

Blood Pressure Pattern among Adults in Lagos: Analysis of Data from Public Health Screenings

Babawale Taslim Bello, Yemi Raheem Raji¹, Christiana Oluwatoyin Amira, Rotimi William Braimoh, Olamide Olutosin Olowoyo², Babatunde Abdulmajeed Akodu³

Department of Medicine and ³Family Medicine/Primary Care, College of Medicine, University of Lagos, ¹Department of Medicine, College of Medicine, University of Ibadan, ²Departments of Medicine, Lagos University Teaching Hospital, Lagos, Nigeria

Abstract

Background: Knowledge of the pattern of blood pressure (BP) in a population is useful in documenting within-population differences in hypertension prevalence as well as identifying groups at increased risk of complications. **Materials and Methods:** BP data obtained from 1061 participants in population screenings carried out in five local government areas within Lagos were analyzed. BPs were measured in both arms with individuals seated and the limb supported on a table by medical interns using a mercury sphygmomanometer. The higher of the two recordings was taken as the patient's BP. **Results:** The study population was made up of 54.5% females with an overall mean age of 39.2 ± 15.0 years and a range of 18–84 years. Mean systolic and diastolic BPs increased significantly and progressively with age in both male and female participants. BP was elevated in 35.6% of the study population with 48.3% of those having moderate-to-severely elevated BP. The prevalence of elevated BP increased with age; however, there was no significant difference in the prevalence of elevated BP between male and female participants. Between 11% and 20% of individuals aged 18–29 years had elevated BP, with the proportion being much higher among males than females. **Conclusion:** The study provides further evidence supporting the fact that hypertension is highly prevalent, is severe, and may have an onset earlier in life among African populations. There is need to institute policies focused on prevention, early detection, and prompt treatment of hypertension.

Keywords: Elevated blood pressure, hypertension, Lagos, Nigeria

INTRODUCTION

Hypertension is an important contributor to the global burden of cardiovascular disease^[1] and is intimately associated with the risk of developing adverse cardiovascular outcomes.^[2] The relationship between blood pressure (BP) and the risk of adverse cardiovascular events is continuous and independent of other risk factors. Furthermore, data from prospective clinical trials have consistently shown that adequate and sustained BP reduction attenuates the risk of these adverse events.^[3–5] Large proportions of individuals with hypertension remain undiagnosed, and even among those diagnosed, BP control is suboptimal in a significant proportion.^[6–8]

The prevalence of hypertension varies between within populations and is affected by factors such as race, age, gender, and locality. Compared to Caucasians, hypertension in Blacks is more prevalent, more severe, has an onset earlier in life, and is linked to a higher burden of target organ damage.^[9–13] Furthermore, the proportion of treated Black hypertensives

that achieve BP targets of $<140/90$ mmHg is lower.^[14–16] In Nigeria, hypertension is the single most common risk factor for stroke, chronic kidney disease, and heart failure among adult Nigerians^[17,18] and estimates of its prevalence are as high as 47%.^[8,19–21]

Knowledge of the pattern of BP in a particular population is useful in documenting within-population differences in hypertension prevalence as well as identifying groups with higher prevalence of hypertension. This would assist in developing targeted programs aimed at early detection, treatment, and monitoring of BP control in these population subgroups. This study aims to describe the pattern of BP among adults residing in Lagos.

Address for correspondence: Dr. Babawale Taslim Bello, Department of Medicine, College of Medicine, University of Lagos, Idi-Araba, Lagos, Nigeria.
E-mail: taslimbello@gmail.com

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Bello BT, Raji YR, Amira CO, Braimoh RW, Olowoyo OO, Akodu BA. Blood pressure pattern among adults in Lagos: Analysis of data from public health screenings. *Niger J Gen Pract* 2018;16:10–4.

Access this article online

Quick Response Code:



Website:
www.njgp.org

DOI:
10.4103/NJGP.NJGP_20_17

MATERIALS AND METHODS

This was a retrospective analysis of pooled data from five separate public health screening programs held between March 2015 and March 2017 within the Lagos metropolitan area. This consisted of three screening programs that were part of events marking the Annual World Kidney Day celebration of each respective year and two other screening programs carried out at residential estates. Lagos is a cosmopolitan state with a population of over 9.1 million inhabitants according to figures from Nigeria's national population commission.^[22] Administratively, it is made up of 20 local government areas (LGAs) and 37 local council development areas. The Lagos metropolitan area comprises 16 of the 20 LGAs which make up the state.^[23] Over 85% of the population of the state resides in metropolitan Lagos, and the screening exercises were carried out at venues located in five different LGAs within it namely Mushin, Surulere, Kosofe, Ifako-Ijaiye, and Lagos Mainland.

Data available from the screening programs were age, gender, and systolic BP (SBP) and diastolic BP (DBP). BP was measured by medical interns using a mercury sphygmomanometer (Accusson®). The first and fifth Korotkoff sounds were taken as the SBP and DBP, respectively. For all participants, BP was measured in both arms with the individuals seated, the arm held in the horizontal position and supported on a table. The higher of the two recordings was taken as the patient's BP. The study protocol was approved by the Health Research Ethics Committee of our institution.

Classification of BP was according to the World Health Organization (WHO)/International Society of Hypertension (ISH) guidelines.^[24] For individuals whose SBP and DBP fell into different categories, the higher category was used for classification. SBP only elevation was defined as measured SBP of 140 mmHg or higher, together with measured DBP lower than 90 mmHg, while DBP only elevation was defined as measured DBP of 90 mmHg or higher, together with measured SBP lower than 140 mmHg.

Data analysis

Data obtained were analyzed using Epi Info™ statistical software package version 7.2.1 (United States Centers for Disease Control and Prevention). Continuous variables were presented as means and standard deviations, while categorical variables were presented as percentages. Comparison between means was done using the Student's *t*-test while that between percentages was done using the Chi-square test. $P < 0.05$ was accepted as being of statistical significance.

RESULTS

A total of 1061 individuals were included in the analysis. Of these, 575 (54.19%) were females while the mean age of the study population was 39.2 ± 15.0 years with a range of 18–84 years. Figure 1 shows the age range distribution of the

study population. As shown in Table 1, the mean age, mean SBP, and mean DBP as well as proportion with elevated BP did not differ significantly between male and female study participants. Figure 2 shows the mean SBP and DBP of the study population by age and gender. Mean SBP and DBP increased progressively with age in both male and female participants from about 20 years of age up to about 70 years and then subsequently declined slightly. This increase in BP was statistically significant (SBP [all patients: $P < 0.001$; males: $P < 0.001$; females: $P < 0.001$] and DBP [all patients: $P < 0.001$; males: $P = 0.005$; females: $P = 0.001$]). As shown in Table 2, although a similar proportion of male and female participants (62.6% vs. 65.9%) had BP below 140/90 mmHg,

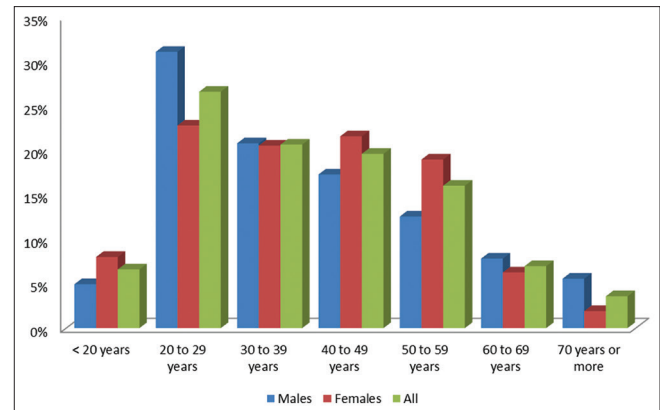


Figure 1: Age-range distribution of the study population stratified by gender

Table 1: Baseline characteristics of the study population

Characteristics	All	Male (%)	Females (%)	P
	1061	486 (45.8)	575 (54.2)	
Mean age (years)	39.2±15.0	39.1±15.8	39.3±14.3	0.88
Mean SBP (mmHg)	129.5±22.0	130.3±19.0	128.9±24.2	0.29
Mean DBP (mmHg)	81.3±13.6	81.1±14.6	81.5±12.3	0.62
Proportion with elevated BP (%)	35.6	37.5	34.1	0.25

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BP: Blood pressure

Table 2: Distribution of blood pressure in the study population according to the World Health Organization/International Society of Hypertension classification of blood pressure

Class of BP	All (%)	Males (%)	Females (%)	P
	1061	486 (45.8)	575 (54.2)	
Optimal BP	244 (23.0)	75 (15.4)	169 (29.4)	<0.001
Normal BP	296 (27.9)	150 (30.9)	146 (25.4)	0.05
High normal BP	143 (13.5)	79 (16.3)	64 (11.1)	0.02
Mildly elevated BP	195 (18.4)	104 (21.4)	91 (15.8)	0.02
Borderline	40 (3.8)	23 (4.7)	17 (3.0)	
Moderately elevated BP	99 (9.3)	49 (10.1)	50 (8.7)	0.46
Severely elevated BP	84 (7.9)	29 (6.0)	55 (9.6)	0.04

BP: Blood pressure

the proportion of participants with BP in the different WHO/ISH classes differed significantly.

Overall, 378 (35.6%) of the study population had elevated BP with 183 (48.3%) of these having moderate-to-severely elevated BP. Figure 3 shows the proportion of the study population with elevated BP stratified according to age range and gender. Overall, the proportion of individuals with elevated BP increased progressively with age till about 70 years of age and thereafter declined slightly. However, the proportion of female participants with elevated BP lagged behind that of males up till about age 40 years before catching up and surpassing it somewhat. In addition, about 15% of individuals <30 years of age had elevated BP, with the proportion being much higher among males.

As shown in Figure 4, elevation of both the SBP and DBP was the most common pattern of BP elevation seen in the study population. However, when participants were stratified into three age groups – young (18–45 years), middle age (46–65 years), and elderly (above 65 years), diastolic only BP elevation was most common among young participants and progressively became less common, while on the contrary, systolic only BP elevation was least common among young participants and progressively became more common as one moved from young to elderly participants.

DISCUSSION

Hypertension is known to be more prevalent, more severe and may have onset earlier in life among Black compared to non-Black populations.^[10] The pattern of BP found in this study is in keeping with this. The proportion with elevated BP was high. In addition to this, among those with elevated BP readings, BP was in the moderate-to-severely elevated range in proximity to half. Furthermore, the prevalence of elevated BP was high among younger individuals with rates of between 20% and 30% among men aged 18–29 years; and as has been reported in many other populations,^[25-28] SBP, DBP, and the prevalence of elevated BP were all found to increase with increasing age. However, overall mean SBP and DBP as well as prevalence of elevated BP did not differ significantly between male and female study participants.

The overall prevalence of elevated BP of 35.6% found in this study is consistent with that reported from other studies conducted in urban populations in Nigeria.^[28-30] In addition, three recently conducted systematic reviews of studies on hypertension from Nigeria^[31-33] put the current prevalence of hypertension in adults at between 22% and 47.2% with higher prevalence reported among urban compared with rural populations. Our finding of an absence of a gender difference in prevalence of elevated BP is however at variance with majority of published data from Nigeria which appear to suggest that hypertension is more common in men. It is important to point out however that this is not the first study to report this lack of gender bias in Nigeria. At least three previous studies^[34-36] had reported similar findings and

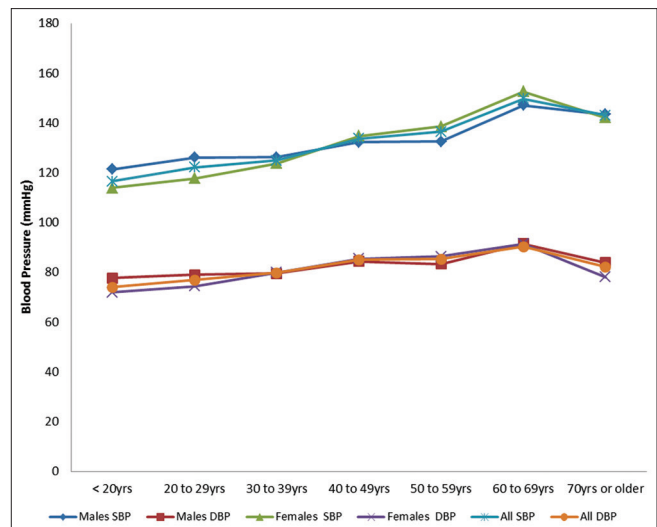


Figure 2: Mean systolic and diastolic blood pressure, by gender and age group. SBP: Systolic blood pressure, DBP: Diastolic blood pressure

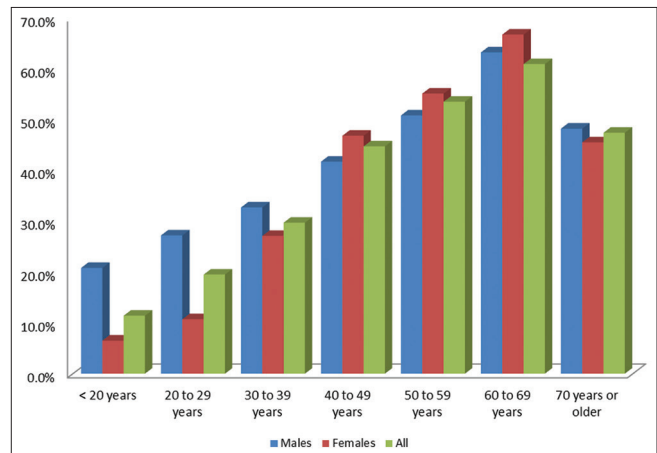


Figure 3: Proportion of the study population with elevated blood pressure stratified by age range

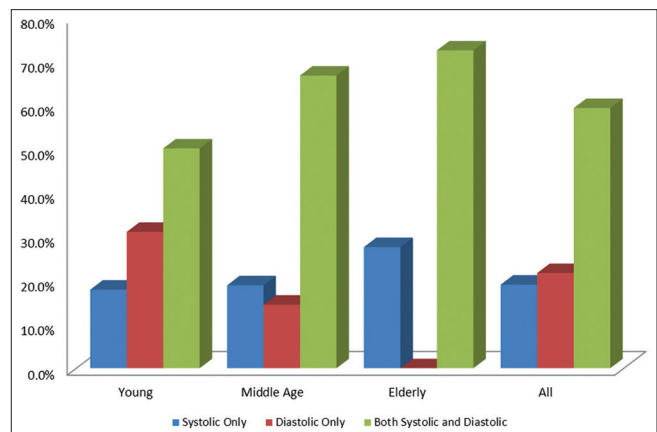


Figure 4: Pattern of blood pressure elevation in the study population. Young: 18–45 years old, middle aged: 46–65 years old, elderly: above 65 years old

the recent review by Ogah *et al.*^[33] also found no gender differences in hypertension prevalence.

That age is an independent risk factor for hypertension is an almost universally documented fact with data demonstrating a rise in BP with increasing age available for virtually every population.^[25-28,37,38] We similarly found that BP increased with increasing age peaking at about age 70 years before dipping slightly thereafter. Age-related atherosclerotic vascular changes are believed to be responsible for this phenomenon.^[39,40] We however noted gender differences in the effect of age on prevalence of elevated BP. Prevalence of elevated BP in females lagged behind those of males up till about age 40 years thereafter catching up and surpassing it. Differences in the hormonal profile may explain this. Estrogen is thought to be protective against hypertension and other cardiovascular diseases; however, this protective role is lost during the climacteric and postmenopausal periods which generally occurs after 45 years of age.^[41,42]

There were unusually high rates of elevated BP among young male participants aged 18–29 years compared to females in this study. Although premenopausal women are known to have lower BP than age-matched men,^[43] the sheer magnitude of the difference in this study suggest that factors other than hormonal differences may be at play. Another possible explanation may be that women in this age bracket access healthcare more, especially for obstetric reasons, and thus have more opportunities for BP interventions compared to men. Among individuals with elevated BP in this study, about 20% each had SBP only and DBP only elevation, with SBP only elevation being most common in the elderly and least common in the young and the reverse for DBP only elevation. There has been a recent research focus on isolated diastolic hypertension due to its association with adverse cardiovascular outcomes, especially in young adults,^[44,45] while opinions continue to differ among clinicians and researchers alike about the benefits of treating isolated systolic hypertension, especially in young adults.^[46-49]

Certain factors should be considered in interpreting the results of this study though. Since the study participants were recruited from among individuals who showed up for the screening programs, caution should be exercised in generalizing the findings to the entire population of Lagos. Further, BP was recorded in the population on one occasion only, and therefore, the prevalence of elevated BP does not necessarily imply the prevalence of hypertension. Finally, because the BP was recorded using mercury sphygmomanometers, there is possibility of inter-observer variability in BP recordings.

CONCLUSION

The study findings provide further evidence in support of the fact that hypertension is more prevalent and severe in Black populations and may have an onset earlier in life. There is need for increased public health awareness campaigns focused on prevention, early detection, and prompt treatment of hypertension. Widespread, population-based health education and screening programs are urgently needed if we are to avert an epidemic of hypertension-related complications.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Hansson L, Zanchetti A, Carruthers SG, Dahlöf B, Elmfeldt D, Julius S, *et al.* Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: Principal results of the Hypertension Optimal Treatment (HOT) randomised trial. HOT study group. *Lancet* 1998;351:1755-62.
- Chalmers J, Arima H. Management of hypertension: Evidence from the blood pressure lowering treatment trialists' collaboration and from major clinical trials. *Pol Arch Med Wewn* 2009;119:373-80.
- Turnbull F, Blood Pressure Lowering Treatment Trialists' Collaboration. Effects of different blood-pressure-lowering regimens on major cardiovascular events: Results of prospectively-designed overviews of randomised trials. *Lancet* 2003;362:1527-35.
- Schillaci G, Vaudo G. Effects of ACE inhibitors, calcium antagonists, and other blood-pressure-lowering drugs: Results of prospectively designed overviews of randomized trials. *Ital Heart J Suppl* 2001;2:799-802.
- Neal B, MacMahon S, Chapman N, Blood Pressure Lowering Treatment Trialists' Collaboration. Effects of ACE inhibitors, calcium antagonists, and other blood-pressure-lowering drugs: Results of prospectively designed overviews of randomised trials. Blood pressure lowering treatment trialists' collaboration. *Lancet* 2000;356:1955-64.
- Rampal L, Rampal S, Azhar MZ, Rahman AR. Prevalence, awareness, treatment and control of hypertension in Malaysia: A national study of 16,440 subjects. *Public Health* 2008;122:11-8.
- Centers for Disease Control and Prevention (CDC). Vital signs: Awareness and treatment of uncontrolled hypertension among adults – United States, 2003-2010. *MMWR Morb Mortal Wkly Rep* 2012;61:703-9.
- Ekwunife OI. Prevalence, awareness, treatment and control of hypertension in a Nigerian population. *Health* 2010;2:731-5.
- Soyannwo MA, Ogbuchi ME, Adeyeni GA, Soyeni AI, Lipede MR, Lucas AO, *et al.* Studies on the prevalence of renal disease and hypertension in relation to schistosomiasis. III. Proteinuria, haematuria, pyuria and bacteriuria in the rural community of Nigeria. *Niger Med J* 1978;8:451-64.
- Cooper R, Rotimi C, Ataman S, McGee D, Osotimehin B, Kadiri S, *et al.* The prevalence of hypertension in seven populations of West African origin. *Am J Public Health* 1997;87:160-8.
- Addo J, Smeeth L, Leon DA. Hypertension in sub-Saharan Africa: A systematic review. *Hypertension* 2007;50:1012-8.
- Cozier Y, Palmer JR, Horton NJ, Fredman L, Wise LA, Rosenberg L, *et al.* Racial discrimination and the incidence of hypertension in US black women. *Ann Epidemiol* 2006;16:681-7.
- Peer N, Steyn K, Lombard C, Gwebushe N, Levitt N. A high burden of hypertension in the urban black population of Cape Town: The Cardiovascular Risk in Black South Africans (CRIBSA) study. *PLoS One* 2013;8:e78567.
- Calhoun DA, Booth JN 3rd, Oparil S, Irvin MR, Shimbo D, Lackland DT, *et al.* Refractory hypertension: Determination of prevalence, risk factors, and comorbidities in a large, population-based cohort. *Hypertension* 2014;63:451-8.
- Wright JT Jr., Agodoa LY, Appel L, Cushman WC, Taylor AL, Obegdegebe GG, *et al.* New recommendations for treating hypertension in black patients: Evidence and/or consensus? *Hypertension* 2010;56:801-3.
- Douglas JG, Bakris GL, Epstein M, Ferdinand KC, Ferrario C, Flack JM, *et al.* Management of high blood pressure in African Americans: Consensus statement of the Hypertension in African Americans Working Group of the International Society on Hypertension in Blacks. *Arch Intern Med* 2003;163:525-41.
- Ulasli II, Ijoma CK. The enormity of chronic kidney disease in Nigeria: The situation in a teaching hospital in South-East Nigeria. *J Trop Med* 2010;2010:501957.

18. Kolo PM, Jibrin YB, Sanya EO, Alkali M, Peter Kio IB, Moronkola RK, *et al.* Hypertension-related admissions and outcome in a tertiary hospital in Northeast Nigeria. *Int J Hypertens* 2012;2012:960546.
19. Akinkugbe OO. Non-communicable Diseases in Nigeria. Final Report of a National Survey. Lagos, Nigeria: Ministry of Health and Social Services; 1997. p. 5-41.
20. Abengowe CU. Cardiovascular disease in Northern Nigeria. *Trop Geogr Med* 1979;31:553-60.
21. Adebayo RA, Balogun MO, Adedoyin RA, Obashoro-John OA, Bisiriyu LA, Abiodun OO, *et al.* Prevalence of hypertension in three rural communities of Ife North Local Government Area of Osun State, South West Nigeria. *Int J Gen Med* 2013;6:863-8.
22. National Population Commission. Population Report by State; 2016. Available from: <http://www.population.gov.ng/core-activities/surveys/dataset/2006-phc-priority-tables/>. [Last accessed on 2017 Sep 25].
23. Rasaki R. Managing Metropolitan Lagos. A Speech delivered at the Inaugural Programme of the African Leadership Forum in Ota, Ogun State, Nigeria: October 24th to November 1st 1998. African Leadership Forum; 1988. p. 1-30.
24. Chalmers J. The WHO-ISH Hypertension Guidelines Committee. 1999 World Health Organization-International Society Of Hypertension guidelines for the management of hypertension. *J Hypertens* 1999;17:151-83.
25. Wilkins K, Campbell NR, Joffres MR, McAlister FA, Nichol M, Quach S, *et al.* Blood pressure in Canadian adults. *Health Rep* 2010;21:37-46.
26. Wolf-Maier K, Cooper RS, Banegas JR, Giampaoli S, Hense HW, Joffres M, *et al.* Hypertension prevalence and blood pressure levels in 6 European countries, Canada, and the United States. *JAMA* 2003;289:2363-9.
27. Banegas JR, Rodríguez-Artalejo F, de la Cruz Troca JJ, Guallar-Castillón P, del Rey Calero J. Blood pressure in Spain: Distribution, awareness, control, and benefits of a reduction in average pressure. *Hypertension* 1998;32:998-1002.
28. Ulasi II, Ijoma CK, Onwubere BJ, Arodiwe E, Onodugo O, Okafor C, *et al.* High prevalence and low awareness of hypertension in a market population in Enugu, Nigeria. *Int J Hypertens* 2011;2011:869675.
29. Isezu SA, Sabir AA, Ohwovorilole AE, Fasanmade OA. Prevalence, associated factors and relationship between prehypertension and hypertension: A study of two ethnic African populations in Northern Nigeria. *J Hum Hypertens* 2011;25:224-30.
30. Adediran OS, Okpara IC, Adeniyi OS, Jimoh AK. Hypertension prevalence in an urban and rural area of Nigeria. *J Med Med Sci* 2013;4:149-54.
31. Adeyoye D, Basquill C, Aderemi AV, Thompson JY, Obi FA. An estimate of the prevalence of hypertension in Nigeria: A systematic review and meta-analysis. *J Hypertens* 2015;33:230-42.
32. Akinlua JT, Meakin R, Umar AM, Freemantle N. Current prevalence pattern of hypertension in Nigeria: A Systematic review. *PLoS One* 2015;10:e0140021.
33. Ogah OS, Okpechi I, Chukwuonye II, Akinyemi JO, Onwubere BJ, Falase AO, *et al.* Blood pressure, prevalence of hypertension and hypertension related complications in Nigerian Africans: A review. *World J Cardiol* 2012;4:327-40.
34. Adedoyin RA, Mbada CE, Balogun MO, Martins T, Adebayo RA, Akintomide A, *et al.* Prevalence and pattern of hypertension in a semiurban community in Nigeria. *Eur J Cardiovasc Prev Rehabil* 2008;15:683-7.
35. Lawoyin TO, Asuzu MC, Kaufman J, Rotimi C, Owoaje E, Johnson L, *et al.* Prevalence of cardiovascular risk factors in an African, urban inner city community. *West Afr J Med* 2002;21:208-11.
36. Owoaje EE, Rotimi CN, Kaufman JS, Tracy J, Cooper RS. Prevalence of adult diabetes in Ibadan, Nigeria. *East Afr Med J* 1997;74:299-302.
37. Yusuf S, Reddy S, Ounpuu S, Anand S. Global burden of cardiovascular diseases: Part I: General considerations, the epidemiologic transition, risk factors, and impact of urbanization. *Circulation* 2001;104:2746-53.
38. Skrobbonja A, Kontosic I. Arterial hypertension in correlation with age and body mass index in some occupational groups in the harbour of Rijeka, Croatia. *Ind Health* 1998;36:312-7.
39. McEniery CM, Wilkinson IB, Avolio AP. Age, hypertension and arterial function. *Clin Exp Pharmacol Physiol* 2007;34:665-71.
40. O'Rourke M. Arterial stiffness, systolic blood pressure, and logical treatment of arterial hypertension. *Hypertension* 1990;15:339-47.
41. Coylewright M, Reckelhoff JF, Ouyang P. Menopause and hypertension: An age-old debate. *Hypertension* 2008;51:952-9.
42. Martins D, Nelson K, Pan D, Tareen N, Norris K. The effect of gender on age-related blood pressure changes and the prevalence of isolated systolic hypertension among older adults: Data from NHANES III. *J Gen Specif Med* 2001;4:10-3, 20.
43. Daugherty SL, Masoudi FA, Ellis JL, Ho PM, Schmittiel JA, Tavel HM, *et al.* Age-dependent gender differences in hypertension management. *J Hypertens* 2011;29:1005-11.
44. Niiranen TJ, Rissanen H, Johansson JK, Jula AM. Overall cardiovascular prognosis of isolated systolic hypertension, isolated diastolic hypertension and pulse pressure defined with home measurements: The finn-home study. *J Hypertens* 2014;32:518-24.
45. Li Y, Wei FF, Wang S, Cheng YB, Wang JG. Cardiovascular risks associated with diastolic blood pressure and isolated diastolic hypertension. *Curr Hypertens Rep* 2014;16:489.
46. Protogerou AD, Blacher J, Safar ME. Isolated systolic hypertension: 'to treat or not to treat' and the role of central haemodynamics. *J Hypertens* 2013;31:655-8.
47. O'Rourke MF, Adji A. Guidelines on guidelines: Focus on isolated systolic hypertension in youth. *J Hypertens* 2013;31:649-54.
48. McEniery CM, Franklin SS, Wilkinson IB, Cockcroft JR. Isolated systolic hypertension in the young: A need for clarity. *J Hypertens* 2013;31:1911-3.
49. O'Rourke MF, Adji A. Isolated systolic hypertension in the young: A need for clarity. Reply. *J Hypertens* 2013;31:1913-4.