RESEARCH PAPER

THE PREVALENCE OF OBESITY AS INDICATED BY BODY MASS INDEX AMONG APPARENTLY HEALTHY ADULTS LIVING IN ABA, ABIA STATE, NIGERIA

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ABSTRACT

The aim of this study is to determine the prevalence of obesity using BMI and to assess the relative associations with some cardiovascular risk factors (CVD). Subjects for this study were apparently healthy volunteers who willingly granted their informed consent. They reported at the various study zones of the town after an over-night fast where their weights (in Kg), heights (in Metres), and blood pressures (mm Hg) were measured and recorded. Blood samples were also collected via venipuncture for serum lipid profile studies. The data obtained were analysed using the Statistical Package for Social Sciences (SPSS). The student t-test was used and $p \leq 0.05$ was considered as statistically significant. The results showed that the prevalence of obesity as determined by BMI $\geq 30kg/m^2$ was 16.56%. Obesity was more prevalent among the subjects older than 40 years and among females than males ($p<0.05$). BMI appeared to be significantly associated with CVD risks factors. Thus, healthier eating and increase physical activities are strongly encouraged to reduce the increasing prevalence of obesity and the associated CVD risk burden.

Key words: Prevalence, BMI, Obesity, Aba, Nigerians

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INTRODUCTION

Obesity is defined as an excess of adipose tissue. The prevalence of overweight and obesity in most developed countries and urban towns of many less developed countries has been increasing markedly over the past twenty years (Heymsfield, 2004). Similarly, the incidence of type 2 diabetes has equally increased by a similar measure during this period, and is presumed to be a direct consequence of the obesity epidemic (Mokdad et al., 2003).

Indeed many disorders occur with greater frequency in obese people than in others. The most important and common being hypertension, type 2 diabetes mellitus, hyperlipidaemia, coronary artery disease, degenerative joint disease, and psycho-social disability (Baron, 2007; McDermott, 2006). Approximately 60% of person with obesity in the USA have metabolic syndrome as defined by the USA National cholesterol education program, Adult Treatment Panel (NIH 2001; Baron, 2007). Until recently, obesity was considered to be the direct result of sedentary lifestyle and chronic ingestion of excess calories (Willet, 1998). Although, without a doubt, these are the principal causes in some cases.

However, there is now evidence for strong genetic influence on the development of obesity. Adopted children demonstrate a close relationship between their body mass index and that of their biological parents; and genetic

determinants of some types of obesity have now been established (Baron, 2007). In fact, it has been suggested that most human obesity develops from the interaction of multiple genes, environmental factors and behaviours (Baron, 2007).

On the other hand, current facts show that obesity is a statistically-significant cardiovascular risk factor in world populations (Yusuf et al., 2004) and the rise in the prevalence of obesity have been linked to environmental adaptation and changes in lifestyles (Okafor et al., 2008). As such, rapid urbanization, industrialization as well as increasing economic capabilities, have the propensity of leading to abnormal weight gain and development of the various complication of obesity.

This paper therefore, investigates the prevalence of obesity (as determined by BMI) in association with cardiovascular risks amongst Nigerian adults living in the metropolitan city of Aba, in South Eastern Nigeria.

MATERIALS AND METHODS

Study duration and protocol: The study lasted between April and June 2008 and the National Protocols for utilizing human subjects were closely adhered to. However, the study was conducted in compliance with the Declaration on the Right of the Patient (WMA, 2000).

Participants: Three hundred and twenty (320) apparently healthy adults volunteers (162 females (50.63%) and 148 males (49.37%) were involved in this study. They were made up of traders, artisans, hospital staff, patient relations and visitors to the hospital who granted verbal consent and met the inclusion criteria for the study.

Inclusion and exclusion criteria: The inclusion criteria included a blood pressure in the absence of any antihypertensive drug use, normal fasting blood sugar in the absence of antidiabetic medication and respondent who were non –smokers and did not take alcohol beverages on a regular basis.

Also, pregnant women as well as disabled and non ambulatory subjects who cloud not stand for height and weight measurements were excluded.

Study procedure, sample collection and analysis: All the subjects who gave consent were weighed on light clothing using the DAN5 weighing scale (Seca, UK) which was regularly standardized with a 10kg steel weight. Height was measured using a standard meter rule mounted on a stand. From both measurements, the body mass indices (BMI) was calculated using the formula BMI= weight (in Kg)/ height (in meters^2).

All respondents for lipid estimations were asked to do an overnight fast for at least 12-14 hours Blood was stored in lithium heparin bottle (4mls) and lipid assay done within three hours of collection (Gibbons and Ballantyne, 1981). To assess obesity-related risk factors, blood pressure was determined by auscultation (Ganong, 1997) while serum triglycerides were determined as described by Gibbons and Ballantyne (1981).

Statistical Analysis: Data analysis was done using the SPSS version 10. Comparison of mean was done using the student t-test. The level of statistical significance was taken as $p<0.05$.

RESULTS

The age and sex distribution of the subjects is shown in table 1. The range of the body mass index (BMI) was 21.87 kg/m^2 - 40.83 kg/m^2 with a mean of 27.89±1.08 kg/m^2. The mean BMI of the female subjects was 28.85±1.25 kg/m^2 while that of the males was 26.75±1.05 kg/m^2 as shown in table II.

The prevalence of obesity in this study is therefore 16.56%. Analysis of the BMI showed that amongst the study population, 101 (53.43%) had normal BMI of less than 25kg/m^2; 96 (30.0%) had BMI in the overweight range (25–29.9kg/m^2), while 53 (16.56%) had BMI in the obesity range as shown in table III.

3(0.94%) females and a male (1; 0.31%) were found to have elevated serum triglyceride level of 2.26 mmol/L, giving an overall prevalence of elevated triglyceride cholesterol of 1.25 percent. Obesity was clearly seen to be associated with increased risk factors as shown in table IV.

Table I. Demographic Profile of the Study Population

Age range	Males (number)	Females (number)	Total (number)
20 – 29 yrs	36	43	79
30-39 yrs	40	52	92
40 – 49 yrs	37	35	72
50 – 59 yrs	24	18	42
60 – 69 yrs	21	14	35
Total	158	162	320

Table II. Cross tabulation of BMI in relation to age

Age range (years)	BMI range (kg/m2)	Mean BMI value (kg/m2)
20 – 29 yrs	21.87 – 30.08	24.92 ± 3.65
30-39 yrs	23.05 – 34.53	24.98 ± 3.80
40 – 49 yrs	25.73 – 40.83	29.79 ± 2.60
50 – 59 yrs	24.21 – 35.41	29.88 ± 3.10
60 – 69 yrs	26.17 – 38.89	29.95 ± 2.80

Table III. Mean BMI distribution among the subjects (SPSS version 10, p<0.05)

BMI	Male	Female	Total
<25.00 (kg/m2)	84±0.85	87±0.90	171 (53.43%)
25 – 29.99 (kg/m2)	47 ± 1.25	49 ± 1.30	96 (30.00%)
≥ 30.00 (kg/m2)	26 ± 1.1	27 ± 1.20	53 (16.57%)
Total	157	163	320 (100%)

Table IV. Relationship between obesity and risk factors

BMI	No of subjects	Systolic hypertension (mm Hg)	Diastolic hypertension (mm Hg)	Hypertriglyceridaemia (mmol/L)
< 25.00 (kg/m2)	171	19 (11.1%)	5 (2.9%)	25 (14.61%)
25 – 29.99 (kg/m2)	96	32 (33.30%)	18 (18.75%)	11 (11.40%)
>30.00 (kg/m2)	53	42 (78.20%)	36 (67.92%)	17 (32.08%)

DISCUSSION

Increasing urbanization has been observed to be associated with modernization in lifestyle, which is largely characterized by physical in activity, change in dietary pattern and consequently, development if Obesity (Hodge et al., 1997). Many Nigerian cities like Aba, have witnessed an increase in the number of fast food outlets as well as information technology revolution, both of which have greatly influenced the way we live. The BMI in this study is 28.98kg/m^2 and is in keeping with overweight. This is similar to 28.76 +5.9kg/m^2 observed by Akpa et al. (2006) in Port-Harcourt, Nigeria, among healthy adults. This is understandable as Aba, a cosmopolitan town, is quite close to Port-Harcourt, and according to WHO (1998), have similar socio-economic stratum.

The less developed countries become more obese as they become more affluent. The mean age in this study is 48 years which is within the middle age group. This is similar to the study in Port-Harcourt (Akpa et al., 2006) and Benin (Ukoli et al., 1997). Obesity increase with age as physical activity diminishes, and abdominal obesity arises as peripheral fat is diverted to central sites (Barkman et al., 1983). In this study, the BMI and hence obesity, increased

with age as shown in table III. Aging can lead to increased sedentary living, excessive food intake and consequently obesity. It is also associated with reduced cholesterol metabolism and thus increased accumulation of lipids in the body (Meludu et al., 2005).

Indeed, the increasing prevalence of overweight and obesity is gaining world-wide attention. Countries with food security and under-nutrition problems like Nigeria are paradoxically not spared due to the fact that mal-distribution of resources and affluence co-exist with abject poverty (Massaiger, 2004). This problem appears to be increasing rapidly in children as well. The prevalence of childhood obesity in the United State has risen dramatically in the past several decades with 25 – 30 per cent of children been affected (Moran, 1999). The prevalence of obesity in this study is 16.56 percent. This is similar to the results of previous studies in other parts of Nigeria with obesity range of 5.2 – 18 percent (Senbanjo and Adejuyigba, 2007; Owa and Adejuyigba, 1997).

The prevalence in this study is however, lower than that of the study by Osuji et al., (2010) which showed an obesity prevalence of 20.7% among a group of women attending August meeting in Owerri, Imo State. This is not surprising since the study was done only on females with a higher prevalence than males.

Comparatively, the prevalence in this study is higher than the Greek study with a prevalence of 15%. The prevalence of obesity in this study is also lower than the Australian study (Cameron et al., 2003) as well as the Tehran Study (Azizi et al., 2005) that has a prevalence of 20.8%. it is lower than the Port-Harcourt (Akpa et al., 2006) with a prevalence of 33.69%, the Canadian study with a prevalence of 27% (MacDonal et al., 1997), the Indian study with a prevalence of 31% (Stroder et al., 2003), the American study with a prevalence of 34% (Flegal et al., 2002) but higher than the study by Bakari et al (2007) with a prevalence of 13.1%. It is interesting to note that both American and Canada are among the group of most prosperous and developed countries of the world where obesity is recognized as a serious health problem. In these societies, high BMI is not unexpected as obesity is related to prosperity and affluence (WHO, 1998).

The high prevalence of overweight and obesity in this study is alarming as our society is one where being fat (overweight/obese) is regarded as evidence of good life without bothering about the health consequences and in some cultures fattening ceremonies precede becoming a woman or marriage (Osuji et al., 2010). The high rate of overweight and obesity raise question on the health implication of this on health outcomes in our environment as obesity is a risk factor for many chronic conditions including diabetes mellitus, hypertension, hypercholesterolemia, stroke, heart disease, certain cancer and arthritis (Morkdad et al., 2001).

The mechanisms leading to hypertension in obese persons are not completely known. It is hypothesized that increased sympathetic nervous activity, insulin resistance and hyper-insulinemia, sodium retention and enhanced vascular reactivity are involved in the development of hypertension (Cassano et al., 1990; Huang and Willert, 1998). Some investigations have reported a decrease in plasma rennin activity and plasma Aldosterone levels after weight loss. This suggests that rennin angiotensin-aldosterene axis may play a role in causing hypertension in obese persons.

The prevalence of overweight in this study is 30%. This is higher than the results from previous studies with overweight range of 3.7 – 13.7 (Senbanjo and Adejuyigba, 2007). This may be due to the ever increasing number of fast food centres in the city of Aba which encourages ingestion of high calorie diet and cholesterol. This is a very serious problem therefore as more adults are at increased risk of becoming obese. Adults who are obese are at a higher relative morbidity risk compared to those who are normal (Freedman et al., 1999).

Changes in lifestyle dietary habits, physical activity and the social and cultural environments are associated with the occurrence of obesity. Dietary factors, particularly the level of fat and energy intake are strongly associated with excess body weight (WHO, 1998) and this may play an important role in the rise of obesity. This is particularly true with large shift from traditional type of diet to more westernized diets which are characterized by high fat, high cholesterol and low fibre contents (Omueme and Omueme, 2010).

Women are generally less physically active than men (Akinkugbe, 1997; Rana et al., 2007). It has been previously reported that obesity is more prevalence in female Nigerian (Amodu et al., 2004; Fadinpin et al., 2004) and that abnormal obesity and BMI increases with age (Ansa et al., 2001; Grundy, 2006). The higher prevalence of BMI and obesity among women in this study is therefore not suprising. Similar study (Ben Bassey et al., 2007) demonstrated that obesity is not only more prevalence but also more severe in Nigerian Women as demonstrated by a significantly higher BMI in obese women compared to obese men.

Several studies have suggested that preventing obesity may be important in reducing long term complications of diabetes and cardiovascular risk factors (Straub et al., 1994; Williams, 1999). The prevention of obesity on the long term may require very early interventional strategy such as regular physical exercise instituted in childhood and adolescents (Manson et al., 1991). Other measures include implementing a comprehensive program including live style modification and pharmacological interventions. As Swinburn and Egger (2002) pointed out, taking a more comprehensive approach by increasing policies based initiatives, developing and communication specific action messages and developing a strong advocacy voice for greater professional, public and political support may be successful in surmounting obesity.

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REFERENCES

Akinkugbe O.O. (1997). Final report of national survey of non-communicable disease in Nigeria Ed. Lagos. Federal Ministry of Health and Social Services.

Akpa M.R., Agomuoh D.I., Alasia D.D. (2006). Lipid profile of healthy adult Nigerians in Port Harcourt, Nigeria. *Nigerian Journal of Medicine 15(2)137-140.*

Amodu P.H, Mbah I.O, Lawson L. (2004). Prevalence of obesity and dyslipidaemia in hypertensives seen in Abuja, Nigeria. *Scan. H. Clin. Lab. Invest. Suppl. 240:14-17*

Ansa V.O, Odigwe C.O, Anah MV. (2001). Profile of body mass index and obesity in Nigeria children and adolescentrs. *Niger. J. Med. 10(2): 78-80*

Azizi F, Azadbakht L, Mirmiran P. (2005). Trends in overweight, obesity and central fat accumulation. *Ann. Nutri and metab: 49(1): 3-8.*

Bakari A.G, Onyemelukwe G.C, Sani B.G, Aliyu I.S, Hassan S.S, Aliyu T.M. (2007). Obesity, overweight and underweight in suburban Northern Nigeria. *Int. J. Diabetes and metobolies 15:68-69.*

Barkman G, Hultz D, Gerzof S, Robbins A.H, Subert C.K. (1983). Age changes in body composition revealed by computed tomography. *J. Gerontol 36:637-677.*

Baron R.B. (2007). Nutritional Disorders. In: Current medical Diagnosis and Treatment, (Mc Phee S.J, Papadakis MA and Tiemey LM, eds). Mc Graw Hill Medical, New York, 46th edition: 1290-1296.

Ben Bassey U.P, Oduwale A.O, Ogundipe O.O. (2007). Prevalence of Overweight and obesity in Eti-osa L.G.A., Lagos, Nigeria. *Rev*. 8(6): 475-479.

Cameron A.J, Welborn T.A, Zimmet P.Z, Dunstand D.W, Own N, Salmon J. (2003). Overweight and obesity in Australia: the 1999-2000 Australia Diabetes, obesity and lifestyle study (AusDial). *MJI;* 178(9): 427-432.

Cassano P.A, Segal M, R, Vokonas P.S, Weiss S.T. (1990). Body fat distribution, blood pressure and hypertension. A protective cohort, of man in the Normative Aging Study. *Ann Epidemiol. 1 : 33-48.*

Fadinpin G.T, Joserph E.U, Kesehinro O.O. (2004) Prevalence of obesity among type 2 diabetes in Nigeria: a case study of patients in Nigeria, Oyo State. *Afr. J. Med Sci 33 (4): 381-384.*

Flegal K.M, Caroll M.D, Ogden C.L, Johnson C.L. (2002). Prevalence and trends in obesity among US adults. 1999-2000. *JAMA* 288:1723-1727.

Freedman D.S, Dietz W.H, Srinivaan SR, Berenson G.S. (1997). The relation of weight to cardiovascular risk factors among children and adolescents. The Bogalusa Heart Study. *Paediatrics* 103; 1175-1182.

Ganong W.F. (1997). Review of medical physiology. Appleton and Lange, Stanford, Connecticut, 18th Edition 536-552.

Grundy S.M. (2006). Does a diagnosis of metabolic syndrome have value in clinical practice. *Am J. Clin Nutr. 83 (6):1248-1251.*

Gibbons V.B., Ballantyne F.C. (1981). Triglyceride estimation in high density lipo proteins. *Med Lab Sci; 38(3):277-279.*

Heymsfield S.B. (2004) In: Handbook of obesity: Etiology and Pathophysiology (Bray G and Bouchard C. eds). Mercel and Decker, New York, 33-79.

Hodge A.M, Dowse G.K, Toelupe P, Collins V.R., Zimmet P.Z. (1997). The association of modernization with dyslipidaemia and changes in lipid level in the Polynesian population of Western Samoa. *Int J. Epidemiol; 26(2):297-306.*

Huang Z, Willert W.C. (1998). Body weight, Body change and risk of Hypertension in Women. *Ann Int. Medi; 128:81-88.*
MacDonal S.M, Reader B.A, Chen Y, Despres J.P, The Canadian Heart Health surveys research group. (1997). Obesity in Canada: a descriptive analysis. *CMAJ*: 157 supl 1:53-59.

Manson J.E, Rimm E.B, Stanpfer M.J. (1991). Physical activity and incidence of non insulin dependent diabetes mellitus in women. *Lancet* 338:771-778.

Massaiger A.O. (2004). Overweight and obesity in the Eastern Mediterranean region. Can we control it? *Eastern Mediterranean Health Journal 10(6):789-793.*

McDermontt A.Y. (2006). Clinical nutrition and obesity conference coverage: selected presentations from the 20th Annual Practical Approaches to the Treatment of obesity. *Medscape General Medicine*: 8(4): 61.

Meludo S.C, Dioka C.E, Orisakwe O.E, Osuji C, Asomugha L, Okoye O. (2005). Serum lipids and glucose concentrations in relation to some physiological variables in college students from Nnewi, Nigeria. *Ann Nig. Med. 4 (2):58-61.*

Mokdad A.H, Ford E.S, Bowman B.A, Dietz W.H, Vinicor F, Bales V.S, Mark J.S. (2003). Prevalence of obesity, diabetes, and obesity related health risk factors 2001. *JAMA*: 289(1):76-79.

Morkdad A. H, Ford E. S, Bowman B.A., Dietz W. H, Vinicor F., Blaes V. S, Marks J. S. (2001). Prevalence of obesiy, diabetes and obesity related Health Risk Factors. *JAMA*: 281 (1) 76 – 79.

Moran R. (1999). Evaluation and treatment of childhood obesity. *The American Academy of family physicians. 59(4):60.*

Okafor C.I, Fasanmade O.A, Oke D.A. (2008). Pattern of dyslipidaemia among Nigerians with type 2 Diabetes Mellitus. *Nig. J. Clin Pract. Vol. 11 (1)25-31.*

Omueme V.O, Omueme C.E. (2010). The prevention of overweight and its risk factors among adolescents in an urban city Edo State. *Nig J. Clin Pract.* 13(2):128-133.

Osuji C.U, Nzerem B.A, Meludu S, Dioka C.E, Nwobodo E, Awulo G.I. (2010). Prevalence of obesity, overweight, and dyslipidaemia among a group of women attending "August" meeting. *J. Nma 51(4):155-159.*

Owa J.A., Adejuyigba O. (1997). Fat mass., Fat mass percentage, body mass ondex and mid upper circumference in a healthy population of Nigerian children. *J. Tropic. Paediatrics; 43:13-19.*

Rana J.S, Mason J.E., HU F.B. (2007). Obesity is a greater risk than activity in women. *Diabetes Care;* 30:53-58

Senbanjo I.O, Adejuyigba E.A. (2007). Prevalence of overweight and obesity in Nigerian pre-school children. *Nutrition and Health. 18(4):391-399.*

Straub R.H, Thum M, Holler Bach C, Politzsch K.D, Scholmerich J. (1994). Impact of Obesity on neuropathic late complications in NIDDM. *Diabetes Care; 17(11): 1290-1294.*

Strodal H, Marrygat J, Elosua R, Covas M.I. (2003). Relationship between body mass index, serum cholesterol, leisure time, physical activity and diet in a mediteranean southern Europe. *Br J Nutr. 90(2):431-439.*

Swinburn B, Egger G. (2002). Preventive Strategies against weight gain and obesity. *Obes*. Rev; 3:289-301.

National Institutes of Health (NIH). (2001). Third Report of the National Cholesterol Education Program Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II). Bethesda, Md; National Institutes of Health, National Heart Lung and Blood Institutes, 2001 (NIH Publication No. 01-3670).

Ukoli F.A.M, Bunker C.H, Fabio A. (1997) Sex differences in serum lipids pattern and their correlates in a Nigerian Urban Elderly population. *Nig. Med J.32(3):85-89.*

Willet, W.C. (1998). Nutritional epidemiology. Oxford University Press. New York. 244 – 273.

Williams G. (1999). Obesity and type 2 diabetes: a conflict of interest? *Int. J. Obes. Relat. Metab. Disord;* 23 suppl 7:52-54.

World Health Organization (WHO) (1998). Obesity. Preventing and managing the global epidemic. Report of a WHO consultation on obesity, Geneva, 3-5 June 1997. WHO/NUT/NCD/98. 1 WHO:

World Medical Association (WMA) (2000). World Medical Association declaration of Helsinki ethical principles for medical research involving human subjects. 52nd WMA General Assembly, Edinburgh, Scotland.http://oss-sperchin.agenziafarmaco.it/normative/direttive_OsSC-000122-000000.phf.

Yusuf S, Hawken S, Oupuu S, Dans T,Avezum A, Lanas F, Mcqueen M, Budaj A, Pais R, Varigas J, Lisheng L (2004). INTERHEART study investigations. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): *Lancet*; 364(9438):912-914.

AUTHORS' CONTRIBUTIONS

Ngwogu KO, Ekpo BO, Akpuaka FC, Ngwogu AC. and Okhiai O., contributed to the successful completion of this study. Their career background played important roles.