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ORIGINAL RESEARCH

Prevalence of hypertension and its risk factors in southwest Ethiopia: a hospital-based cross-sectional survey

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Background: Hypertension is a common medical condition worldwide. It is an important public health challenge because of the associated morbidity, mortality, and the cost to the society. The objective of this study was to determine the prevalence of hypertension and its risk factors among attendants of adult outpatient departments at Jimma University Specialized Hospital in southwest Ethiopia.

Materials and methods: A hospital-based cross-sectional study was conducted on 734 participants aged 15 years or older from May 2012 to June 2012. A pretested structured questionnaire consisting of characteristics related to sociodemographic profiles and risk factors for hypertension was used for data collection. Three separate measurements of blood pressure and relevant anthropometric evaluation were taken according to current recommended standards. Chi-square test and other statistical analyses were done to employ appropriate interpretations of the findings. *P*-values of <0.05 were considered statistically significant.

Results: The mean age of the participants was 42.3 ± 13.2 years and 71.7% of them were 35 years and older; 58% of them were females. Overall prevalence of hypertension – defined by systolic blood pressure ≥140 and/or diastolic blood pressure ≥90 or reporting history of hypertension – was found to be 13.2%. Only 35.1% of them were aware of their hypertension and only 23.7% were on treatment. The overall control rate was 15.5%. Family history of hypertension, having diabetes mellitus, being overweight, and oral contraceptive use were associated with high blood pressure.

Conclusion: Hypertension was found to be prevalent; morbidity, awareness, treatment, and control in those with hypertension were low. Hence, intervention measures should be undertaken at the community level; particular emphasis should be placed on prevention by introducing lifestyle modifications and creating awareness about the problem so that early detection and intervention is possible.

Keywords: hypertension, cardiovascular disease, Ethiopia, Jimma

Background

There is no sharp demarcation between normal blood pressure (BP) and hypertension. However, for clinical purposes, hypertension is defined as systolic BP (SBP) ≥140 mmHg or diastolic BP (DBP) ≥90 mmHg, any prior diagnosis of hypertension made by a health professional, and taking antihypertensive drugs.[1,2]

Hypertension is an important public health problem accounting for about 6% of deaths worldwide.[1] As much as 1 billion people have hypertension worldwide and 7.1 million deaths a year may be attributable to hypertension.[2] High BP is responsible for 62% of cerebrovascular disease and 49% of ischemic heart disease.[3] The prevalence of hypertension in general increases with advancing age, and it is higher in

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urban than rural areas due to differences in lifestyle.[4–7] In the Framingham Heart Study,[5] the age-adjusted prevalence of hypertension was 18.5% in males and 28% in females.

Hypertension is asymptomatic and is usually diagnosed incidentally or after major organ damage has occurred.[3] Independent risk factors for hypertension are obesity, high dietary salt intake, low dietary intake of calcium and potassium, alcohol consumption, psychosocial stress, low levels of physical activity, and family history of hypertension.[1,2,8,9]

Hypertension was thought to be rare in Africa, but it is now recognized as one of the most important cerebrovascular diseases contributing for about 40% of these diseases on the continent.[7,10–14] Its prevalence in urban areas is practically as high as that in the developed world, ranging from 5% to 20% overall.[8] Despite their growing importance in sub-Saharan Africa (SSA), hypertension and other cardiovascular diseases were not given due attention. An increasing burden of hypertension in this region will thus result in grave consequences, as only very few people get treatment, and control is likely to be low.[6,7]

The epidemiology of hypertension in Ethiopia is not well studied. Some community-based surveys have shown that the prevalence of hypertension in the country varies from 1.8% in the rural community[15] to 30% in urban areas of Addis Ababa and Gondar.[16–18] Being obese or overweight, as well as physical inactivity, were strong predictors of hypertension in urban dwellers in Ethiopia.[16]

The main aim of this study was to assess the prevalence of hypertension and its risk factors among adults visiting outpatient units of Jimma University Specialized Hospital (JUSH) for various reasons. It will provide further information regarding the burden of hypertension and its risk factors to plan further interventions.

Materials and methods

Settings

The study was conducted at JUSH, the only referral hospital in southwestern Ethiopia, with a catchment population of over 15 million. It is located in the town of Jimma, which is 356 km southwest of the capital, Addis Ababa. It is a general hospital with over 500 outpatient visits daily and 523 inpatient beds. Patients older than 14 years of age are treated at the adult wing of the hospital.

Study design and period

A cross-sectional study was conducted between May 2012 and June 2012 to determine the prevalence of hypertension and its risk factors among adults visiting outpatient units of the hospital for various ailments.

Selection of participants

All individuals aged 15 years or older attending the outpatient department for various reasons during the study period were recruited consecutively based on their willingness and eligibility to participate in the study.

Exclusion criteria

All patients with severe illnesses, acute life-threatening conditions, and severe injury, including patients with head injuries, were excluded from the study.

Data collection

A structured questionnaire that included variables on sociodemographic characteristics, risk factors for hypertension, and physical examination findings such as body weight, height, hip and waist circumferences, and three BP records was used for data collection.

Consideration and procedures

BP was measured using a mercury sphygmomanometer (adult size) and stethoscope. A patients' BP was taken while the patient was in a sitting position, from the right arm after the patient rested for at least 5 minutes before measurement. Three measurements of BP on a single visit were taken at least 3 minutes apart, and the averages of the three records were used for the computation of results. The point at which the first Korotkoff sound was heard was taken as SBP, and the DBP was taken to be the point at which the sound disappeared.[8]

Weight and height were measured with participants standing without shoes and wearing light clothing. Weight was measured using a digital weighing scale. The scale was calibrated to the zero level before each measurement, and was tested for repeatability of the measures. Height was measured by using a stadiometer while the patient was in an upright position.

Waist and hip circumferences were measured by using a flexible tape meter at both the level just above the iliac crest and at the maximum circumference of the hip, respectively.

Data analysis and presentation

The data were cleaned, edited, and entered into a computer to be analyzed using SPSS, Windows version 16.0 (IBM Corporation, Armonk, NY, USA). A chi-square test was used to analyze the associations between different variables,

and other descriptive statistics were used where necessary. Multivariate and logistic regression analyses were done to see the association between dependent and independent variables. *P*-values of <0.05 were considered statistically significant.

Data quality control

Data collectors were trained for 1 day before the survey to ensure consistency and to reduce intra- and interobserver variations. Close supervision was done by the principal investigators throughout the data collection. Collected data were checked for completeness and consistency.

Ethical consideration

Ethical approval was obtained from the Jimma University Ethics Review Board. Written informed consent was obtained from participants after a comprehensive explanation of the purpose and procedure of the study in local languages. For participants younger than 18 years of age (and ≥15 years of age), verbal agreement from the participants and written consent from attendants were obtained. The data collected from the participants will remain anonymous for an indefinite period of time. Patients incidentally found with life-threatening conditions during the survey were referred to the emergency unit, and those with newly detected hypertension were advised to start follow-up treatment at the hospital or nearby health facility.

Operational definition

BP measurements of ≥140 mmHg for SBP and/or ≥90 mmHg for DBP were considered as elevated BP. Hypertension was defined as presence of persistently elevated BP or a history of treatment with antihypertensive agents.

Positive smoking history was based on patients' history of using manufactured or locally-made tobacco. Similarly, alcohol use was to refer to the consumption of local or manufactured alcohol beverages on a daily basis. Individuals who reported khat (*Catha edulis* leaves) use for 5 days or more in a week were considered to be regular khat chewers, and this was considered to be clinically significant.

Body mass index (BMI) ≥ 25 but <30 kg/m^2 was considered as overweight, and those above that range were considered obese. Abdominal obesity was defined as a waist-to-hip ratio (WHR) > 0.85 for women and >1 for men.

Results

Background characteristics

A total of 734 participants attending adult Out-Patients Department of JUSH were included in the study; 58% (n = 426) of them were women. The age range was 15 years to 81 years, with a mean age of 42.3 ± 13.25 years. Nearly three-fourths (71.7%) of the participants were 35 years or older. One-third of them (32.3%) were farmers and 43.5% were illiterate (Table 1).

Prevalence, awareness, treatment, and control of hypertension

The overall prevalence of hypertension was defined as a systolic BP of ≥140 mmHg and/or a diastolic BP of ≥90 mmHg; the percentage of those reporting a previous history of hypertension was found to be 13.2% (11.7% in females and 15.3% in males, but there was no significant difference; $P = 0.164$). Most of the participants (84.5%) had high BP at the time of the study (≥140/90 mmHg); the rest were known hypertensive patients who had normal measurements at the time of this survey.

Table 1 Background characteristics of the adults visiting the Jimma University Hospital outpatient units, southwest Ethiopia, 2012

	Number	%
Age group in years		
<35	208	28.3
35–55	423	57.6
>55	103	14
Gender		
Male	308	42.0
Female	426	58.0
Marital status		
Single	147	20.0
Married	537	73.2
Divorced	8	1.1
Widowed	42	5.7
Educational status		
Illiterate	319	43.5
Read and write	21	2.9
Primary school	41	5.6
High school	136	18.4
Tertiary school	217	29.6
Occupational status		
Farmer	237	32.3
Merchant	36	4.9
Government employee	173	23.05
Housewife	251	34.19
Others	37	5.04
Risk factors of hypertension		
Family history of hypertension	24	3.3
Diabetes mellitus	16	2.2
Khat use	539	73.4
Oral contraceptive use	5	0.7
Coffee consumption	513	69.9
Smoking	99	13.5

Only 19 of the 82 participants with high BP during this study (23.2%) knew that they had hypertension. Among the 34 individuals who had a previous diagnosis of hypertension, only 23 (67.6%) were being followed-up regularly and receiving drug treatment. However, only 15 (44.1%) of previously known hypertensive patients had their BP controlled at the time of study. Putting these all together, the overall self-awareness of hypertension was 35.1%, and the rates of hypertension treatment and hypertension control were 23.7% and 15.5%, respectively (Table 3).

Risk factors of hypertension

Age

An increasing prevalence of hypertension with age has been detected in this study. The mean age of those with hypertension was 45.8 ± 10.2 years, as compared to 41.8 ± 13.5 years for those with normal BP ($P < 0.001$). When categorizing by age, it was found that only 3.8% of adults younger than 35 years old were hypertensive. The prevalence rate of hypertension in those between the ages of 35 years to 55 years of age was 16.3%, whereas 19.4% of adults older than 55 had hypertension ($P < 0.001$).

Family history of hypertension

Family history of hypertension was reported in 24 (3.3%) of the participants, and in 19.6% of those with hypertension. It was found to be a strong risk factor of hypertension (odds ratio [OR]: 30.79; 95% confidence interval [CI]: 11.18–84.78) (Table 2).

Diabetes mellitus

Sixteen (2.2%) participants had been diagnosed with diabetes mellitus. The prevalence rate of hypertension in this group was found to be high (37.5% in diabetic individuals versus 12.7% in nondiabetic individuals) (OR: 4.13; 95% CI: 1.47–11.65) (Table 2).

Behavioral risk factors

Certain behavioral risk factors for hypertension were assessed in the study. Over 73% (88.3% of men and 62.7% of women) of the participants reported khat use. However, its association with hypertension was only marginal with an OR of 0.627 (95% CI: 0.4–1.0).

About 13.5% (99) of the participants reported having a history of cigarette smoking. Smoking prevalence was 31.5% in men and 0.5% in women. However, there was no significant association between smoking and hypertension ($P = 0.052$).

Table 2 Risk factors of hypertension among adults visiting the outpatient units of Jimma University Hospital, southwest Ethiopia, 2012

	Hypertension		OR (95% CI)	*P*-value
	Yes	No		
Gender				
Male	47 (15.3)	261 (84.7)	1.354 (0.882; 2.078)	0.164
Female	50 (11.7)	376 (88.3)		
Family history of hypertension				
Yes	19 (79.2)	5 (20.8)	30.79 (11.18; 84.78)	<0.001
No	78 (11.0)	632 (89.0)		
Diabetes mellitus				
Yes	6 (37.5)	10 (62.5)	4.13 (1.47; 11.65)	0.004
No	91 (12.7)	627 (87.3)		
BMI (kg/m^2)				
≥25	66 (34.0)	128 (66.0)	8.47 (5.30; 13.53)	<0.001
<25	31 (5.7)	509 (94.3)		
Drinking coffee				
Yes	56 (10.9)	457 (89.1)	0.538 (0.35; 0.83)	0.005
No	41 (18.6)	180 (81.4)		
Khat use				
Yes	63 (11.7)	476 (88.3)	0.627 (0.40; 0.99)	0.042
No	34 (17.4)	161 (82.6)		
OCP use				
Yes	4 (80.0)	1 (20.0)	32.61 (5.57; 298.02)	<0.001
No	46 (10.9)	375 (89.1)		
Smoking				
Yes	7 (7.1)	92 (92.9)	0.461 (0.21; 1.03)	0.052
No	90 (14.2)	545 (85.8)		

Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index; OCP, oral contraceptive.

The prevalence of coffee drinking was 69.9%. Hypertension was detected in only 10.8% of patients, as compared to 18.9% of those who never drank coffee (OR: 0.538; 95% CI: 0.35–0.83) (Table 2).

Oral contraceptive use

Only five women reported ever using oral contraceptives, and four of them (80%) were found to be hypertensive ($P < 0.001$).

Body mass index (BMI)

The mean BMI was 22.4 ± 2.4 kg/m^2 (range: 13.2 kg/m^2 to 41.3 kg/m^2). About two-thirds of the participants (65.9%) had a normal BMI, whereas 26.4% had a BMI ≥ 25 kg/m^2. Only one person had a BMI over 30 kg/m^2. BMI over 25 kg/m^2 was found to be a strong predictor of hypertension (OR: 8.47; 95% CI: 5.30–13.53) (Table 2).

Waist-to-hip ratio (WHR)

The mean WHR was 0.92 ± 0.11 (1.01 ± 0.12 in men and 0.86 ± 0.05 in women). Overall, 14.7% of participants had

a WHR exceeding 1, which was found in 33.1% of men as compared to 1.4% of women ($P < 0.001$). Applying separate definitions for abdominal obesity for women of WHR > 0.85, 61.6% of them fulfilled the criteria. The prevalence of hypertension in men having a WHR of >1 was 41.2% versus 2.4% with a WHR of ≤1 ($P < 0.001$). Similarly, 14.2% of women with a WHR > 0.85 had hypertension as compared to only 7.8% in those with a WHR of ≤0.85 ($P = 0.045$).

Discussion

This is a hospital-based cross-sectional study conducted in southwest Ethiopia. Hypertension was found to be prevalent. A large proportion of those with high BP did not know their hypertensive status before the study, and treatment and control rates in those with hypertension were very low. The findings from this study are helpful in strengthening the finding of previous studies conducted in the country,[16,18] and will help alert policymakers so they can plan timely interventions.

The overall prevalence of hypertension was 13.2%, which is significantly higher than that of previous reports in the country of 1.8% three decades ago.[15] However, the current finding is lower than those found in most recent community-based studies in Ethiopia (28.3% in Gondar city,[18] and 30% in Addis Ababa[16]). This could be due to the fact that both of these previous studies involved urban dwellers only. In this study, 57% of the participants were from rural areas and 76% of hypertensive individuals were urban residents. This coincides well with findings in most studies conducted in SSA, where the prevalence rate of hypertension was found to be higher in urban dwellers than in rural dwellers.[7] On the other hand, the two studies conducted in the country involved older individuals (≥25 years in Tesfaye et al[16] and ≥34 years in Awoke et al,[18] as compared to ≥15years in our study). This has also undoubtedly resulted in this huge difference in the prevalence of hypertension.

When compared to the prevalence rates of hypertension in other parts of the world, the prevalence rate in southwestern Ethiopia is much lower than that of 28.6% in the USA,[19] 44.2% in Europe,[20] and 44.8% in India.[21] This finding is also lower than the prevalence rate of 21.8% for Uganda,[22] and the estimated prevalence of 16.2% for SSA[23] (Table 3).

An increase in the prevalence of hypertension associated with age has been detected in this study, which is consistent with the global trend.[2,7,16,18] Women have lower prevalence rate of hypertension than men before menopause, but a higher prevalence thereafter.[24] However, the overall prevalence rate is comparable among both

Table 3 Comparison of the current findings with previous studies conducted in the country, and in sub-Saharan Africa, India, North America, and Europe

	Current study	Previous studies in Ethiopia		Uganda	India	USA	England
		Tesfaye et al[16]	Awoke et al[18]	Musinguzi et al[22]	Chaturvedi et al[21]	Yoon et al (NCHS)[19]	Falaschetti et al[25]
Study setting	Hospital-based, Jimma (Southwest Ethiopia)	Community-based, Addis Ababa	Community-based, Gondar (Northwest Ethiopia)	Community-based Buikwe and Mukano districts	Community based, Delhi	NHANES 2009–2010, All over USA	HSE, 2006, All over England
Participants	57% are from rural areas	Urban	Urban	Urban and rural	Urban	non-institutionalized	non-institutionalized
Age (years)	≥15	25–64	≥35	≥15	≥20	≥18	≥18
Number of participants	774	3,273	679	4,563	2,318	National health statistics data	7,478
Prevalence of hypertension (%)	13.2	30.3	28.3	21.8	44.8	28.6	30
Awareness of hypertension (%)	35.1	35.1	63.0	28.2	53.8	81.9	66
Treatment of all hypertension (%)	23.7	11.0	63.0	14.2	43.2	76.4	54
Aware and treated	67.6	31.3	100	51.6	80.3	Not stated	Not stated
Treated and controlled (%)	65.1	25.7	42.1	65.5	21.2	Not stated	52
Overall control rate (%)	15.5	2.8	26.7	9.3	9.1	53.3	24

Abbreviations: NCHS, National Center for Health Statistics; NHANES, National Health and Nutrition Examination Survey; HSE, Health Survey for England; USA, United States of America.

Table 4 Logistic regression analysis of the common risk factors for hypertension

Variables	Adjusted OR	95% CI for OR	*P*-value
Age	1.053	(1.02, 1.098)	0.001*
Family history of hypertension	23.885	(4.41, 29.36)	0.000*
Coffee consumption	0.504	(0.24, 1.07)	0.073
Khat use	0.496	(0.24, 1.03)	0.061
Diabetes mellitus	1.009	(0.11, 9.68)	0.994
Oral contraceptive use	50.758	(2.90, 89.96)	0.007*
Body mass index (kg/m^2)	1.509	(1.30, 1.76)	0.000*
High waist-to-hip ratio	1.171	(0.53, 2.61)	0.700

Note: *Statistically significant at $P < 0.05$.
Abbreviations: OR, odds ratio; CI, confidence interval.

genders.[24] Similarly, in this study and in previous studies conducted in the country,[16,18] no significant difference in the prevalence of hypertension among both genders was detected.

Given the asymptomatic nature of hypertension, its detection is usually incidental, and at times only occurs after significant complications have arisen.[3] As a result, the real burden of hypertension in most societies, particularly in the developing world, is underreported.[6] Self-awareness, as well as the treatment and control of hypertension are very low in both low-[16,18,21,22] and high-income countries,[25] except in the USA[24] where self-awareness, pharmacologic treatment, and control rates of hypertension are 81.9%, 76.4% and 53.3%, respectively. In this study, of the 97 who were found to be hypertensive, only 34 (35.1%) were aware of their hypertension and only 23 (23.7%) were on pharmacologic treatment. The overall control rate was dismal at only 15.5% (Table 3). These factors might have contributed to the increasing burden of stroke[26] and myocardial infarction[27] in Ethiopia, where patients were diagnosed with hypertension only after these complications occurred.

Common risk factors for hypertension, such as a family history of hypertension, diabetes, or being overweight, have been found to be strongly associated with high BP in this study. Bivariate analysis for khat use, smoking, and coffee consumption showed some trends towards a lower prevalence of hypertension. However, when all possible risk factors were controlled using logistic regression analysis, their effects on hypertension vanished (Table 4). As participants were only asked about current use of these substances, which does not take into account their cumulative dose effects, an interaction between their use and risk of hypertension can hardly be established. The effect of their use on the risk of hypertension should be uncovered in a large-scale prospective study, or through analyzing the serum levels of potential active ingredients of these substances.

Using BMI criteria, only one person was classified as obese with a BMI exceeding 30 kg/m^2. However, the prevalence rate of abdominal obesity, which was defined as a WHR >1 for males and >0.85 for females, was strikingly high. Only, 13% of men in Tesfaye et al[16] fulfilled the criteria for being obese; however, 33.1% of men in the current study had abdominal obesity. The figure for women is comparable between the two studies.[16] The discrepancy between BMI and WHR in detecting obesity is an established fact.[28,29] WHR is more sensitive in detecting cardiovascular risks than BMI.[30] In this study, both high BMI (≥25 kg/m^2) and WHR (>0.85 for women and >1.0 for men) were associated with hypertension upon bivariate analysis. However, when controlling for other variables, only high BMI was associated with hypertension (Table 4).

Even though this survey has come up with important findings regarding the burden of hypertension in Ethiopia, there are certain limitations worth mentioning here. First of all, none of our patients knew their exact birth date, and as a result there was no reliable account of their age. Secondly, there was possibility that patients underreported their family history of hypertension and personal history of diabetes, which was based on only self-reports of a previous diagnosis. The fact that this was a hospital-based cross-sectional study indicates that this study may lack generalizability for the community at large. Finally, as this was a cross-sectional study, it is difficult to clearly state whether or not the behavioral risk factors preceded the occurrence of hypertension.

Conclusion

Hypertension was found to be prevalent in this population, but awareness, treatment, and control rates in those with the disease were low. Certain factors like family history of hypertension, diabetes, and being overweight were found to be associated with high BP. The findings in this study and other recent studies conducted in the country have clearly shown that hypertension is becoming a serious public health concern.

Thus, policymakers should make this chronic illness a part of the public health agenda, and they should plan timely interventions. Intervention measures at the community level should be undertaken using health education and other measures by providing an emphasis on the prevention, early detection, and treatment of hypertension. Furthermore, researchers and health care providers should work to uncover the burden of hypertension overall.

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EKG and YM designed the study, developed survey instrument, supervised data collection and data entry, and participated in data analysis and manuscript writing. SA participated in the study design, supervised instrument development, reviewed the analysis, and contributed to manuscript editing.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Kotchen TA. Hypertension control: trends, approaches, and goals. *Hypertension*. 2007;49(1):19–20.
2. Chobanian AV, Bakris GL, Black HR, et al; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National High Blood Pressure Education Program Coordinating Committee. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*. 2003;289(19):2560–2572.
3. World Health Organization. The World Health Report 2002: Reducing *Risks*, *Promoting Healthy Life.* Geneva, Switzerland: World Health Organization; 2002.
4. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet*. 2005;365(9455):217–223.
5. Vasan RS, Beiser A, Seshadri S, et al. Residual lifetime risk for developing hypertension in middle-aged women and men: The Framingham Heart Study. *JAMA*. 2002;287(8):1003–1010.
6. Addo J, Smeeth L, Leon DA. Hypertension in sub-saharan Africa: a systematic review. *Hypertension*. 2007;50(6):1012–1018.
7. Opie LH, Seedat YK. Hypertension in sub-Saharan African populations. *Circulation*. 2005;112(23):3562–3568.
8. Hypertension control. Report of a WHO Expert Committee. *World Health Organ Tech Rep Ser*. 1996;862:1–83.
9. Pickering TG. The effects of environmental and lifestyle factors on blood pressure and the intermediary role of the sympathetic nervous system. *J Hum Hypertens*. 1997;11 Suppl 1:S9–S18.
10. Lekoubou A, Awah P, Fezeu L, Sobngwi E, Kengne AP. Hypertension, diabetes mellitus and task shifting in their management in sub-Saharan Africa. *Int J Environ Res Public Health*. 2010;7(2):353–363.
11. Whelton PK, He J, Muntner P. Prevalence, awareness, treatment and control of hypertension in North America, North Africa and Asia. *J Hum Hypertens*. 2004;18(8):545–551.
12. World Health Organization. *The World Health Report 1998 – Life in the 21st Century: A Vision for All.* Geneva, Switzerland: World Health Organization; 1998.
13. World Health Organization, Regional Office for Africa. *Cardiovascular Diseases in the African Region: Current Situation and Perspectives: Report of the Regional Director*. Maputo, Mozambique: World Health Organization, Regional Office for Africa; 2005.
14. Maiz HB, Kheder MA, Abderrahim E. Arterial hypertension in Tunisia. *Saudi J Kidney Dis Transpl*. 1999;10(3):372–375.
15. Zein ZA, Assefa M. Blood-pressure levels and hypertension in rural Ethiopian communities. *Ethiop Med J*. 1986;24(4):169–178.
16. Tesfaye F, Byass P, Wall S. Population based prevalence of high blood pressure among adults in Addis Ababa: uncovering a silent epidemic. *BMC Cardiovasc Disord*. 2009;9:39.
17. Lester FT. Blood pressure levels in Ethiopian outpatients. *Ethiop Med J*. 1973;11(2):145–154.
18. Awoke A, Awoke T, Alemu S, Megabiaw B. Prevalence and associated factors of hypertension among adults in Gondar, Northwest Ethiopia: a community based cross-sectional study. *BMC Cardiovasc Disord*. 2012;12:113.
19. Yoon SS, Burt V, Louis T, Carroll MD. Hypertension among adults in the United States, 2009–2010. *NCHS Data Brief*. 2012;107:1–8.
20. Wolf-Maier K, Cooper RS, Banegas JR, et al. Hypertension prevalence and blood pressure levels in 6 European countries, Canada, and the United States. *JAMA*. 2003;289(18):2363–2369.
21. Chaturvedi S, Pant M, Yadav G; Neelam. Hypertension in Delhi: prevalence, awareness, treatment and control. *Trop Doct*. 2007;37(3):142–145.
22. Musinguzi G, Nuwaha F. Prevalence, awareness and control of hypertension in Uganda. *PLoS ONE*. 2013;8(4):e62236.
23. Twagirumukiza M, De Bacquer D, Kips JG, de Backer G, Stichele RV, Van Bortel LM. Current and projected prevalence of arterial hypertension in sub-Saharan Africa by sex, age and habitat: an estimate from population studies. *J Hypertens*. 2011;29(7):1243–1252.
24. Igho Pemu P, Ofili E. Hypertension in women: part I. *J Clin Hypertens (Greenwich)*. 2008;10(5):406–410.
25. Falaschetti E, Chaudhury M, Mindell J, Poulter N. Continued improvement in hypertension management in England: results from the Health Survey for England 2006. *Hypertension*. 2009;53(3):480–486.
26. Zenebe G, Alemayehu M, Asmera J. Characteristics and outcomes of stroke at Tikur Anbessa Teaching Hospital, Ethiopia. *Ethiop Med J*. 2005;43(4):251–259.
27. Mamo Y, Oli K. Trends of acute myocardial infarction admissions over a decade, Tikur Anbessa Hospital. *Ethiop Med J*. 2001;39(3):193–202.
28. Gandhi R, Dhotar H, Tsvetkov D, Mahomed NN. The relation between body mass index and waist-hip ratio in knee osteoarthritis. *Can J Surg*. 2010;53(3):151–154.
29. Jia WP, Lu JX, Xiang KS, Bao YQ, Lu HJ, Chen L. Prediction of abdominal visceral obesity from body mass index, waist circumference and waist-hip ratio in Chinese adults: receiver operating characteristic curves analysis. *Biomed Environ Sci*. 2003;16(3):206–211.
30. Asia Pacific Cohort Studies Collaboration. Central obesity and risk of cardiovascular disease in the Asia Pacific Region. *Asia Pac J Clin Nutr*. 2006;15(3):287–292.