glucose testing machine from NIPRO DIAGNOSTICS Ft. Lauderdale, Ft 33309 EE. U U. Socio-economic status was done according to the method used by Oyedeyi (Oyedeji, 1985) in Nigeria and was grouped into low, middle and high. Data was analysed using SPSS version 21.0 and alpha level of significance at 95% confidence level was set at < 0.05.

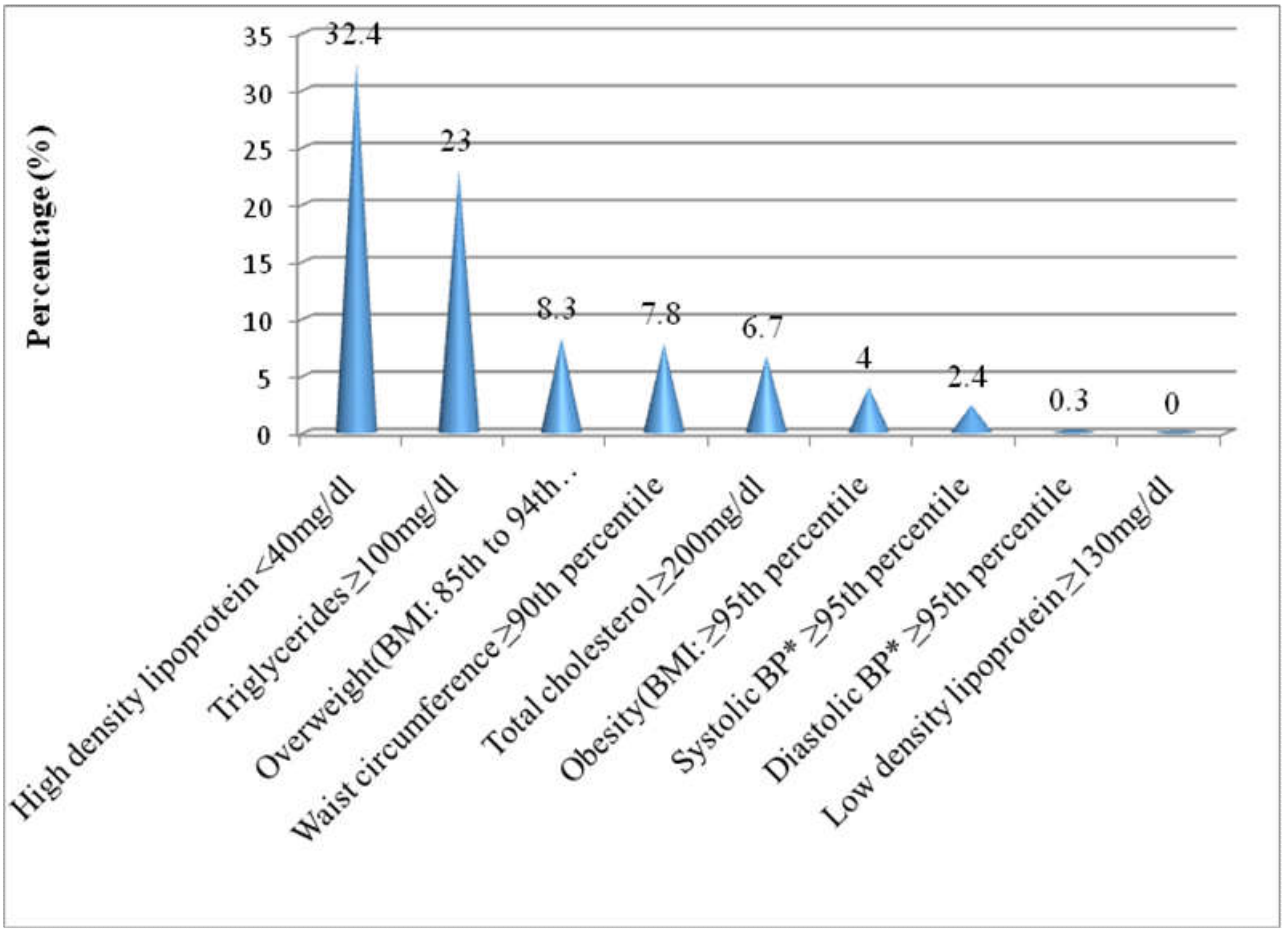
RESULTS

A total of 374 children aged 6 to 12 years were recruited for the study, out of which 160 (42.8%) were males and 214 (57.2%) were females with mean age of 9.48±1.42 years. The mean BMI was 16.55± 2.57 $Kg/m.^2$Thirty one (8.3%) were overweight, with a male to female ratio of 3:5 and 15(4.0%) were obese, with a male to female ratio of 1:3. Twenty nine (7.8%) had WC $\geq 90^{th}$ percentile with a male to female ratio of 1:2. Mean systolic blood pressure (SBP) was 95.9±8.8mmHg and diastolic blood pressure (DBP) 59.6±5.5mmHg. Twenty nine (7.8%) and 9 (2.4%) had elevated systolic blood pressure and hypertension respectively, with male to female ratio 1:1 and 1:8 respectively. The biochemical parameters were mean TC 151±28.8mg/dl, range of 100- 236mg/dl. Sixty eight (18.2%) and 25 (6.7%) had borderline and abnormal high TC. Mean TG was 83.1±34.7mg/dl, range of 45 to 249mg/dl with 112 (29.9%) and 86 (23.0%) having borderline and abnormal levels respectively. Out of which 37 (9.8%) were males and 49 (11.8%) were females. Mean HDL was 45.9±14.0mg/dl, range of 15 to 60mg/dl, but 121 (32.4%) had levels below 40mg/dl. Mean LDL was 22.8±15.7mg/dl No abnormality was found with a range of 11 to 72mg/dl. In relation to WC, 37.9% of those whose WC was $> 90^{th}$ percentile had dyslipidaemia, X ($p= 0.005$), which was statistically significant. (Fig 1).

Table I shows the various lipid profile of the participants in relation to their sex and SES. Apart from LDL-cholesterol that was normal for all the participants, other lipid fractions had various levels of abnormalities as seen. When these values were tested against SES and SEX, only HDL- cholesterol had a statistically significant relationship with SEX; X^2 ($p= 0.005$).
All subjects had normal random blood sugar levels less than 11mmol/L. Table II, shows the anthropometric indices of the participants in relation to the sex and SES of participants. Of those with WC greater than the 90^{th} percentile, 9 (5.6%) and 20 (9.3%) were males and females respectively .Many of the children were mostly of the middle and upper socio-economic families (6.3%) (12.6%) respectively. However the relationship between WC and sex; X^2 ($p=0.183$) and SES; X($p= 0.067$) was not statistically significant. More females had overweight and obesity compared to the males most of who were of the middle and upper socio-economic families. When findings were tested against BMI, SES and SEX the difference was not statistically significant.

DISCUSSION

The prevalence of overweight and obesity in this study was 8.3% and 4.0% respectively. This is higher than the prevalence of 6.8% and 1.7% for overweight and obesity respectively earlier reported byAnsa *et al*. (2003) two decades ago in the same locality, Calabar, Niger Delta region of Nigeria, Ben-Bassey *et al*. (2007) in Lagos and Mustapha *et al*. (2013) in Ondo, all in Western Nigeria had reported lower prevalences. Findings from this study shows an increase in overweight and obesity in Nigeria. Calabar has undergone a lot of changes over the years with a lot of westernization of her culture and eating habits. For instant, the yearly international Christmas carnival over the past 15 years might have contributed. A lot of fast food shops have sprung up as it is the tourism destination in the country (Adam, 2019). This could have contributed to this increased prevalence, couple with possible sedentary life style as most children of the middle and higher socio-economic families are often driven in cars to-and- from school by their parents. These children also spend most of their time watching television and playing computer games. More studies however, are needed to look into these changes in lifestyles as they are bound to affect the populace. This trend was reported in neighbouring Benue state, north of Calabar by Danladi *et al*(9)with a prevalence of 18.3% and 3.2% forover weight and obesity respectively. Nigeria needs to have a look into the activities and eating habits of her citizens as well as factors known to increase the prevalence of over weight and obesity. In South Africa, Zandile and Eleni (Zandile, 2013) reported a prevalence of obesity of 13.5% among South African children which is much higher than the reported prevalence in this study.



BP*=Blood Pressure

Figure 1. Prevalence of different cardiovascular risk factors among study participants

Table 1. Relationship between biochemical parameters and socio-economic status

	MALE	FEMALE	LSES	MSES	USEC
TG(mg/dl)	37(23.1%)	49(22.9%)	21(24.0%)	37(21.1%)	28(25.3%)
Mean TG±SD	X^2(p-value) 1.397(0.497)		X^2 (p-value)		
83.1±34.7mg/dl			0.973(0.914)		
TC(mg/dl)	44(27.5%)				
Mean TC±SD	x^2(p-value) 3.009(0.083)	17(7.9%)	5(5.6%)	10(5.7%)	10(9.0%)
151.1±29.8mg/dl			x^2(p-value) 1.283(0.526		
HDL-C(mg/dl)<40mg/dl	44(27.5%)	77(36.0%)	34(38.6%)	50(28.6%)	37(33.3%)
Mean HDL±SD					
45.9±14.0mg/dl					

- LSES; Lower socio-economic status
- MSES; Middle socio-economic status
- USES; Upper socio-economic status

Table 2. Relationship between anthropometric measurements and socio-economic status

	MALE	FEMALE	LSES	MSES	USES
WC >90% tile	*9(5.6%)*	20(9.3%)	4(4.5%) x^2 (p-value)5.486(0.067)	11(6.3%)	14(12.6%)
	x^2(p-value) 1.770.183)				
Over weight	12(7.5%)	19(8.9%)	6(5.6%)	10(5.7%)	16(14.4%)
Obesity	6(3.8%)	9(4.2%)	3(3.4%)	7(4.0%)	5(4.5%)
BMI±SD	Chi square-2.920		Chis qaure-7.813		
16.55±2.371g/m^2	p-value 0.864		p-value 0.029		

- LSES; Lower socio-economic status
- MSES Middle socio-economic status
- USES; Upper socio-economic status

The prevalence of Waist circumference (WC) greater than the 90thpercentile was 7.9% among the subjects which further lends credence to the threat. WC correlates with abdominal fat mass (subcutaneous and intra-abdominal). It is associated with cardio-metabolic disease and reflects central adiposity.The WC was higher among children in the middle and upper social classes and this was statistically significant. There was no gender difference. This however, appears to be different in developed countries where these are common among children of the lower socio-economic status (SES) (Chinn, 2002; Yannis, 2004; Youfa Wang, 2001). In addition, more females than males had overweight and obesity in this study but, this was not statistically significant. This agrees with many studies (YoufaWang, 2001; Sclin, 1974-1994) both in developed and developing economies. This may be explained by the fact that males are generally more active than females in most societies. Interestingly, Mostafa *et al*. (2011) identified more males than females to be overweight and obese in a study among school children in Egypt, while Mustapha *et al*. (Mustapha, 2013) in Ondo, Nigeria reported higher prevalence of overweight among girls and higer prevalence of obesity among boys in the same study.In Nigeria, children of the lower SES walk to school and are not indulgence to sedentary lifestyle. However this study was not set out to investigate this. The world health organization WHO has recommended that children should be encouraged to reduce time spent on watching television (Robert, 2002).

In this study (7.8%) and (2.4%) of the children had elevated systolic blood pressure and systolic hypertension respectively. This being a cross sectional study needs to be tracked to see whether it will be sustained. Many children usually have white coat hypertension and this might not have been completely ruled out. We also did not rule out family history of hypertension. However, this prevalence falls within the estimated global prevalence of childhood hypertension (The Fourth Report on the Diagnosis, 2004). Okoh *et al*. (2012) reported prevalence of childhood hypertension of 4.7% in Port Harcourt also in Niger delta region of Nigeria. In Egypt, Mostafa *et al*. (2011) reported 5.4% and 4.0% for elevated blood pressure and hypertension respectively. The higher prevalence of hypertension among females compared to males agrees with the report of Ahmastos *et al*. (2003) that pre-pubertal females have greater arterial wall thickness compared to males, with a tendency to have elevated blood pressure. But, Mostafa *et al*. (2011) found no sex difference for childhood hypertension. Coto V *et al*. (1987) reported that hypertension was higher in children with a family history of hypertension, high socio-economic status, sedentary lifestyle and obesity.

In this study no subject had high level of LDL-cholesterol. This is encouraging despite the prevalence of obesity and overweight among them. There was difficulty in assessing their dietary intake, more studies are needed in this area. There were however, various degrees of abnormalities in total cholesterol (6.7%), triglycerides (23%) and 32.4% of the children had high density lipoprotein HDL-cholesterol in the lower range. These abnormalities though not statistically significant, will increase the cardiovascular risk of these primary school children, hence, they were referred for follow-up. There is paucity of information with regards to lipid profile among Nigerian children. All the children in the study had normal blood glucose. Blood glucose level is rarely measured in many studies, but it is a known CVD risk factor. A better result would have been obtained if glycosylated haemoglobin levels were measured as it gives a long term level of glucose control in the body. The limitations encountered in the study were the inability to evaluate the dietary habits and contents as well as the exercise profile in relation to their SES. In addition, the difficulty in doing glycosylated haemoglobin levels to rule out occult diabetes.

Conclusion

This is study has shown that CVD risk factors are present in Nigerian children, with obesity on the increase. Also, females and children of the middle and upper socio-economic families are mostly affected.Hence every effort should be made to stem the rising trend in CVD at all levels of the society.

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Conflict of interest: There is no conflict of interest with regards to this study.

LIST OF ABBREVIATIONS

BP: Blood Pressure
DBP: Diastolic Blood Pressure
BMI: Body mass Index
CVD: Cardiovascular Disease
DM: Diabetes Mellitus
HDL-C: High Density Lipoprotein- Cholesterol
IDF: International Diabetic Federation
ITF: International Obesity Task Force
LDL-C: Low Density Lipoprotein Cholesterol
LSES: Lower Socio-economic Status
MSES: Middle Socio-economic Status
SES: Socio-economic Status
TC: Total Cholesterol
TG: Triglycerides
USES: Upper Socio-economic Status
WC: Waist Circumference
WHO: World Health Organization

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