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Socioeconomic Status and Obesity among Semi-Urban Nigerians

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Key Words

Socioeconomic status · BMI · Overweight · Obesity

Summary

Objective: The relation between socioeconomic status (SES) and obesity in Sub-Saharan Africa (SSA) has been inconsistent. **Methods:** This study examined the prevalence of obesity and SES/obesity relations in 1,067 adults aged 30–60 years from a semi-urban Nigerian population. A structured questionnaire validated by a pictorial self-rating ladder was used to determine the participants' SES. **Results:** SES was found to be inversely related ($p < 0.010$) to weight and BMI, respectively. The odds ratio (OR) and 95% confidence interval (CI) for obesity among lower SES individuals were OR 2.4 and CI 1.91–2.88 compared with OR 2.9 and CI 2.42–3.39 in those of the middle and higher socioeconomic strata. Among males, the OR and 95% CI for obesity among lower SES individuals were OR 1.9 and CI 1.21–2.59 compared with OR 1.7 and CI 1.00–2.39 in those of the middle and higher socioeconomic strata. Among females, the OR and 95% CI for obesity among lower SES individuals were OR 3.0 and CI 2.32–3.68 compared with OR 4.7 and CI 4.02–5.38 in those of the middle and higher socioeconomic strata. **Conclusion:** SES was inversely associated with the risk of obesity, with a higher prevalence of obesity in the lower socioeconomic stratum of the semi-urban Nigerian population.

Introduction

Recent reports indicate that the prevalence of obesity in Africa is rising and of concern [1–8]. The recent upsurge in the prevalence of obesity in the developing countries of Africa is believed to be linked to the acculturation that these nations undergo, with alterations in diet and activity patterns resulting from Westernisation [1, 9]. This growing prevalence has been reported to represent a pandemic that requires urgent attention if the potential morbidity, mortality, and economic tolls that will be left in its wake are to be avoided [4].

Amoah [7] summarised that obesity in adults is associated with increased risk for cardiovascular and other chronic disorders, type 2 diabetes, abnormal levels of total cholesterol [10–13], dyslipidaemia [10–11], endocrine disorders [14], stroke, osteoarthritis, some cancers, and gall bladder disease [15–17]. Several accepted classifications and definitions exist for degrees of obesity; the one most widely accepted is the World Health Organization (WHO) criterion based on BMI [4]. The aetiology of obesity is multifactorial, with genetic predisposition and environmental factors having been implicated in most studies [18, 19]. Stunkard et al. [20, 21] stated that socioeconomic status (SES) is the most thoroughly studied measure of environmental influence on obesity. In the past, low SES has been an important factor associated with high incidences of obesity [22–26]. Several studies from the developed countries using individual measures of socioeconomic variables, such as income, education, and occupation, have shown that individuals with a lower SES are more likely to be obese, as shown by an increase in BMI with decreasing SES [25–28].

People of African descent in the Caribbean and the USA have been reported to have particularly high predispositions to develop obesity [4, 29, 30]. It is believed that Africans share a common ethnogenetic heritage with Blacks in the Caribbean and the USA but live in socioeconomic environments that diverge widely [29, 31]. High-risk ethnic and racial groups such as Africans have been reported to have far less prevalence for obesity in their countries of origin and that this changes sig-

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nificantly when such groups have immigrated to the affluent northern hemisphere, with altered dietary and activity habits [4]. Nonetheless, little data exist on obesity in Sub-Saharan populations in Africa [7, 32].

In developed Western countries, a consistent and strong inverse relationship has been established between SES and prevalence of obesity in women, whereas in men, it is characterised by a weaker and more variable association with SES [22, 33–35]. Research on socioeconomic determinants of obesity in developing countries is scarce; available data are mainly from Latin America and Asia [36–38]. The influence of SES on obesity in the developing countries is believed to be positive and strong, implying that the higher the SES the more obesity [33, 34, 39–41]. However, the relation between SES and obesity in the developing countries has been inconsistent and controversial. It is believed to be highly dependent upon the stage of industrial development of a country or region [6, 22]. Fezeu et al. [42] suggested that the reported positive association between SES and obesity in both men and women may not be true for all developing societies. To our knowledge, empirical reports on the relationship between SES and obesity among indigent Africans are scant and this constitutes a momentous shortcoming. The aims of this study were to examine relationships between SES and BMI, investigate whether variations in BMI are influenced by differences in SES, and estimate the prevalence of overweight and obesity in a semi-urban population in Nigeria.

Subjects and Methods

Subjects

The setting for this study was the historical ancient town of Ile-Ife, a semi-urban city in South-West Nigeria. (Ile-Ife is referred to as the cradle and ancestral place of origin of the Yoruba race, one of the major ethnic tribes in Nigeria.) The inhabitants of Ile-Ife are primarily civil servants, academics, students, traders, and peasant farmers. Using the WHO [43] guidelines for conducting community surveys, 5 out of the 11 political wards into which the Ife central local government area was divided were randomly chosen. In each ward, 3 census enumeration areas were randomly selected and houses with odd numbers were selected for survey. The study design intended to recruit a total of 1,500 adults. Each enumeration area was expected to include 100 adults aged 20 years and older. All eligible adults were recruited until approximately 100 participants were available in an enumeration area. The structured SES questionnaire and a pictorial self-rating SES ladder were also used. A total of 1,067 adults whose ages ranged between 30 and 60 years consented to the cross-sectional study, therefore yielding a response rate of 71.1%. The chief reasons for non-participation observed in this study were cultural inhibitions and some religious attitudes that led to some subjects being reluctant to declare their status or assets needed to determine their SES group.

Procedures

The chiefs and elders in each of the quarters within the 5 political wards consented to this study. The participants were fully informed about the purpose of the study and their consent was obtained before measurements were taken. Local dialect was used for participants who were not literate in the English language. Data were collected at the close of the day when the participants could be met at home (4:00 to 8:00 pm).

Height was measured with a height meter calibrated from 0 to 200 cm. The participants' heels, the back, and the occiput were touching the scale, with the participants looking straight ahead during measurement. The height of each participant was measured to the nearest 0.1 cm. Body weight was measured in kilograms to the nearest 1.0 kg, with the participant standing and not wearing shoes. BMI was calculated by dividing weight in kilograms by height in metres squared (kg/m^2) [44]. The participants' age was also recorded.

A modified version of the SES questionnaire used by Balogun et al. [45] was used to collect information on the subjects' highest educational attainment, level of income, and occupational status. This was used to classify the subjects into the 3 different socioeconomic groups. The scoring of the questionnaire items was based on their importance in the Nigerian society. Based on the summative score, the participants were categorised into lower (<9), middle (10–18), or upper socioeconomic class (19–27). Due to the cultural inhibitions and reluctance of Nigerians about disclosing their properties and status [46], a pictorial self-rating SES ladder of 9 rungs adopted from the MacArthur research network on SES [47] was also employed to subjectively assess the participants' SES and to test the validity of the questionnaire. Each rung of the ladder was assigned a score of 3, and a maximum score of 27 was possible for any participant who rated himself/herself to be on the 9th rung. A high positive concurrent-criterion validity was obtained between the modified questionnaire and the socioeconomic ladder ($r = -0.951$; $p < 0.01$) used to assess the SES of the participants.

Analyses

The data analyses were carried out using SPSS 13.0 version software (SPSS Inc., Chicago, IL, USA). The descriptive statistics of means, standard deviation, and 95% confidence interval (CI) were used to summarise the data collected. One-way analysis of variance (ANOVA) was used to determine if there was any significant difference between the age, weight, height, and BMI of the participants in the 3 socioeconomic strata. Least significance difference (LSD) post hoc analysis was used to probe the specific differences found in the F ratio of the ANOVA. Overweight and obesity was calculated for all participants using BMI, and the WHO criterion [1] was applied: normal ≥18.5–24.9 kg/m^2; overweight ≥25–29.9 kg/m^2; obesity ≥30–39.9 kg/m^2. Pearson's product-moment correlation analysis was used to determine the relationship among total SES scores and each score of weight, height, and BMI of the participants. Multivariate linear regression analysis was used to test the relationship between SES and age as independent variables and BMI as dependent variable. The confidence level was set at $p < 0.05$.

Results

A total of 1,067 adults (552 men (51.7%); 515 women (48.3%)) whose ages ranged between 30 and 60 years participated in the study. The mean age, height, weight, and BMI of all the participants were 44.33 ± 6.78 years, 166 ± 8.58 cm, 64.41 ± 11.46 kg, and 23.45 ± 3.89 kg/m^2, respectively. The physical characteristics of the participants in the 3 socioeconomic strata are presented in table 1. Participants in the lower socioeconomic stratum were found to have a higher weight and BMI than the participants in the middle and higher socioeconomic strata. Pearson's product-moment correlation analysis revealed a significant but weak inverse correlation between socioeconomic scores and scores of weight ($r = -0.113$, $p = 0.010$) and BMI ($r = -0.172$, $p = 0.010$), respectively. The multivariate regression analysis revealed a significant association between SES

Table 1. Summary of the one-way analysis of variance and LSD post-hoc test between the three socioeconomic strata

Variables	Socioeconomic strata			F ratio	p value
	lower (n = 319)	middle (n = 460)	higher (n = 288)		
Age, years	45.74 ± 7.17[a]	42.22 ± 6.48[b]	46.13 ± 8.6[a]	2.962	0.000
Height, cm	165 ± 9.03[a]	167 ± 7.61[b]	166 ± 9.30[a]	7.471	0.001
Weight, kg	66.40 ± 13.4[a]	64.24 ± 10.7[b]	62.49 ± 10.01[b]	8.407	0.000
BMI, kg/m^2	24.59 ± 4.42[a]	23.158 ± 3.79[b]	22.68 ± 3.05[b]	20.664	0.000

[a,b] For a particular variable, mode means with different superscripts are significantly ($p < 0.05$) different. Mode means with same superscripts are not significantly ($p < 0.05$) different.

Table 2. Mean values of BMI and distribution of BMI categories by age and sex for the lower, middle, and higher socioeconomic strata (SES), respectively

Sex and age group, years	Subjects	Mean BMI, kg/m^2 (95% CI)	Distribution of BMI (kg/m^2), % of subjects		
			18.5–24.9	25.0–29.9	≥30.0
Male					
Lower SES					
30–39	23	25.9 (23.6–28.2)	39.1	43.5	13.0
40–49	87	24.3 (23.3–25.3)	51.7	24.1	12.6
50–60	46	24.1 (23.1–25.1)	60.9	30.4	4.3
Total	156	24.5 (23.8–25.2)	52.6	28.9	10.3
Middle SES					
30–39	81	21.5 (20.9–22.1)	75.3	9.9	0.0
40–49	120	22.7 (22.0–23.4)	65.8	21.0	4.2
50–60	30	25.1 (23.5–26.7)	46.7	23.3	23.3
Total	231	22.6 (22.1–23.1)	67.4	15.7	5.65
Higher SES					
30–39	14	23.7 (22.7–24.7)	64.3	14.3	0.0
40–49	63	23.8 (23.0–24.6)	77.8	12.7	1.6
50–60	51	22.3 (21.7–22.9)	72.6	15.7	5.9
Total	128	23.5 (22.5–24.5)	72.7	11.7	6.25
Female					
Lower SES					
30–39	22	22.7 (21.2–24.2)	72.7	9.1	9.1
40–49	72	24.8 (23.8–25.8)	55.6	25.0	15.2
50–60	69	24.7 (23.6–25.8)	53.6	23.2	17.4
Total	163	24.5 (23.8–25.2)	58.3	20.9	15.3
Middle SES					
30–39	51	23.4 (22.5–24.3)	70.6	21.6	3.9
40–49	127	23.3 (22.7–23.9)	72.4	20.5	4.7
50–60	51	24.0 (23.0–25.0)	64.7	25.5	7.8
Total	229	23.5 (23.0–24.0)	69.1	22.2	5.65
Higher SES					
30–39	18	21.7 (20.5–22.9)	72.2	16.7	0.0
40–49	91	23.1 (22.4–23.8)	78.0	15.4	3.3
50–60	51	22.7 (21.7–23.7)	64.7	19.6	5.9
Total	160	22.8 (22.3–23.3)	73.1	16.9	3.75
All participants					
Lower SES	319	24.6 (24.1–25.1)	55.5	24.8	12.9
Middle SES	460	23.2 (22.9–23.6)	68.3	18.9	5.65
Higher SES	288	22.7 (22.4–23.1)	72.9	14.6	4.86

and age with BMI (B coefficient = 24.754; standard error = 0.881; p = 0.000).

The sex- and age-specific means (with 95% CI) and distribution of BMI categories for all the participants in the lower, middle, and higher socioeconomic strata are presented in table 2. In the different socioeconomic strata, no definite pattern was observed in the mean BMI values by age and by gender stratification. Nonetheless, a consistent decrease in mean BMI with increasing SES was observed. The crude prevalence of overweight and obesity obtained in this study were 19.9 and

7.1%, respectively. The prevalence of overweight was higher in women than in men (11.2 vs. 9.3%), while the rates of obesity were comparable between women (3.60%) and men (3.61%). The participants in the lower socioeconomic stratum had the highest prevalence of overweight (25.4%) and obesity (12.9%), while the prevalence of overweight (15.6%) and obesity (3.5%) was least among the participants in the higher socioeconomic stratum. The relative risks (odds ratio (OR)) and 95% CI for obesity among individuals in the lower SES were OR 2.4 and CI 1.91–2.88 compared with OR 2.9 and CI 2.42–3.39 among individuals in the middle and higher socioeconomic strata. Among males, the OR and 95% CI for obesity among individuals of lower SES were OR 1.9 and CI 1.21–2.59 compared with OR 1.7 and CI 1.00–2.39 in those of the middle and higher socioeconomic strata. Among females, the OR and 95% CI for obesity among individuals with low SES were OR 3.0 and CI 2.32–3.68 compared with OR 4.7 and CI 4.02–5.38 in those of the middle and higher socioeconomic strata.

Discussion

This study investigated the relationship between SES and obesity among adults in a semi-urban Nigerian community. The result of this study revealed a low inverse correlation between socioeconomic scores and each score of weight and BMI, respectively. We found overweight and obesity to be associated with low SES. This finding is at variance with previous reports stating a strong positive association between SES and obesity in developing countries [22, 39–42]. Abubakari et al. [8] summarised in a recent meta-analysis on trends of obesity in adult West-African populations that a higher prevalence of obesity was found in the higher socioeconomic group compared with those individuals in the lower category. Interestingly, the significant association of obesity with low SES found in the present study is contrary to the meta-analysis but reflects a similar trend of obesity/SES in more developed countries.

The overall prevalence rates of overweight and obesity in the lower, middle, and higher socioeconomic strata were 24.8 and 12.9%, 18.9 and 5.65%, and 14.6 and 4.86%, respectively. BMI values also differ significantly among the socioeconomic strata, with individuals in the lower socioeconomic stratum having a higher mean value. Our finding is consistent with studies concerning Western populations which show that adult individuals with poor SES have a higher BMI than their better educated and wealthier counterparts [48, 49]. This finding supports previous observational studies linking overweight and obesity to poor SES [50, 51]. However, our findings are at variance with two recent reports from neighbouring African countries. In a study among adult residents of Accra, Ghana, Amoah [7] found higher rates of overweight among individuals of higher social class compared with their lower-income counterparts, while Fezeu et al. [42] reported a positive SES/obesity relation in another study in urban Cameroon.

In our study, the relative risks of developing obesity among individuals of lower SES is twice that of individuals in the middle SES and thrice that of individuals in the higher SES. Among males, the risks of obesity among individuals in the lower SES were almost twice that of persons in the middle and higher SE strata. Females of lower SES had a risk of obesity three times that of females of middle SES and five times that of females of higher SES. Higher risks of developing obesity than their male counterparts were observed especially among females of lower SES.

Obesity is regarded as one of the diseases of civilisation; it is adduced that the prevalence of obesity and the trend of its relation with SES may indicate the level of economic and social development of a society. Developing countries like Nigeria are regarded as transitional societies undergoing acculturation and Westernisation with consequent changes in lifestyle (dietary pattern and physical activity). Monteiro et al. [38] stated that the trend of obesity in relation to SES in the developing societies is changing. The findings of this study supported the assumption that with increasing development, the burden of obesity in the developing societies will shift from the affluent to the poor people. It is believed that with ongoing socioeconomic change and development, factors such as food scarcity and high energy expenditure among the poor, having protected them against obesity, tend to dissipate and that a greater capacity of individuals with high SES to obtain adequate food supply as well as cultural values favouring plump body shapes as a symbol of privilege and wealth will be evoked [9, 38, 52].

In conclusion, SES was inversely associated with the risk of obesity, with a higher prevalence of obesity in the lower socioeconomic stratum of the semi-urban Nigerian population. This can be attributed to a low level of education and poverty, with consequent limited access to healthy foods, lack of knowledge about weight control and safe exercise, a low level of awareness of health hazards of obesity, and cultural values favouring plump body shapes as a sign of good living. Among the poor and less educated Sub-Saharan Africans, culture still holds a strong influence on health beliefs as overweight and obesity are still perceived as a sign of wealth [42, 46, 53]. Meanwhile, an increase in the prevalence of obesity within a population is often seen prior to a rise in the occurrence of chronic non-communicable diseases, such as hypertension and diabetes [54]. It is therefore imperative that public action should be taken to prevent obesity and its health-related consequences especially among the poor. It is recommended that health education in order to improve the level of knowledge of the risks of overweight or obesity, a healthy diet, safe physical activity and exercise, and also a correct perception of appropriate body shape should be focused on.

One of the limitations of this study is that BMI was the only surrogate measure for body fatness used. BMI is believed to be limited in predicting the measure of fatness across different body builds, ages, sex, and ethnic backgrounds, however,

it remains the most simple acceptable tool for determining relative body fatness in both clinical and epidemiological studies [55, 56]. Nonetheless, measures or indices of central adiposity have been reported by some studies as better indicators of total body fatness than BMI [57–60]. Other potential limitations of this study are the small sample size and generalisability of the results to the rural and urban parts of Nigeria. Nonetheless, the socioeconomic and lifestyle characteristics of this population are typical of other semi-urban/urban cities in Nigeria but the different socioeconomic strata may not be represented in the same proportion in all of the cities. Further research that will take care of the limitations of this study and also verify the SES/obesity trends in rural and urban populations and on a national scale in Nigeria is warranted.

Disclosure

There is no conflict of interest to declare.

References

1 World Health Organization (WHO): Obesity: preventing and managing the global epidemic. Report of a WHO Consultation (1997). Presented at the World Health Organization, June 3–5, Geneva, Switzerland. Publication WHO/NUT/NCD/98. 1998:1.
2 Seidell JC: Time trends in obesity: an epidemiological perspective. Horm Metab Res 1997;29:155–158.
3 Sørensen TIA: The changing lifestyle in the world; body weight and what else? Diabetes Care 2000; 23(suppl 2):B1–B4.
4 Uwaifo G, Arioglu E: Obesity. 2006. *www.emedicine.com/med/topic1653.htm*.
5 Wickelgren I: Obesity: how big a problem? Science 1998;280:1364–1367.
6 Sørensen TIA: Socio-economic aspects of obesity: causes or effects? Int J Obes Relat Metab Disord 1995;19(suppl 6):S6–8.
7 Amoah AGB: Obesity in adult residents of Accra, Ghana. Ethn Dis 2003;13(suppl 2):97–101.
8 Abubakari AR, Lauder W, Agyemang C, Jones M, Kirk A, Bhopal RS: Prevalence and time trends in obesity among adult West African populations: a meta-analysis. Obes Rev 2008;9:297–311.
9 Popkin BM: The nutrition transition in low income countries: an emerging crisis. Nutr Rev 1994;52:285–298.
10 Ferrannini E: Physiological and metabolic consequence of obesity. Metabolism 1995;44(suppl 3):1–3.
11 Stern M: Epidemiology of obesity and its link to heart disease. Metabolism 1995;44(suppl 3):1–3.
12 Hughes GH, Areghan GA, Knight BN: Obesity and the African-American adolescent in Mississippi: an overview. South Med J 2005;98:72–78.
13 Manson JE: Body weight and mortality among women. Am J Clin Nutr 1995;61:284.
14 Björntorp P: Endocrine abnormality in obesity. Diabetes Rev 1997;5:52–68.
15 Deslypere JP: Obesity and cancer. Metabolism 1995;44(suppl 3):24–27.
16 Bray GA: Health hazards of obesity. Endocrinol Metab Clin North Am 1996;25:907–919.
17 Burton BT, Foster WR, Hirsch J, Vanitallie TB: Health implications of obesity. NIH Consensus Development Conference. Int J Obes Relat Metab Disord 1998;22:39–43.
18 Maes HHM, Neale MC, Eaves LJ: Genetic and environmental factors in relative body weight and human adiposity. Behav Genet 1997;27:325–351.
19 Hill JO, Wyatt HR, Melanson EL: Genetic and environmental contributions to obesity. Med Clin North Am 2000;84:333–346.
20 Stunkard AJ, Foch TT, Hrubec Z: A twin study of human obesity. JAMA 1986;256:51–54.
21 Stunkard AJ, Sørensen TI, Hanis C, Teasdale TW, Chakraborty R, Schull WJ, Schulsinger F: An adoption study of human obesity. N Engl J Med 1986;314:193–198.
22 Sobal J, Stunkard AJ: Socioeconomic status and obesity: a review of the literature. Psychol Bull 1989; 105:260–275.
23 Flegal KM, Carroll MD, Ogden CL, Johnson CL: Prevalence and trends in obesity among US adults, 1999–2000. JAMA 2002;288:1723–1727.
24 Hardy R, Wadsworth M, Kuh D: The influence of childhood weight and socioeconomic status change in adult body mass index in a British national birth cohort. Int J Obes Relat Metab Disord 2000;24:725–734.
25 Silventoinen K, Sarlio-Lahteenkorva S, Koskenvuo M, Lahelma E, Kaprio J: Effect of environmental and genetic factors on education-associated disparities in weight and weight gain: a study of Finnish adult twins. Am J Clin Nutr 2004;80:815–822.
26 Lyratzopoulos G, McElduff P, Heller RF, Hanily M, Lewis PS: Mid-term Body Mass Index increase among obese and non-obese individuals in middle life and deprivation status. BMC Public Health 2005; 5:32.
27 Martikainen PT, Marmot MG: Socioeconomic differences in weight gain and determinants and consequences of coronary risk factors. Am J Clin Nutr 1999;69:719–726.
28 Lahmann PH, Lissner L, Gullberg B, Berglund G: Socio-demographic factors associated with long-term weight gain, current body fatness and central adiposity in Swedish women. Int J Obes Relat Metab Disord 2000;24:685–694.
29 Forrester T, Wilks R, Bennett F, McFarlane-Anderson N, McGee D, Cooper R, Fraser H: Obesity in the Caribbean. Ciba Found Symp 1996;201:17–26; discussion 26–31, 32–36.
30 Wilks R, McFarlane-Anderson N, Bennett F, Fraser H, McGee D, Cooper R, Forrester T: Obesity in peoples of the African diaspora. Ciba Found Symp 1996;201:37–48; discussion 48–53, 188–193.
31 Cooper R, Rotimi C, Ataman S, McGee D, Osotmehin B, Kadiri S, Muna W, Kingue S, Fraser H, Forrester T, Bennett F, Wilks R: The prevalence of hypertension in seven populations of West African origin. Am J Public Health 1997;87:160–168.
32 Epstein FH, Higgins M: Epidemiology of obesity; in Björntorp P, Brodoff BN (eds): Obesity. Philadelphia, PA, Lippincott, 1992, pp 330–342.
33 Stunkard A: Socioeconomic status and obesity. Ciba Found Symp 1996;201:174–182; discussion 182–187, 188–193.
34 Rissanen AM: The economic and psychosocial consequences of obesity. Ciba Found Symp 1996;201: 194–201; discussion 201–206.
35 Winkleby MA, Jatulis DE, Frank E, Fortmann SP: Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. Am J Public Health 1992;82: 816–820.
36 Yu Z, Nissinen A, Vartiainen E, Song G, Guo Z, Zheng G, Tuomilehto J, Tian H: Associations between socioeconomic status and cardiovascular risk factors in an urban population in China. Bull World Health Organ 2000;78:1296–1305.
37 Monteiro CA, Conde WL, Lu B, Popkin BM: Obesity and inequities in health in the developing world. Int J Obes Relat Metab Disord 2004;28:1181–1186.
38 Monteiro CA, Moura EC, Conde WL, Popkin BM: Socioeconomic status and obesity in adult populations of developing countries: a review. Bull World Health Organ 2004;82:940–946.
39 Bovet P, Ross AG, Gervasoni JP, Mkamba M, Mtasiwa DM, Lengeler C, Whiting D, Paccaud F: Distribution of blood pressure, body mass index and smoking habits in the urban population of Dar es Salaam, Tanzania, and associations with socioeconomic status. Int J Epidemiol 2002;31:240–247.
40 Bunker CH, Ukoli FA, Nwankwo MU, Omene JA, Currier GW, Holifield-Kennedy L, Freeman DT, Vergis EN, Yeh LL, Kuller LH: Factors associated with hypertension in Nigerian civil servants. Prev Med 1992;21:710–722.
41 Gilberts EC, Arnold MJ, Grobbee DE: Hypertension and determinants of blood pressure with special reference to socioeconomic status in a rural south Indian community. J Epidemiol Community Health 1994;48:258–261.
42 Fezeu L, Minkoulou E, Balkau B, Kengne AP, Awah P, Unwin N, Alberti GKMM, Mbanya JC: Association between socio-economic status and adiposity in urban Cameroon. Int J Epidemiol 2006;35: 105–111.
43 World Health Organization (WHO); Sethi D, Habibula S, McGee K, Peden M, Bennet S, Hyder AA, Klevens J, Odero W, Suriyawongpaisal P (eds): Guidelines for conducting community surveys on injuries and violence. Geneva, World Health Organization, 2004.
44 Himes JH: Agreement among anthropometric indicators identifying the fattest adolescents. Int J Obes Relat Metab Disord 1999;23(suppl 2):S18–21.
45 Balogun JA, Obajuluwa VA, Olaogun MOB, Oyeyemi AY, Balogun MO, Adeodu OO: Influence of parental socio-economic status on casual blood pressures of Nigerian school children. Int J Cardiol 1990; 29:63–69.

46 Adedoyin RA, Mbada CE, Awofolu OO, Oyebami OM: The influence of socio-economic status on casual blood pressures of the adult Nigerians. Eur J Cardiovasc Prev Rehabil 2005;12:271–273.
47 MacArthur JD, MacArthur CT: The MacArthur Scale of Subjective Social Status. Research Network on Socioeconomic Status and Health 2000.
48 Reilly JJ, Methven E, McDowell ZC: Health consequences of obesity. Arch Dis Child 2003;88:748–752.
49 Kuczmarski RJ, Flegal KM: Criteria for definition of overweight in transition: background and recommendations for the United States. Am J Clin Nutr 2000;72:1074–1081.
50 Averett S, Korenman S: Black-white differences in social and economic consequences of obesity. Int J Obes 1999;23:166–173.
51 Cawley J: The impact of obesity on wages. J Hum Resour 2004;39:451–474.
52 Song YM: Commentary: varying relation of socioeconomic status with obesity between countries at different stages of development. Int J Epidemiol 2006;35:112–113.
53 Kruger HS, Venter CS, Vorster HH, Margetts BM: Physical inactivity is the major determinant of obesity in black women in the North West province, South Africa: the THUSA study. Transition and Health During Urbanization of South Africa. Nutrition 2002;18:422–427.
54 Poulter NR, Khaw K, Hopwood BE, Muqambi M, Peart WS, Sever PS: Determinants of blood pressure changes due to urbanization: a longitudinal study. J Hypertens 1985;3(suppl 3):5375–5377.
55 WHO Expert Consultation: Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004;363:157–163.
56 Prentice AM, Jebb SA: Beyond body mass index. Obes Rev 2001;2:141–147.
57 Pouliot MC, Despres JP, Lemieux S, Moorjani S, Bouchard C, Tremblay A, Nadeau A, Lupien PJ: Waist circumference and abdominal sagittal diameter: best simple anthropometric indexes of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women. Am J Cardiol 1994;73:460–468.
58 Dobbelsteyn CJ, Joffres MR, MacLean DR, Flowerdew G; Canadian Heart Surveys Research Group: A comparative evaluation of waist circumference, waist-to-hip ratio and body mass index as indicators of cardiovascular risk factors. The Canadian Heart Health Surveys. Int J Obes Relat Metab Disord 2001;25:652–661.
59 Foucan L, Hanley J, Deloumeaux J, Suissa S: Body mass index (BMI) and waist circumference (WC) as screening tools for cardiovascular risk factors in Guadeloupean women. J Clin Epidemiol 2002;55:990–996.
60 Eckel RH, Grundy SM, Zimmet PZ: The metabolic syndrome. Lancet 2005;365:1059–1062.