A Comparative Evaluation of the clinical profile of obese and non obese subjects in relation to age and gender

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ABSTRACT

In spite of the rising global epidemic of obesity, and increasing number of studies on obesity, the relationship between clinical features of obese and non obese subjects in relation to age and gender have not been fully explored up to date. The aim of this study was to evaluate the clinical features of obese and non obese subjects in relation to age and gender. A total of 224 subjects participated in the study. 144 obese and 80 non-obese (control). The weight, height, waist circumference and hip circumference were measured, BMI and WHR were calculated, and B.P measured. Fasting blood glucose (FBG) test and fasting lipid profile test were carried out on all subjects. The results showed that in the male subjects, generally, with the exception of age, and LDL cholesterol, the values of the demographic and clinical features are higher for the obese males compared to the non-obese males. However, there were no significant difference in the mean age, height, systolic BP, fasting blood glucose, total cholesterol, HDL cholesterol and LDL cholesterol, between the obese and non-obese male subjects. Conversely, there were significant differences in the weight (P = 0.000), BMI (P = 0.000), waist circumference (WC) (P = 0.000), hip circumference (P = 0.000), waist hip ratio (WHR) (P = 0.000), diastolic BP (P = 0.048), VLDL cholesterol (P = 0.005) and triglycerides (TG) (P = 0.049). But in the female subjects, with the exception of age and height, the values of the demographic and clinical features were generally higher for the obese than the non-obese female subjects. Significant difference was found in the age (P = 0.006), weight (P = 0.000), height (P = 0.012), BMI (P = 0.000), WC (P = 0.000), Hip circumference (P = 0.000), WHR (P = 0.018), total cholesterol (P = 0.000), HDL cholesterol (P = 0.030) and VLDL cholesterol (P = 0.022). There was no significant difference in their systolic and diastolic blood pressure, fasting blood glucose, LDL cholesterol and triglycerides. In the female obese subjects, the LDL cholesterol was significantly higher in the older age group compared to the younger age group. There is no significant difference in all the other demographic and clinical features between the older and younger obese male and female subjects. In conclusion results from this research showed that fasting blood glucose, total cholesterol and high blood pressure are more in levels in the obese groups than the non-obese groups (although not statistically significant).

Keywords: Clinical features, obese, non obese, age and gender.

INTRODUCTION

Obesity is a growing public health problem leading to significant morbidity and mortality worldwide [1]. However, all obese individuals do not present with metabolic risk factors, and conversely, all nonobese individuals need not be metabolically healthy [2]. This has led to the identification of different subtypes of obesity such as metabolically obese normal weight (MONW) and metabolically healthy obese (MHO) subtypes of obesity [3].

The concept of MONW individuals was identified in the 1980s [4]. These are individuals who, despite having a normal weight and body mass index (BMI), present with metabolic abnormalities and features of metabolic syndrome (MS) [5]. These abnormalities include increased visceral adiposity, increased blood pressure (BP), low levels of high-density lipoprotein (HDL) cholesterol, elevated levels of triglycerides, and impaired fasting blood glucose [6]. Historically the Metropolitan life Insurance Company data that express body fatness as percent ideal body weight have been used,[5] but currently overweight and obesity are classified by body mass index (BMI). BMI (weight in kilograms/height^2 in meters) is frequently used as a surrogate measure of fatness in children and adults. In adults, overweight is defined as BMI of 25.0 to 29.9 kg/m^2; obesity is defined as a BMI of $\geq$ 30.0 kg/m^2 [6]. Through the use of BMI, the epidemic of obesity that began in the 1980s has been tracked through the end of the century [4,7]. The original alarm was sounded in 1994 by the National centre for Health Statistics when they reported their data from the first 3 years of the National Health and Nutrition Examination Survey (NHANES) [8]. The authors observed that from 1988 – 1994 (NHANES III) to NHANES 1999 – 2000, the prevalence of overweight increased from 55.9% to 64.5%, and that of obesity increased from 22.9% to 30.5% [4,8]. This sudden unanticipated rapid increase in prevalence of obesity led to the American Heart Association (AHA) call for action to curb the consequences of this epidemic [9]. More recently, the AHA has addressed and reviewed a variety of weight loss approaches for the management and treatment of obesity [10]. Obesity was occasionally considered a symbol of wealth and social status in cultures prone to food shortages or famine. Well into the early modern period in European cultures it often served this role. But as food security was realized, it came to serve more as a visible significance of "lust for life", appetite, and immersion in realm of the erotic. This was especially the case in the visual arts such as the paintings of Rubens (1577 – 1640), whose regular use of the full female figures gives us the description *Rubenesque* for plumpness [10, 11, 12,13, 14].

RATIONALE FOR THE STUDY

In the developed countries of Europe and America, studies on obesity abound. But in the developing nations of Africa, and particularly, the West African sub region, only a few studies have been reported [15]. Therefore it is needful to carry out more studies in order to enrich our obesity data base in this part of the world. Secondly, considering that we live in an environment with scarce resources and limited manpower, it would be useful to know which of the anthropometric measures of obesity best indicates risk of cardiovascular disease, so that emphasis could be rightly placed on the particular measure(s) in the evaluation and management of obesity. This will ultimately help in the reduction of the global burden of cardiovascular diseases.

AIM OF THE RESEARCH

The aim of this research was to evaluate the clinical features of obese and non obese subjects in relation to age and gender.

MATERIALS AND METHODOLOGY

Design

The study was cross-sectional, descriptive and hospital based.

Setting

Place of study

This was at the University of Nigeria Teaching Hospital, UNTH, Enugu, South

Eastern Nigeria, a 760 bed tertiary institution serving Enugu and neighbouring states.

Sample population

Eligible and consenting patients were drawn from the medical out-patient department of the UNTH from March 2006 to November 2006. Most of the patients were Ibos,a tribe in the South Eastern part of Nigeria, with a relatively high literacy level, although majority of them were traders.

Ethical clearance

Ethical clearance was obtained from the Ethics committee of the UNTH, Enugu (see Appendix).

Basis of Diagnosis

Obesity

- Subjects with BMI of 30kg/m^2 and above were taken as obese; those with BMI of less than 30kg/m^2 were taken as non obese.
- Abdominal (waist) circumference of 88cm for women and >102 for men were taken as central/visceral obesity.
- Waist-hip ratio of >0.85 for women and >0.9 for men were also taken as central/visceral obesity.

Hypertension

A mean blood pressure of $\geq$ 140 mmHg (systolic) and/or $\geq$ 90 mmHg (diastolic) was regarded as Hypertension.

Hyperglycaemia

Using capillary whole blood sample: Fasting blood glucose level of:

- 3.3 mmol/L - 5.6 mmol/L was normal
- >5.6 mmol/L and < 6.1 mmol/L was impaired fasting glycaemia (IFG).
- $\geq$ 6.1 mMol/L was Diabetes Mellitus.

Hyperlipidaemia (Dyslipidaemia)

- Total cholesterol level of > 6.2 mmol/L (>240 mg/dl) is high
- LDL level of > 3.36 (>130 mg/dl) is high
- VLDL level of > 1.3 (50mg/dl) is high
- HDL level of <0.9 (<35 mg/dl) is low and regarded as dyslipidaemia
- Triglyceride level of > 1.69 mmol/L (150mg/dl) is hypertriglyceridaemia

Sample Size

Patient (sample) population

The prevalence of obesity in adult Nigerians is estimated at 10.5% Using the WHO formula for sample size determination in a finite population (Fischer's formula):

$$n = \frac{Z^2 Pq}{d^2}$$

Where n = the minimum sample size

P = prevalence rate (in a previous study)

Z = Standard deviation value at 95% confidence interval

d = Sample error tolerated (5.0%)

The sample size is thus calculated to be 144.

Control Subjects

Eighty (80) non-obese patients were recruited consecutively along side the obese patients. These served as a control for the study.

Consent

Informed consent was obtained from subjects, both sample and control groups. Those who were not literate enough to sign their signature were free to use thumb printing.

Study Criteria

Inclusion Criteria

The study included adult patients of both sexes, up to 18 years and above but not more than 75 years, who were not pregnant and had no chronic debilitating diseases like tuberculosis, metastastic cancers and other diseases mentioned in the exclusion criteria.

Exclusion Criteria

- Age below 18 years and above 75 years
- Smokers
- Pregnant women
- Women on oral or parenteral contraception.
- AIDS patients.
- Tuberculosis patients
- Patients who have metastatic cancer and patients on cytotoxic therapy.
- Patients with chronic renal failure, nephrotic syndrome, chronic glomerulo-nephritis etc.
- Oedematous patients
- Patients with congestive cardiac failure, cardiomyopathies and structural heart diseases including valvular heart diseases.
- Patients who have kyphoscoliosis.
- Amputees
- Patients who could not stand.

Withdrawal Criteria

- Verbal withdrawal of consent
- Failure to turn up for laboratory tests.

Materials

Equipment for study

(a)Stadiometer (Hospitex brand)
(b) Weighing balance (incorporated in the stadiometer)
(c) Tape measure.
(d) The mercury sphygmomanometer (Accoson brand) with standard cuff size 15cm x 55xm, and Lithmans stethoscope.
(e) Standard 3 – channel electrocardiograph (ECG) machine (cardiette authoruler) with 12 leads.
(f) Glucometer (Accutest)
(g) Autoanalyzer
(h) 2 Dimensional Echocardiography machine (Hewlett Packard m2406A Ultrasonic system)

Methodology

Procedure

Anthropometric data (weight, height, waist circumference and hip circumference) of all eligible patients who attended the medical outpatient clinic during the period of study were collected. To obtain the anthropometric measurements, each subject or control was asked to stand on the stadiometer bare foot and with minimal clothing, without shoes in a special room set out for the purpose. The weight and height were thus measured. Then the waist circumference (WC) was measured using the tape measure, with the patient standing bare foot on the floor. The WC was taken at the level of the iliac crests [16], passing along the umbilical level of the unclothed abdomen; and the hip circumference was measured at the level of the external margins of the anterior superior iliac spines [17]. The mean of two readings was taken.

Patients whose BMI were up to 30kg/m^2 and above were recruited for the study, and those with BMI <30kg/m^2 were recruited as controls, if they satisfied the inclusion criteria, and gave their consent. Data collection sheet was pre-tested on about 10 consecutive patients. These were reviewed and then applied to consenting subjects. Blood pressure was measured in the sitting position, with the patient's index arm resting on the consulting table, after patient must have relaxed for at least 10 minutes. The right arm was used for every patient for the purpose of uniformity. The 1st Korotkoff sound was used to determine the systolic blood pressure, and the disappearance of the sound (or muffling if the sound does not disappear) was used to determine the diastolic blood pressure. Two readings were taken at 10 minutes interval, and the mean of the two reading was recorded as the blood pressure. About 8 am, after an overnight fast: a drop of capillary blood was used for fasting blood glucose test, by means of glucometer. 5 millilitres of blood sample was also drawn for laboratory tests [18].

Data Analysis

Analysis of data was done using SPSS version 11, while statistical calculations were carried out with the computer software PEPI (programme for Epidemiologists), version 4.0. Categorical variables were compared using the non parametric chi-square (χ^2), while parametric variables were compared using the student t-test. The relationship between anthropometric variables and the cardiovascular risk factors was analyzed by Pearson's correlation coefficient test, while the relationship between anthropometric variables and echocardiographic parameters was evaluated by Spearman's rho coefficient of correlation test, Pearson's correlation coefficient and Stepwise regression analysis. Partial correlation was used to correct for differences in age and to control for blood pressure.

RESULTS

Table 1: Demographic and clinical features of the obese and non obese groups

	Male			Female		
Characteristics	Obese n = 36 mean (SD)	Non Obese n = 54 mean (SD)	P-value	Obese n = 108 mean (SD)	Non Obese n = 26 mean (SD)	P-value
Age (yrs)	50.94 (10.27)	54.24 (13.87)	0.225	51.12 (9.32)	57.04 (11.04)	0.006*
Wt (kg)	96.7 (13.50)	68.68 (9.61)	0.000*	95.42 (16.14)	67.08 (10.92)	0.000*
Ht (m)	1.66 (0.82)	1.66 (0.08)	0.999	1.62 (0.07)	1.66 (0.08)	0.012*
BMI (kg/m^2)	35.75 (5.46)	24.92 (3.49)	0.000*	36.09 (5.27)	24.58 (3.22)	0.000*
WC (cm)	110.18 (10.56)	89.10 (9.66)	0.000*	109.43 (13.76)	89.27 (11.44)	0000*
HC (cm)	101.67 (9.20)	90.44 (6.68)	0.000*	104.14 (10.75)	88.44 (8.01)	0.000*
WHR	1.09 (0.08)	0.98 (0.14)	0.000*	1.04 (0.14)	0.96 (0.20)	0.018*
S. BP (mmHg)	154.17 (25.82)	149.22 (20.87)	0.311	149.94 (21.00)	144.54 (20.61	0.240
D. BP (mmHg)	97.5 (14.81)	91.35 (13.91)	0.048*	95.53 (12.65)	92.58 (15.86)	0.312
FBG (mmol/L)	5.13 (1.26)	4.96 (0.82)	0.440	5.50 (2.16)	4.85 (0.63)	0.132
Lipid Profile:						
TC (mmol/L)	5.55 (1.41)	5.38 (1.28)	0.555	5.70 (1.23)	4.86 (0.96)	0.001*
HDL (mmol/L)	1.41 (0.55)	1.33 (0.31)	0.381	1.55 (0.72)	1.23 (0.38)	0.030*
LDL (mmol/L)	3.30 (1.25)	3.36 (1.26)	0.825	3.21 (1.06)	2.86 (0.91)	0.123
VLDL (mmol/L)	0.92 (0.42)	0.66 (0.42)	0.005*	0.91 (0.43)	0.70 (0.35)	0.022*
TG (mmol/L)	1.55 (0.58)	1.28 (0.66)	0.049*	1.67 (0.82)	1.36 (0.70)	0.078

* Statistically significant; $P < 0.05$ is significant

Wt = weight, Ht = height, WC = waist circumference, HC = hip circumference, WHR = waist hip ratio, S.BP = systolic blood pressure, D.BP = diastolic blood pressure, FBG = fasting blood glucose, TC = total cholesterol, TG = Triglyceride

In the male subjects, generally, with the exception of age, and LDL cholesterol, the values of the demographic and clinical features are higher for the obese males compared to the non-obese males. However, there were no significant difference in the mean age, height, systolic BP, fasting blood

glucose, total cholesterol, HDL cholesterol and LDL cholesterol, between the obese and non-obese male subjects. Conversely, there were significant differences in the weight (P = 0.000), BMI (P = 0.000), waist circumference (WC) (P = 0.000), hip circumference (P = 0.000), waist hip ratio (WHR) (P = 0.000), diastolic BP (P = 0.048), VLDL cholesterol (P = 0.005) and triglycerides (TG) (P = 0.049). But in the female subjects, with the exception of age and height, the values of the demographic and clinical features were generally higher for the obese than the non-obese female subjects. Significant difference was found in the age (P = 0.006), weight (P = 0.000), height (P = 0.012), BMI (P = 0.000), WC (P = 0.000), Hip circumference (P = 0.000), WHR (P = 0.018), total cholesterol (P = 0.000), HDL cholesterol (P = 0.030) and VLDL cholesterol (P = 0.022). There was no significant difference in their systolic and diastolic blood pressure, fasting blood glucose, LDL cholesterol and triglycerides.

Table 2:Demographic and clinical features of the obese subjects in relation to age and gender

Characteristics	Male			Female		
	Obese<40 yrs n = 4 mean (SD)	Obese≥40 yrs n = 32 mean (SD)	P-value	Obese <40 yrs n = 11 mean (SD)	Obese≥40 yrs n = 97 mean (SD)	P-value
Wt (kg)	95.50 (10.54)	96.89 (13.96)	0.850	101.45 (20.36)	94.73 (15.57)	0.192
Ht (m)	1.62 (0.08)	1.66 (0.08)	0.297	1.65 (0.09)	1.62 (0.07)	0.170
BMI (kg/m^2)	37.95 (10.32)	35.48 (5.41)	0.401	38.55 (9.31)	35.82 (4.60)	0.357
WC (cm)	106.63 (13.54)	110.63 (10.32)	0.483	112.24 (17.68)	109.11 (13.32)	0.477
HC (cm)	101.13 (10.38)	101.73 (9.22)	0.903	109.27 (12.89)	103.55 (10.39)	0.095
WHR	1.10 (0.04)	1.09 (0.08)	0.859	1.01 (0.10)	1.04 (0.14)	0.489
S. BP (mmHg)	132.50 (17.08)	156.88 (25.61)	0.074	140.91 (26.25)	150.96 (20.22)	0.133
D. BP (mmHg)	90.00 (16.33)	98.44 (14.62)	0.289	90.91 (12.21)	96.05 (12.65)	0.203
FBG (mmol/L)	4.43 (0.62)	5.22 (1.29)	0.239	4.77 (1.53)	5.58 (2.21)	0.242
Lipid Profile:						
TC (mmol/L)	5.58 (1.26)	5.54 (1.44)	0.967	5.67 (1.31)	5.70 (1.23)	0.942
HDL (mmol/L)	1.48 (0.54)	1.40 (0.56)	0.802	1.80 (0.35)	1.52 (0.74)	0.946
LDL (mmol/L)	3.38 (0.81)	3.28 (1.31)	0.887	2.60 (0.85)	3.28 (1.06)	0.045*
VLDL (mmol/L)	1.18 (0.28)	0.88 (0.43)	0.197	1.03 (0.45)	0.90 (0.43)	0.346
TG (mmol/L)	1.72 (0.57)	1.53 (0.58)	0.103	1.59 (0.68)	1.67 (0.84)	0.740

* Statistically significant; P < 0.05 is significant

Wt = weight, Ht = height, WC = waist circumference, HC = hip circumference, WHR = waist hip ratio, S.BP = systolic blood pressure, D.BP = diastolic blood pressure, FBG = fasting blood glucose, TC = total cholesterol, TG = Triglyceride

In the female obese subjects, the LDL cholesterol was significantly higher in the older age group compared to the younger age group. There is no significant difference in all the other demographic and clinical features between the older and younger obese male and female subjects.

DISCUSSION

In previous studies, obesity has been associated with different cardiovascular risk factors and morbidities like Hypertension, diabetes, as well as different cardiovascular fatal and non-fatal events and mortality for all causes [19,20]. Different workers have implicated different aspects of obesity for various cardiovascular risks and events [21]. In describing the clinical characteristics of the subjects in this study, there was similarity in the mean BMI, waist circumference and waist-hip ratio of the male and female subjects; but there was a significant higher mean diastolic blood pressure level for the obese males than the non-obese males, and generally higher blood pressure values (systolic and diastolic) for both the male and female obese subjects, although these were not statistically significant. This finding of higher blood pressure in the obese groups support the fact that there is strong association between obesity and hypertension [22]. The findings showed generally higher fasting blood glucose levels in the obese groups than the non-obese

groups (although not statistically significant) is in keeping with previous reports that obesity is associated with abnormal glucose tolerance and diabetes mellitus [23]. Total cholesterol and fractions were generally of higher values in the obese compare to the non obese. This supports the finding by Amodu and colleagues of a high association between obesity and dyslipidaemia among hypertensives in Abuja [24]. The finding of a generally higher blood pressure values in the older male and female obese subjects than in the younger obese subjects (though not statistically significant) is in keeping with literature as age has been recognized by WHO/ISH and JNC VII as one of the modifiable risk factors for the development of hypertension.

CONCLUSION

In conclusion results from this research showed that fasting blood glucose, total cholesterol and high blood pressure are more in levels in the obese groups than the non-obese groups (although not statistically significant).

LIMITATION

1. The study was hospital based. Perhaps, a study of such based in the community will elucidate the clinical characteristics more clearly.
2. Being a hospital based study, the sample size is relatively limited and this may explain why there is no statistical significance in the difference observed in clinical features such as glucose, total cholesterol and high blood pressure. A more robust sample size is recommendable for future studies.

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