

# Prevalence and correlation of hypertension among adult population in Bahir Dar city, northwest Ethiopia: a community based cross-sectional study

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**Background:** Hypertension is one of the most common causes of premature death and morbidity and has a major impact on health care costs. It is an important public health challenge to both developed and developing countries. The aim of this study was to determine the magnitude and correlates of hypertension.

**Methods:** A community-based cross-sectional study was conducted in June 2014 among 681 adult residents of Bahir Dar city using multistage sampling techniques. An interview-administrated questionnaire and physical measurements such as blood pressure (BP), weight, height, and waist and hip circumferences were employed to collect the data. The data were coded, entered, and analyzed with SPSS version 16 software package.

**Results:** A total of 678 responses were included in the analysis resulting in a response rate of 99.6%. The findings declared that 17.6%, 19.8%, and 2.2% of respondents were prehypertension, hypertension stage I, and hypertension stage II, respectively, on screening test. The overall prevalence of hypertension (systolic BP  $\geq 140$  mmHg, or diastolic BP  $\geq 90$  mmHg, or known hypertensive patient taking medications) was 25.1%. According to the multivariate logistic regression analysis, age; having ever smoked cigarette; number of hours spent walking/cycling per day; number of hours spent watching TV per day; history of diabetes; adding salt to food in addition to the normal amount that is added to the food during cooking; and body mass index were statistically significant predictors of hypertension.

**Conclusion:** One out of every four respondents of the study had hypertension, and more than one out of three cases of hypertension (38.8%) did not know that they had the hypertension; 17.6% of the respondents were in prehypertension stage, which adds to overall future risk of hypertension. Therefore, mass screening for hypertension, health education to prevent substance use, regular exercise, reducing salt consumption, and life style modifications are recommended.

**Keywords:** blood pressure, body mass index, noncommunicable disease, salt consumption

## Introduction

Noncommunicable diseases (NCDs) are a major cause of morbidity and mortality globally. These diseases account for two-thirds of all deaths worldwide; in opposition to the common misconception, the burden of these diseases is worst in low- and middle-income countries where 80% of all NCDs occur.<sup>1</sup> Hypertension is one of the main public health challenges because of its high frequency and associated risks of cardiovascular and kidney diseases such as myocardial infarctions, strokes, and renal failures.<sup>2</sup>

Hypertension is the biggest risk factor for death, responsible for 9.4 million deaths and 7% of disability worldwide. This makes it the single most important cause of

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**Table 1** Level of blood pressure

Category	SBP mmHg	and/or	DBP mmHg
Normal	<120	and	<80
Prehypertension	120–139	or	80–90
Hypertension stage I	140–159	or	91–100
Hypertension stage II	≥160	or	≥100

**Abbreviations:** DBP, diastolic blood pressure; SBP, systolic blood pressure.

morbidity and mortality worldwide.<sup>3</sup> It was almost nonexistent in African societies in the first half of the twentieth century; however, estimates now show in some settings in Africa that more than 40% of adults have hypertension.<sup>4</sup>

Hypertension is not only an important public health problem; rather, it will also have a big economic impact as a significant proportion of the productive population becomes chronically ill and stays at home, leaves their job, or dies, leaving their families in poverty.<sup>5</sup> It is called the “silent killer” because it often has no warning signs or symptoms, and many people do not realize they have it.<sup>6</sup>

Various factors contribute to the occurrence of hypertension including excessive intake of saturated fatty acids and higher consumption of salts, which are risk factors for cardiovascular diseases. Unhealthy diet and physical inactivity contribute to around 30% of preventable morbidity and mortality from NCDs, including due to hypertension.<sup>7</sup>

The dietary approach is to promote food items containing fruits, vegetables, low-fat dairy products, and whole grains while limiting the amount of meat, sweets, and sugar and reducing sodium intake to reduce the mean population blood pressure (BP).<sup>8,9</sup>

Sedentary life style is also a cause of overweightness that produces higher body mass indexes (BMIs) and waist-to-hip ratios. In turn, these factors are associated with hypertension and other cardiovascular diseases.<sup>10–12</sup>

Studies in Africa have indicated that hypertension is a highly prevalent disease; accordingly, a study conducted in Nigeria showed prevalence of hypertension ranging from 8% to 46.4%; in Cameroon it was 47.5%; and in Tanzania it ranged from 25.4% to 41.1%.<sup>12–14</sup>

**Table 2** WHO classification of BMI

Categories of BMI	Description
<18.5	Underweight
18.5–24.9	Healthy weight
25.0–29.9	Overweight
≥30	Obese

**Abbreviations:** BMI, body mass index; WHO, World Health Organization.

**Table 3** Waist-to-hip ratio classified into low and high based on World Health Organization classification in the following ways

	Low waist-to-hip ratio	High waist-to-hip ratio
Male	≤0.95	>0.95
Female	0.85	>0.85

In developing countries like Ethiopia where urbanization is expanding, lifestyles are changing, literacy rate is low, and people are still living in poverty, hypertension and its impact on development and health is particularly critical. However, little work has been done on NCDs. Therefore, there is a need to fill the gap regarding the magnitude (prevalence) of high BP and to identify factors associated with high BP in our country, which prompted the conduct of this study. Once the prevalence of hypertension and its associated risk factors have been identified in the target area, the findings will contribute to regional health offices and concerned bodies designing intervention strategies and prevention measures. Moreover, research organizations and those who are interested in the field of cardiovascular diseases would benefit from this information.

## Materials and methods

### Study design and period

A community-based cross-sectional study was conducted in people living in Bahir Dar city in June 2014.

### Study setting

Ethiopia has eight regions (very large administrative units). Amhara region is one of those eight regions of the country, and Bahir Dar city is the capital city of Amhara region; this is where the study was conducted. Bahir Dar city possesses nine kebeles (the smallest administrative units). The city is located in northwest Ethiopia at a distance of 565 kilometers from Addis Ababa, the capital city of Ethiopia. The sample population was selected at random from the population residing in the city, which implies that the selected sample is representative of the adult population in the area; therefore, the result can be extrapolated to the adult population in Ethiopia and other African nations.

### Source population

All adult aged 30 years or more living in the city during the study period were eligible for the study.

### Exclusion criteria

Pregnant women were excluded from the study to avoid confounding.

## Sample size determination

The sample size of the study was determined from a previous study, considering an estimated 30.2% as the expected proportion of hypertension.<sup>15</sup> Any particular outcome was to be within 5% marginal error and 95% confidence interval (CI) of certainty. Based on these assumptions, the final sample size with design effect of 2 and an additional 10% for nonresponse rate was determined to be 681 people.

## Sampling procedure

Bahir Dar city has nine administrative units or kebeles; four of the nine kebeles (44.4%) were selected randomly to get representative samples of the population. The study participants were selected from the target population through a multistage sampling technique and probability proportionate to size of the households from each selected kebele of the city.

The calculated sample size of 681 was distributed among each selected kebele proportional to the size of the population in each administrative unit. Then, after determining the number of individuals to be studied in each kebele, the sample size in each kebele was divided by the number of households in the kebele to determine the proportion of individuals to be studied in each selected kebele. This allowed a systematic sampling technique to be used in order to select the study units in the selected households.

After getting the sampling fraction in the selected kebeles or administrative units, a simple random method was used among the first “k” units of the households. Then, every kth units of households was visited to get the required number of study participants in all selected kebeles of the city.

Finally, a simple random sampling technique was used to select the study units in the selected households in the case that more than one person of 30 years of age or more was present in the house.

## Study variables

### Dependent variable

The dependent variable of the study was hypertension.

### Independent variables

The independent variables of the study were:

- Sociodemographic characteristics: sex, age, marital status, ethnicity, religion, educational status, occupation, income
- Behavioral factors: Alcohol consumption, smoking, physical activity, lifestyle, feeding practices
- Other factors: BMI, waist-to-hip circumference ratio, history of hypertension, diabetes mellitus.

## Operational definitions

Hypertension was defined as self-reported use of antihypertensive medication within the past 2 weeks or an average systolic BP  $\geq 140$  mmHg, an average diastolic BP  $\geq 90$  mmHg, or both. The level of hypertension was measured based on the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) (Table 1).<sup>16</sup>

An adult who had a BMI between 25 and 29.9 was considered overweight. An adult who had a BMI of 30 or higher was considered obese. BMI is defined as the individual's body mass divided by the square of their height. Categories of BMI were done based on World Health Organization (WHO) classification (Table 2). Waist-to-hip ratio was measured based on the World Health Organization classification as in the following way: for males  $\leq 0.95$  and  $>0.95$  low and high respectively; and for females  $\leq 0.85$  and  $>0.85$  low and high respectively (Table 3).

## Data collection procedures and data collection tools

The data was collected using a structured interview questionnaire and physical measurements. The questionnaire was adapted from “WHO STEP wise approach to chronic disease risk factor surveillance (STEPS)”.<sup>17</sup>

A digital measuring instrument was used to measure the weight of adult individuals who were included in the study. Weight measuring scales were checked and adjusted at zero level between each measurement. Height was measured with stadiometers following the standard steps. Waist circumference was measured just at the midpoint between the anterior superior iliac spine and the lowest rib using tape meters, marking the area with a single thin piece of cloth.

BP was measured twice in a sitting position (using a standard sphygmomanometer BP cuff with an appropriate size to cover two-thirds of the upper arm) after the participant rested for at least 5 minutes, with no smoking or caffeine allowed for 30 minutes before measurement. The second measurement was taken 5–10 minutes after the first measurement.

Seven clinical nurses acted as data collectors, and two supervisors were recruited for the field work.

## Data quality management

The questionnaire was initially prepared in English, was translated into the local language (Amharic) in order to obtain the required information from the respondents, and was

translated back to English to check for any inconsistencies in meaning of words by language experts.

A pretest was done among 5% of the sample population among individuals in kebeles that were not included in the main survey. Data collectors and supervisors were trained for period of 2 days on procedures of measuring BP, heart rate, weight, height, and waist and hip circumferences of the participants, and were also made familiar with the questionnaires.

## Data processing and analysis

Prior to data entry, questionnaires were checked for errors and coded; next, data were entered into SPSS version 16 software package. Data was cleaned by doing simple frequency and cross-tabulation between each independent and dependent variable.

Univariate and bivariate analyses were computed to see the frequency distribution and to test whether there was association/difference between hypertension and selected independent variables, respectively. Factors associated with hypertension on bivariate analysis were identified, and the variables with *P*-values of 20% or less were taken to multi-variable logistic regression analysis and the model was built with backward elimination.

Finally, *P*-values less than 0.05 was considered statistically significant.

## Ethical considerations

Ethical clearance was obtained from the ethical review committee of Bahir Dar University and was communicated to the Amhara regional health bureau and Bahir Dar city administrative offices to receive permission letters. After obtaining permission letters and selection of the study subjects, the objective of the study was clearly explained for the study participants to get consent.

## Results

### Demographic characteristics of the study participants

A total of 678 responses were included in the analysis from the desired sample size of 681 participants interviewed; only three responses were excluded from analysis because of incompleteness, resulting in a response rate of 99.6%.

Out of the total study participants included in the study, 369 (54.4%) were females and the mean and standard deviation of the age of respondents was 49.2±1.37 years. Regarding the literacy level of respondents, 272 (40.1%) were illiterate. Concerning ethnicity and marital status of

**Table 4** Demographic characteristic of people in Bahir Dar city, June 2014

Variables	Categories	Frequency, N=678	Percentages
Sex	Male	309	45.6
	Female	369	54.4
Age	30–40 years	257	37.9
	41–50 years	189	27.9
	>50 years	232	34.2
Educational status	Illiterate	202	29.8
	Able to read and write but no formal education	70	10.3
	Grade 1–8	148	21.8
	Grade 9–12	94	13.9
Ethnicity	Diploma and above	164	24.2
	Amhara	638	94.1
	Agew	22	3.2
	Tigray	11	1.6
Marital status	Others	7	1.0
	Married	430	63.4
	Single	59	8.7
	Separated	15	2.2
Occupation	Divorced	65	9.6
	Widowed	109	16.1
	Civil servant	135	19.9
	NGO	40	5.9
	Private employee	324	47.7
Monthly income	Retired	86	12.7
	House servant	94	13.8
	<700	171	25.2
	700–1,100	157	23.1
1,101–2,000	203	29.9	
>2,000	119	17.5	

**Note:** The currency for the monthly income is Ethiopian birr.

**Abbreviation:** NGO, nongovernmental organization.

the respondents, 94.1% were Amhara and more than 60% were married (Table 4).

### History of substance use

The findings of this study indicated that 41 (6.0%) were smokers during the time of the survey and 46 (6.8%) of the respondents had smoked cigarettes once in their life time. About 28 (60.8%) reported that they had started smoking before 24 years of age.

Regarding alcohol consumption, 408 (59.4%) and 502 (73.9%) drank alcohol in the last 1 month and 12 months, respectively. Out of the respondents who took alcohol in the last 1 month, 278 (68.1%), 118 (28.9%), and 12 (3.0%) of them reported that they were taking alcohol less than 3 days, 3–5 days, and more than 5 days per week, respectively (Table 5).

### Physical activity of respondents

The study found that 89 (13.1%) of the respondents' occupations involved vigorous physical activity, 75 (84.3%) were

**Table 5** Substance use among adult population in Bahir Dar city, June 2014

Variables	Categories	Frequency, N=678	Percentages
Smoking cigarettes	Yes	41	6.0
	No	637	94.0
Daily smoking	Yes	7	17.1
	No	34	82.9
Ever smoked cigarettes	Yes	46	6.8
	No	632	93.2
Age at smoking initiation	<18 years	9	25.0
	18–20 years	11	30.6
	20.1–24 years	8	22.2
	>24 years	8	22.2
Ever drink alcohol	Yes	651	96.0
	No	27	4.0
Drunk alcohol in the last 12 months	Yes	502	73.3
	No	174	25.6
Frequency of alcohol consumption in the last 12 months	Daily	43	8.5
	Weekly	91	18.1
	Every 2 weeks	122	24.3
	Every 3 weeks	18	3.5
Alcohol consumption in the last 30 days	Every month	229	45.5
	Yes	408	59.4
	No	274	40.6
Frequency of alcohol consumption in the last 30 days	<3 days/week	278	68.1
	3–5 days/week	118	28.9
	>5 days/week	12	3.0

doing vigorous physical activity more than 4 days per week, and 77 (86.5%) of them spent over 5 hours per day doing occupations involving vigorous physical activities.

However, 476 (70.1%) of respondents' occupations involved moderate physical activity, and 310 (64.7%) of them were doing moderate physical activity more than 4 days per week. One hundred and seventy-eight (44.2%) respondents cycled or walked continuously for at least 10 minutes for less than 4 days per week, and 235 (58.3%) of them cycled or walked for more than 5 hours per day. About 33 (4.9%) of the study participants reported were doing sports involving vigorous physical activity, and 24 of them did so for less than 3 days per week (Table 6).

### Feeding habits of people in Bahir Dar city

The findings of this study showed that 403 (59.4%) respondents did not consume fruit at all and only 238 (35.1%) and 37 (5.5%) were consuming one to two and three or more servings of fruit per week, respectively. Regarding vegetable consumption, 20.9% of the respondents did not consume vegetable at all in their usual diet.

About 158 (23.3%) and 39 (5.8%) of respondents consumed food out of their home one to three and four or more times per week, respectively. Regarding sweet food

**Table 6** Physical activity of people living in Bahir Dar city, June 2014

Variables	Categories	Frequency, N=678	Percentages
Occupation involves vigorous physical activity	Yes	89	13.1
	No	589	86.9
Number of days of vigorous physical activity done per week	≤4 days/week	14	15.7
	>4 days/week	75	84.3
Number of hours spent on vigorous physical activity per day	≤5 hrs/day	12	13.5
	>5 hrs/day	77	86.5
Occupation involves moderate physical activity	Yes	475	70.1
	No	203	29.9
Number of days of moderate physical activity done per week	≤4 days/week	169	35.3
	>4 days/week	310	64.7
Use bike or walk continuously for at least 10 minutes	Yes	398	58.7
	No	280	41.3
Number of days walking or cycling for at least 10 minutes continuously	≤4 day/week	178	44.2
	>4 days/week	225	55.8
Number of hours to walk or cycle per day	≤5 hrs/day	168	41.7
	>5 hrs/day	235	58.3
Do vigorous sport physical activity	Yes	33	4.9
	No	645	95.1
Number of days of vigorous sport done per week	≤3 days/week	24	75.0
	>3 days/week	8	25.0
Do moderate-intensity sports	Yes	398	58.8
	No	280	41.2
Number of days of moderate-intensity sports per week	≤5 days /week	262	65.8
	>5 days/week	136	34.2

consumption, 258 (38.2%) and 129 (19.1%) of the participants consumed sweet food one to three times and three or more times per week, respectively.

About 220 (59.9%) and 27 (7.4%) of our study participants reported that they consumed meat-containing foods two and three times per week, respectively. Moreover, more than 10% of respondents declared that they added salt to their food in addition to the normal amount that was added to the food during cooking (Table 7).

### Hypertension and blood sugar level among the adult population of Bahir Dar city

According to the current study, 410 (60.5%) of respondents had measured their BP by health professionals, and 104 (15.3%) were taking medications for hypertension. Out

**Table 7** Feeding habits of adult population in Bahir Dar city, June 2014

Variables	Categories	Frequency	Percentages
Frequency of fruit consumption per week	None	403	59.4
	One to two times	238	35.1
	Three or more times	37	5.5
Frequency of vegetable consumption per week (678)	None	142	20.9
	One to two times	322	47.6
	Three or more times	214	31.5
Common type of oil consumed	Vegetable oil	398	58.6
	Sesame seed oil	185	27.2
	Mixed type of oil	62	9.1
	Do not know	33	4.9
Average times food eaten out of home per week (678)	None	481	70.9
	One to three times	158	23.3
	More than three times	39	5.8
Average times sweet food consumed per week (675)	None	288	42.7
	One to three times	258	38.2
	More than three times	129	19.1
Number of times food containing meat consumed per day (367)	One time	120	32.7
	Two times	220	59.9
	Three times	27	7.4
Use of additional salt (678)	Yes	74	10.9
	No	604	89.1

of the total known hypertensive patients, 31 (29.8%) visited traditional healers, and 16 of these patients (51.6%) were taking herbal medications during the survey. About 144 (21.2%) of the respondents had measured their blood sugar level, and 33 (4.9%) were taking medications for high blood sugar level (Table 8).

### Frequency distribution of BP, BMI, and waist-to-hip ratio among people in Bahir Dar city

The level of hypertension on screening tests had showed that 119 (17.6%), 134 (19.8%), and 15 (2.2%) respondents had prehypertension, hypertension stage I, and hypertension stage II, respectively, showing that the magnitude of respondents with systolic BP greater than or equal to 140 mmHg or diastolic BP greater than or equal to 90 mmHg was 149 (21.9%) on screening (Figure 1). However, the prevalence of known hypertensive patients who were taking antihypertensive drugs during the survey were 104 (15.3%). The overall prevalence of respondents whose systolic BP was greater or equal to 140 mmHg, whose diastolic BP was greater than or equal to 90 mmHg, or who were known hypertensive patients taking medications was 170 (25.1%).

Seventy-nine (76%) of the known hypertensive cases had systolic or diastolic BP of greater than 140 or 90 mmHg during the survey, respectively. Moreover, out of the total hypertensive patients, 66 (38.8%) were newly screened and unaware of being hypertensive during the survey (Table 9).

Regarding the BMI of the respondents, 104 (2.9%) and 20 (15.3%) respondents were found to be obese and overweight, respectively; of the total obese and overweight patients, 77 (62.1%) were females (Figure 2).

### The association between predictor variables and hypertension among the adult population in Bahir Dar city

Beyond the descriptive analysis on this study, the bivariate logistic regression analysis was computed. Accordingly, on the bivariate analysis, age; marital status; occupation; having ever smoked cigarettes; occupation with vigorous or moderate physical activity; walking or cycling to work; number of days walking per week; number of hours spent walking/cycling per day; number of hours spent watching TV; history of high blood sugar level; and BMI were found to be significantly associated with hypertension at *P*-value level of 0.2 (Table 10).

### Multivariate logistic regression analysis between predictor variables and hypertension among people living in Bahir Dar city

The effect of multicollinearity intra-predictor variables was tested observing the standard errors for beta coefficients. The assumptions of multiple logistic regression analysis were assessed using the Hosmer–Lemeshow model fitness test, resulting in a *P*-value of 0.985.

In the multivariate logistic regression analysis, age; having ever smoked cigarettes; number of hours spent walking/cycling per day; number of hours spent watching TV per day; history of high blood sugar level; adding salt to food in addition to the normal amount that was added to the food during cooking; and BMI were statistically significant predictors of hypertension.

Accordingly, the odds of developing hypertension among respondents of age 41–50 years and greater than 50 years were more than two- and seven-times more likely compared to those aged 30–40 years, respectively (adjusted odds ratio [AOR]=2.50, 95% CI: 1.25–5.02, and AOR=7.05, 95% CI: 3.51–14.15). The odds of developing hypertension among

**Table 8** History and current hypertension status of adult population in Bahir Dar city, June 2014

Characteristics	Classifications	Frequency	Percentages
BP ever measured by health professionals (678)	Yes	410	60.5
	No	268	39.5
Taking medications/known HTN (678)	Yes	104	15.3
	No	574	84.7
Currently receiving treatments/advice (104)	Took medicine in the past 2 weeks	60	57.7
	Advice to decrease salt	102	98.1
	Advice to decrease weight	54	51.9
	Consultation to stop smoking	10	9.6
	Advice to start sport	44	42.3
Ever seen traditional healer for HTN (104)	Yes	31	29.8
	No	73	70.2
Currently receiving herbal or traditional remedy for HTN (31)	Yes	16	51.6
	No	15	48.4
Blood sugar level ever measured by health professionals (678)	Yes	144	21.2
	No	534	78.8
Had history of high blood sugar level (678)	Yes	33	4.9
	No	645	95.1
Currently receiving treatments/advice (33)	Insulin	28	84.8
	Medication in the last 2 weeks	29	87.9
	Advice to use special food	27	81.8
	Advice to decrease weight	20	60.6
	Advice to stop smoking	2	6.1
	Advice to start sports	9	27.3

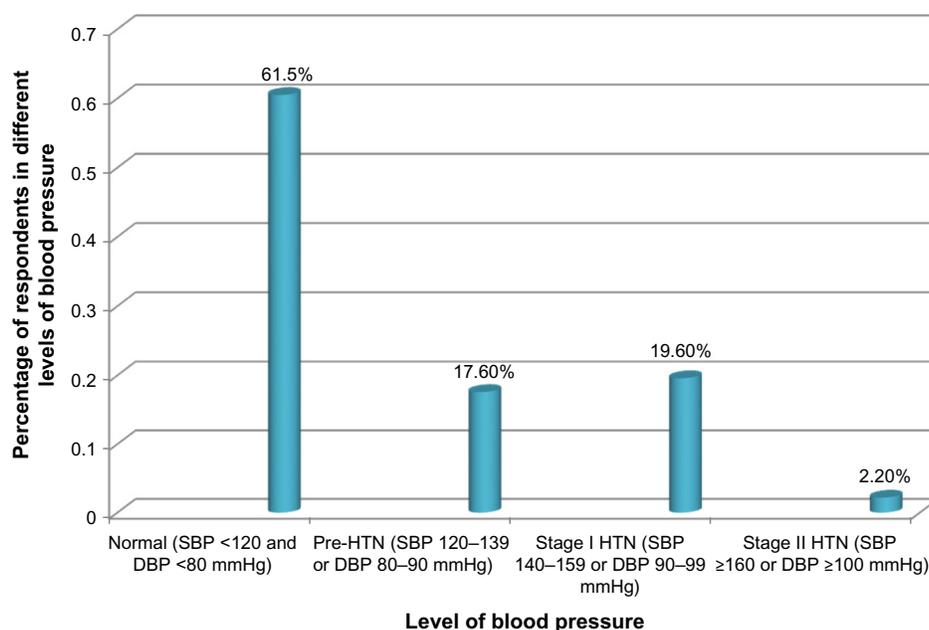
**Note:** The percentages for variables current receiving treatments/advice for hypertension and high blood sugar level were more than 100% because of the possibility of a single person being in multiple classifications.

**Abbreviations:** BP, blood pressure; HTN, hypertension.

respondents who had ever smoked cigarettes was more than three-times more likely compared to the counterparts who had never smoked (AOR =3.2, 95% CI: 1.37–7.70). Respondents who spent 4 or more hours watching TV per day were more than two-times more at risk of developing

hypertension compared to those spent less than 4 hours watching TV (AOR =2.1, 95% CI: 1.26–5.76).

Having history of high blood sugar level was the other significant predictor of hypertension, so that respondents who had a history of high blood sugar level were about three-times more

**Figure 1** Level of hypertension among people in Bahir Dar city, June 2014.

**Abbreviations:** DBP, diastolic blood pressure; HTN, hypertension; SBP, systolic blood pressure.

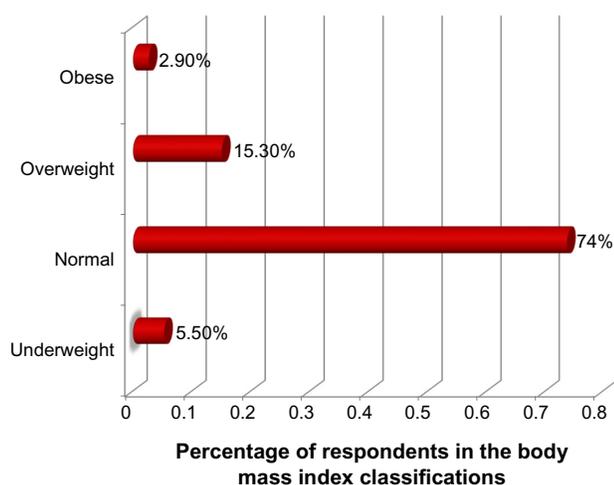
**Table 9** Frequency distribution of blood pressure, BMI, and waist-to-hip ratio among population of Bahir Dar city, June 2014

Factors	Categories	Frequency	Percentages
Level of HTN in screening	Normal	410	60.4
	Prehypertension	119	17.6
	Hypertension stage I	134	19.8
Diagnosis of HTN	Hypertension stage II	15	2.2
	Normal plus prehypertension	529	78.1
Taking medications/ known HTN (678)	Hypertension stage I and II	149	21.9
	Yes	104	15.3
Controlled HTN (104)	No	574	84.7
	Yes	25	24.0
Hypertension (SBP $\geq$ 140 mmHg or DBP $\geq$ 90 mmHg or taking medications) (678)	No	79	76.0
	Yes	170	25.1
Newly screened HTN	No	508	74.9
	Yes	66	38.8
	No	104	61.2
	BMI	<18.5	37
Waist-to-hip ratio	18.5–24.9	502	74.0
	25.0–29.5	104	15.3
	>30.0	15	2.9
	Lower risk	330	48.7
	Higher risk	347	51.2

**Notes:** Waist-to-hip ratio lower risk:  $\leq 0.95$  for males and  $\leq 0.85$  for females; and higher risk:  $> 0.95$  for males and  $> 0.85$  for females.

**Abbreviations:** BMI, body mass index; DBP, diastolic blood pressure; HTN, hypertension; SBP, systolic blood pressure.

likely to develop hypertension as compared to those had no history of high blood sugar level (AOR = 2.8, 95% CI: 1.64–4.75). Also, respondents who add salt to food in addition to the normal amount that was added to the food during cooking were more

**Figure 2** Body mass index of adult population of Bahir Dar city, June 2014.

than three-times more likely to have hypertension compared to those who do not add additional salt to food.

Moreover, the BMI of the respondents was statistically associated with developing hypertension, the odds of hypertension being more than six- and eleven-times higher among respondents whose BMI ranged from 25.0 to 29.9 and greater than 30.0 compared to whose BMI was less than 18.5, respectively (AOR = 6.3, 95% CI: 2.16–20.49, and AOR = 11.6, 95% CI: 2.93–46.21), respectively (Table 11).

## Discussion

The aim of this study was to determine the prevalence and factors associated with hypertension among an adult population. Accordingly, the prevalence of hypertension was 170 (25.1%). This finding is in line with other similar studies conducted in Durame and Gondar town where the magnitudes of hypertension were 22.4% and 28.3%, respectively.<sup>18,19</sup> Also, our finding is in accordance with studies conducted in Jeddah, Egypt, and Maharashtra State, India, where the magnitudes of hypertension were 25.2% and 23%, respectively.<sup>20,21</sup>

However, our finding is lower than other similar studies conducted in different regions of Africa. A study conducted in Cameron found a much higher prevalence than our findings, with a prevalence of hypertension of 47.5%.<sup>13</sup>

Our finding is also much lower than that of a study conducted in Ghana and South Africa, where the magnitudes of hypertension among adult populations were 42.4% and 46%, respectively.<sup>22</sup> However, our finding was higher than that of a study conducted in Bedele town, south Ethiopia, where the prevalence of hypertension was 16.9%.<sup>23</sup> Also, the current study was much higher than that of a study conducted in River state in the Niger Delta region of Nigeria, where the magnitude of hypertension was 20.2%.<sup>24</sup> The probable reason for the differences could be attributed to difference in sociodemographic characteristics, sample size, life style, and feeding habits.

About 61.2% of hypertension patients are aware of their hypertension status; however, 38.6% of hypertension patients are unaware of the condition, indicating that more than one out of three cases of hypertension do not know that they have it. This supports the notion that hypertension is a silent killer. This finding is in agreement with other similar studies, where 37% and 44.8% of hypertension patients did not know their status.<sup>18,23</sup>

Also, several variables were found to be significant predictors of hypertension. The odds of developing hypertension among respondents aged 41–50 years and greater than 50 years were more than two- and seven-times as likely

**Table 10** The association between selected predictor variables and hypertension on crude effect among adult population in Bahir Dar city, June 2014

Variables	Categories	Hypertension		COR (95% CI)
		Yes	No	
Age	30–40 years	21	236	1.00
	41–50 years	38	151	2.18 (1.69–5.98)
	>50 years	111	121	10.31 (6.13–19.12)
Marital status	Married	103	327	1.00
	Single	4	55	0.21 (0.06–0.67)
	Separated in place	1	14	0.23 (0.04–2.11)
	Divorced	12	53	0.78 (0.39–1.56)
	Widowed	50	59	2.40 (1.53–3.77)
Occupation	Civil servant	27	108	0.73 (0.38–1.37)
	NGO	7	33	0.65 (0.25–1.66)
	Private worker	59	265	0.49 (0.28–0.86)
	Retired	53	33	3.34 (1.78–6.29)
	House servant	24	69	1.00
Ever smoked cigarettes	Yes	21	20	3.47 (1.82–6.60)
	No	149	488	1.00
Occupation involves vigorous physical activity	Yes	12	77	1.00
	No	158	431	2.35 (1.25–4.44)
Occupation involves moderate physical activity	Yes	95	380	1.00
	No	75	128	2.34 (1.63–3.37)
Walk/bike to go work	Yes	69	329	1.00
	No	101	179	2.69 (1.88–3.84)
Number of days walked per week	≤4	23	154	1.00
	>4	47	178	1.77 (1.03–3.04)
Number of hours spent to walk or cycle per day	≤4	20	148	1.00
	>4	50	184	2.01 (1.15–3.53)
Number of hours spent watching TV	≤4 hrs/day	133	448	1.00
	>4 hrs/day	37	58	2.15 (1.36–3.39)
History of high blood sugar level	Yes	18	15	3.89 (1.92–7.91)
	No	152	493	1.00
Add salt to food when eating	Yes	32	42	2.57 (1.56–4.23)
	No	138	466	1.00
BMI	<18.5	4	33	1.00
	18.5–24.9	100	402	2.02 (0.71–5.93)
	25.0–29.5	48	56	7.07 (2.34–21.39)
	>30.0	11	9	10.08 (2.59–39.33)

**Abbreviations:** BMI, body mass index; CI, confidence interval; COR, crude odds ratio; NGO, nongovernmental organization.

compared to respondents aged less than 40 years, respectively (AOR =2.50, 95% CI: 1.25–5.02, and AOR =7.05, 95% CI: 3.51–14.15). This is in line with other studies where the risks of hypertension increase with age.<sup>20,22,25,26</sup>

The odds of developing hypertension among smokers was more than three-times as likely compared to their counter parts, who never smoked cigarette (AOR =3.2, 95% CI: 1.37–7.70). This supports that substance use is associated with cardiovascular diseases including hypertension. Our finding is in agreement with others similar studies where substance use was a significant predictor of hypertension.<sup>27,28</sup>

The study also revealed that self-reported diabetes was another significant predictor of hypertension. Diabetic patients were about three-times more likely to have hypertension as

compared to those who had no history of high blood sugar level (AOR =2.8, 95% CI: 1.64–4.75). This finding was in accordance with other studies where high blood sugar level was significantly associated with hypertension.<sup>19,29</sup>

This study also indicated that respondents who added salt to food in addition to the normal amount that was added to the food during cooking were more than three-times as likely to have hypertension compared to those who did not added additional salt to food (AOR =3.04, 95% CI: 1.41–6.56). This finding is supported with evidence that high dietary salt consumption is associated with an increase in the mean population BP, as well as the prevalence of hypertension.<sup>30,31</sup>

Moreover, BMI was statistically associated with hypertension, with the odds of hypertension being more than

**Table 11** The correlation between selected predictor variables and hypertension after adjustment for confounding effect among people living in Bahir Dar city, June 2014

Variables	Categories	Hypertension		COR (95% CI)	AOR (95% CI)
		Yes	No		
Age	30–40 years	21	236	1.00	
	41–50 years	38	151	2.18 (1.69–5.98)	2.50 (1.25–5.02)
	>50 years	111	121	10.31 (6.13–19.12)	7.05 (3.51–14.15)
Ever smoked cigarettes	Yes	21	20	3.47 (1.82–6.60)	3.24 (1.37–7.70)
	No	149	488	1.00	
Number of hours spent watching TV per day	≤4	133	448	1.00	
	>4	37	58	2.15 (1.36–3.39)	2.06 (1.26–5.76)
Had history of high blood sugar level	Yes	18	15	3.89 (1.92–7.91)	2.78 (1.64–4.75)
	No	152	493	1.00	
Add additional salt to food	Yes	32	42	2.57 (1.56–4.23)	3.04 (1.41–6.56)
	No	138	466	1.00	
BMI	<18.5	4	33	1.00	
	18.5–24.9	100	402	2.02 (0.71–5.93)	2.05 (0.69–5.98)
	25.0–29.5	48	56	7.07 (2.34–21.39)	6.66 (2.16–20.49)
	>30.0	11	9	10.08 (2.59–39.33)	11.64 (2.93–46.21)

**Abbreviations:** AOR, adjusted odds ratio; BMI, body mass index; COR, crude odds ratio.

six- and eleven-times higher among respondents who were overweight and obese as compared to respondents whose BMI was less than 18.5 (AOR = 6.7, 95% CI: 2.16–20.49 and AOR = 11.6, 95% CI: 2.93–46.21), respectively. This finding is in accordance with other similar studies, where higher BMI was associated with hypertension.<sup>18,19,21,23</sup>

## Conclusion

This study showed that the prevalence of hypertension among a sample of the adult population in Bahir Dar city was 170 (25.1%). More than one out of three cases of hypertension (38.8%) did not know that they had the disease during the survey. The study further implies that 119 (17.6%) of the respondents were in prehypertension stage, which adds to the overall future risk of hypertension.

The analytic component of the study indicated that age; having ever smoked cigarettes; number of hours spent walking/cycling per day; number of hours spent watching TV per day; history of diabetes; adding salt to food in addition to the normal amount that was added to the food during cooking; and BMI were statistically significant predictors of hypertension.

Therefore, mass screening of hypertension, health education to prevent smoking, regular exercise, reducing salt consumption (especially discouraging adding salt to food in addition to the normal amount that was added to the food during cooking), and life style modifications are recommended.

## Acknowledgments

We are indebted to all participants in this study. We thank our data collectors and supervisors for their valuable time spent

collecting data. Also, we would like to acknowledge Bahir Dar University College of Medical Sciences where ethical approval for the study was obtained.

## Author contributions

ZAA conceptualized the research problem and was involved in interpretation of data, report writing, and manuscript preparation. WAY was involved in writing the research proposal, data analysis, and manuscript writing. DBA was involved in writing the research proposal and the report, and was involved in manuscript preparation.

## Disclosure

The authors report no conflicts of interest in this work.

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