Original Article

Obesity and Its Cardio-metabolic Co-morbidities Among Adult Nigerians in a Primary Care Clinic of a Tertiary Hospital in South-Eastern, Nigeria

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Abstract

Background: Obesity once thought the medical problem of affluent countries now exist in Nigeria and has been described as a time bomb for the future explosion in the frequency of cardio-metabolic diseases. The most deleterious health consequences of obesity are on the cardiovascular system and associated disorder of lipid and glucose homeostasis. **Aim:** This study was designed to determine the magnitude of obesity and its cardio-metabolic co-morbidities among adult Nigerians in a primary care clinic of a tertiary hospital South-Eastern, Nigeria. **Materials and Methods:** A cross-sectional study carried out on 2391 adult Nigerians who were assessed for obesity using body mass index (BMI) criterion. 206 patients who had BMI ≥30kg/m^2 were screened for cardio-metabolic co-morbidities. The data collected included basic demographic variables, weight, height, blood pressure; fasting plasma glucose and lipid profile. **Results:** The prevalence of obesity was 8.6%. Grade I obesity (67.5%) was the most common pattern; others included grade II obesity (23.3%) and grade III obesity (9.2%). Hypertension (42.7%) was the most common cardio-metabolic morbidity. Others included low HDL-cholesterol (22.8%), diabetes mellitus (15.1%), high triglyceride (12.6%), high total cholesterol (9.2%), and high LDL-cholesterol (6.8%). **Conclusion:** Obesity and its cardio-metabolic morbidities exist among the study population. Anthropometric determination of obesity and screening for its associated cardio-metabolic co-morbidities should constitute clinical targets for intervention in primary care clinics.

Keywords: Adult, cardio-metabolic co-morbidities, Nigeria, obesity, primary care clinic

Introduction

Obesity is a chronic non-communicable disease with clinical and public health challenges.[1] It is defined as an excess of adipose tissue resulting in body mass index (BMI) ≥30kg/m^2.[2] BMI is calculated by dividing measured body weight in kilogram by the square of the height in meters. The National Institute of Health defines normal weight as BMI (18.5-24.9), overweight (BMI: 25-29.9), class I obesity (BMI: 30-34.9), class II obesity (BMI: 35-39-9), and class III obesity (BMI: ≥40).[3]

The aetiology of obesity is poly-factorials resulting from an interaction of genetic and environmental factors.[4] It is becoming an emerging disease in Nigeria due to increasing westernization of Nigerian cities and change in lifestyles.[5,6]

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A range of cardio-metabolic risk factors such as hypertension and associated disorder of lipid and glucose homeostasis have also been linked to obesity.[5-8] The risk of obesity co-morbidities is negligible in normal weight range, mildly increased in overweight, moderately increased in class I obesity (mild obesity), severe in class II obesity (moderate obesity) and very severe in class III obesity (extreme obesity).[9]

Obesity once thought the health problem of affluent Western World now has increased in prevalence in many developing countries such as Nigeria[3,5,6,10] and has been described as a time bomb for the future explosionin the frequency of cardiovascular diseases, type 2 diabetes mellitus, and dyslipidaemia.[10-13]

The prevalence of obesity has increased significantly during the past two decades in developed countries and this trend is rising.[2,8,11] In England and Wales, there have been increases in the prevalence rates of obesity from 6% to 8%, respectively

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for men and women in 1980 to 8% and 12% in 1990 and to over 21% for both in 2000.[2] In United States of America, the two national surveys have helped to improve early evaluation and management of risk factors leading to diabetes mellitus and the National Health And Nutritional Examination Surveys have shown that increase in BMI is usually associated with increase in the prevalence of diabetes mellitus, hypertension and dyslipidaemia.[8]

The prevalence of obesity and obesity-related morbidities is showing an upward trend in most developing countries and Nigeria is not an exception.[5,10] The magnitude of obesity and its primary co-morbidities have been reported among adult patients in Port Harcourt, an urban area of Rivers State[3] Okporo, a semi-urban area of Imo State[14] and Amurie-Omanze, a rural area of Imo State, Nigeria.[15] An interrelationship between lifestyle and obesity, hypertension and diabetes mellitus has also been described in Nigeria,[5,6] a nation where obesity is not perceived as a health risk. However, the local perception of obesity as a feature of wellness and prosperity are common and to challenge such socio-cultural belief is difficult especially in a milieu of phenomenal increase in the number of fast food outlets, infiltration of the market by simple sugar sweetened soft drinks and beverages, conversion of most recreational facilities for commercial uses and church activities and abandonment of the local vigorous life for sedentary living as a result urbanization and modernization of lifestyle.

Globally, rising trends in obesity have led the World Health Organization and other international and national organizations to device strategies for obesity control.[10,16] The principal aim is to determine the magnitude of this medical condition, its constitutional and non-constitutional factors and to formulate a suitable programme for early detection and effective control. Some professional bodies and organizations like US Preventive Services Task Force recommend that clinicians should screen adult patients for obesity and offer behavioural interventions to promote healthy weight among other diverse strategies.

In Nigeria, the burden of obesity is not limited to the general population.[10] It also occurs among hospital patients.[3,6,14,15] There has been an upsurge in the number of obese patients presenting to the primary care clinicians at the study centre. Some of these obese patients have obesity-related cardio-metabolic co-morbidities. These cardio-metabolic correlates worsen the patients' prognosis with some of them developing acute and chronic complications of obesity.[5,7] The failure to diagnose obesity and screen for obesity-related cardio-metabolic morbidities by clinicians leads to missed opportunities to counsel obese patients on lifestyle modifications. The early recognition of obesity by clinicians working in primary care clinic is quintessential to its management whilst identifying its cardio-metabolic correlates avails great opportunities for prevention and control. This study was designed to determine the magnitude of obesity and its cardio-metabolic co-morbidities among adult Nigerians in a primary care clinic of a tertiary hospital in South-Eastern, Nigeria.

Materials and Methods

Ethical consideration

Ethical certificate was obtained from the Ethics Committee of the hospital. Informed consent was also obtained from patients included in the study.

Study design

This was a clinic-based cross-sectional study carried out from May 2010 to July 2010. A total of 2391 consecutive adult patients were assessed for obesity using BMI criterion (BMI ≥ 30kg/m^2). Two hundred and six patients who had BMI ≥ 30kg/m^2 were screened for cardio-metabolic co-morbidities at the department of Family Medicine of Federal Medical Centre, Owerri, a tertiary hospital in Owerri, Imo State, South-Eastern, Nigeria.

Study setting

Owerri is the capital of Imo State, South-East Nigeria. The State is endowed with abundant mineral and agricultural resources with supply of professional, skilled, semi-skilled and unskilled manpower. Economic and social activities are low compared with industrial and commercial cities such as Onitsha, Port Harcourt and Lagos in Nigeria. Until recently, the capital city and its environ have witnessed an upsurge in the number of banks, hotels, schools, markets, industries, junk food restaurants in addition to the changing dietary and social lifestyles.

Federal Medical Centre, Owerri is located in the municipal city of Owerri. It is a tertiary hospital established with the tripartite mandate of service delivery, training and research and serves as a referral centre for primary and secondary public health institutions as well as missionary and private hospitals in Imo State and neighbouring States of Abia, Ebonyi, Rivers and Akwa Ibom States of Nigeria.

The department of Family Medicine serves as a primary care clinic within the tertiary hospital setting of the Medical Centre. All adult patients excluding those who need emergency health care services, paediatric patients and antenatal women are first seen at the department of Family Medicine where diagnoses are made. Patients who need primary care are managed and followed up in the clinic while those who need other specialists care are referred to the respective core specialist clinics for further management. The clinic is run by consultant family physicians and postgraduate resident doctors in Family Medicine.

Inclusion and exclusion criteria

The inclusion criteria were obese patients aged ≥18 years who gave informed consent. The exclusion criteria included pregnant women, patients who had ascites and other forms of oedema and patients who had physical deformities affecting the spine and/

or the limbs and critically ill patients who could not stand for height and weight measurement were excluded from the study.

Sample size determination

Sample size estimation was determined using the formula[17] for calculating minimum sample size $N = Z^2pq/d^2$ where N = minimum sample size, Z = standard normal deviation usually set at 1.96 which corresponds to 95% confidence interval, *P* = proportion of the population estimated to have a particular characteristic. Proportion was taken from previous study in Port Harcourt, Nigeria[3] 14.0%(0.14). q = 1.0–p = 1.0-0.14 = 0.86, d = degree of accuracy set at 0.05. Hence $N = (1.96)^2 \times 0.14 \times 0.86/(0.05)^2$. Therefore, N = 185.

The minimum sample size was 185. However, to improve the precision of the study and accommodate non-response, the selected sample size = Ns was calculated considering an anticipated response rate of 90% (0.9). The selected sample size (Ns) was calculated by dividing the original calculated sample size (N) by the anticipated response rate[17] as follows, Ns = N/0.9, where N = minimum calculated sample size, Ns = selected sample size, Anticipated response rate = 0.9. Thus, the selected sample size used for this study = 185/0.9 = 206.

Sampling technique

The sample selection was done consecutively using every adult patient who registered to see the clinicians on each consulting day during the study period and who met the inclusion criteria. This sampling technique was judgementally chosen by the authors based on the fact that the researchers believed that those selected were likely to be representative of the study population.[17]

Basic demographic data

The basic demographic data collected from the study population included age, sex, marital status, education and occupation. The social classification of patients was based on five points occupational scale used by Abramson.[18] However, this was re-classified into lower, middle and upper occupational classes to suit Nigerian environment. Class I and II belongs to upper class, class III belongs to middle class while class IV and V belongs to lower class.

Diagnostic procedures

The weight was measured in kilograms with patients standing bare feet in their minimal clothing and with their pockets free of objects that might add to their weights such as mobile phones, wallets, keys, rings etc., using pre-validated stadiometer combined with weighing scale by Techmel and Techmel USA (ZT-120) measured to the nearest 0.1Kg. The weighing scale was checked with 10 Kg standard weight every morning before use and the zero mark was checked after each measurement. While measuring the height, the patient who was barefooted and without head-gear or cap stood and against the stadiometer on the weighing scale with the Achilles, gluteus and occiput touching it. A pointer was pressed firmly against the scalp and the measurement read on the scale in meters to the nearest 0.5 cm. The BMI was estimated by dividing measured weight in kilograms by the height in meters squared.

The blood pressure was measured using auscultatory method with standard mercury in glass Accuson sphygmomanometer. Prior to the measurement, the patient was seated and rested for 5 min[19] in sitting position on a chair that supported the back comfortably. The left arm muscles were relaxed and the forearm was supported with the cubital fossa at the heart level. A cuff of suitable size was applied evenly to the exposed arm. The cuff was rapidly inflated until the manometer reading was about 30mmHg above the level at which the pulse disappeared and then slowly deflected. During this time, the Korotkoff sounds were monitored using a Littman stethoscope placed over the brachial artery. The systolic blood pressure was noted at the pressure at which the first heart sounds were heard (Korotkoff phase I). The diastolic blood pressure was taken as the pressure at the point when the heart sounds disappeared (Korotkoff phase V). The blood pressure was also measured in the right arm as described for the left arm in order to rule out significant inter-arm blood pressure difference and the arm that gave the higher reading was subsequently used.[19] The systolic and diastolic blood pressures were measured twice separated by an interval of 2 min.[19] The three readings were recorded and the mean value was calculated.

The blood glucose was determined after an overnight fast between 8 h to 10 h using venous plasma by glucose oxidase method.

The fasting lipid profile was assessed after an overnight fast between 8 h to 10 h by enzymatic method according to manufacturer's guidelines. Serum total cholesterol and high density lipoprotein (HDL)-cholesterol were determined by cholesterol oxidase method, serum triglyceride by glycerol kinase method and low density lipoprotein (LDL)-cholesterol was calculated using Friedwald's formula.[3]

Operational definitions

The BMI ≥ 30kg/m^2 was taken as the definition of obesity with the following categorization: Grade I obesity (mild obesity) = BMI of 30-34.9, grade II obesity (moderate obesity) = BMI of 35-39.9 and grade III obesity (severe obesity) = BMI of ≥40.[3,14,15]

Hypertension was defined as systolic and/or diastolic blood pressures ≥140/90 mmHg or documented use of antihypertensive medications in a previously diagnosed person with hypertension.[14,15,20]

Diagnosis of diabetes mellitus was based on venous plasma glucose of ≥126 mg/dL after an overnight fast which was confirmed by a repeat test on second clinic visit.[14,15]

Dyslipidaemia was defined as serum total cholesterol ≥200mg/dL (5.17mmol/l), and/or triglyceride ≥150mg/dL (1.7mmol/l) and/or low density lipoprotein cholesterol ≥100mg/dL (2.58mmol/l)

and/or high density lipoprotein cholesterol <40mg/dL (1.03 mmol/l).[14,15,21]

Data analysis

The results generated were analyzed using software Statistical Package for Social Sciences version 13.0, Inc. Chicago, IL, USA for the calculation of percentages for categorical variables and mean for continuous data.

Results

Two hundred and six (8.6%) out of a total of 2391 adult patients assessed for obesity using BMI criterion were obese with 139 (67.5%) having grade I obesity, 48 (23.3%) had grade II obesity and 19 (9.2%) had grade III obesity [Table 1].

The age of the obese patients ranged from 19 to 76 years with mean age of 44.7 ± 13.4 years. Majority of the obese patients were middle-aged adults (40-64 years) (60.7%) followed by the young adults (18-39 years) (34.5%) and then the elderly (≥65 years) (4.8%). There were 33 (16.0%) males and 173 (84.0%) females with male to female ratio of 1:5.2. Majority of the obese patients were married (67.5%), Public servants (31.1%) and belonged to lower social class (69.4%) [Table 2].

Eighty-eight (42.7%) of the obese patients were hypertensive while 118 (57.3%) had normal blood pressure. Thirty-one (15.0%) of the obese patients were diabetic while 175 (85.0%) had fasting plasma glucose <126mg/dl. The lipid profile showed that 19 (9.2%) had raised total cholesterol ≥200mg/dL, 26 (12.6%) had raised triglyceride ≥150mg/dL, 14 (6.8%) had raised LDL cholesterol and 47 (22.8%) had low HDL cholesterol [Table 3].

Discussion

The prevalence of obesity in this study was 8.6%. Grade I obesity (67.5%) was the most common pattern; others included grade II obesity (23.3%) and grade III obesity (9.2%). Hypertension (42.7%) was the most common cardio-metabolic co-morbidity followed by low HDL-cholesterol (22.8%), diabetes mellitus (15.1%), high triglyceride (12.6%), high total cholesterol (9.2%) and high LDL-cholesterol (6.8%).

The prevalence of obesity of (8.6%) in this study is higher than that reported from Amurie-Omanze (6.0%)[15] and Okporo (7.4%),[14] in the same Imo State, South-East Nigeria and Jos (6.4%), North-central Nigeria.[22] However, the prevalence of obesity in this study is lower than that reported from Port Harcourt (14.0%),[3] and in other countries such as Cameroon (17.1%)[23] and Ghana (16.1%).[24] The relative disparities between the prevalence of obesity in this study and other cited studies were probably due to the epidemiological characteristics of the study population. This study has demonstrated that obesity is an issue of phenomenal medical importance in the study area and occurs among the study

Table 1: Prevalence of obesity (body mass index ≥30 kg/m²) and BMI categories of obese patients

Prevalence	
Status	**Number (%)**
BMI ≥30kg/m²	206 (8.6)
BMI <30kg/m²	2185 (91.4)
Total	2391 (100.0)
BMI ≥30kg/m² categories	
Grade I obesity (BMI: 30-34.9)	139 (67.5)
Grade II obesity (BMI: 35-39.9)	48 (23.3)
Grade III obesity (BMI: ≥40)	19 (9.2)
Total	206 (100.0)

BMI: Body mass index

Table 2: Demographic variables of the obese patients

Parameter	Number (%)
Age (years)	
18-39	71 (34.5)
40-64	125 (60.7)
≥65	10 (4.8)
Total	206 (100.0)
Gender	
Male	33 (16.0)
Female	173 (84.0)
Total	206 (100.0)
Marital status	
Single	28 (13.6)
Married	139 (67.5)
Widowed	36 (17.5)
Separated/divorced	3 (1.4)
Total	206 (100.0)
Education	
No formal education	13 (6.3)
Primary	38 (18.5)
Secondary	57 (27.7)
Tertiary	80 (38.8)
Post-tertiary	18 (8.7)
Total	206 (100.0)
Occupation	
Unemployed	28 (13.6)
Student/apprentice	14 (6.8)
Public/civil servants	64 (31.1)
Farming	5 (2.4)
Trading	63 (30.6)
Professionals	13 (6.3)
Artisans	12 (5.8)
Retired public/civil servants	7 (3.4)
Total	206 (100.0)
Social class	
Lower	143 (69.4)
Middle	49 (23.8)
Upper	14 (6.8)
Total	206 (100.0)

Table 3: Cardio-metabolic co-morbidities of the obese patients

Parameter	Number (%)
Hypertension (SBP/DBP ≥140/90 mmHg)	
Yes	88 (42.7)
No	118 (57.3)
Total	206 (100.0)
Fasting plasma glucose	
<126 mg/dl	175 (85.0)
Diabetes mellitus	31 (15.0)
Total	206 (100.0)
Lipid profile	
Total cholesterol	
<200 mg/dl	187 (90.8)
≥200 mg/dl	19 (9.2)
Total	206 (100.0)
Triglyceride	
<150 mg/dl	180 (87.4)
≥150 mg/dl	26 (12.6)
Total	206 (100.0)
Low density lipoprotein cholesterol	
<100 mg/dl	192 (93.2)
≥100 mg/dl	14 (6.8)
Total	206 (100.0)
High density lipoprotein cholesterol	
<40 mg/dl	47 (22.8)
≥40 mg/dl	159 (77.2)
Total	206 (100.0)

population. This finding has buttressed the consideration by World Health Organization (WHO) that obesity is no longer the lifestyle disease of affluent countries and has corroborated the observation by WHO that obesity is an emerging disease in Nigeria with a rising epidemic.[5] This obese medical condition invariably predisposes these patients to increased cardiovascular morbidity and mortality. This study therefore should create a pedestal for the general patients to understand obesity as medical risk not an indication of prosperity that can be reduced through lifestyle modifications involving healthy diet, adequate exercise among other diverse interventions.[25]

Grade I obesity (68%) was the most common pattern of obesity among the study population. This pattern is similar to the pattern of obesity reported in Amurie-Omanze[15] and Okporo[14] communities of Imo state, Port Harcourt, Rivers State, South-south Nigeria,[3] Jos, North-central Nigeria[22] and Cameroon.[23] This pattern of obesity is supported by the observation that body build at the level of grade I obesity is culturally and socially desirable and acceptable in Nigeria and not usually regarded as a pathological condition.[3,14,15] In addition, those with mild obesity were less likely to be aware of their obese condition.[14,15]

The finding in this study of higher prevalence of obesity among middle-aged adult patients is similar to the reports from Amurie-Omanze[15] and Okporo[14] communities of Imo state, Port Harcourt[3] and other African countries such as Cameroon,[23] Ghana[24] and Tanzania.[26] This is probably a reflection of adopted dietary and behavioural patterns among the middle-aged adults. The middle-aged group are usually working class who may indulge in eating fast food in preference to home food, probably due to exigencies of their work. These high-density calories foods are added to the typical carbohydrate-based staple diet in the study area. In addition, sedentary lifestyle is perceived as a sign of wealth among the middle-aged group in the study area.[14,15]

This study observed higher prevalence of obesity among females (84.0%) compared with males (16.0%). This finding is similar to reports from Amurie-Omanze[15] and Okporo[14] communities of Imo state, Port Harcourt[3] and other countries such as Cameroon,[23] and Ghana.[24] The higher prevalence of obesity among the female gender may be attributed to changes in the energy density of the diet. This may be attributed to the socio-cultural belief that body built at the level of obesity is an evidence of good husband care, wealth and beauty.[3] More so, married women are likely to be multi-parous which is associated with high risk of obesity.[27] In addition, females are generally less physically active than males.[23] However, apart from changes in the energy density of diets and physical inactivity, genetic differences between the sexes may be contributory.[28]

In this study hypertension (42.7%) was the most common cardio-metabolic co-morbidity among the study population. The prevalence of hypertension in this study is higher than that reported from Amurie-Omanze (16.3%)[15] and Okporo (18.4%)[14] areas of Imo State and Port Harcourt (37.9%).[3] The finding in this study has shown that obesity is not only a pathological condition itself but may co-exist with hypertension.[29] Obesity is therefore regarded as an independent risk factor of hypertension and prevalence of hypertension usually follows observed pattern of obesity as blood pressure increases with increase in BMI.[30] While obese patients are prone to hypertension, hypertensive patients also appear to be prone to weight gain. It is likely that obesity and hypertension interact metabolically and thus potentiate their individual impact. Evidence from studies has shown that decrease in body weight is associated with lowering of blood pressure and reduction of cardio-vascular risk.[16,19,20] This finding therefore makes for a strong call to action for obese adult patients to adopt interventional approaches aimed at ensuring normal weight especially among adult Nigerians patients who are living in a resource-poor environment.

The pattern of dyslipidaemia in this study is similar to the pattern described in previous studies[14,15,26] with low/high density lipoprotein cholesterol being the most frequent lipid abnormality. According to these reports, dyslipidaemia is becoming an important medical problem and is associated with obesity in a clustering of medical conditions and/or risk factors that lead to dysmetabolic syndrome. Although, each of the abnormal lipid fractions is independently atherogenic but the pattern of dyslipidaemia may vary with its operational definitions among the study population. Screening for dyslipidaemia among the obese adult patients should be at diagnosis as the damage by them even starts before the diagnosis is made.

The prevalence of diabetes mellitus of 15.0% in this study is higher than that reported from Amurie-Omanze (3.9%)[15] and Okporo (3.4%)[14] areas of study State, Port Harcourt (6.8%),[3] and in other countries such as Tanzania (14.6%).[26] The finding of the Nigerian studies are in consonance with the reports that prevalence of diabetes mellitus is changing in Nigeria.[10] Establishing a baseline for plasma glucose measurements among obese patients and checking it during subsequent visits can provide the clinicians with excellent means of evaluating and educating their obese patients on lifestyle modifications.

Implications of the study

Obesity is widely reported as a rapidly growing medical risk globally and in 1997 it was recognised by WHO as a health problem that poses a threat to public health. In Nigeria, obesity is assuming an increasing importance among adult Nigerians. The lifestyles and behavioural patterns of adult Nigerians are changing rapidly and these being favourable to the looming epidemics of obesity and its cardio-metabolic co-morbidities. Screening adult Nigerians in a primary care setting for obesity and its cardio-metabolic correlates to prevent cardiovascular disease is a current cardiovascular health imperative.

This study provides additional evidence on the co-existence of obesity with cardio-metabolic-morbid conditions for consultative purposes. This study therefore will improve the quality of patient care and informs the patients to consider obesity as a disease entity that would require treatment even in the absence of metabolic co-morbidities. The health managers and policy makers should direct interventional strategies to control obesity as envisioned in the WHO global strategy on diet, physical activity and health.[16]

Strengths of the study

The main strength of the study is that it is the first cross-sectional study on obesity and its cardio-metabolic correlates in the study area. However, the findings of this study should be explored further in prospective clinic-based studies. This will provide the context for collaborative analysis of the studies as well as systematic reviews and meta-analysis in this area.

Limitations of the study

The authors had certain constraints which imposed some degree of limitations to the absolute generalization of the findings: The limitations imposed by the descriptive nature of the study design are recognized by the researchers. However, this study stimulates the need for longitudinal studies. This would enable a quasi-cause-effect relationship to be drawn and also for a reliable and valid conclusion to be ascertained.

The sample size used was comparatively small, but this was more than the minimum estimated sample size for the study.

The sample was drawn from hospital attendees in the study area as only patients who presented to the clinic were studied. Thus extrapolation and generalization of the results of the study to the entire population should be done with utmost caution because the findings may not be a true representation of what may be obtained in the community.

The study was also limited by the paucity of similar studies in study area and the absence of systematic reviews and meta-analytic data in Nigeria for referencing.

Conclusion

Obesity and its cardio-metabolic co-morbidities exist among the study population with grade I obesity being the most common pattern and hypertension, the most common cardio-metabolic co-morbidity. Anthropometric determination of obesity and screening for its associated cardio-metabolic co-morbidities should constitute clinical targets in primary care clinics. Identification and implementation of primary and secondary preventive measures that are timely, inexpensive and culturally acceptable are advocated.

Future research direction

In the study area, further hospital-based and community-based studies are recommended in order to effect population-based control for obesity. This will provide clinical and epidemiological data for collaborative purposes.

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