

Prevalence of Hypertension and Its Associated Factors Among Gimbi Town Residents, Ethiopia: A Community-Based Cross-Sectional Study

This article was published in the following Dove Press journal:
Integrated Blood Pressure Control

Birhanu Yadecha ¹
Firew Tekle ²
Getahun Fetensa ³
Ashenafi Habte ³
Bisrat Zeleke ⁴

¹Department of Nursing, Ambo University Woliso Campus, Woliso, Ethiopia; ²Department of Public Health, Institute of Health Science, Wollega University, Nekemte, Ethiopia; ³Department of Nursing, Institute of Health Science, Wollega University, Nekemte, Ethiopia; ⁴Department of Nursing, Wolkite University, Wolkite, Ethiopia

Background: Globally, sixty-two percent of cerebrovascular disease and forty-nine percent of ischemic heart disease are attributable to increased blood pressure. Half of the patients with stroke and heart disease were due to hypertension.

Objective: This study aimed to identify prevalence of hypertension and its associated factors in Gimbi town, Ethiopia.

Methods: We conducted a community-based cross-sectional study from May to June 2017 on 471 participants in Gimbi town, western Ethiopia. A systematic sampling method was used to recruit study participants. Data collectors used structured questionnaires to gather data through face to face interview. The standardized procedure followed to measure blood pressure and anthropometric measurements by trained extension health workers. We entered data into Epi-data and exported to SPSS version 20.00 for analysis. Variables having a P-value less than or equal to 0.05 were declared as statistically significant in multivariable analysis.

Results: Four hundred seventy-one participants were included with a response rate of 98.85%, and 248 (52.6%) were female. The prevalence of isolated systolic and diastolic hypertension was 9.55% and 9.3%, respectively. Of 157 (33.5%) hypertensive participants, 117 (24.8%) were newly diagnosed. Age 35–55 [AOR: 2.335 95% CI (1.360–4.009)], ≥ 55 [(AOR: 3.566 95% CI (1.288–9.876))], occupation, government employee [(AOR: 3.072 95% CI (1.458–6.474))], merchants [(AOR: 3.177 95% CI (1.290–7.824))], ever alcohol drinker [(AOR: 2.333 95% CI (1.320–4.122))], and family history of hypertension [(AOR: 6.642 95% CI (4.068–10.843))] were found to be predictor variables for hypertension.

Conclusion: The findings of this study indicated a hidden high prevalence of hypertension indicating the need for stakeholders' collaboration to design and implement a mobile blood pressure screening programs at the community level.

Keywords: hypertension, increased blood pressure, non-communicable disease, Ethiopia

Background

A force of blood against the wall of the bigger and smaller arteries constitutes Blood Pressure.¹ Hypertension is a clinical condition in which the pressure of blood consistently exceeds the normal range.² "Hypertension is a systolic blood pressure of above 140 mm Hg and a diastolic pressure of above 90 mm Hg over a continual period, based on the average of two or more blood pressure measurements taken in two or more contacts by a health care professional after an initial measurement."³ Hence, the patient having hypertension is free of symptoms it is often called "the silent killer".⁴ Worldwide the magnitude of non-communicable disease is increasing.

Correspondence: Birhanu Yadecha
Tel +251 924844228
Email birhanuyad@gmail.com

Hypertension was responsible for half of the stroke and cardiac ailment.⁵ In 2014, the worldwide magnitude of elevated blood pressure among adults aged 18 years and over was around 22%. Age-standardized prevalence of hypertension in men and women varies in different WHO region. Generally, hypertension is higher in the African region (30%) and lowers in the American region 18% (21% of men and 16% for women). In Ethiopia magnitude of Hypertension was 24.4%.⁶ In all WHO regions, men have a slightly raised blood pressure than women.⁶ The Prevalence of hypertension in low- and middle-income countries ranges from 52.7% in India to 77.9% in South Africa.⁷ In 2010 the magnitude of hypertension in Africa was 30.8%.⁸ Furthermore, hypertension contributes to 40% of the stroke on the continent.⁹ The research conducted in four sub-Saharan African countries showed 36.9% elevated blood pressure.¹⁰ In Ethiopia, various prevalence studies had conducted: Aksum (13.3%),¹¹ Humera (30.7%),¹² Northern Ethiopia (18.1%),¹³ Gondar town (16.5%),¹⁴ Addis Ababa (27.7%),¹⁵ Durame (22.4%),¹⁶ and Bedelle (16.9%).¹⁷

“Identification of risk factors for this disease in Ethiopia is important to take action to eliminate them and reduce the risk.” Commonly studied factors include obesity, the lack of physical inactivity, and the use of stimulants, but not all results in the literature are unambiguous.^{5,11} The type of diet can affect the risk of hypertension by providing adequate levels of nutrients, including micronutrients with antioxidant properties.^{18,19} In the current study area, the magnitude of the hypertension was unknown hence the purpose of this research project was to uncover the magnitude of hypertension and its associated factors among Gimbi town residents.

Methods

Study Design, Study Setting, and Period

A community-based cross-sectional study design was conducted from May –June 2017 in Gimbi town, Ethiopia. Gimbi town is a capital city of West Wollega Zone, it is located about 441 km far away from Addis Ababa to the west of the country. According to census, the town was populated by 30,981 of whom 15,716 were men and 15,265 were women.²⁰

Sample Size Determination and Sampling Technique

Sample size was determined by using the single population proportion formula by considering the prevalence of hypertension 16.9% from a previous study was done in Bedelle

town¹⁷ $\alpha=0.05$ ($z=1.96$), a margin of error ($d=0.05$), design effect of 2 and 10% non-response rate giving a final sample size of 476. Systematic sampling was used to reach study subjects who were 18 years and older. Among the major town in west Wollega zone, Gimbi town was selected by chance. Besides, Gimbi town has four kebeles (smallest administrative unit). A constant number k was obtained by dividing the total household in each selected Kebele by the sample size allotted to the respective kebele. Then, the first household was selected from each selected kebele by lottery method, and preceding households were selected by taking consecutive k th households until the allotted sample size for each kebele was obtained. The Households in selected kebeles were used as a sampling frame. Head of the household was asked in case if the head of the family is unavailable the eldest family member was recruited.

Data Collection Instrument and Procedure

The instrument for data collection was adopted from WHO stepwise surveillance for non-communicable disease. The tool modified to fit the current study and has three parts (part I: socio-demographic variables, part II: Lifestyle and behavioral variables, part III: anthropometric measurements). A digital weighing scale with height was used to measure the weight and height of the patient. Blood pressure (BP) was assessed with a digital measuring device (Heuer wrist type Blood pressure monitor) after participants resting for at least 5 min in a sitting position. Three measurements were taken with intervals of 3 min between consecutive measurements. Besides, participants were asked whether they were taking any medications for the treatment of hypertension. Average systolic BP (SBP) and diastolic BP (DBP) were determined from the second and third measurements. Hypertension was defined as SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg or self-reported use of antihypertensive medication, with the adaptation of the recent WHO definitions.²¹

Data Quality Control

To ensure reliability and validity of the data collection instrument, a pre-test was conducted on 24 (5%) of study individuals at Nekemte town chalalaki kebele 2 weeks before actual data collection. Necessary amendments on data collection instruments were made prior to actual data collection. Two days of training was given to health extension workers in following the objective of the study. Data were collected

by trained local extension health workers, and nurses by going house-to-house.

Data Analysis

Data were entered into Epi-data version 3.1 and exported to SPSS version 20 for analysis. Frequency analysis of socio-demographic data was performed with SPSS. Initially, likely risk factors were assessed using bivariable analyses. Then, variable with a p-value of <0.20 were included in the multivariable logistic regression model. The results were regarded as statistically significant if P-value was less than or equal to 0.05 in multivariable logistic regression.

Definition of Terms

Hypertension: Hypertension was defined as SBP \geq 140 mm Hg or DBP \geq 90 mm Hg or self-reported use of antihypertensive medication

Isolated Systolic Hypertension: Systolic Blood pressure of \geq 140 mm Hg and DBP of 60–90 mm Hg

Isolated Diastolic Hypertension: Systolic Blood pressure of 100–140 mm Hg and DBP of \geq 90 mm Hg

Previously Diagnosed Hypertension: A patient with a history of blood pressure measurement and declared hypertensive and/or taking anti-hypertensive medications

Newly Diagnosed Hypertension: A patient whose blood pressure measurement is above normal during the data collection period and unaware about an increase in blood pressure

Overall hypertension: is the sum of all types of hypertension

Ever smoker: A person with a history of use of any tobacco product

Current smoker: A person with a history of tobacco use in the past 30 days

Ever alcohol drinker: A person with a history of any types of alcohol use in the past

Current alcohol drinker: A person with history of any types of alcohol use in the past 30 days

Underweight: BMI<18.5, normal: BMI 18.5 to <25.0, overweight: BMI 25.0 to <30.0, and Obese: BMI \geq 30 in adults.

Simple physical activity: walk or use a bicycle for at least 10 min continuously to get to and from places

Moderate Physical activity: moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking or carrying light loads for at least 10 min continuously

Hard physical activity: vigorous-intensity activity that causes large increases in breathing or heart rate like

Table 1 Frequency Distribution of Socio-Demographic Characteristics of Study Participants in Gimbi Town, Western Ethiopia 2017

Variables	Frequency	Percentage
Age		
<35 years	329	69.9
35–54 years	117	24.8
>55 years	25	5.3
Sex		
Male	223	47.3
Female	248	52.7
Educational		
Illiterate	52	11.0
Primary school	92	19.5
Secondary school	162	34.4
College and above	165	35.0
Religion		
Protestant	235	49.9
Orthodox	162	34.4
Muslim	53	11.3
Catholic	6	1.3
Adventist	15	3.2
Marital status		
Single	143	30.3
Married	284	60.3
Divorced	22	4.7
Widowed	22	4.7
Ethnicity		
Oromo	418	88.7
Amara	39	8.3
Others*	14	3.0
Occupation		
Employee	169	35.9
Daily laborer	80	17.0
Housewife	67	14.2
Merchant	55	11.7
Student	100	21.2

Note: Others*, Tigre, Gurage.

carrying or lifting heavy loads, digging or construction work for at least 10 min continuously.

Ethical Consideration

Ethical approval was obtained from Wollega University research ethical review committee. A formal letter for permission and support was written to the Gimbi town

administration. The purpose of the study was clearly explained to Gimbi town administrators and the health bureau. All the study participants were informed about the purpose of the study, their right to refuse, and written consent was obtained before the interview. The study participants were also told that the information obtained from them would be treated with complete confidentiality. Instruments and procedures would not cause any harm to the study participants, the community, the data collectors and supervisors, who were involved in the research project.

Result

Socio-Demographic Characteristics of Study Participants

Overall 471 (98.95%) respondents were interviewed of which 248 (52.1%) were female. The mean ages of the respondents were 32.37 ± 11.41 SD years. The majority of subjects were attended college and above in educational status, about half of them were protestant in religion. Most participants (88.7%) were from the Oromo ethnic group, and about two-thirds were married (Table 1).

Regarding age distribution by sex, the majority 181 (38.4%) were females between 18 and 35 years of age (Figure 1).

Prevalence of Hypertension

The mean systolic and diastolic blood pressures were 117.78 mmHg and 81.31 mmHg, respectively.

Hypertension was categorized as follows: isolated systolic hypertension, isolated diastolic hypertension, previously diagnosed hypertension, newly diagnosed hypertension, and overall hypertension. One-fourth of the study participants had undiagnosed hypertension. Hypertension was also classified based on its severity as mild, moderate, and severe (Table 2).

Risk Factors of Hypertension

Among hypertensive patients, 82 (51.9%) were male and 45.6% of them were college and above in their education. The prevalence of hypertension is highest among the advanced age group (Figure 2).

Respondents were asked whether there are family members with hypertension or not. Accordingly, 143 (30.4%) of the subjects were responded that there were hypertensive patients within the family. Father/mother 86%, grandparents 9% and siblings 5% were reported hypertensive.

The prevalence of ever smoker and current smokers was 6.4% and 4%, respectively (Table 3). Among ever smoker 86.7% started smoking at the age of less than 30 and about two-thirds were male. Most smokers 23 (76.7) smoke 1–9 cigars per day. Ninety-six of the respondents were ever alcohol consumer and 85 of the subjects had alcohol in the past 1 year. The prevalence of current alcohol drinker was 18%. Regarding physical activities, the majority of the subjects, 190 (44.1) were involved in simple activities at workplace and the time takes to workplace was 1–29 min

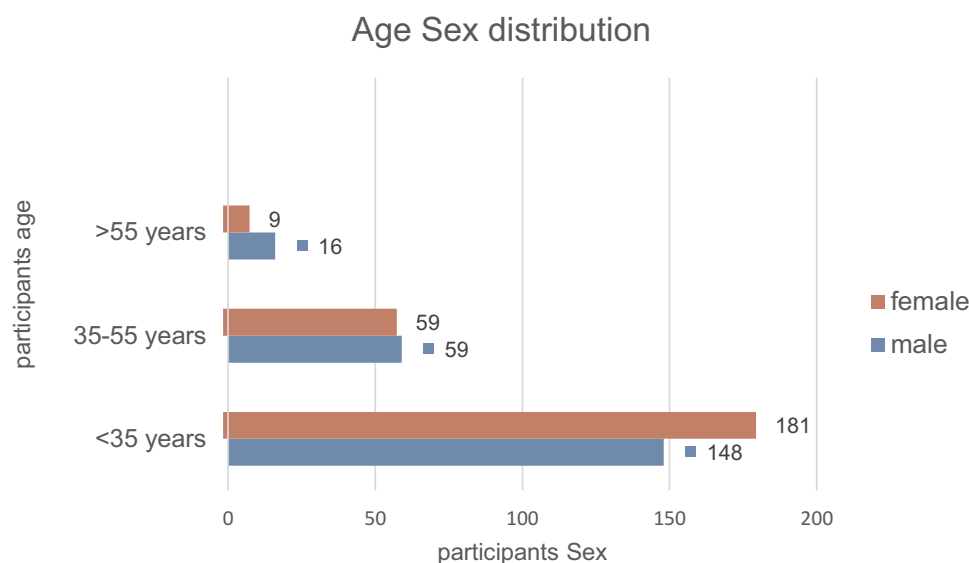


Figure 1 Frequency distribution of age by sex of study participants in Gimbi Town, Ethiopia 2017.

Table 2 Frequency Distribution of Hypertension Phenotypes Among Study Participants Gimbi Town, Western Ethiopia 2017

Hypertension Phenotypes	Frequency (%)	Mean (SD)	Maximum (mmHg)	Minimum (mmHg)
Overall n=471	158 (33.5)			
Isolated systolic	45 (9.6)	117.78 (16.051)	180	90
Isolated diastolic	42 (9.3)	81.31 (11.477)	120	60
Previously identified	40 (8.5)			
Newly diagnosed	118 (25)			
Mild hypertension	86 (18.3)			
Moderate	50 (10.6)			
Severe hypertension	22 (5.6)			

for 219 (50.8) study participants. Four hundred nine (86.84) reported vegetables/fruit use. As body mass index increases from underweight to the overweight, prevalence of hypertension also increases (Table 2).

Logistic Bivariable and Multivariable Analysis

The results of bivariable logistic regression analysis indicated that age and occupation were significantly associated with the outcome variables. Hypertension is 2 and 6 times greater among study subjects greater than 55 (COR: 6.080 CI 95% 2.342–15.781) years of age than those in between 35 and 55 (COR: 2.955 CI 95% 1.824–4.788) years of age and below 35 years of age, respectively. Similarly,

hypertension is greater among merchants (COR: 5.923 CI 95% 2.733–12.840), Housewife, and Daily laborer. Sex and educational status were not associated with hypertension. Results of bivariable logistic analysis indicated that ever smoking, current smoking, ever and alcohol drinkers were significantly associated with hypertension. Physical activity, consumption of vegetables/fruits was protective from being hypertensive. Hypertension was 2 times more common among overweight individuals than normal body frames.

Multivariable Logistic Regression Analysis of Risk Factors of Hypertension

Multivariable logistic regression analysis was conducted to see the association between independent variables and the

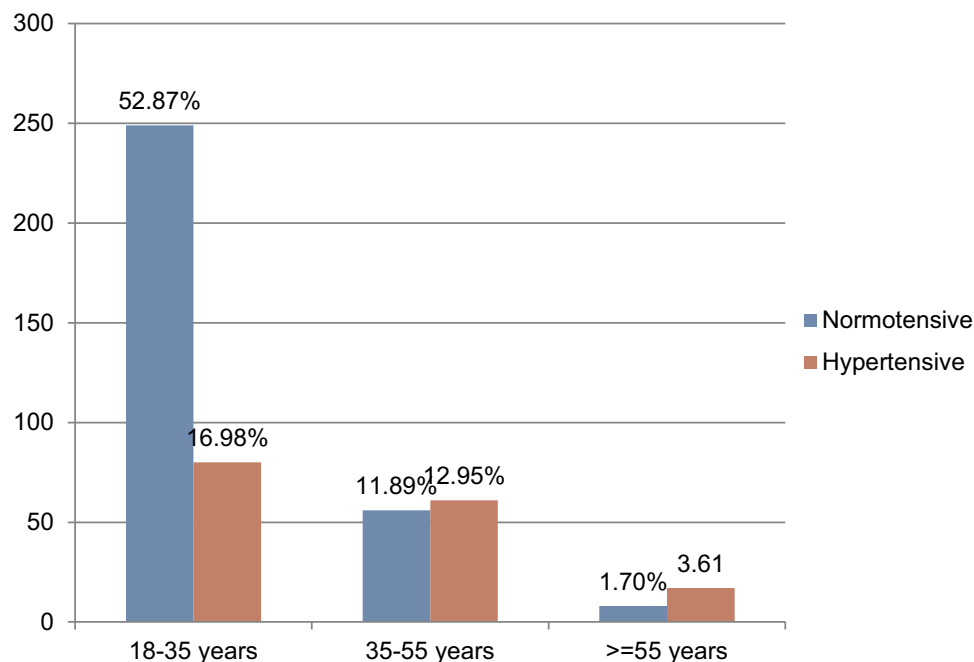
**Figure 2** Distribution of blood pressure measurement by age among study participants in Gimbi Town, Ethiopia 2017.

Table 3 Frequency Distribution of the Risk Factors Among Hypertensive and Normotensive Study Participants Gimbi Town, Western Ethiopia 2017

Variables	Status of Blood Pressure Measurements	
	Hypertensive (%)	Normotensive (%)
Sex		
Male	82 (17.5)	141 (29.9)
Female	76 (16.0)	172 (36.5)
Age		
<35 years	80 (17.0)	249 (52.9)
35–54 years	61 (13.0)	56 (11.9)
>55 years	17 (3.5)	8 (1.7)
Ever smoker		
Yes	19 (4.0)	11 (2.4)
No	139 (29.5)	302 (64.1)
Current smoker n= 30		
Yes	13 (2.8)	6 (1.3)
No	145 (30.7)	307 (65.2)
Ever alcohol drinker		
Yes	51 (10.8)	45 (9.6)
No	107 (22.7)	268 (56.9)
Current alcohol use n= 96		
Yes	41 (42.7)	44 (45.8)
No	3 (3.1)	8 (8.3)
Physical inactivity		
Yes	22 (4.7)	18 (3.8)
No	136 (28.8)	295 (62.7)
Physical activity level n= 431		
Simple	66 (15.3)	124 (28.8)
Medium	47 (10.9)	114 (26.5)
Hard	32 (7.4)	48 (11.1)
Vegetables/fruits use		
Yes	151 (32.0)	305 (64.8)
No	7 (1.5)	8 (1.7)
Amount of vegetables/fruits n=456		
4–7/week	137 (30)	272 (59.6)
<3/week	16 (3.5)	31 (6.8)
BMI		
Normal	9 (1.9)	44 (9.3)
Underweight	98 (20.8)	216 (45.9)
Overweight	51 (10.8)	53 (11.3)

outcome variables while controlling for confounding variables. Accordingly, age, occupation, ever smoker, ever alcohol drinking, physical activities were found to be predictors' variables. As age increases by 20 years the risk for hypertension increases by 2.5 times. Merchants were at high risk for hypertension. Smokers and drinkers had 2.7 times and 2 times the risks of hypertension than their counterparts, respectively (Table 4).

Discussion

Worldwide Hypertension is a major challenge to the public though it can be modified by the client's behaviors. The majority of cardiovascular diseases and death are attributable to hypertension.^{9,10} Half of the patients with stroke and heart disease were because of hypertension.⁵ About a third (33.5%) of the study participants from Gimbi town were hypertensive.

In 2014 the global prevalence of hypertension in those 18 and above was 22%. A systematic review conducted in India showed the prevalence of hypertension in the urban setting of about 33%.²² Similarly, the study conducted in Fulani eastern Cameron showed the prevalence of hypertension of 31.1%.²³ Studies conducted in different parts of Ethiopia showed different prevalence of hypertension: Aksum 16.5%,¹¹ Addis Ababa 27.3%,¹⁵ North West Ethiopia 30.7%,¹³ Durame 22.4%,¹⁶ Gondar town 13.3%,¹⁴ Humera 18.1%,¹² Gondar University 7.7%²³ and Bedelle 16.9%.¹⁷

The prevalence of hypertension in Gimbi town is almost comparable with the studies conducted in Fulani, Cameron, Addis Ababa, North West Ethiopia. On the other hand, the result of this study showed higher prevalence as it is compared to the global prevalence of hypertension, studies conducted in Aksum, Tigray, Durame, Gondar, Humera, Gondar University, and Bedelle. These discrepancies might be related to the study setting, age of the study participants, Sample size. The finding of this study showed a direct relationship between age and hypertension. This finding is similar to the findings of other studies.^{11,12,15,24,25} Merchants and government employees were found to be positively associated with hypertension. While cigarette smoking is a predictor for hypertension in some studies,¹¹ cigarette smoking was not significantly associated with hypertension in other studies^{12,13,15,22,24} and the finding of this study. This might be due to the low rate of cigarette smoking in the community studied.

Table 4 Multivariable Logistic Regression Analysis of Risk Factors of Hypertension Among Study Participants Gimbi Town, Western Ethiopia 2017

Variables	Status of Hypertension		COR (95% CI)	AOR (95% CI)
	Hypertensive	Non-Hypertensive		
Age				
<35	27	129	1	1
35–54	43	100	2.95 (1.824–4.788)	2.34 (1.360–4.009*)
>55	38	56	6.08 (2.342–15.781)	3.57 (1.288–9.876*)
Occupation				
Employee	74	95	4.78 (2.520–9.087)	3.07 (1.458–6.474*)
Daily laborer	22	58	2.33 (1.103–4.924)	1.07 (0.425–2.675)
Housewife	21	46	2.80 (1.305–6.028)	1.56 (0.627–3.861)
Merchant	27	28	5.92 (2.733–12.840)	3.18 (1.290–7.824*)
Student	14	86	1	1
Ever smoker				
Yes	15	15	3.75 (1.739–8.099)	1.87 (0.724–4.817)
No	143	298	1	1
Ever alcohol drinker				
Yes	46	50	2.83 (1.793–4.493)	2.33 (1.320–4.122*)
No	112	263	1	1
Physical activity				
Yes	146	285	1	1
No	22	18	2.65 (1.377–5.105)	1.72 (0.820–3.599)
Vegetables and fruits use				
Yes	152	302	1	1
No	11	6	3.83 (1.389–10.554)	1.54 (0.387–6.139)
Hypertension in family				
Yes	93	50	7.53 (4.857–11.662)	6.64 (4.068–10.843*)
No	65	263	1	1
BMI				
Normal	98	216	1	1
Underweight	9	44	0.451 (0.212–0.960)	0.74 (0.307–1.764)
Overweight	51	53	2.121 (1.349–3.335)	1.67 (0.951–2.946)

Note: *Statistically significant.

Ever Alcohol drinking was significantly associated with raised blood pressure in the study population. Hypertension was about two times common among alcohol drinkers than non-drinkers. Previous studies indicated that alcohol consumption was a risk factor for high blood pressure.^{11,15}

Those who had a family history of hypertension were 6.6 times more likely to have hypertension. This finding is

in line with the results of some other studies in Gondar, Northwest Ethiopia, and Addis Ababa.^{11,15,22} This might be because participants with a family history of hypertension might have the same genetic components and the fact that family tends to share the same lifestyle choices and behavior. Smoking, physical inactivity, vegetable/fruit use, and BMI were predictors of hypertension in other

studies^{11,12,14,15,22,24} were not significantly associated with the current study. This might be related to the low prevalence of the above factors in the study area.

This study identified a high prevalence of hypertension among the study participants. Advanced age, occupation (merchant and government employee), non-consumption of vegetable/fruit, and family history of hypertension were found to be predictor variables to the outcome variables.

An increase in BP with age is mostly related to changes in arterial and arteriolar stiffness. Large artery stiffness (LAS) is mainly due to arteriosclerotic structural alterations and calcification.²⁶ Work-related chronic stress has been associated with high blood pressure later in life.²⁷ Eating a diet that is poor in whole grains, fruits, vegetables, polyunsaturated fats, and dairy products increases the risk of hypertension.²⁸

So stake holder's federal ministry of health, regional health bureau, zonal and town health office should integrate hypertension screening programs and health information dissemination to extension health programs to detect and refer those with elevated blood pressure.

Data Sharing Statement

All data analyzed during this study are included in this published article.

Ethics and Consent to Participate

Ethical approval was obtained from Wollega University research ethical review committee. Written consent was secured from each participant. I confirm that this study was conducted in accordance with the Declaration of Helsinki.

Acknowledgment

We would like to acknowledge Wollega University for financial support and study respondents for their response.

Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Funding

Fund was obtained from Wollega University.

Disclosure

The authors declare that they have no competing interests.

References

- Grinspun D, Coote T. *Nursing Management of Hypertension: Nursing Best Practice Guideline-Shaping the Future of Nursing*. Toronto, Canada: Heart and Stroke Foundation and Registered Nurses' Association of Ontario publications; June 2005:23–24
- Tobe SW, Lum-kwong MM, Perkins N, Von S, Sebaldt RJ, Kiss A. Heart and Stroke Foundation of Ontario (HSFO) high blood pressure strategy's hypertension management initiative study protocol. *BMC Health Serv Res*. 2008;11:1–11.
- Bakris G The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure ... 2014; May 2003.
- Shaffer KL. The health care 'industry'. *Alabama Med*. 1991;61(5):24–7.5.
- WHO. *A Global Brief on Hypertension. Silent Killer; Global Public Health Crisis*. Geneva, Switzerland: World Health Organization; September 10, 2013.
- World Health Organization. Attaining the nine global noncommunicable diseases targets; a shared responsibility. *Global Status Report on NCDs*; 2014.
- Lloyd-Sherlock P, Beard J, Minicuci N, Ebrahim S, Chatterji S. Hypertension among older adults in low-and middle-income countries: prevalence, awareness and control. *Int J Epidemiol*. 2014;43(1):116–128. doi:10.1093/ije/dyt215
- Adeloye D, Basquill C. Estimating the prevalence and awareness rates of hypertension in Africa: a systematic analysis. *PLoS One*. 2014;9(8):e104300. doi:10.1371/journal.pone.0104300
- Addo J, Smeeth L, Leon DA. Global health — hypertension in Sub-Saharan Africa a systematic review. *Hypertension*. 2007;50(6):1012–1018. doi:10.1161/HYPERTENSIONAHA.107.093336
- Guwatudde D, Nankya-Mutyoba J, Kalyesubula R, et al. The burden of hypertension in sub-Saharan Africa: a four-country cross sectional study. *BMC Public Health*. 2015;15(1):1211. doi:10.1186/s12889-015-2546-z
- Gebrihet TA, Mesgna KH, Gebregiorgis YS, Kahsay AB, Weldehaweria NB, Weldu MG. Awareness, treatment, and control of hypertension is low among adults in Aksum town, northern Ethiopia: a sequential quantitative-qualitative study. *PLoS One*. 2017;12(5):e0176904. doi:10.1371/journal.pone.0176904
- Mengistu MD. Pattern of blood pressure distribution and prevalence of hypertension and prehypertension among adults in Northern Ethiopia: disclosing the hidden burden. *BMC Cardiovasc Disord*. 2014;14(1):33.
- Abebe SM, Berhane Y, Worku A, Getachew A. Prevalence and associated factors of hypertension: a cross-sectional community based study in Northwest Ethiopia. *PLoS One*. 2015;10(4):e0125210. doi:10.1371/journal.pone.0125210
- 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(1):113. doi:10.1186/1471-2261-12-113
- Angaw K, Dadi AF, Alene KA. Prevalence of hypertension among federal ministry civil servants in Addis Ababa, Ethiopia: a call for a workplace-screening program. *BMC Cardiovasc Disord*. 2015;15(1):76. doi:10.1186/s12872-015-0062-9
- Helelo TP, Gelaw YA, Adane AA. Prevalence and associated factors of hypertension among adults in Durame Town, Southern Ethiopia. *PLoS One*. 2014;9(11):e112790. doi:10.1371/journal.pone.0112790
- Bonsa F, Gudina EK, Hajito KW. Prevalence of hypertension and associated factors in Bedele Town, Southwest Ethiopia. *Ethiop J Health Sci*. 2014;24(1):21–26. doi:10.4314/ejhs.v24i1.3

18. Djordjević VB, Grubor-Lajsić G, Jovanovic-Galović A, et al. Selenium-dependent GSH-Px in erythrocytes of patients with hypertension treated with ACE inhibitors. *J Environ Pathol Toxicol Oncol*. 1998;17(3–4):277–280.
19. Lewandowska M, Więckowska B, Sajdak S, Lubiński J. First trimester microelements and their relationships with pregnancy outcomes and complications. *Nutrients*. 2020;12(4):1108. PMID: 32316207; PMCID: PMC7230599. doi:10.3390/nu12041108
20. Ethiopia. Office of the Population, Housing Census Commission. Summary and statistical report of the 2007 population and housing census: population size by age and sex. Federal Democratic Republic of Ethiopia, Population Census Commission; 2008.
21. 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;289:2560–2572.
22. Anchala R, Kannuri NK, Pant H, et al. Hypertension in India: a systematic review and meta-analysis of prevalence, awareness, and control of hypertension. *J Hypertens*. 2014;32(6):1170. doi:10.1097/HJH.0000000000000146
23. Nyuyki CK, Ngufor G, Mbeh G, Mbanya JC. Epidemiology of hypertension in Fulani indigenous populations—age, gender and drivers. *J Health Popul Nutr*. 2017;36(1):35. doi:10.1186/s41043-017-0112-2
24. Tadesse T, Alemu H. Hypertension and associated factors among university students in Gondar, Ethiopia: a cross-sectional study. *BMC Public Health*. 2014;14(1):937. doi:10.1186/1471-2458-14-937
25. Moges B, Amare B, Fantahun B, Kassu A. High prevalence of overweight, obesity, and hypertension with increased risk to cardiovascular disorders among adults in northwest Ethiopia: a cross sectional study. *BMC Cardiovasc Disord*. 2014;14(1):155. doi:10.1186/1471-2261-14-155
26. Pinto E. Blood pressure and ageing. *Postgrad Med J*. 2007;83(976):109–114. doi:10.1136/pgmj.2006.048371
27. Cornelissen VA, Smart NA. Exercise training for blood pressure: a systematic review and meta-analysis. *J Am Heart Assoc*. 2013;2:e004473. doi:10.1161/JAHA.112.004473
28. Gay HC, Rao SG, Vaccarino V, Ali MK. Effects of different dietary interventions on blood pressure: systematic review and meta-analysis of randomized controlled trials. *Hypertension*. 2016;67:733–739. doi:10.1161/HYPERTENSIONAHA.115.06853

Integrated Blood Pressure Control

Dovepress

Publish your work in this journal

Integrated Blood Pressure Control is an international, peer-reviewed open-access journal focusing on the integrated approach to managing hypertension and risk reduction. Treating the patient and comorbidities together with diet and lifestyle modification and optimizing healthcare resources through a multidisciplinary team approach constitute key features of the journal. This journal is indexed on

American Chemical Society's Chemical Abstracts Service (CAS). The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/integrated-blood-pressure-control-journal>