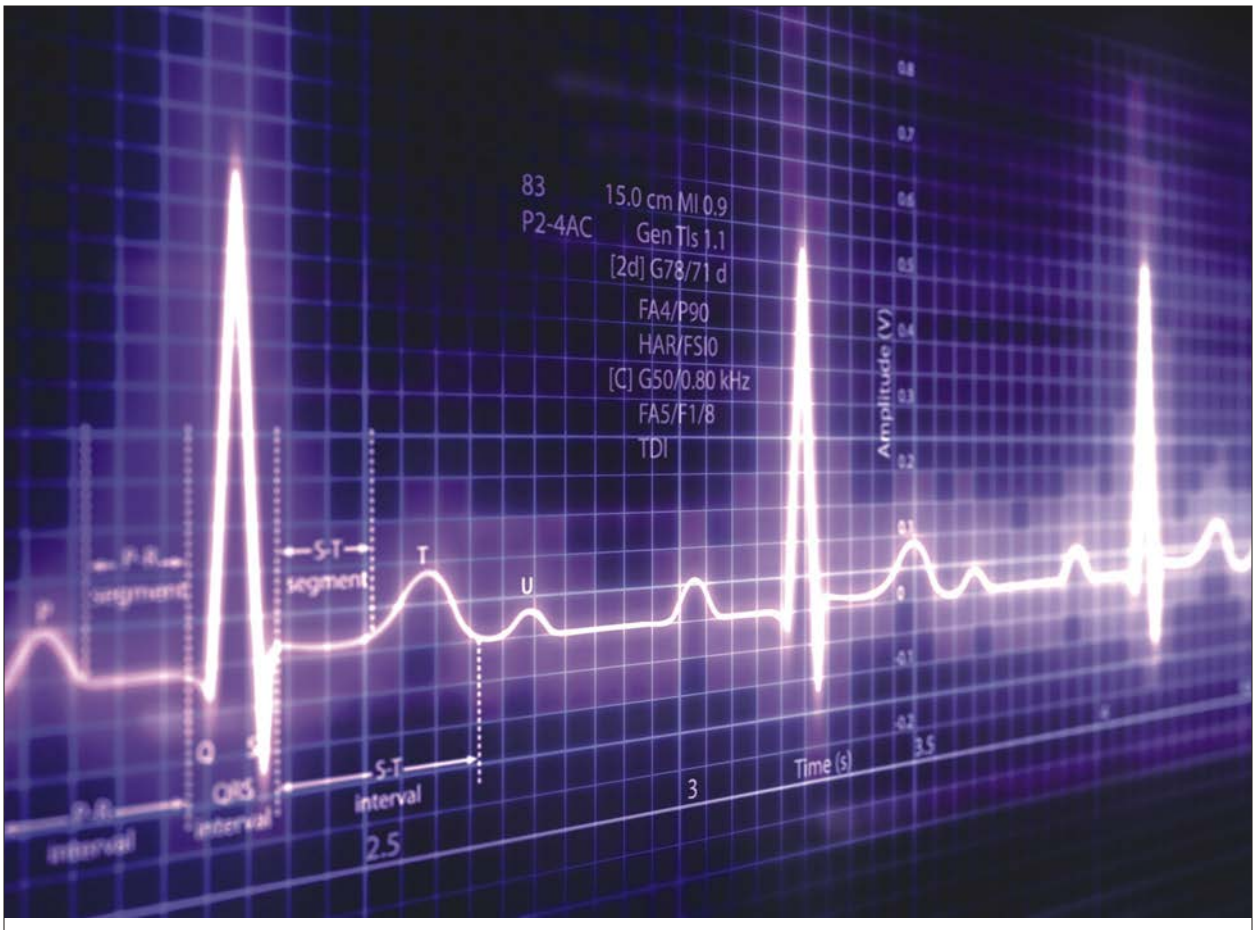

Research Journal of Cardiology

ISSN 1819-3404

Academic Journals Inc.

www.academicjournals.com

Research Journal of Cardiology 6 (1): 19-27, 2013
ISSN 1819-3404 / DOI: 10.3923/rjc.2013.19.27

Prevalence and Determinants of Obesity among Workers in Lomé (Togo)

F. Damorou, K. Yayehd, M.P. N'cho Mottoh, T. Tchérou, E. Ehlan, N.W. N'da and F. Randrianarisoa
Department of Cardiology, Campus University Teaching Hospital of Lomé, Togo

Corresponding Author: Findibe Damorou, Department of Cardiology, Campus Teaching Hospital of Lomé, Postal address: 03 BP: 30284 Lomé, Togo Tel: (+228) 90097612 Fax: (228) 250 17 68

ABSTRACT

Obesity is increasing throughout the world, particularly in low- and middle-income populations, leading to an increase of cardiovascular diseases rates, suggesting more primary prevention programs in these populations. However, there are few data on this risk factor in our country. This cross sectional survey aimed to determine the prevalence of obesity and its risk factors among workers in Lomé. A questionnaire was filled out on the life style and the anthropometric data and blood pressure were taken in all the respondents. Plasma total cholesterol and fasting glucose have also been measured. The prevalence of obesity (Body Mass Index (BMI)>30 kg m^{-2}) was 30.6% and that of abdominal obesity was 39.4%. Being female ($p<0.0001$), low education level (OR = 2.45 95% CI: 1.78-4.55, p = 0.001) and lack of physical activity (OR = 3.57 95% CI = 2.34-9.67, p = <0.001) were the main factors significantly associated with obesity. BMI was positively correlated to age ($r = 0.145$, $p = 0.0004$), diastolic blood pressure ($r = 0.10$, $p = 0.013$) and waist circumference was positively correlated to age ($r = 0.381$, $p<0.0001$), systolic blood pressure ($r = 0.289$, $p = 0.0001$) and diastolic blood pressure ($r = 0.194$, $p<0.0001$), but there was no correlation between anthropometric data and total serum cholesterol and fasting glucose. The prevalence of obesity was high in the worker's population of Lomé especially in female and is associated with low education level and lack of physical activity.

Key words: Body mass index, waist circumference, overweight, obesity, Lomé workers

INTRODUCTION

According to the American Heart Association, obesity is an independent cardiovascular risk factor. Obesity is epidemic and its prevalence is increasing worldwide (Lopez-Jimenez *et al*., 2006). WHO estimated that there are more than 1.1 billion adults overweight in the world and related a rapid rising of obesity in low- and middle-income populations concerning more than 115 million people suffering from obesity-related problems (WHO, 2008).

Several prospective epidemiological studies have shown a relationship between overweight and cardiovascular morbidity and mortality and total mortality (McGee, 2005; Ford *et al*., 2002; Hu *et al*., 2004). Overweight is associated with a cluster of metabolic and cardiovascular risk factors (Haslam and James, 2005; Veghari and Golalipour, 2007) and there is evidence link between obesity and the risk for cardiovascular diseases (CVD) (Eisenmann *et al*., 2005; Poirier *et al*., 2006; Badaruddoza *et al*., 2011), glucose intolerance and type 2 diabetes mellitus (Kopelman, 2000; Afoakwah and Owusu, 2011), cancer occurring and asthma (Batty *et al*., 2005; Calle *et al*., 2003; Mathew *et al*., 2009), premature mortality (Adams *et al*., 2006) and health service costs

(Maaten *et al.*, 2008). Unhealthy lifestyle including dietary intake and lack of physical activity has been incriminated in several studies as possible causal factors in developing countries (Gonzalez-Suarez *et al.*, 2009; Suleiman *et al.*, 2009; Veghari and Golalipour, 2007).

In Togo, there are few data on the prevalence of obesity in the population hence, the interest of this study. The aim of the present study was to determine the prevalence of obesity and its relationship with other risk factors among workers in Lomé.

MATERIALS AND METHODS

This cross sectional survey was performed among 207 employees of a governmental institution (ministry of agriculture) and 303 market workers in Lomé, between September 1st and October 14, 2011.

Data collection and procedures: Data have been collected by a medical team composed of three doctors and six nurses. The interview lasted average 10 min per person. A questionnaire has been filled out on the lifestyle (tobacco smoking, lipids and fatty foods, regular exercise) and educational status. Weight and height were measured using an adult hospital lever balance with participants wearing light clothing and no shoes or extra articles. The Body Mass Index (BMI) of Quetelet was calculated using weight in kilogram divided by the square of the height in meter. The BMI was classified using the WHO classification of BMI. The respondents were classified in four groups: the thin respondents with BMI<18.5 kg m^{-2}, respondents with normal weight if the BMI comprised between 18.5 and 24.9 kg m^{-2}, overweight respondents in which the BMI was between 25 and 29.9 kg m^{-2} and obese respondents having a BMI≥30 kg m^{-2}. The severity of obesity was stratified in three stages: Moderate obesity with BMI ranging between 30 and 34.9 kg m^{-2}, mild obesity for BMI ranging between 35 and 39.9 kg m^{-2} and morbid obesity for BMI≥40 kg m^{-2} (WHO, 2000).

Waist circumference was measured midway between the iliac crest and the lower most margin of the ribs with bare belly and at the end of normal expiration and the hip girth was measured at the intertrochanteric level according to the WHO guidelines. The waist circumference of >88 cm for females and 102 cm for male respondents were considered abnormal (Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults, 2001).

The supine blood pressure in both two arms was measured by a nurse using a manual sphygmomanometer, twice after 10 min rest using appropriate cuff size and Accoson brand of mercury sphygmomanometer (Mancia *et al.*, 2007). Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were the first and fifth Korotkoff sounds, respectively. The mean of three readings, five minutes apart, was determined. Hypertension was defined as SBP greater than or equal to 140 mmHg and/or DBP equal to or greater than 90 mmHg. The Joint National Committee 7 (JNC 7) classification was used to stratify this population's blood pressure (Chobanian *et al.*, 2003).

Smoking was defined as the fact to smoke at least one cigarette per day. The education level was categorized in the following way: Illiterate, primary school, secondary school and university level. Less than secondary school has been consider as low education level.

Lipids and fatty foods (Consumption more than twice a week of the following foods: groundnut sauces, palm nut sauces, cracklings, bad quality oil, butters, fast-foods) and regular exercise were checked.

Blood samples were taken during fasting. Serum total cholesterol and fasting glucose were measured in all the respondents. High levels were defined for a total serum cholesterol >200 mg dL^{-1} and a fasting glucose >110 mg dL^{-1}.

Ethical considerations: Consent was required and obtained after clear explanations on the objectives of this study according to the declaration of Helsinki. Each respondent's answers and medical data were kept confidential. After the screening, councils have been provided to all the respondents and some of them were referred to the hospitals.

Data analysis: Continuous variables are presented as the Mean±SD and categorical variables are presented as the number and its corresponding percentage. The χ^2 test was used for categorical variables and the ANOVA test or t-test for continuous variables. Correlation coefficients were determined by linear regression to assess the relationship between anthropometric data, age, blood pressure, plasma total cholesterol and fasting glucose.

Odds Ratios (OR) and 95% confidence intervals (95% CI) were calculated using a logistic regression analysis. The p-values<0.05 were considered to be statistically significant. All statistical analyses were performed using the Center of Diseases Control (CDC) Epi-Info version 7 software.

RESULTS

Table 1 shows the characteristics of the respondents according to the profession. There was no significant difference between mean age of two professional groups (p = 0.78). There was a female prevalence in the market workers (242 women vs. 61 men, sex ratio: 0.25) whereas, one noted a male prevalence in the governmental institution (68 women vs. 139 men, sex-ratio: 2.04). Secondary school has been achieved by 178 (86%) employees in the ministry vs. 62 (20.5%) market workers, p<0.0001, 85.7% of workers had fatty foods and 9.0% of them did regular exercise.

Table 1: Characteristics of the respondents according to the profession

Parameters	Total (n = 510)	Ministry (n = 207)	Market (n = 303)	p-value
Age (Mean±SD)	43.6±11	42.8±9.8	44.5±12.3	0.78
Male	200 (39.2)	139 (67.1)	61 (20.1)	<0.0001
Education level				
University or higher	110 (21.6)	108 (52.2)	2 (0.66)	<0.0001
Secondary school	130	70 (33.8)	60 (19.8)	0.0003
Primary school	123	25 (12.1)	98 (32.3)	<0.0001
Illiterate	147	4 (1.9)	143 (47.2)	<0.0001
BMI				
Thinness	17 (3.3)	8 (3.9)	9 (3)	0.58
Normal weight	186 (36.5)	100 (48.3)	86 (28.4)	<0.001
Overweight	151 (29.6)	73 (35.3)	78 (25.8)	0.02
Moderate obesity	85 (16.7)	21 (10.1)	64 (21.2)	0.001
Mild obesity	45 (8.8)	5 (2.4)	40 (13.2)	<0.0001
Morbid obesity	26 (5.1)	(0.0)	26 (8.6)	<0.0001
Blood pressure (JNC 7)				
Normal	160 (31.4)	59 (28.5)	101 (33.3)	0.24
Prehypertension	165 (32.3)	66 (31.9)	99 (32.7)	0.85
HBP stage I	100 (19.6)	33 (15.9)	67 (22.1)	0.08
HBP stage II	85 (16.7)	49 (23.7)	36 (11.9)	0.001
Dietary habits				
Smoking	15 (2.9)	14 (6.8	1 (0.3)	<0.0001
Lipids and fatty foods	437 (85.7)	166 (80.2)	271 (89.4)	0.003
Regular exercise	46 (9.0)	17 (8.2)	29 (9.6)	0.59

Data are in n (%) otherwise precise, BMI: Body mass index, WC: Waist circumference, HBP: High blood pressure

The prevalence of HBP was 36.3% and smoking was exclusively seen in male (2.9%). Among the overweight 151 respondents, there was a non significant male prevalence (34.5% in male vs. 26.4% in female, p = 0.05). We noticed a female prevalence among obese workers (6.5% in male vs. 46.1% in female, p<0.0001) and also a high female prevalence for abdominal obesity (57.7% in female vs. 11% in male, p<0.0001). There was no gender difference in mean plasma cholesterol (174±69.6 mg dL^{-1} in female vs. 166.4±79.3 in male, p = 0.25) and fasting glucose (65.5±19.6 in female vs. 71.6±48.1 in male, p = 0.127) (Table 2).

The prevalence of obesity increased from low age to high ages with two picks (Fig. 1): The first pick at 35-44 years (34.3%) and the second one at 55-64 years (40%).

Table 3 shows the correlation coefficients between anthropometric data and other risk factors. There was a positive correlation between anthropometric data and age (BMI: r = 0.145, WC: r = 0.381), DBP (BMI: r = 0.10, WC: r = 0.194); only WC showed a positive correlation with SBP (r = 0.289, p = 0.0001). There was no correlation between anthropometric data and serum total cholesterol (BMI: r = 0.020; WC: r = 0.034) and fasting glucose (BMI: r = -0.027; WC: r = -0.003). Low education level (OR = 2.45; 95% CI: 1.78-4.55, p = 0.001) and lack of physical activity (OR = 3.57; 95% CI = 2.34-9.67, p = <0.001) were the main factors significantly associated with obesity; logistic regression shows a strong association between HBP (high blood pressure) and WC (OR = 2.36; 95% CI: 1.41-3.94, p = 0.001); this difference persisted after adjusting for age and sex

Table 2: Characteristics of the respondents according to gender

Parameters	Total	Women	Men	p-value
No.	510	310 (60.8)	200 (39.2)	
Age (Mean±SD)	43.6±11	45.3±13	42.9±10	00.03
BMI (Mean±SD)	27.4±6.6	29.2±7.1	24.4±4	< 0.0001
BMI<25 kg m^{-2}	203 (39.8)	85 (27.4)	118 (59)	< 0.0001
Overweight	151 (29.6)	82 (26.4)	69 (34.5)	00.05
Obesity	156 (30.6)	143 (46.1)	13 (6.5)	< 0.0001
WC (Mean±SD)	94.1±16	95.9±15.9	86.6±13.9	< 0.0001
Normal WC	309 (60.6)	131 (42.3)	178 (89)	< 0.0001
High WC	201 (39.4)	179 (57.7)	22 (11)	< 0.0001
Biological data				
Total cholesterol (Mean±SD)	167.6±72.7	174±69.6	166.4±79.3	00.25
Fasting glucose (Mean±SD)	66.7±27.7	65.5±19.6	71.6±48.1	00.127

BMI: Body mass index, WC: Waist circumference, Data are in n (%) otherwise they are precise

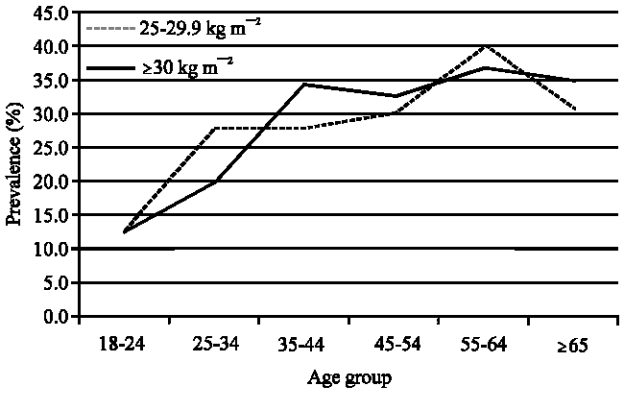

Fig. 1: Prevalence of overweight and obesity in different age-groups, p = 0.07

Table 3: Correlation coefficients between anthropometric data and other risk factors

	Body mass index			Waist circumference		
Parameters	r	SE	p-value	r	SE	p-value
Age	0.145	0.041	0.0004	0.381	0.077	<0.0001
SBP	0.070	0.023	0.002	0.289	0.076	0.0001
DBP	0.10	0.04	0.013	0.194	0.045	<0.0001
Fasting glucose	- 0.027	0.018	0.148	- 0.003	0.052	0.957
Total cholesterol	0.020	0.007	0.005	0.034	0.013	0.01

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, SE: Standard error

Table 4: Odds ratios between WC and conventional risk factors

Parameters	OR	95% CI	p-value	OR*	95% CI	p-value
Low education level	2.45	1.78-4.55	0.001	2.23	1.54-6.06	0.001
Lack of physical activity	3.57	2.34-9.67	<0.001	3.02	1.64-9.52	<0.001
High blood pressure	2.36	1.41-3.94	0.001	2.15	1.15-4.02	0.01
High fasting glucose	1.32	0.24-7.34	0.75	0.95	0.13-6.75	0.96
High plasma cholesterol	0.43	0.23-0.75	0.003	0.32	0.11-7.22	0.001

*Odds ratios adjusted for age and sex

(Table 4); contrary there was no association with high cholesterol (OR = 0.43 95% CI: 0.24-0.75, p = 0.003) and fasting glucose (OR = 1.32 95% CI: 0.23-7.34, p = 0.75).

DISCUSSION

This cross sectional survey was performed in two significant professional groups of the economy of the municipality of Lomé: There was a female prevalence among the market workers but a male prevalence among the employees of the governmental institution; this reflects a real contrast in our country where women are generally less educated and then are few in civil services. Thus, nearly 80% of women in the market had an educational level lower than secondary school. There was no significant difference between the average ages of the respondents of these two activity sector. The frequency of obesity was 30.8% with a significant female prevalence, p<0.0001 and that of abdominal obesity was 39.4% with also a significant female prevalence.

The prevalence of obesity was high in this survey. Globally, the prevalence of obesity ranges from as low as 0.6% in Gambia among males to as high as 80.2% in Nauru. Among females, obesity ranges from 0.2% in Ethiopia to 78.6% in Nauru (Krause *et al*., 1998; WHO, 2011). In western countries, about two thirds of adults in the United States and United Kingdom are overweight or obese and at least one quarter is obese (Spiegel and Alving, 2005; Sniehotta *et al*., 2011).

In a recent study in the households of Dar Es Salam in Tanzania, obesity was present in 19.2% of the cases (Shayo and Mugusi, 2011) with a strong female prevalence, p<0.001; some studies reported that increasing age, female sex, lack of physical activity (Suleiman *et al*., 2009; Shayo and Mugusi, 2011), marriage, high socioeconomic status (Shayo and Mugusi, 2011) increase the likelihood for obesity in their population. However, Suleiman *et al*. (2009) related a high prevalence of obesity among lower monthly income populations in Jordanian.

In this study, we observed a strong prevalence of obesity in low educational level people where obesity is often perceived like a sign of ease. Moreover, WHO describes obesity as one of the most blatantly visible, yet most neglected public-health problems that threaten to overwhelm both more and less developed countries (WHO, 2000); so, obesity have achieved global recognition as health

problems only during the past 10 years, contrary to malnutrition and infectious diseases, which have always dominated thinking (WHO, 2000).

Contrary to that observed in high-income populations and where obesity is becoming more prevalent among young people and teenagers, the present survey performed in a low-income country (Togo) highlighted a high prevalence of obesity among adults. Thanks to the epidemiological transition, increased longevity and the impact of smoking, high-fat diets and other risk factors for chronic diseases have now combined to make CVD and cancer the leading causes of death in most countries. These changes began in higher income populations, but as they gradually spread to low- and middle-income countries, CVD mortality rates have increased globally (Gaziano and Gaziano, 2011).

However, some studies related a downward in the trends of obesity in high-income populations this last decade; as a result, Flegal *et al.* (2010) reported that in 2007-2008, the prevalence of obesity was 32.2% among adult men and 35.5% among adult women and that the increases in the prevalence of obesity previously observed do not appear to be continuing at the same rate over the past 10 years, particularly for women and possibly for men. But China, once considered one of the leanest populations in the world, has experienced rapidly escalating rates of overweight and obesity (Shen *et al.*, 2012); then, a recent meta-analysis of nationally representative data by Wang *et al.* (2006) estimated that the prevalence of overweight and obesity rose 49.5% between 1992 and 2002, from 20.0 to 29.9%.

In our survey, obesity was positively correlated to age, gender (female), low educational level and blood pressure. Many other studies reported a strong correlation between obesity and blood pressure (Afoakwah and Owusu, 2011; Mahajan *et al.*, 2009). Thus, according to a study performed in Finnish population, Hu *et al.* (2004) showed that the risk of CVD associated with obesity was partly mediated through other risk factors, such as blood pressure, blood lipid and diabetes, in women particularly and that all obesity indicators predicted the risk of CVD in men, but in women only BMI had an independent association after adjustment for the obesity-related risk factors. However, Ulasi *et al.* (2011) reported a negative correlation between anthropometric data and blood pressure in a market population in Nigeria.

Generally, according to the WHO, smoking and lipid consumption are increasing in our low- and middle-income populations because of aggressive campaigns publicities led by tobacco firms and the increasing of availability of unhealthy vegetable oils, fatty and red meat at low cost, making obesity to become one of the main burden problem to which developing countries will face in next decades (Yusuf *et al.*, 2001; Mackay and Mensah, 2004).

Limitation of the study: This study was performed among workers population of Lomé, the extension of these results to the whole of the Togolese worker's population must be relative because 60% of this population fringe is rural. The diagnosis of hypertension was based on a mean of three blood pressure measurements at one sitting and this may have affected the overall prevalence of hypertension in this study.

CONCLUSION

The prevalence of obesity was high among workers in Lomé and was correlated with female sex, age, low education level and high blood pressure. The fight against obesity in our context will have to pass by a better schooling of the female population and the sensitizing on the diet, whose focal

point will have to be a reinforcement of the national program of fight against obesity and cardiovascular diseases.

REFERENCES

Adams, K.F., A. Schatzkin , T.B. Harris, V. Kipnis and T. Mouw *et al.*, 2006. Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. N. Engl. J. Med., 355: 763-778.

Afoakwah, A.N. and W.B. Owusu, 2011. The relationship between dietary intake, body composition and blood pressure in male adult miners in Ghana. Asian J. Clin. Nutr., 3: 1-13.

Badaruddoza, K. Gill and P.K. Sandhu, 2011. Factor analysis of anthropometric, physiometric and metabolic risk traits associated with cardiovascular diseases in North Indian Punjabi adults. J. Applied Sci., 11: 2843-2848.

Batty, G.D., M.J. Shipley, R.J. Jarrett, E. Breeze, M.G. Marmot and G.D. Smith, 2005. Obesity and overweight in relation to organ-specific cancer mortality in London (UK): Findings from the original Whitehall study. Int. J. Obes., 29: 1267-1274.

Calle, E.E., C. Rodriquez, K. Walker-Thurmond and M.J. Thun, 2003. Overweight, obesity and mortality from cancer in a prospectively studied cohort of U.S. adult. N. Engl. J. Med., 348: 1625-1638.

Chobanian, A.V., G.L. Bakris, H.R. Black, W.C. Cushman and L.A. Green *et al.*, 2003. The seventh report of the joint national committee on prevention, detection, evaluation and treatment of high blood pressure: The JNC 7 report. J. Am. Med. Assoc., 289: 2560-2572.

Eisenmann, J.C., P.T. Katzmarzyk, L. Perusse, A. Tremblay, J.P. Despres and C. Bouchard, 2005. Aerobic fitness, body mass index and CVD risk factors among adolescents: The Quebec family study. Int. J. Obes., 29: 1077-1083.

Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults, 2001. Executive summary of the 3rd report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation and treatment of high blood cholesterol in adults (Adult Treatment Panel III). J. Am. Med. Assoc., 285: 2486-2497.

Flegal, K.M., M.D. Carroll, C.L. Ogden and L.R. Curtin, 2010. Prevalence and trends in obesity among US adults, 1999-2008. JAMA, 303: 235-241.

Ford, E.S., W.H. Giles and W.H. Dietz, 2002. Prevalence of the metabolic syndrome among US adults: Findings from the 3rd national health and nutrition examination survey. J. Am. Med. Assoc., 287: 356-359.

Gaziano, T.A. and J.M. Gaziano, 2011. Global Burden of Cardiovascular Disease-epidemiologic Transitions. In: Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine, Bonow, R.O., D.L. Mann, D.P. Zipes and P. Libby (Eds.). 9th Edn., Elsevier Saunders, Boston, pp: 1-5.

Gonzalez-Suarez, C., K. Grimmer-Somers and A. Worley, 2009. Is food intake associated with pre-adolescent obesity? An observational study in Metro Manila, Philippines. Asian J. Clin. Nutr., 1: 107-119.

Haslam, D.W. and W.P.T. James, 2005. Obesity. Lancet, 366: 1197-1209.

Hu, G., J. Tuomilehto, K. Silventoinen, N. Barengo and P. Jousilahti, 2004. Joint effects of physical activity, body mass index, waist circumference and waist-to-hip ratio with the risk of cardiovascular disease among middle-aged finnish men and women. Eur. Heart J., 25: 2212-2219.

Kopelman, P.G., 2000. Obesity as a medical problem. Nature, 404: 635-643.

Krause, R.M., M. Winston, B.J. Fletcher and S.M. Grundy, 1998. Obesity: Impact on cardiovascular disease. Circulation, 98: 1472-1476.

Lopez-Jimenez, F., J.S. Johnson, V.K. Somers and G.T. Gau, 2006. Dyslipidemia and ClasSsical Factors for Atherosclerosis-Obesity. In: Mayo Clinic Cardiology-Concise Textbook, Murphy, J.G. and M.A. Lloyd (Eds.). Mayo Clinic Scientific Press, Rochester, ISBN: 0-8493-9057-5, pp: 714-724.

Maaten, S., G. Kephart, S. Kirkland and P. Andreou, 2008. Chronic disease risk factors associated with health service use in the elderly. BMC Health Services Res. Vol. 8, 10.1186/1472-6963-8-237

Mackay, J. and G.A. Mensah, 2004. The Atlas of Heart Disease and Stroke. WHO, Geneva.

Mahajan, D.C., S.S. Birari, G.S. Khairnar, Y.P. Patil, V.J. Kadam and Y.M. Joshi, 2009. Prevalence of non-communicable diseases risk factors in two groups of urban populations. Asian J. Epidemiol., 2: 1-8.

Mancia, G., G. De Backer, A. Dominiczak, R. Cifkova, R. Fagard and G. Germano *et al.*, 2007. Guidelines for the management of arterial hypertension: The task force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). J. Hypertens, 25: 1105-1187.

Mathew, A.C., S. Shaijin, R. David, S. Ramalingam, K. Srikanth and M. Yunsheng, 2009. Association between obesity and asthma among adults: A hospital based case-control study. Asian J. Epidemiol., 2: 33-43.

McGee, D.L., 2005. Body mass index and mortality: A meta-analysis based on person-level data from twenty-six observational studies. Ann. Epidemiol., 15: 87-97.

Poirier, P., T.D. Giles, G.A. Bray, Y. Hong, J.S. Stern, F.X. Pi-Sunyer and R.H. Eckel, 2006. Obesity and cardiovascular disease: Pathophysiology, evaluation, and effect of weight loss. Arterioscler Thromb. Vasc. Biol., 26: 968-976.

Shayo, G.A. and F.M. Mugusi, 2011. Prevalence of obesity and associated risk factors among adults in Kinondoni municipal district, Dar Es Salaam Tanzania. BMC Public Health, 11: 365-365.

Shen, J., A. Goyal and L. Sperling, 2012. The emerging epidemic of obesity, diabetes, and the metabolic syndrome in China. Cardiol. Res. Pract., Vol. 2012.

Sniehotta, F.F., S.U. Dombrowski, A. Avenell, M. Johnston and S. McDonald *et al.*, 2011. Randomised controlled feasibility trial of an evidence-informed behavioural intervention for obese adults with additional risk factors. PLoS One, 6: e23040-e23040.

Spiegel, A.M. and B.M. Alving, 2005. Executive summary of the strategic plan for National Institutes of Health Obesity Research. Am. J. Clin. Nutr., 82: 2115-2145.

Suleiman, A.A., O.K. Alboqai, N. Yasein, J.M. El-Qudah, M.F. Bataineh and B.A. Obeidat, 2009. Prevalence of and factors associated with overweight and obesity among Jordan University Students. J. Biol. Sci., 9: 738-745.

Ulasi, I.I., C.K. Ijoma, B.J.C. Onwubere, E. Arodiwe, O. Onodugo and C. Okafor, 2011. High prevalence and low awareness of Hypertension in a market population in Enugu, Nigeria. Int. J. Hypertension., (In Press).

Veghari, G.R. and M.J. Golalipour, 2007. The comparison of nutritional status between Turkman and non-turkman ethnic groups in North of Iran. J. Applied Sci., 7: 2635-2640.

WHO, 2000. Obesity: Preventing and managing the global epidemic. Report of a WHO Consultation. WHO. Tech. Rep. Ser., 894: 1-253.

WHO, 2008. Controlling the global obesity epidemic. World Health Organization.

WHO, 2011. Preventing and Managing the Global epidemic. Report of WHO consultation on Obesity, World Health Organization, Geneva, http://whqlibdoc.who.int/hq/1998/WHO_NUT_NCD_98.1_ (p1-158).pdf

Wang, Y., J. Mi, X.Y. Shan, Q.J. Wang and K.Y. Ge, 2006. Is China facing an obesity epidemic and the consequences? The trends in obesity and chronic disease in China. Int. J. Obes., 31: 177-188.

Yusuf, S., S. Reddy, S. Ounpuu and S. Anand, 2001. Global burden of cardiovascular diseases, part II: Variations in cardiovascular disease by specific ethnic groups and geographic regions and prevention strategies. Circulation, 104: 2855-2864.