

# Prevalence and associated factors of hypertension in Amhara regional state city and its' surrounding rural districts: a community-based cross-sectional study

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## Abstract

**Background:** Nowadays, among non-communicable diseases hypertension is a growing public health important disease both in developed and developing nations.

**Objective:** The aim of this study was to determine the prevalence and associated factors of hypertension in Amhara Regional State city and its' surrounding rural districts, Ethiopia.

**Method:** Community-based cross-sectional study was conducted in the urban and rural communities living in Amhara Regional State city and its' surrounding rural districts administrations in 2015. The WHO Stepwise approach was used for data collection.

**Result:** A total of 1405 subjects participated and the response rate was 95.5%. The overall prevalence of hypertension was 11.4% either previously diagnosed or undiagnosed and was higher in older ages. Whereas the prevalence of hypertension was 13% for urban and 10% for rural residents. Nearly half of them (46.3%) were newly diagnosed. A family history of hypertension, being underweight, overweight, obese, and raised fasting blood sugar were found to be significantly associated with raised blood pressure.

**Conclusion:** One among every three (37.4 %) and one among every nine study participants were found to have pre-hypertension and hypertension respectively.

**Keywords:** Prevalence of hypertension, blood pressure, Bahir Dar.

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## Introduction

The growing burden of non-communicable diseases (NCDs) represents a major challenge to health development. NCDs are responsible for a high proportion of death and disability burden around the globe. In developing countries, the burden of disease caused by NCDs is increasing rapidly and will have significant social, economic, and health consequences<sup>1</sup>. In sub-Saharan Afri-

ca, NCDs are projected to surpass infectious diseases by 2030<sup>2</sup>.

Hypertension is a NCD which, also known as high or raised blood pressure, is a global public health issue. It rarely causes symptoms in the early stages and many people go undiagnosed. It contributes to the burden of heart disease, stroke, kidney failure, premature mortality, and disability. It disproportionately affects populations in low- and middle-income countries where health systems are weak. Globally, the overall prevalence of Hypertension in adults aged 18 years and above in 2014 was 22%<sup>3</sup>, around 40 % in people  $\geq$  25years, 46 % in Africa region and 35% in Americas in 2008. Moreover, it was estimated to cause 7.5 million deaths, about 12.8% of the total of all deaths worldwide<sup>4</sup>.

In Africa, hypertension cases are increasing from time to time, in 1990 the prevalence was 19.7% and it grew to an

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overall pooled prevalence of 30.4% in 2010. It was estimated that 130.2 million people had hypertension. However, it is projected that there will be 216.8 million cases of hypertension by 2030. Besides, many hypertensive individuals are not aware of their condition<sup>5</sup>.

A systematic review and meta-analysis conducted in 2014 to assess the recent burden of hypertension in sub-Saharan Africa in the last 14 years showed that hypertension prevalence varied widely across the studies ranging from 15%–70%<sup>6</sup>.

In Ethiopia, a cross-sectional study conducted on adults aged  $\geq 35$  years in the rural and urban communities of Dabat district and Gondar town in 2012 showed that overall prevalence of hypertension was 27.9% with the proportion of the urban and rural residents being 30.7% and 25.3% respectively<sup>7</sup>.

A systematic review and meta-analysis on subjects aged 15 years and above showed that the prevalence of hypertension among Ethiopian population was estimated to be 19.6 %, and that the prevalence was higher in the urban population (23.7 %) than in rural and urban combined 14.7 %. The prevalence of hypertension among males was 20.6 % and females 19.2 % was similar. This study found that the prevalence of hypertension in Ethiopia is increasing<sup>8</sup>.

The overall prevalence of hypertension among adults in Durame Town, Southern Ethiopia in 2013 was found to be 22.4%. Besides this study also showed that older age, male sex, having a family history of hypertension, physical inactivity, poor vegetable diet, additional salt consumption and obesity were important risk factors associated with hypertension<sup>9</sup>.

Studies have shown risk factors such as age, sex, obesity, physical activity, and family history have a significant association with hypertension<sup>9-11</sup>.

Most studies done on hypertension incorporate 25 years and above which would over-estimate the overall prevalence of hypertension in the community hence this study resolved this gap by considering people aged 18 years and above at the bottom and 65 years and above at the top. The main objective of the study was to quantify the prevalence of hypertension and its associated factors among in Amhara Regional State city and its' surrounding rural districts' community in Ethiopia.

Early detection, intervention, and avoidance of risk fac-

tors for hypertension have a significant contribution to the reduction of the burden of hypertension. Therefore, quantifying the magnitude and risks of hypertension is crucial. This community-based study which included the urban and rural community, young to old participants with large age range would share its own contribution especially showing the magnitude and associated factors of hypertension in the capital city of Amhara Regional State and its' surrounding rural districts, NorthWest Ethiopia. Besides, it would help stakeholders to design and intervene based on scientific evidence.

## **Methods and material**

**Study design and period:** A Community-based cross-sectional study was conducted in 2015.

**Study area:** The study was conducted in Bahir Dar, capital city of Amhara Regional State and its' surrounding rural districts. Bahir Dar is a capital city of Amhara regional state located 565 Km from Addis Ababa to North West Ethiopia. Based on central statistical agency Ethiopian Demographic and Health Survey EDHS report of 2011 the city has estimated total population of 274,836.5<sup>12</sup>.

**Study population:** The study populations were all individuals aged 18 and above in Bahir Dar city and Bahir Dar Surrounding rural districts. The study units were sampled individuals from Bahir Dar city and surrounding Kebeles.

**Inclusion and exclusion criteria:** All sampled individuals aged  $\geq 18$  years old were included in the study. Pregnant women, mothers in the post-partum period, and individuals who were severely ill were excluded from the study.

**Sample size and sampling procedure:** This study was a part of a large study that studied diabetes mellitus (DM). Hence the sample size was determined by the prevalence of DM so as to gain a large sample size. The sample size was calculated by using EPI INFO stat calc for the two population proportions by taking the prevalence of urban DM to be 5.1% and that of rural DM to be 2.1% from the study done in Gondar<sup>13</sup> and taking 95% confidence interval, 80% power and 10% of non-response rate. Accordingly, the total calculated sample size became 1472 for urban and 736 for rural settings.

A multistage cluster and random sampling strategy was employed to select study participants from urban and ru-

ral districts. Initially, clusters of 12 Kebeles/‘Kebele’ is the smallest administrative units in Ethiopia/ for both urban and rural were selected using simple random sampling from the list of the district.

Then, households were selected from each kebele proportional to the number of eligible individuals in each kebele using systematic random sampling technique. Finally, the study unit individual participants from each household were selected using a lottery method.

### Study variables

**Independent variables:** included socio-demographic variables residence, age, sex, marital status, educational status, religion, occupation and ethnicity, lifestyle feeding habit, daily activity, regular exercise, Khat chewing (a natural stimulant with amphetamine-like effects commonly used for social recreation in East African countries), smoking, alcohol consumption; anthropometric measurements, that is; Body mass index [BMI], waist circumference [WC], waist to hip ratio [WHR], blood pressure [BP], and health profile related variable; that is, family history of hypertension

**Dependent variable:** Status of hypertension

**Data collection and procedures:** The data was collected by 24 nurses and laboratory technicians using structured and pre-tested questionnaire. Data collectors were given two days training on data collection techniques before starting data collection. The questionnaire has been adapted from World Health Organization WHO for NCDs surveillance in developing countries<sup>14</sup>.

Data were collected in accordance with the STEP-wise approach of the WHO for NCDs surveillance in developing countries<sup>14</sup>. The approach has two levels: 1) questionnaire to gather demographic and behavioral information, 2) simple physical measurements weight, height, waist circumference and hip circumference and 3) fasting blood sugar measurement. In accordance with the STEPS manual, questions related to alcohol and substance use were tailored to reflect the local context of Ethiopia<sup>14</sup>. A few additional questions were added to supplement the questionnaire and to reflect the local context of Ethiopia. Data regarding socio –demographic variables, health profile variables, and lifestyle were collected by interview. Anthropometric measurements were taken without heavy outdoor clothing. Stature was measured to the

nearest millimeter using an Anthropometric rod. Weight was measured on a pre-standardized digital body weighing scale, and BMI calculated using the formula weight in kilogram divided by height in meters squared. The hip circumference was measured at the maximum circumference around the hips and the waist circumference obtained at the level of the umbilicus at the midpoint between the lower margin of the last palpable posterior rib and the top of the iliac crest hip bone using an inelastic measuring tape while the participants were standing erect. In this study the researchers used a manual BP measuring device Ce/ISO Approved Medical Adult Aneroid Sphygmomanometer MT01028001 to measure study participants blood pressure with participants sitting after resting for at least five minutes. Three measurements of BP on a single visit were taken at least one minute apart, and the averages of the records used for computation of the results. At least two visits were made for those study participants whose BP were elevated at the first contact.

### Operational definitions

Underweight: BMI < 18.5 kg/m<sup>2</sup>

Normal Weight: BMI 18.5–24.9 kg/m<sup>2</sup>

Overweight: BMI 25.0–29.9 kg/m<sup>2</sup>

Obese: BMI > 30.0 kg/m<sup>2</sup>

**Centrally obese:** waist-hip ratio (WHR) > 0.95 for men and 0.85 for women<sup>15</sup>.

**Normotensive\*:** systolic BP < 120 mmHg and diastolic BP < 80 mmHg

**Pre-hypertension\*:** average of two consecutive systolic BP 120–139 mmHg or diastolic BP 80–89 mmHg;

**Hypertension\*:** systolic BP ≥ 140 mmHg and or diastolic BP ≥ 90 mmHg

\*= if test result falls in different categories either for systolic or diastolic BP measurement the highest measurement value used to categorize individuals BP status.

**Data quality control measures:** The standardized questionnaire has adapted from WHO STEPS NCDs surveillance in developing countries<sup>14</sup>. Some questions were added to address the local context and tested for the accuracy and consistency of the tool before actual data collection.

The English version questionnaire was translated to the local language (Amharic) and transcribed back into the English language. The questionnaire was pre-tested in 5%

of the total calculated sample sizes in similar settings , and these were not included in actual study, modified as necessary for clarity, sensitiveness, completeness, and reliability of some newly incorporated questions.

Furthermore, the supervisors and the principal investigators monitored the overall data collection process. For easier understanding of terms in the questionnaire, data collectors and supervisors trained and practiced the questionnaire before the actual data collection. Completion, accuracy, and clarity of the collected data was checked carefully on a regular basis.

**Data processing:** Data were entered into EPI info 3.5.1 then transferred to IBM SPSS Version 20 Statistics for windows for data cleaning, coding, and analysis. The dependent variable, blood pressure, was dichotomized into hypertensive and not hypertensive. To explain the study population in relation to relevant variables, frequencies, mean values and other summary statistics were used and

presented in tables and figures. Both bivariate and multivariable logistic regression models were used to identify associated factors for hypertension. Variables having P-value  $\leq 0.20$  in the bivariate analysis were retained in the multivariable model to control the effect of confounders. The Hosmer-Lemeshow goodness of fit statistic was used to assess the fitness of the model. Odds ratios (OR) with their 95% confidence intervals 95% CI were calculated to measure the strength of association. P value  $< 0.05$  was considered as statistically significant.

## Results

A total of 1,472 participants were involved in this study and 1405 subjects responded which makes it a 95.5% response rate. Half of the participants 50.8% were urban dwellers and the remaining rural dwellers. The mean age of participants was found to be  $36.99 \pm 15.71$  years old, and ranged from 18 to 97 years old. More than half 56.7% of the participants were females Table 1.

**Table 1. Socio-demographic Characteristics of Study Participants in North West Ethiopia, 2015 (N=1405)**

Variable	Variable Category	Frequency	Percent
Residence	Urban	691	49.2
	Rural	714	50.8
Sex	Male	609	43.3
	Female	796	56.7
Age Category	18 - 23 Years	297	21.1
	24 - 34 Years	445	31.7
	35 - 44 Years	246	17.5
	44 - 54 Years	189	13.5
	55 - 64 Years	134	9.5
	$\geq 65$ Years	94	6.7
Marital Status	Single	324	23.1
	Married	924	65.8
	Divorced	72	5.1
	Widowed	84	6.0
Educational Status	Unable to read and Write	525	37.4
	Only read and write	208	14.8
	Grade 1 -8	244	17.4
	Grade 9 – 12 <sup>th</sup>	227	16.2
	Diploma and above	201	14.3
Religion	Orthodox	1287	91.6
	Muslim	98	7.0
	Protestant	19	1.4
Occupation	Student	112	8.0
	Employed	161	11.5
	Merchant	142	10.1
	Farmer	424	30.2
	House Wife	349	24.8
	Daily laborer and have no regular occupation	217	15.4

## Lifestyle

### Feeding /dietary habits of Study Subjects

Almost half of the participants, (49.3%) reported that they ate vegetables and fruits in each week. Regarding frequency of vegetable and fruit consumptions, half of the participants (50.8%) reported that they did not eat

vegetables and fruits within a week whereas 548(39%) ate vegetables for 1-3 days per week and 143 (10.2%) ate vegetables for 4 -7 days/week.

More than two third of the participants (66%) reported they eat fat while eating meat. Besides, 867 (61.8%) participants had a habit of eating raw not cooked meat.

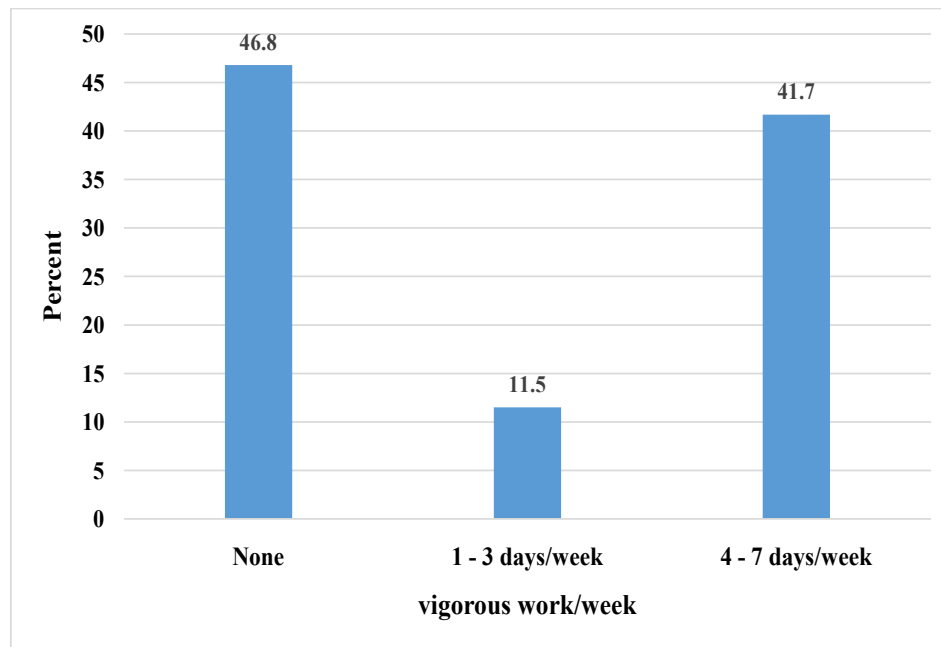


Figure 1. Participants' vigorous work/week, North West Ethiopia 2015.

### Physical exercise

More than half of the participants (53.2%) reported that their work involved vigorous-intensity activity like lifting and digging. More than two thirds (68.2%) of the participants walked or used a bicycle to get to and from places. One hundred seventeen (8.3%) study participants reported that they engaged in vigorous sport activities. The majority of participants (46.8%) did not engage in vigorous work/week Figure 1.

### Cigarette smoking, alcohol, and Khat chewing

Thirteen (0.93%) participants stated that they smoked cigarette at least once in their life. While only 5 sub-

jects (0.36%) were smoking at the point of data collection period and reported 8 cigarettes or more every day. Regarding participants' alcohol use 1139 (81.10%) ever drunk alcohol and 1114 (79.30%) were drinking alcohol during the data collection period. In the past 12 months, among participants who were drinking alcohol n=1114, the frequency of alcohol consumption was reported as occasionally 520(46.7%), weekly 456 (40.9%) and daily 138(12.4%). The types of most used alcohol were "Tela"<sup>a</sup> 1041(93.45%), "Areki"<sup>a</sup> 210(14.95%), Beer 181(12.88%), Wuski 61(4.34%), and "Teji"<sup>a</sup> 35 (2.5%).

Seventy-six (5.41%) participants ever chewed khat and 654.63% were chewing khat in the study period.

a = locally prepared beverage /alcohol in Ethiopia

### Family history of hypertension

One hundred forty-one (10%), 4(0.28%), 16(0.43%), and 66 (4.7%) participants reported they had a family history of hypertension, stroke, heart attack and diabetes mellitus respectively.

### Physical measurements

The mean values of weight was  $55.04 \pm 9.08$  kilograms,

height was  $1.62 \pm 0.88$  meters, waist circumference was  $79.85 \pm 10.51$  centimeters, waist to hip ratio was  $0.88 \pm 0.08$ . Participants mean BMI was  $21.10 \pm 3.24$  Kg/m<sup>2</sup>. When the BMI score of the participants was categorized according to the definition given above 130 (9.3%) of the participants were found to be overweight while 30 (2.1%) were obese. For the waist to hip ratio WTHR 38.9 % (547) had central obesity. WTHR > 0.95 for men and 0.85 for women in Table 2.

**Table 2. Mean value of physical measurements by sex, North West Ethiopia 2015. (n=1405)**

Variable	Mean $\pm$ SD						p-Value
	Overall		Male		Female		
Weight (Kg)	55.0	9.1	56.8	8.7	53.7	9.1	<0.001
Height (m)	1.62	0.09	1.66	0.09	1.58	0.07	<0.001
Waist circumference (cm)	79.9	10.5	78.8	9.2	80.6	11.4	0.0018
Hip circumference (cm)	91.2	9.9	88.9	8.4	93.0	10.6	<0.001
BMI (kg/m <sup>2</sup> )	21.1	3.4	20.5	3.1	21.5	3.5	<0.001
Waist to hip ratio	0.876	0.081	0.887	0.061	0.867	0.092	<0.001
Fasting blood glucose level (mg/dl)	91.2	21.3	90.7	21.5	91.5	21.2	0.48

BMI: Body Mass Index, SD: Standard Deviation

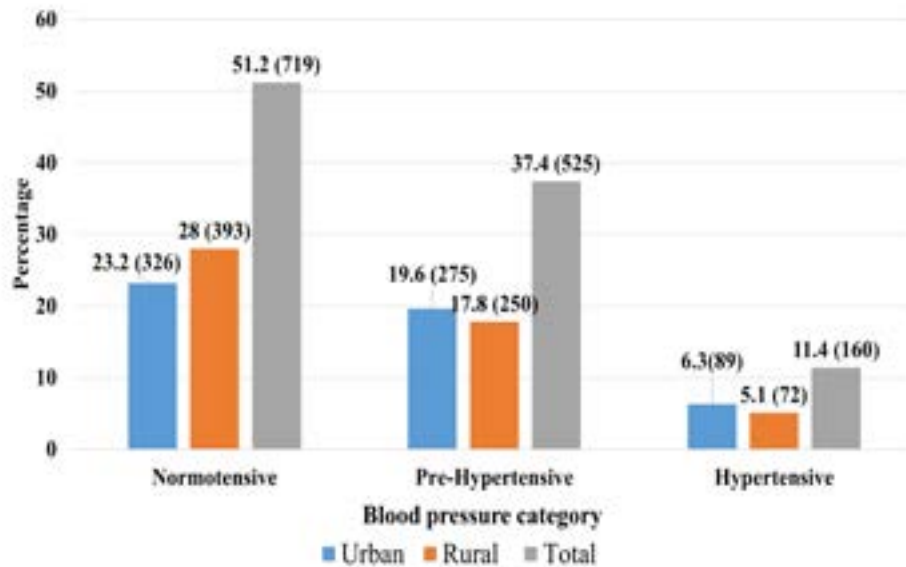
### Prevalence of hypertension

The overall prevalence of hypertension was 11.4% [95% CI 11.0, 13.0] including either previously diagnosed or undiagnosed. For the urban resident participants the prevalence of hypertension was 13.0% [95% CI: 10.0, 15.0] and while it was lower for rural residents i.e 10.0% [95%CI: 8.0, 12.0]. Eleven percent of males [95% CI: 8.0, 13.0] and twelve percent of females [95% CI: 10.0, 14.0] were found to be hypertensive in this study.

Systolic and diastolic BP mean were  $113.48 \pm 16.78$ mmHg and  $71.96 \pm 11.56$ mmHg respectively.

More than half of the participants were found to have normal blood pressure (51.2%) and from these, 23.20 % (326) were urban, and 28% (393) rural dwellers.

Five hundred twenty-six (37.4 %) were found to be pre-hypertensive among these 19.64 % (276) were urban dwellers, and 17.79% (250) rural dwellers. And 51.2% (719) were normotensive among these 23.2% (326) were urban and (393) 28% were rural dwellers Figure 2.



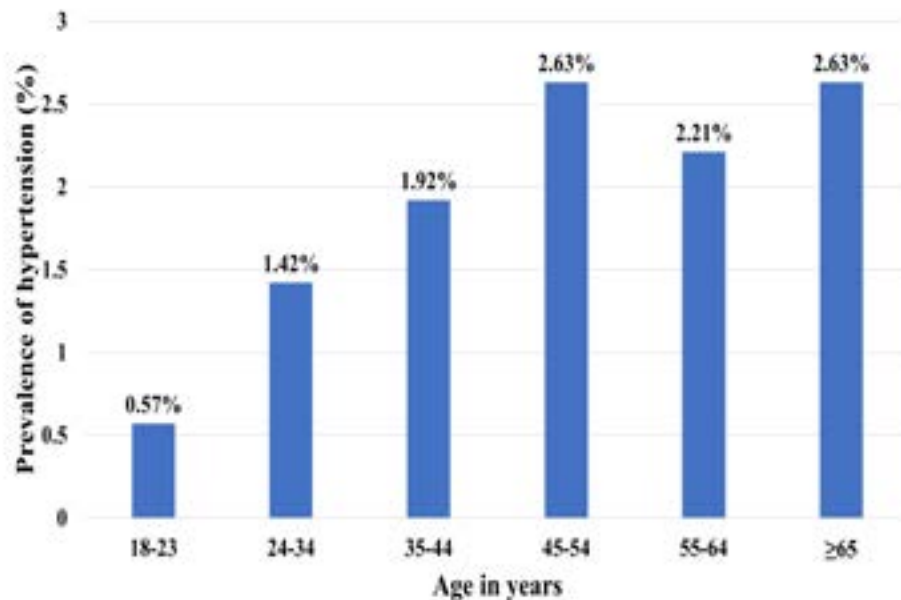
**Figure 2. Blood pressure category of study participants by residence in Northwest Ethiopia, 2015.**

About 2/3<sup>rd</sup>s (62.28%) of the study participants reported that they had never had their BP measured.

Among 160 hypertensive cases, over half(53.75%) of them were known hypertensive individuals and the rest 46.25% had never had their BP measured and hence they were new hypertensive cases identified by this survey. The mean, median, mode, the minimum and maximum age for subjects with hypertension was 50.71, 50, 60, 20 and 90 years respectively. As the age increased, the prevalence of hypertension was also found to increase Figure 3.

### Factors associated with hypertension

The odds of having hypertension increased in a trend fashion as age increased from younger to older. Study participants who were in the age group 35 – 44 years had higher odds of hypertension (aOR: 6.62, 95% CI: 2.17 to 17.72) compared to those in 18-23 years category. Subjects aged 65 years and above compared to younger 18-23 years had a strong association with the odds of hypertension (aOR: 27.20 95% CI: 8.96 to 82.57). Table 3.



**Figure 3: Prevalence of hypertension across age groups among study participants, Northwest Ethiopia, 2015.**

**Table 3. Bivariate and multivariate logistic regression analysis of factors associated with hypertension among study participants in North West Ethiopia, 2015 (N=1405)**

Variable		Hypertension		Unadjusted OR	Adjusted OR
		Yes	No	(95% CI)	(95% CI)
Residence	Urban	89(6.3%)	602(42.8%)	1.34 (0.96, 1.86)	0.82(0.48, 1.41)
	Rural	71(5.1%)	643(45.8%)	1.00	1.00
Age category	18 – 23 Years	8 (0.57%)	289(20.57%)	1.00	1.00
	24 – 34 Years	20(1.42%)	425(30.25%)	1.70(0.74, 3.91)	2.08(0.77, 5.60)
	35 – 44 Years	27(1.92%)	219(15.59%)	4.45(1.99, 9.99)	6.20(2.17, 17.72)*
	44 – 54 Years	37(2.63%)	152(10.82%)	8.79(3.99, 19.36)	11.42(3.99, 32.69)*
	55 – 64 Years	31(2.20%)	103(7.33%)	10.87(4.84, 24.42)	14.13(4.79, 41.63)*
	>= 65 Years	37(2.63%)	57(4.06)	23.45(10.38, 52.99)	27.20(8.96, 82.57)*
Marital Status	Single	16(1.1%)	308(21.9%)	1.00	1.00
	Married	105(7.5%)	819(58.3%)	2.46 (1.43, 4.24)*	0.81(0.40, 1.67)
	Divorced	14(1%)	58(4.1%)	4.64 (2.15, 10.03)*	1.89(0.73, 4.90)
	Widowed	24(1.7%)	60(4.3%)	7.7 (3.86, 15.35)*	1.26(0.50, 3.19)
Educational Status	Unable to read and Write	71(5.1%)	454(32.3%)	1.00	1.00
	Only read and write	29(2.1%)	179(12.7%)	1.03(0.65, 1.65)	1.10(0.64, 1.89)
	Grade 1 -8	30(2.1%)	214(15.2%)	0.89(0.57, 1.42)	1.31(0.73, 2.36)
	Grade 9 – 12	14(1%)	213(15.2%)	0.42(0.23, 0.76)*	0.73(0.33, 1.62)
	Diploma and above	16(1.1%)	185(13.2%)	0.55(0.31, 0.98)*	1.10(0.47, 2.58)
Occupation	Employed	13(0.9%)	148(10.8%)	1.00	1.00
	Student	9(0.6%)	103(7.3%)	0.08 (0.41, 2.41)	3.09(1.00, 9.55)
	Merchant	14(1%)	128(9.1%)	0.99(0.56, 2.74)	1.44(0.56, 3.68)
	Farmer	41(2.9%)	383(27.3%)	1.24(0.63, 2.33)	0.85(0.33, 2.23)
	House Wife	51(3.6%)	298(21.2%)	1.21(1.02, 3.69)*	0.90(0.39, 2.11)
	Daily laborer and have no regular Occupation	32(2.3%)	185(13.2%)	1.94(0.99, 3.88)	1.26(0.53, 2.98)
Do you consume vegetable and fruit weekly	Yes	71(5.05%)	621(44.2%)	1.25 (0.90, 1.73)	0.71(0.47, 1.06)
	No	89(6.33%)	624(44.41%)	1.00	1.00
Family History of HTN	Yes	40(2.8%)	101(7.2%)	3.78 (2.50, 5.70)*	3.07(1.88, 5.02)*
	No	120(8.54%)	1116(81.42%)	1.00	1.00
Body mass index/BMI/	Datasets Weight	93(6.6%)	857(61%)	1.00	1.00
	Under Weight	20(1.4%)	275(19.6%)	0.67 (0.40, 1.10)	0.54(0.31, 0.93)*
	Over Weight	37(2.6%)	93(6.6%)	3.66 (2.36, 5.67)*	2.66(1.55, 4.56)*
	Obese	10(0.7%)	20(1.4%)	4.6 (2.09, 10.13)*	3.46(1.34, 8.92)*
Waist to hip ratio			54.58(7.08, 383.9)*	0.94(0.08, 11.27)	
Fasting Blood sugar mg/dl			1.016(1.01, 1.02)*	1.01(1.01, 1.02)*	

\*= P-value < 0.05

A family history of hypertension had higher odds of having hypertension compared to those who did not have a family history (aOR: 3.07, 95% CI: 1.88 to 5.02). The odds of being hypertensive was 46% (95% CI 7% to 69%) lower for underweight as compared to normal weight. Being overweight compared to normal has almost 3 (aOR: 2.66, 95% CI: 1.55 to 4.56) times more likelihood of having to have hypertension. Obese compared

to normal weight had higher odds of hypertension (aOR: 3.46, 95% CI: 1.34 to 8.92). Age, fasting blood glucose, family history of hypertension, and body mass index, had statistically significant association with hypertension. The possibility of having hypertension increased with advancing age. Residence, marital status, academic status, occupation, and vegetable & fruit consumption in a week were not significantly associated with hypertension.



## Discussion

Hypertension is a global public health issue which rarely causes symptoms in the early stages and many people go undiagnosed<sup>3</sup>. The objective of this study was to determine the prevalence and associated factors of hypertension in Amhara Regional State city and its' surrounding rural districts in NorthWest Ethiopia. The overall prevalence of hypertension in the study area was 11.4% which was lower than other studies conducted in Ethiopia Gondar Northwest Ethiopia, 27.9%<sup>7</sup>, Durame South Ethiopia 22.4%<sup>9</sup>, Ethiopian population 19.6%<sup>8</sup>, pooled prevalence in sub-Saharan African<sup>6</sup> and Uganda 30.5%<sup>16</sup>. This discrepancy could be due to age difference of study participants; this study included a younger population  $\geq 18$  years old while other studies included older populations. For example, a study done in Gondar used aged  $\geq 35$  years old, in Durame<sup>9</sup> study adults older than 31 years and the Ethiopia population<sup>8</sup> and in SSA study were a pooled prevalence of systematic review and meta-analyses<sup>6</sup> which would incorporate researches with different methodologies and study designs. However, the prevalence in the current study is slightly higher than a study done in Sidama Southern Ethiopia 9.9%<sup>11</sup>.

Hypertension is a highly prevalent condition with numerous health risk factors, and the incidence is greatest among older adults. In this study, age had a significant association with hypertension, besides it proved that with increasing age the risk of hypertension occurrence also highly increased. This is in line with several studies<sup>6-9,17,18</sup>. It was also found that with increasing fasting blood glucose level the prevalence of hypertension also increased. The finding is congruent with the study done in Dabat district and Gondar NorthWest Ethiopia<sup>7</sup>. This is because an increased blood sugar potentially increases insulin and leptin level and these causes blood pressure to increase<sup>19</sup>.

It is known that fruits and vegetables are high in potassium, magnesium and fiber. In addition they are low in sodium contents. So, consuming such varieties of foods will help in reducing the risk of hypertension. Even if it is well established that the consumption of fruits and vegetables decreases the risk of hypertension, the current study did not revealed a significant association and this finding is congruent with findings from a study done in Gondar Northwest Ethiopia<sup>10</sup> and Nepal<sup>20</sup>. This might

depend on the respondents' perception and response for questions that assess the fruit and vegetable consumption during the interview.

Risk factors like family history of hypertension, being overweight and obesity were significantly associated with hypertension and this agrees with previous studies<sup>6-9,17,18,21</sup>. Educational status had no association with being hypertensive which is contrary to a study done in Uganda that revealed individuals who attained tertiary education (Diploma and above) were nearly 3 times more likely to be hypertensive compared to those who never went to school. This difference may be due to; in this study almost 86% of subjects were not passed through tertiary education which could show these people would have less likely to have a sedentary life such as prolonged sitting in an office, rather they would have exposure to vigorous activity.

Congruent with Uganda study<sup>16</sup>; residence and occupation were not significantly associated with the prevalence of hypertension.

## Strength and limitation

The strength of this study might be inclusion of a relatively large sample size, using objective measurements and also including a younger adult age group; which could contribute to preventing an overestimation of the overall prevalence of hypertension in the general population. The limitations of our study included; alcohol consumption reported as only frequency and type of alcohol, it do not consider the amount of alcohol consumed due to the fact that local drinks measurement and alcohol volume is difficult, and varies.

## Conclusion

Compared to other studies, the current study revealed that lower prevalence of hypertension. The study also showed that 1 among every 3 and 1 among every 9 study participants were found to have pre-hypertension and hypertension respectively.

A family history of hypertension, body mass index and raised fasting blood glucose were found to be the predictors of hypertension.

Community-based prevention and control strategies such as mass screening of community at certain inter-

vals would contribute to the reduction and control of the growing prevalence of hypertension.

### Abbreviations

BMI; Body mass index

BP; Blood pressure

NCD; Non-communicable diseases

WC; waist circumference

WHR; Waist to hip ratio

### Ethics approval and consent to participate

Ethical approval and clearance were obtained from Institutional Review Board of Bahir Dar University prior to enrollment. After clearly explaining the objective of the study, verbal consent was obtained from each participant before conducting the interview and measurements. All identified hypertensive and pre-hypertensive individuals were referred to health institutions. Data was kept confidentially and communicated without disclosing identity.

### Consent for publication

Not applicable.

### Availability of data and material

Data sets supporting the conclusion of this article within the article and its additional file.

### Competing interests

None declared.

### Funding

Bahir Dar University funded this research project.

### Author contributions

WAT conceived and designed the study: WAT, TDT, AS, & YS lead the study process. TDT, WAT, AS & YS analyzed the data. TDT, AS & WAT prepared the manuscript. All authors read and approved the manuscript.

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