International Scholars Journals

African Journal of Nursing and Midwifery ISSN 2756-3332 Vol. 10 (2), pp. 001-007, February, 2022. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

The effect of body weight on the incidence and prevalence of hypertension in Yaoundé

Azantsa Kingue Gabin Boris, Yangoua Mafo Cecile Huguette, Ngondi Judith Laure* and Julius Enyong Oben

Laboratory of Nutrition and Nutritional Biochemistry, Department of Biochemistry, University of Yaoundé I, Cameroon.

Accepted 21 January, 2022

The prevalence of obesity and its related complications are on the increase in the industrialized as well as developing nations. This study assesses prevalence of hypertension, the influence of body weight on blood pressure variation and the relationship between obesity and hypertension in Yaoundé. A descriptive, cross- sectional study was conducted in 5 757 participants (61.6% females; mean age 33.7 ± 10.3 years old and 38.4% males; mean age 33.0 ± 11.5 years old) participated in health campaign program. Weight classification was done according to WHO criteria as 18.5 >BMI 24.9 (normal); 25 BMI 29.9 (overweight) and BMI 30 (obese). High blood pressure was recorded following both the National Cholesterol Education Program (ATP III) and World Health Organization criteria. Out of the 5757 participants, 34.5% were normal weight, 31.7% were overweight and 33.8% were obese individuals. Using the NCEP and WHO criteria respectively, diastolic high blood pressure was observed in 43% and 32.8% of participants. A positive correlation was found between BMI and both diastolic and systolic blood pressure. This study showed that there was a strong association of BMI with blood pressure and a high prevalence of diastolic hypertension among obese participants. The present result underpins the need for a consistent national emphasis on prevention and control of hypertension and obesity in younger adults.

Key words: Hypertension, body mass index, blood pressure.

INTRODUCTION

Hypertension in Africa is a widespread problem of immense economic importance because of its high prevalence in urban areas, its frequent underdiagnosis, and the severity of its complications (Opie and Yackoob, 2005). It is becoming a public health emergency worldwide, especially in developing countries, where studies have projected an increase by 80% in the number of hypertensive by the year 2025. In Africa, more than 30 million people have hypertension. World health Organisation (WHO) predicts that, if nothing is done about it, by 2020 three quarters of all deaths in Africa will be attributable to hypertension (Kearney et al., 2005). In Cameroon, surveys on hypertension reported a prevalence varying from 12 to 22% in those above 25 years in 1998 and an estimated prevalence of 24% in 2003 (Mbanya et al., 1998). Several epidemiological studies have shown that, blood pressure (BP) is strongly related to body weight and that control of obesity is a critical component of prevention and control of hypertension (Kummayinka, 1997).

Treatment of hypertension is known to reduce the risk of occurrence of cardiovascular events. Therefore, the early detection, treatment and control of hypertension are the key components of the integrated management of cardiovascular risk. Unfortunately, studies conducted showed that awareness, detection and control of hypertension are generally poor in sub-Saharan Africa and particularly rare in Cameroon.

The objective of this study was to provide detailed information on the distribution of blood pressure and to determine the prevalence of hypertension in relation to levels of BMI for representative samples in Yaoundé.

METHOD

The study was a descriptive, cross-sectional and took place from

*Corresponding author: E-mail: Juliusoben@hotmail.com. Tel: (237) 77 67 13 75.

January 2005 to May 2008. Cameroonian male and female of African origin aged 18 - 80 years Participated. They were from two urban areas of Yaoundé, the capital of the Republic of Cameroon. Participants attended the Laboratory of Nutrition and Nutritional Biochemistry during health campaign programs. A total of 6 483 individuals took part in the study with an eligible population of 6 399 - 2 649 males and 3 750 females. All 6 399 eligible individuals participated in the study and 5 757 (89.9%) consented. Participants with inadequate personal data were eliminated from the study.

Participants were made of mostly middle grade civil servants, students and middle income earners from the private and public sector. The principal eligibility criteria for study participation included age between 18 - 80 years and no evidence of pregnancy. Participants gave a written informed consent prior to participation. After filling a questionnaire related to their lifestyle (cigarette, alcohol, fruit and vegetable consumption, practice of physical activity), The following parameters: age, gender, weight, height, blood pressure, body fat using bioelectrical impedance (Nayeli et al., 2007), waist and hip circumferences were recorded. Body Mass Index (BMI) was derived from weight and height measurements and waist to hip ratio (WHR) from waist and hip measurements. Height was measured to the nearest 0.5 cm, weight to the nearest 0.5 kg, waist and hip circumferences to the nearest 0.5 cm, with participants dressed in light clothing and the body mass index (BMI) was calculated (weight/height^2, kg/m^2) (Keys et al., 1972). Participants were classified as obese if they had a body mass index (BMI) 30 kg/m^2, overweight for a 25 BMI 29.9 kg/m^2 and normal weight for 19 BMI 24.9 (WHO, 1999).

Measurements of BP was done using Blood Pressure Monitor (BDM-1) based on oscillometric measurement method with Fuzzy-logic technique. Blood pressure records were made three times on the upper left arm. The first measurement was taken after a 5 min rest in a sitting position and was followed by two subsequent measurements in the middle and at the end of the interview. The average of the three measurements was used to assess the presence or absence of hypertension/ high blood pressure according to two criteria SBP 140 mm Hg and/ or 90 mmHg as referred to WHO and SBP 130 mmHg and/or a DBP 85 mmHg as referred to National Cholesterol Program (Adult Treatment Panel III) (NCEP, 2001).

Statistical analysis

Data analysis was performed using the statistical package for social sciences (SPSS) for windows version 10.1. Main analysis included descriptive statistics. However relationships between variables were explored using cross tabulations and correlation of Pearson. Incidence of hypertension was expressed as the proportion of hypertensive in all study participants. Comparison of prevalence and means among groups were done using chi square and ANOVA tests respectively. Results were expressed as mean ± standard deviation (SD) under 95% confidence intervals.

Ethical approval

This study was approved by the Faculty of Medicine and Biomedical Sciences' ethical board of the University of Yaoundé I, Cameroon.

RESULTS

Of the 5,757 participants included in this study, aged 18 - 80 years, and BMI 18 -62.50 Kg/m^2; 3,347 individuals (61.6%) were females and 2,210 males (38.4%); with SBP range between 97 - 271 mmHg and DBP 78 - 228 mmHg. When comparing anthropometric measurements; there was no significant difference ($p > 0.05$) between males and females mean age (33.78 ± 10.39) years and (33.05 ± 11.53) years respectively. Also SBP (125.45 ± 18.51) mm Hg and (123.90 ± 19.19) mm Hg; DBP (83.69 ± 15.16) mm Hg and (83.77 ± 15.69) mm Hg. Heart rate (HR) (74.12 ± 14.38) beats/min and (74.19 ± 12.67) beats/min; WHR (0.83 ± 0.09) and (0.84 ± 0.35) showed no significant differences in males compared to females respectively. However, males and females were significantly different ($p < 0.05$) for parameters like BMI (28.38 ± 6.07) and (27.48 ± 6.44) Kg/m^2 and body fat 31% and 34.44% respectively.

Distribution of blood pressure according to WHO criteria

In the studied population, 14.9% of participants were systolic hypertensive compared to 32.8% of diastolic hypertensive. Females had a higher prevalence of diastolic hypertension (20.4%) compared to males (12.4%). Proportion of diastolic hypertensive among females was about 3.3 times higher than systolic hypertensive among males as shown in Figure 1.

Distribution of BMI

Distribution of BMI varied with sex, race/ethnicity, and age. It was observed as shown in Table 1 that in the population 33.8% participants were obese. The prevalence of obesity was almost 2 times higher in females (23.7%) compared to males (10.1%) and was more common among participants aged 25 - 39 years old. Among females, the proportion of participants increased progressively with increasing BMI, from 29.3% at a BMI 25 to 38.4% at a BMI 30 while among males; it was progressively decreasing from 42.7% to 26.5%.

Among females aged 25 - 39 years, the proportion of participants was higher at the highest (BMI 30) compared to the lowest BMI category (<25). While among males of the same age; it was the contrary (decrease of 1.3 times). However, among females aged 40 - 54 years, the proportion of participants was 3 times higher at the highest (30) BMI compared to the lowest BMI category (< 25). Among older males (> 55 years old), there was a gradual increase in proportion of participants (about 2.5 times) with BMI < 25 compared to those with BMI >30. The smallest proportion of participants was observed among older. Greater proportions of females compared to males were observed in different BMI categories at almost similar proportions. The proportion of males and females in all BMI categories (<25 and 30) decreased with increasing age from 40 - 54 years to older (> 55 years old).

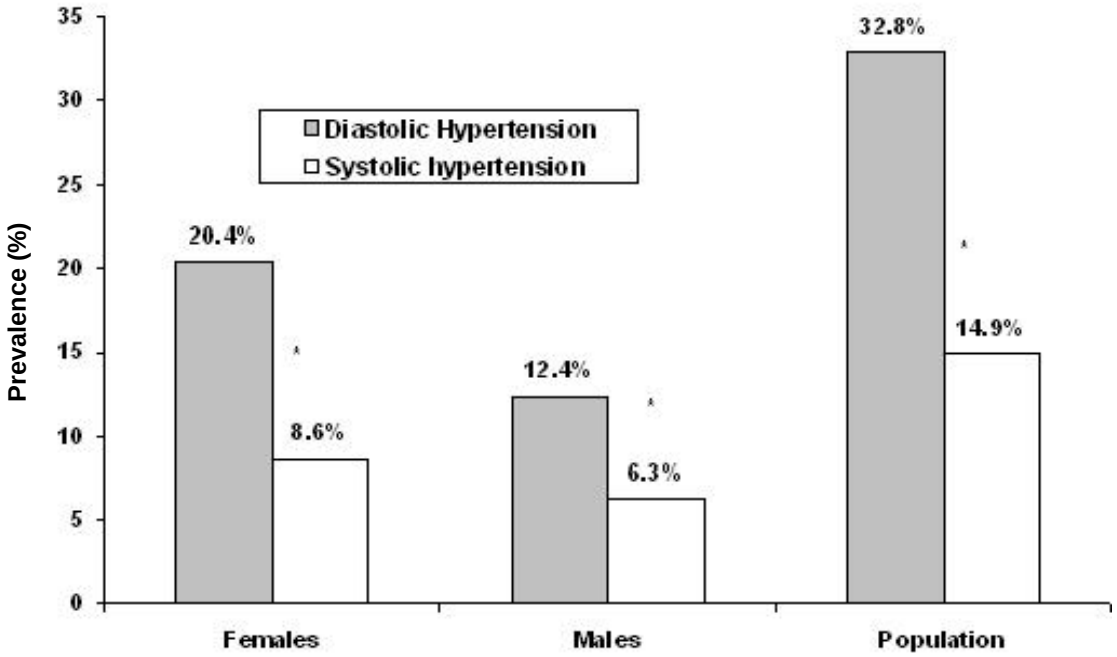

Figure 1. Prevalence of hypertension.
*p<0.01 sex adjusted prevalence of diastolic (n =1175 females, n = 363 males) and systolic hypertension (n = 479 females, n = 714 males).

Table 1. Distribution of BMI in the study population.

	Normal weight	Overweight	Obese	Total
	N (%)	N (%)	N (%)	N (%)
Female	1,038 (29.3)	1,146 (32.3)	1,362 (38.4)	3,546 (100)
10-24	414 (11.7)	192 (5.4)	111 (3.1)	1,195 (20.2)
25-39	408 (11.5)	642 (18.1)	690 (19.5)	1,740 (49.1)
40-54	174 (4.9)	297 (8.4)	513 (14.5)	328 (27.7)
> 55	42 (1.2)	15 (0.4)	48 (1.3)	93 (2.3)
Males	945 (42.7)	681 (30.8)	585 (26.5)	2,211 (100)
10-24	354 (16.0)	117 (5.3)	66 (3.0)	537 (24.3)
25-39	399 (18.0)	351 (15.9)	291 (13.2)	1,041 (47.1)
40-54	132 (6.0)	174 (7.9)	207 (9.4)	513 (23.2)
> 55	60 (2.7)	39 (1.8)	21 (0.9)	108 (0.5)
Total	1983 (34.5)	1827 (31.7)	1,947 (33.8)	5,757 (100)

N stands for sample size. This table represents an age and sex adjusted prevalence in different body mass index categories

Influence of body weight on the diastolic and systolic BP

BMI positively correlated with both systolic BP ($r = 0.685$ $p < 0.01$) and diastolic ($r = 0.825$, $p < 0.01$) and varied slightly when controlled for age and sex. Mean systolic and diastolic BP increased with increasing BMI in males and females (Table 2). An increase of systolic and diastolic blood pressure was also observed in overweight and obese males over 55 years old. In obese patients, the increase of systolic BP and Diastolic BP was observed in each of the age groups from younger to older while in normal weight and overweight patients, it was the contrary. The expected higher BP at older ages were seen within each BMI category for SBP and DBP at age over 55 years and in both sexes. SBP increases (> 130 mmHg) with overweight females aged > 55 years (144.4 ± 40.8 mmHg) and in obese females of over 55 years old. SBP was 6 mm Hg higher for males (122.6 compared to 128.8 mm Hg) and 8 mm Hg higher for females (120

Table 2. Relation between body weight and systolic / diastolic blood pressure.

	Systolic blood pressure								Diastolic blood pressure							
	Normal weight		Overweight		Obese		Total		Normal weight		Overweight		Obese		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Females	120.0	19.2	122.8	17.2	128.1	19.9	123.9	19.1	77.9	13.4	82.7	13.6	89.4	17.1	83.7	15.6
10-24	119.3	22.4	122	18.1	123.5	14.5	120.7	20.3	76.2	13.2	81.4	11.5	87.8	12.7	79.4	13.3
25 -39	119.2	18.0	120.0	15.2	124.5	18.9	121.6	17.5	78.2	13.2	81.3	12.1	88.2	18.4	83.3	15.7
40-54	118.1	15.1	127.1	17.2	132	19.3	128.0	18.6	78.4	13.4	86.4	15.4	90.43	14.5	87.0	15.2
> 55	126.7	13.8	144.4	40.8	143,1	33.8	140.0	17.1	78.7	14.7	84.2	31.0	100.0	25.5	13.5	17.3
Males	122.6	16.7	125.5	19.2	128.8	19.2	125.4	18.5	82.2	13.6	83.8	16.9	85.3	14.7	83.6	15.1
10-24	121.49	15.2	119.8	18.3	121.2	10.4	121.1	15.3	80.3	12.6	81.3	20.4	78.1	12.8	80.2	14.7
25 -39	120.8	16.1	122.2	13.3	124.3	14.3	122.3	14.7	83.9	12.8	83.0	13.1	82.3	12.9	83.2	12.9
40-54	126.9	20.1	131.2	23.0	134.0	18.0	131.2	20.4	80.7	17.0	86.6	17.7	91.4	14.5	87.0	16.8
> 55	131,3	25,1	140.7	22.4	164.2	39.5	137.2	29.9	86,6	18.0	85.6	12.6	99.1	19.3	89.3	17.9
Total	121.2	18.1	123.9	18.1	128.3	19.6	124.5	18.9	79.9	13.6	83.2	15.1	87.9	16.4	83.7	15.4

N: stands for sample size. This table represents mean (mm Hg) and standard deviation (SD) of systolic and diastolic blood pressure in different body mass index categories.

compared to 128.1 mm Hg) in the highest BMI category (30) compared with the lowest BMI category (< 25).DBP increases in overweight females aged 40 - 55 years old (86.4 ± 15.4 mmHg). The difference in DBP between the highest BMI category and the lowest was 3 mm Hg for males and 11.5 mm Hg for females.

Prevalence of hypertension and mean high blood pressure by BMI category

The prevalence varied remarkably according to sex and age group. Among females, the prevalence of hypertension increased progressively with increasing BMI, from 3.91% at a BMI < 25 to 10.84% at a BMI 30 while in males, it was progressively decreasing from 5.11% to 3.77%. Proportions of hypertensive females increase with increasing body weight from 43.35, 61.70 and 74.20% respectively in normal weight, overweight and obese patients while in hypertensive males, those proportions decrease 56.65, 38.30, 25.80 respectively in normal weight, overweight, obese patients. Proportions of hypertensive males was lower in obese and overweight while in normal weight, it was the contrary with 56.65% compared to 43.35% in hypertensive females. Proportions of hypertensive females aged 10 - 24 years old decrease from BMI < 25 (15.03%) to BMI 30 (4.64%) but increase in age range 25 - 54 years old. In hypertensive males of each age group, proportions of hypertensive patients decrease from BMI < 25 to BMI 30. Among females aged 25 to 39 years, the prevalence of hypertension was 3 times higher at the highest BMI 30 compared to the lowest (<25) BMI category. In males of the same age range; it was the contrary. However, among females aged 40 - 55 years old, the prevalence was 5 times higher at the highest BMI (>30) compared to the lowest (<25) BMI category (Table 3). Among elder males > 55, there was a slight decrease in prevalence (about 3 times) in BMI category (< 25) compared to BMI >30. In overweight participants, it doubled among females aged 25 - 39 years old compared to those of 10 - 24 years old; while it was three times higher in males of the same age ranges. In obese females compared to normal weight, prevalence of hypertension was three times higher in participants aged 25 - 39; about five times among participants with age 40 - 54 and four times among participants over 55 years old. In obese females compared to males, the prevalence of hypertension was three times higher among participants aged 25 - 39 and two times among those of 40 - 54 years old. Prevalence of hypertension decreases with age among normal weight participants, and according to BMI categories, prevalence of hypertension was 9.01, 9.21, 14.61% in normal weight, overweight and obese participants respectively. Among obese participants, the highest proportion of obese hypertensive patients (36.7%) was found in age group 25 to 39 years old.

DISCUSSION

The number of participants in the present study reduces with increasing age because of the relative low life expectancy in Cameroon that is 53.6 years old. The prevalence of hypertension in the studied population was 32.8% compared to 14.9% with systolic hypertension (Figure 1). In fact, an increase in the stiffness of the aorta and large elastic arteries not accompanied by a rise in arteriolar resistance may lead to systolic hypertension. In contrast, a predominant rise in arteriolar resistance may lead to diastolic hypertension if arterial stiffness is normal or low. Thus, diastolic hypertension might be viewed as a

Table 3. Prevalence of hypertension.

	Normal		Overweight		Obese		Total	
	N	%	N	%	N	%	N	%
Females	**225**	**3.91**	**327**	**5.68**	**624**	**10.84**	**1176**	**20.4**
10-24	78	1.35	60	1.04	39	0.68	177	3.0
25 -39	93	1.62	129	2.24	306	5.32	528	9.2
40-54	45	0.78	131	2.28	246	4.27	422	7.4
55- 69	9	0.16	7	0.12	33	0.57	49	0.8
Males	**294**	**5.11**	**203**	**3.53**	**217**	**3.77**	**714**	**12.4**
10-24	93	1.62	32	0.56	9	0.16	134	2.3
25 -39	117	2.03	93	1.62	90	1.56	300	5.3
40-54	57	0.99	63	1.09	102	1.77	222	3.8
55-69	27	0.47	15	0.26	16	0.28	58	0.1
Total	519	9.02	530	9.21	841	14.61	1890	32.8

N: stands for sample size. The table represents an age and sex adjusted prevalence of diastolic high blood pressure in our study population within body mass index categories and according to world health organisation criteria.

marker of a good elasticity of aorta and large arteries, possibly because of a paucity of atherosclerotic lesions (Verdecchia and Angeli, 2005). Several studies have shown not only that systolic hypertension more so than any other hypertension subtype, increases the risk for stroke and coronary heart disease; but also that the control of systolic blood pressure was more important than the control of DBP in hypertensive men. They further stated that DBP was of little value in predicting future cardiovascular risk (Deedwania, 2002).Therefore, cohort studies are needed in order to evaluate the risk for stroke and coronary heart diseases in Cameroon. The present prevalence was higher when compared to the estimation made in the Cameroon Burden of Diabetes report in 2003 (Cameroon burden of Diabetes, 2004) and also higher when compared to 26% observed in Saudi Arabia. The excess of hypertension in females compared to males is in accordance with several previous studies (WHO, 2002; Koate et al., 1987).

Prevalence of obesity

As far as the prevalence of obesity is concerned, although there is a slight increase in proportion of obese people (Table 1), this result is in accordance with the report of Cameroon Burden of Diabetes project in 2003; with a prevalence of obesity in males 10.1% and 23.6% among females (Cameroon burden of diabetes, 2004).The present prevalence is also higher compared to the one obtained in Morocco in 2000 with an increase of obesity among females (19%) compared to males (7%) (WHO, 2002).

Influence of body weight on BP (Table 2)

Both systolic and diastolic BP increase among participants over 40 years old. This result is in accordance with Cappucio et al. (2004) findings. The expected higher BP at older ages observed within each BMI category for systolic and diastolic BP at age over 55 years and in both sexes is comparable with the one obtained in the American population and reflected the distribution of age and initial blood pressure in this study. Also, the significant and positive association of age with systolic and diastolic BP might be due to menopause in older women. In fact, menopause was accompanied by a steeper rise in systolic blood pressure with age while diastolic blood pressure was independent of age and was responsible of body weight increase (Brown et al., 2000).

Prevalence of hypertension in BMI categories

The prevalence of hypertension was 9.01%, 9.21%, 14.61% in normal weight, overweight and obese participants respectively. Obese female patients were highly exposed (10.84%) than males (3.77%) (Table 3). This result is in accordance with several other studies and confirms the positive relationship between body weight and blood pressure (steassen et al., 1997). This result can be explained by the association of adiposity at baseline and incidence of hypertension and dyslipidaemia shown in large prospective cohort studies and by the effect of weight loss on lowering BP and improving lipid values shown in some clinical trials (CDC, 1994). Furthermore, the positive correlation found between body mass index and both systolic and diastolic

BP confirm the NHANES data, which showed that the increase in BMI contributes to explaining more than 50% of the increase in hypertension prevalence in the United States (Hajjar and Kotchen, 2003).

The high prevalence of obesity in females compared to males reflected the body fat measured in the study population with a significant difference 35.4% compared to 31.9% respectively and can be justified by the positive correlation found between BMI and body fatness ($r = 0.74$; $p < 0.001$) in accordance with previous study (Bjorntorp, 1993). However, although WHR was calculated, focus was not made on distribution of body fat in this study, because as demonstrated in recent study, it appears that the cut-points used in WHR are not adapted to African populations (Fezeu et al., 2007). This result although different in proportion was in accordance with Fezeu et al. findings and can be explained apart from genetic and hormonal differences, by the high number of deliveries as well as the lower level of physical activity recorded in participants. The higher prevalence in Yaoundé finds an explanation in consumption of diets rich in lipids and in carbohydrates (Ngogang et al., 1998).

The increase of BP and/or of its prevalence among obese participants in Yaoundé is probably a consequence of a sedentary life style nowadays more common in younger adults. In fact, in recent years, a modest weight loss, defined as a weight loss of 5% to 10% of baseline weight which can be achieved by a decrease in energy intake and/or an increase in energy expenditure, has received increasing attention as a new treatment strategy for overweight and obese (Mertens and Van, 2000). Also, a non pharmacological treatment of hypertension can be described as a series of lifestyle changes such as low sodium intake, moderation of alcohol intake, cessation of smoking, and stress management (Holly, 2005). It is now widely accepted that arterial BP is influenced by diet and a diet balanced with fruits and vegetables which contain antioxidants are very important in health (Mertens et al., 2000). A control of modifiable risk factors such as body weight increase, abdominal fat distribution that contribute to the occurrence of hypertension in the population also help in prevention of metabolic syndrome (NCEP, 2001).

Conclusion

This study showed that diastolic hypertension was common among the population and, revealed the strong association of BMI with hypertension. It also showed high proportion of obese in the population among who many had hypertension. High blood pressure was also common among younger individuals of both sexes of 25 - 39 years old. Given that hypertension is the most important of the known risk factors of cardiovascular diseases and contributes very substantially to the high cardiovascular mortality and morbidity associated with obesity; and understanding therefore of the mechanisms of obesity-induced hypertension is important both for prevention and therapy in Yaoundé with a special care to be deserved to younger adults.

Disclosure

There is no conflict of interest between authors of the present article.

REFERENCES

Bjorntorp P (1993).Visceral obesity: a “civilization syndrome” Obes. Res. 1: 206 –222.

Brown CD, Millicent H, Karen AD, Frederick CR, Robert G, Obarzanek E (2000). Body mass index and the prevalence of hypertension and dyslipidemia. Obes Res. 8: 605– 619.

Cameroon Burden of Diabetes (2004). Baseline survey report-executive summary.

Centers for Disease Control and Prevention (1994). Daily dietary fat and total food-energy intakes: Third National Health and Nutrition Examination Survey, Phase 1, 1988–1991. MMWR Morb Mortal Wkly Rep. pp. 116-117.

Deedwania P (2002). The changing face of hypertension: is systolic blood pressure the final answer? Arch Intern Med. 162: 506-508.

Fezeu L, Balkau B, Kengne AP, Sobngwi E, Mbanya JC (2007). Metabolic syndrome in a sub-Saharan African setting: central obesity may be the key determinant. Atherosclerosis 193(1): 70–76.

Hajjar I, Kotchen TA (2003) Trends in prevalence, awareness, treatment, and control of hypertension in the United States 1988–2000. JAMA 290: 199–206.

Holly JL (2005). Hypertension, Insulin Resistance, Oxidative Stress: What Can I Do? Your Life Your Health-The Examiner.

Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J (2005). Global burden of hypertension: analysis of worldwide data. Lancet 365: 217-223.

Keys A, Fidanza F, Karvonen MJ, Kimura N, Taylor HL (1972). Indices of relative weight and obesity. J Chronic Dis. *25*: 329 –343.

Koate P, Sylla M, Diop G, Gueye M, Sarr M (1987). Arterial hypertension in Senegal. Epidemiology, clinical aspects and approaches to prevention. In: Amery A, Strasser T (eds), Control of hypertension in developing countries with special reference to Africa. Trop. Cardiol. 13(Suppl): 61-68.

Kummayinka SK (1997). The impact of obesity on hypertension management in African American. J. Health Care Poor Underserved *pp.* 352-355.

Mbanya JC, Minkoulou EM, Salaha JN, Balkaub B (1998). The prevalence of hypertension in rural and urban Cameroon. Int. J. Epidemiol. 27: 181-185.

Mertens IL, Van GF (2000). Overweight, obesity, and blood pressure: the effects of modest weight reduction. Obes Res. 8: 270–278.

Nayeli M, Heliodoro A, Julián E, Mauro EV (2007). Body fat measurement by bioelectrical impedance and air displacement plethysmography: a cross-validation study to design bioelectrical impedance equations in Mexican adults. Nutr. J. 6(18): 1- 7

Ngogang J, Raisonnier A, Manguele MA, Dikoum B, Tantchou J, Muna WF (1998). Obésité et métabolisme lipidique chez la femme camerounaise vivant en zone urbaine. Cardio Trop. 14: 17-26.

Opie LH, Yackoob KS (2005). Hypertension in Sub-Saharan African populations. Circulation 112: 3562-3568.

The third report of the National Cholesterol Education Program (NCEP) (2001). Expert Panel on Detection, Evaluation and Treatment of high blood cholesterol in adults (Adult Treatment Panel III) - Executive summary. JAMA. 285(19): 2486-2497.

Verdecchia P, Angeli F (2005). Natural History of Hypertension Subtypes. Circulation 111: 1094-1096.

WHO-EM/NCD/030/E/I (2002). Consultative meeting on integrated community-based programmes for cardiovascular diseases in the

eastern mediterranean region Isfahan, Islamic Republic of Iran pp. 5–8 January.
World Health Organization (1999). Obesity: preventing and managing the global epidemic: report of a WHO consultation. Technical Report Series no. 894. WHO: Geneva.