Prevalence and awareness of hypertension among urban and rural adults in Hohoe Municipality, Ghana

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Abstract

Background: Hypertension is increasingly becoming an important public health issue among adults worldwide. This study determined the prevalence of hypertension among urban and rural adults in Hohoe Municipality. Method: A population-based cross-sectional study involving 350 adults from urban 162 (46.3%) and rural 188 (53.7%) settings. Face-to-face interview using pre-tested questionnaire was used to collect data. Blood pressure (BP) and anthropometric measurements were done following standard procedures. Differences in means were determined using t-test. Chi-square test and logistic regression model were used to determine the association between independent variables and hypertension. Pearson product moment correlation coefficient was used to measure the strength and direction of the relationship between blood pressure and some variables. Results: The prevalence of hypertension at the time of the survey was 89 (25.4%), with 38 (23.5%) from urban and 51 (27.1%) from rural areas (p=0.432). Uncontrolled hypertension was higher among rural adults than urban (53.2% vs. 37.2%, p=0.098). Undiagnosed hypertension was higher but similar in both urban (18.5%) and rural (18.4%) settings. Adults aged 40-49, 50-59 and 60 years and above were 3.96, 5.49 and 4.54 times more likely to have hypertension (AOR=3.96, p<0.001), (AOR=5.49, p<0.001) and (AOR=4.54, p<0.001) respectively. Those with tertiary education were 69% less likely to have hypertension (AOR=0.31, p=0.048). Obese adults were 3.42 times more likely to have hypertension (AOR=3.42, p=0.012). Age and BMI were positively correlated with hypertension (r=0.34, p<0.001) and (r=0.28, p<0.001). Conclusion: There is increasing the prevalence of hypertension among rural adults due to higher uncontrolled and undiagnosed hypertension among urban adults. Increasing age and obesity are the main contributing factors to hypertension. Periodic screening and creation of awareness could enhance the prevention and control of HPT among rural adults in Hohoe Municipality.

Keywords: Diagnosed and Undiagnosed Hypertension, Controlled and Uncontrolled Hypertension, Urban and Rural adults, Hohoe Municipality, Ghana.

INTRODUCTION

The World Health Organization (WHO) defined hypertension (HPT) as a systolic blood pressure (BP) equal to or above 140 mmHg and/or diastolic BP equal to or above 90 mmHg. Hypertension is among the leading causes of non-communicable diseases in developing countries. Most people with hypertension possess a two-fold higher risk of developing coronary artery disease, four times higher risk of congestive heart failure and seven times higher risk of cerebrovascular disease. According to WHO, about 17 million deaths occur worldwide due to cardiovascular diseases (CVDs), of which hypertension accounts for 9.4 million deaths. Approximately, 80% of the CVD-related deaths occurred in the developing countries. The global prevalence of HPT among the adult population is expected to increase from 26% (972 million) in 2000 to 29% (1.56 billion) by 2025 with associated cardiovascular complications. The overall prevalence of HPT (including those on medication for high blood pressure) in adults aged 25 years and above was about 40% in 2008. Both men and women have high rates of BP in the African region with prevalence rates over 40%. A report from rural Nigeria showed the prevalence of hypertension was found to be 37.6%.

The prevalence of hypertension in Ghana has increased steadily over the last two decades with more than ten-fold increase in reported new cases of the disease in public facilities, thus, from 49,087 in 1988 to 505,180 in 2007. A study from Ghana, however, showed the prevalence of HPT to be between 25%-48%, with the prevalence higher in urban populations than in rural populations. Other studies have...
also shown growing trends in HPT in urban communities compared to rural communities [12].

In Africa, the low rates of the awareness, treatment and control of hypertension are major public health concern [13]. The low levels of the above indicators thus imply there will be the majority of populations of hypertensive patients not aware of the increased risk of hypertension-related complications in the years to come. Many studies in Africa have shown that people with hypertension are unaware of their conditions. Many of those who are not aware are not on treatment and many of those treated are not well controlled [14].

In Ghana, studies have shown that many people living with HPT are not aware of it. For example, HPT prevalence in Accra was 34%. Of this, 15% had been previously diagnosed with HPT while 19% were undiagnosed [15].

Elevated body mass index (BMI) has been identified as the main risk factor of HPT [16]. A cross-sectional study in four rural communities in the Ga District of Ghana showed that risk factors associated with high BP include increasing BMI, salt consumption, a family history of hypertension and excessive alcohol intake [17].

According to the Hohoe Municipal Health Directorate, hypertension is ranked among the top ten diseases in the municipality. It also accounted for one-third of all admissions in 2013. There was also an increase in the number of cases reported for hypertension for outpatients. The number of Hypertensives among outpatients at the Hohoe Municipal Hospital increased from 441 in 2011 to 2713 in 2013 [18].

Thus, determining the awareness and prevalence of hypertension among rural and urban adults is very crucial. This is because it will form the basis for planning for both primary and secondary preventions of the disease. It is against this background that this study was undertaken to access the prevalence of HPT and Pre-HPT and to determine awareness and prevalence of HPT among urban and rural adults in Hohoe.

MATERIAL AND METHODS

Study site

The study was carried out in the Hohoe Municipality which is one of the twenty-five administrative municipalities/districts in the Volta Region of Ghana. It is located at longitude 0 degrees 15 East and 0 degrees 45 East and latitude 6 degrees 45 North and 7 degrees 15 North. The Municipality is located in the central part of Volta Region with a population of 167,743 people of which 48.1% are males and 51.9% are females (2010 population census). Hohoe is the Municipal capital with a population of 63,000 people. The municipality covers an area of 1,403 km sq. and has been divided into 7 sub-Municipalities namely; Hohoe, Gbi-Rural, Alavanyo, Agumatsu, Likpe, Akpafu/Santrokofi and Lolobi. The municipality is bounded on the North by Jasikan District, North-west by Biakoye District, West and South-west by Kpando Municipalities, South by Afadjato South District and East by the Republic of Togo. The main economic activity is farming where 55% of the population grow cash crops such as cocoa, maize, cassava, rice, yam and vegetables while trading forms about 25%, livestock rearing 15% and other industrial activities represent 5%. The major ethnic groups in the Municipality are the Ewes, Akpafu/Lolobi, Santrokofi and Likpe. There are 21 health facilities in the Municipality comprising Municipal hospital (1), health centers (14), Reproductive Child Health (RCH) (1) and Community-Based Health Planning and Services (CHPS) compounds (5) [19]. Figure 1 shows the rural and urban communities of Hohoe.

![Figure 1: Hohoe map showing rural and urban communities](image)

**Figure 1:** Hohoe map showing rural and urban communities

Study design

This was a cross-sectional study carried out in February 2017 using 350 adults with 162 from urban and 188 from rural communities. A pre-tested, semi-structured questionnaire, modified from the WHO STEP wise approach to non-communicable disease risk factor surveillance (STEPS) was used to obtain information on the socio-demographic characteristics and anthropometric indices.

Study Population

The study population consisted of adults from 18 years and above residing in the Hohoe municipalities. Adults who were residing in the Municipality (at least a month), not ill, could speak for themselves, and consented, were sampled for the study. Adults who did not reside in the Hohoe municipality, pregnant women and those who did not agree to participate were excluded.

Sample size determination

The minimum sample size for the study was 350. This was obtained by using Cochlear’s formula on sample size calculation \( n = 303.76; \) accounting for 15% non-response rate \( n = 350 \).

Sampling method

The WHO 30 Cluster survey was used to randomly select 30 communities. Twelve (12) eligible adults were recruited from each selected community. The names of all the communities were listed to form a sampling frame of clusters. Simple random sampling was used to select the thirty communities from the 2010 population census list of communities in the municipality. The 30 communities were selected using one-stage cluster sampling.

Selection of communities

A cumulative population of the Municipality was created; the total population was then divided by 30 (the number of clusters needed for the study) to obtain the sample interval \( X \). A random number \( Y \) was selected between one and the sample interval from a Cedi note. The community that falls within that number was selected as the first community for the study. The sample interval was then added to the random number \( X+Y \) to obtain the next community. This procedure was repeated till all the 30 communities were obtained.
Selection of participants

To obtain the number of people to be sampled from each community, the total number of each community was divided by the total number of all the communities and then multiplied by the sample size (N). The center of the community was located and a random direction was chosen by spinning a pen. A random number between 1 and N (sample size) was chosen to represent the house that contained the first household (starting point) to be surveyed. A household (defined as a group of people who live under the same roof and eat together) was eligible if there was an adult in that household at the time of the survey. If there were more than one eligible household in a house, balloting was done to select only one participant.

Data collection procedure

Data was collected using WHO STEPWISE approach for non-communicable disease surveillance (Hypertension) on risk factor assessment with particular emphasis on step 3. **STEP 1** captured information related to nutritional habit, sedentary lifestyle, socio-demographic characteristics, a family history of hypertension and many others with the use of a questionnaire which was administered through face-to-face interview. **STEP 2** also captured information on weight, height, blood pressure level and BMI (This was done with the use of equipment such as an electronic weighing scale, tape measure and digital blood pressure monitor) including **STEP 1**. In **STEP 3**, the height of the participants was measured with a Stadiometer (SECA Leicester height measure with a fixed footplate and movable headboard, USA) to the nearest 0.1 centimetre. The weight was measured with a digital weighing scale (BednBath model BB-3018A, UK) with participants dressed in light clothing to the nearest 0.1 kilogram. All the measurements taken were in accordance with the standard anthropometry guidelines. Blood pressure levels of the participants were measured with the aid of (Omron M2 Basic manufacturing, Omron Corporation, Japan) digital blood pressure monitor. The participants were allowed to rest for 10 minutes before their blood pressure was measured. Blood pressure was measured atone-minute intervals for 3 three times, of which the average reading was recorded.

Data Collection

A pre-tested, semi-structured questionnaire was used to collect information on the socio-demographic characteristics and awareness of hypertension. Data was collected through one-on-one interview. Arterial blood pressure and anthropometric measurement of height, weight, hip and waist circumference were also measured. Qualified health personnel were trained to assist in the data collection. Data quality control was ensured by calibrating all data collection tools for measurements before use.

Blood Pressure measurement

Arterial blood pressure was measured at rest using a digital sphygmomanometer MOTECH™ TrueScan™ (Digital/Automatic Blood Pressure Monitor, Germany). Repeated measurements were taken in triplicate at five-minute intervals, and the averages of the two nearest measurements were recorded to the nearest 1mmHg.

Anthropometric measurements

Weight measurements were taken with an electronic bathroom weighing scale (Secapersonen wage Clara 803 Medical Scales and Measuring Systems, Hamburg, Germany). Weight was taken with participants wearing light clothing without shoes and values obtained were recorded to the nearest 0.5 kg. Heights of the traders were taken with a Stadiometer while standing upright and recorded to the nearest 0.1 cm. Waist Circumference (WC) and Hip Circumference (HC) were measured to the nearest 0.1 cm using an inextensible tape measure and the measurements were done at the naval region for WC and at the level of the greater trochanter for HC.

Classification of Hypertension

Hypertension was classified based on recommended cut-offs as follows:
- Normal: (Systolic BP <120 and Diastolic BP <80 mmHg);
- Pre-hypertension: (Systolic BP = 120-139 and/or Diastolic BP = 80-89 mmHg);
- Hypertension: Stage I hypertension: (Systolic BP = 140-159 and/or Diastolic BP = 90-99 mmHg) and Stage II hypertension: (Systolic BP > 160 and/or Diastolic BP > 100 mmHg).

Classification of physical activity

Physical activity was estimated by quantifying activities such as carrying light loads, washing clothes, brisk walking to the farm or to the market, scrubbing the floor and sweeping inside or around the home. Physical activity was re-categorized as ≥3 days in a week and <3 days in a week.

Statistical analysis

Data was entered into Epi Info 7 and analyzed with STATA 14. Body mass index (BMI) was calculated based on WHO criteria as weight (kg) divided by height squared (m²). Waist-to-Hip Ratio (WHR) was calculated by dividing WC by HC. BMI and WHR were classified based on standard recommendations. Participants were classified as hypertensive using BP threshold of 140/90 mmHg. Frequencies and percentages were used to summarize categorical variables (sex, educational background, ethnicity, religion) while means and standard deviations were used for continuous variables (BMI and BP). Chi-square analysis was used to test for the association between HPT and background characteristics. Pearson product moment correlation coefficient was used to determine the direction and strength of the relation between blood pressure (BP) and BMI, BP and WHR. Multivariate Logistic regression was used to determine the strength of association between some independent variables (age, sex, educational level, marital status business location, ever been diagnosed hypertensive) and HPT (dependent variable). The statistical significance was set at p-value < 0.05.

Ethical considerations

Ethical approval for the study was sought from the Ghana Health Service (GHS) Ethical Review Committee (ERC) with an ID number: GHS-ERC 14/03/17. Permission was also sought from the Hohoe Municipal Health Directorate (HMHD) of the GHS. Each respondent was informed prior to the interview that they were under no obligation to take part. They could withdraw at any time and that all answers would be treated with paramount confidentiality. All the eligible adults who agreed to be part of the study signed an informed consent form before being interviewed and blood pressure measured. Persons with high BP were asked to go to the HPT clinic at the Municipal hospital for further investigations and care.

RESULTS

Table 1 summarizes the background characteristics of the respondents. Overall, 350 adult respondents were surveyed. This included 162 from urban and 188 from rural settings. The overall mean age was 40.4±14.5. Mean age of respondents from the urban area was 39.8±14.5 and from rural was 40.9±14.6. The majority 177 (50.6%) of the participants were less than 40 years, of which 87 (53.7%) were from urban and 90 (47.9%) were from rural areas. This was followed by those between 40-49 years with 32 (19.8%) from urban and 31 (16.5%)
from rural areas. Those aged between 50-59 years were 60 (17.1%) with 21 (13.0%) from urban and 39 (20.7%) from rural areas. The rest were above 60 years 50 (14.3%) with 22 (13.6%) from rural and 28 (17.9%) from urban areas. Males who participated in this study were 180 (51.4%) with 81 (50.0%) from urban and 99 (52.7%) from rural areas. A total number of 170 (48.6%) females participated in this study with 81 (50.0%) from urban and 89 (47.3%) from rural areas. Out of the 350 participants, 79 (22.6%) did not have any formal education with, 37 (22.8%) from urban and 42 (22.3%) from rural areas.

Table 1: Background characteristics of the respondents in urban and rural areas

| Characteristics           | Location          |          |          |          |
|---------------------------|-------------------|----------|----------|----------|
|                           | Urban [N=162] n(%)| Rural [N=188] n (%) | Total N (%) |
| Number recruited          | 162 (46.3%)       | 188 (53.7%) | 350 (100) |
| Mean Age in years (SD)   | 39.8 (14.5)       | 40.9 (14.6) | 40.4 (14.5) |
| Age group (years)        |                   |           |           |           |
| <40                       | 87 (53.7)         | 90 (47.9) | 177 (50.6) |
| 40-49                     | 32 (19.8)         | 31 (16.5) | 63 (18.0) |
| 50-59                     | 21 (13.0)         | 39 (20.7) | 60 (17.1) |
| >60                       | 22 (13.6)         | 28 (17.9) | 50 (14.3) |
| Sex                       |                   |           |           |           |
| Male                      | 81 (50.0)         | 99 (52.7) | 180 (51.4) |
| Female                    | 81 (50.0)         | 89 (47.3) | 170 (48.6) |
| Educational level         |                   |           |           |           |
| Never                     | 37 (22.8)         | 42 (22.3) | 79 (22.6) |
| JHS                       | 63 (38.9)         | 82 (43.6) | 145 (41.4) |
| SHS                       | 44 (27.2)         | 51 (27.1) | 95 (27.1) |
| Tertiary                  | 18 (11.1)         | 13 (6.9)  | 31 (8.9)  |
| Marital status            |                   |           |           |           |
| Single                    | 48 (29.6)         | 52 (27.7) | 100 (28.6) |
| Married                   | 99 (61.1)         | 117 (62.2) | 216 (61.7) |
| Divorced                  | 8 (4.9)           | 7 (3.7)   | 15 (4.3)  |
| Widowed                   | 7 (4.3)           | 12 (6.4)  | 19 (5.4)  |
| Occupation                |                   |           |           |           |
| Unemployed                | 0 (0.0)           | 32 (17.0) | 32 (9.1)  |
| Farming                   | 13 (8.0)          | 73 (38.8) | 86 (24.9) |
| Trading                   | 86 (53.1)         | 15 (8.0)  | 101 (28.9) |
| Artisan                   | 48 (29.6)         | 34 (18.1) | 82 (23.4) |
| Civil servants            | 15 (9.3)          | 34 (18.1) | 49 (14.0) |
| Religion                  |                   |           |           |           |
| Christian                 | 136 (84.0)        | 178 (94.7) | 314 (89.7) |
| Muslim                    | 25 (15.4)         | 6 (3.2)   | 31 (8.9)  |
| Traditionalist            | 1 (0.6)           | 4 (2.1)   | 5 (1.43)  |
| Hypertension status       |                   |           |           |           |
| Normal                    | 124 (76.5)        | 137 (72.9) | 261 (74.6) |
| Hypertensive              | 38 (23.5)         | 51 (27.1) | 89 (25.4) |
| BMI                       |                   |           |           |           |
| Normal                    | 162 (62.1)        | 41 (46.1) | 203 (58.0) |
| Underweight               | 23 (8.8)          | 3 (3.3)   | 26 (7.4)  |
| Overweight                | 60 (23.0)         | 29 (32.6) | 89 (25.4) |
| Obese                     | 16 (6.1)          | 16 (18.0) | 32 (9.1)  |
| Salt intake               |                   |           |           |           |
| Low                       | 33 (20.4)         | 25 (13.3) | 58 (16.6) |
| High                      | 129 (79.6)        | 163 (86.7) | 192 (83.4) |
The majority, 145 (41.4%) had JHS level of education with 63 (38.9%) from urban and 82 (43.6%) from rural. This was followed by SHS level of education, 95 (27.1%) with 44 (27.2%) from urban and 51 (27.1%) from rural areas. Tertiary education attainment was 31 (5.4%) of which 18 (11.1%) were from urban and 13 (6.9%) from rural areas. The majority 216 (61.7%) of the participants were married or cohabiting with their partners of which 99 (61.1%) were from urban and 117 (62.2%) were from rural areas, followed by those who were singles 100 (28.6%) with 48 (29.6%) from urban and 52 (27.7%) from rural areas. Those who were widowed were 19 (5.4%) with 7 (4.3%) from urban and 12 (6.4%) from rural. The least was those who were divorced, thus, 15 (4.3%) with 8 (4.9%) from urban and 7 (3.7%) from rural settings.

The majority, 101 (28.9%) of the participants were traders with 86 (53.1%) from urban and 15 (8.0%) from rural areas, followed by farming 86 (24.9%), with 13 (8.0%) from urban and 73 (38.8%) from rural areas. Artisanship were 82 (23.4%) with 48 (29.6%) from urban and 34 (18.1%) from rural areas. Civil servants were 49 (14.0%) with 15 (9.3%) from urban and 34 (18.1%) from rural areas.

Prevalence of Hypertension and awareness of hypertension status

Overall HPT including those who had been diagnosed and were on treatment was 138 (39.4%). At the time of the survey, HPT was 89 (25.4%) of which 38 (42.7%) were from urban and 51 (57.3%) from rural areas (Figure 2). Among the 260 respondents who had never been diagnosed, 48 (18.5%) were hypertensive (Undiagnosed HPT), with 22 (18.5%) from urban and 26 (18.4%) from rural areas (Figure 3). Overall, those had ever been diagnosed with HPT and were aware of their HPT status (Diagnosed HPT) were 41 (45.6%) with 16 (37.2%) from urban and 25 (53.2%) from rural areas (Figure 4).

| Family history of hypertension | No | Yes |
|-------------------------------|----|-----|
| 106 (65.4)                    | 119 (63.3) | 225 (64.3) |
| 56 (34.6)                     | 69 (36.7)  | 125 (35.7)  |

| Smoking status               | Never smoke | Current smoker | Ex-smoker |
|------------------------------|-------------|---------------|-----------|
| 138 (85.2)                   | 5 (3.1)     | 19 (11.7)     |
| 172 (91.5)                   | 6 (3.2)     | 10 (5.3)      |
| 310 (88.6)                   | 11 (3.1)    | 29 (8.3)      |

| Drinking status              | Never drink | Current drinker | Ex-drinker |
|------------------------------|-------------|----------------|------------|
| 91 (56.2)                    | 52 (32.1)   | 19 (11.7)      |
| 85 (45.2)                    | 92 (48.9)   | 11 (5.9)       |
| 176 (50.3)                   | 144 (41.1)  | 30 (8.6)       |

| Exercise per week            | One day | Two days | Three days | Four days | All days |
|------------------------------|---------|----------|------------|-----------|---------|
| 27 (16.7)                    | 25 (15.4) | 22 (13.6) | 21 (13.0) | 67 (41.4) |
| 14 (7.5)                     | 4 (2.1)  | 19 (10.1) | 32 (17.0) | 119 (63.3) |
| 41 (11.7)                    | 29 (8.3)  | 41 (11.7) | 53 (15.1) | 186 (53.1) |

| Vegetable intake per week    | One day | Two days | Three days | Four days | All days |
|------------------------------|---------|----------|------------|-----------|---------|
| 9 (5.6)                      | 18 (11.1) | 26 (16.5) | 109 (67.3) | 10 (2.9)  |
| 1 (0.5)                      | 10 (5.3)  | 21 (11.2) | 156 (83.0) | 28 (8.0)  |
| 28 (8.0)                     | 47 (13.4) | 265 (75.7) |           |          |

| HPT                          | Normal | Hypertensive | Awareness |
|------------------------------|--------|-------------|-----------|
| 124 (76.5)                   | 38 (23.5) | 137 (72.9) | 51 (27.1) |
| 137 (72.9)                   | 89 (25.4) |           |           |

| Figure 2: Prevalence of hypertension among rural and urban participants |

| Prevalence (%) | Urban | Rural |
|----------------|-------|-------|
| 47.5          | 54.5  | 42.7  |
| 57.3          |       |       |

The majority, 145 (41.4%) had JHS level of education with 63 (38.9%) from urban and 82 (43.6%) from rural. This was followed by SHS level of education, 95 (27.1%) with 44 (27.2%) from urban and 51 (27.1%) from rural areas. Tertiary education attainment was 31 (5.4%) of which 18 (11.1%) were from urban and 13 (6.9%) from rural areas. The majority 216 (61.7%) of the participants were married or cohabiting with their partners of which 99 (61.1%) were from urban and 117 (62.2%) were from rural areas, followed by those who were singles 100 (28.6%) with 48 (29.6%) from urban and 52 (27.7%) from rural areas. Those who were widowed were 19 (5.4%) with 7 (4.3%) from urban and 12 (6.4%) from rural. The least was those who were divorced, thus, 15 (4.3%) with 8 (4.9%) from urban and 7 (3.7%) from rural settings.

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Table 2 shows that there was a significant association between age and HPT, with participants aged 18-29 years (AOR=3.96 [95% CI: 1.88, 8.36]; p<0.001), 30-49 years (AOR=5.49 [95% CI: 2.52, 11.94]; p<0.001) and 50-64 years (AOR=10.7 (95% CI: 2.29, 49.5); p<0.001) respectively. There was also a significant association between age and HPT. Even though the correlation coefficients computed were positive, the variables (BP and age) were directly related (Table 3). The correlation between blood pressure, age and body mass index was computed to measure the strength and direction of the relationship between BP and age, and BP and BMI. There was a statistically significant but weak positive linear relationship between BP and age (r=0.34, p<0.001). There was also a statistically significant positive relationship between BP and BMI (r=0.28, p<0.001). All the correlation coefficients computed were positive, the variables (BP and age, and BP and BMI) were directly related (Table 3). The table 3 shows the correlation between blood pressure, age and body mass index.

Table 2: Correlation between blood pressure, age and body mass index.

| Variable | Hypertension |
|----------|--------------|
| Age      | 0.34         |
| BMI      | 0.28         |

**DISCUSSION**

It was found in the current study that there was no statistically significant association between age and HPT. Even though the prevalence of HPT was higher among rural adults than urban areas (p=0.254). The higher rural prevalence is consistent with studies in southern Nigeria which demonstrated a higher prevalence of HPT in rural than urban societies [19]. In their study, they found 44.3% prevalence of HPT in the rural community compared to 27.5% in the urban (p=0.001). This is in contrast with finding reported in Ghana showing a higher prevalence in urban than rural [20].

This increased prevalence of HPT in rural areas as reported in the current study may be attributed to a rise in westernized lifestyle among the rural dwellers. The prevalence of HPT in this study is slightly lower than the 28.4% reported earlier in Hohe [20]. This may be explained in part by the fact that the previous Hohe study was based on traders while the current study considered the general population.
Table 2: Association between risk factors and hypertension

| Hypertension status | n (%) | Hypertension [89] | Total [350] | Chi square (p-Value) | COR (95% CI) p-Value | AOR (95% CI) p-Value |
|---------------------|-------|-------------------|-------------|---------------------|---------------------|---------------------|
| Normal N=261        |       |                   |             |                     |                     |                     |
| Normal              | 157 (60.2) | 20 (22.5) | 177 (50.6) |                     |                     |                     |
| Hypertension        | 40 (15.3)  | 23 (25.8) | 63 (18.0)  | 38.45 (<0.001)      | 4.51 (2.26, 9.02) <0.001 | 3.96 (1.88, 8.36) <0.001 |
| Total               | 217 (85.5) | 43 (48.3) | 260 (74.1) |                     |                     |                     |
| Chi square          | 6.00 (3.01, 11.98) | 0.001 |                     |                     |                     |                     |
| COR                 | 4.54 (2.52, 10.89) | <0.001 |                     |                     |                     |                     |
| p-Value             | 1.65 (0.87, 3.12) | 0.122 |                     |                     |                     |                     |

**Age group (years)**

- <40: 157 (60.2) 20 (22.5) 177 (50.6) [38.45 <0.001] 4.51 (2.26, 9.02) <0.001 3.96 (1.88, 8.36) <0.001
- 40-49: 40 (15.3) 23 (25.8) 63 (18.0) [38.45 <0.001] 4.51 (2.26, 9.02) <0.001 3.96 (1.88, 8.36) <0.001
- 50-59: 34 (3.0) 26 (29.2) 60 (17.1) [6.00 (3.01, 11.98) <0.001] 5.49 (2.52, 11.94) <0.001
- >60: 30 (11.5) 20 (22.5) 50 (14.3) [5.23 (2.52, 10.89) <0.001] 4.54 (1.95, 10.54) <0.001

**Sex**

- Male: 124 (54.8) 37 (41.6) 180 (51.4) [4.64 (0.031) 1.70 (1.05, 2.78) 0.032 1.65 (0.87, 3.12) 0.122]
- Female: 118 (45.2) 52 (58.4) 170 (48.6) [4.64 (0.031) 1.70 (1.05, 2.78) 0.032 1.65 (0.87, 3.12) 0.122]

**Educational level**

- Never: 53 (20.3) 26 (20.2) 79 (22.6) [0.62 (0.34, 1.15) 0.128 0.57 (0.28, 1.16) 0.121]
- JHS: 111 (42.5) 34 (38.2) 145 (41.4) [0.62 (0.34, 1.15) 0.128 0.57 (0.28, 1.16) 0.121]
- SHS: 74 (28.4) 21 (23.6) 95 (27.1) [3.18 (0.364) 0.58 (0.29, 1.14) 0.112 0.80 (0.35, 1.79) 0.589]
- Tertiary: 23 (8.8) 8 (9.0) 31 (8.9) [0.71 (0.28, 1.80) 0.469 0.31 (0.10, 0.99) 0.048]

**Marital status**

- Single: 91 (34.9) 9 (10.1) 100 (28.6) [23.46 (<0.001) 4.64 (0.21, 9.76) <0.001]
- Married: 148 (56.7) 68 (76.4) 216 (61.7) [23.46 (<0.001) 4.64 (0.21, 9.76) <0.001]
- Divorced: 12 (4.6) 3 (3.4) 15 (4.3) [2.57 (0.59, 10.65) 0.206]
- Widowed: 10 (3.8) 9 (10.1) 19 (5.4) [9.1 (0.93, 28.21) <0.001]

**Occupation**

- Unemployed: 27 (10.3) 5 (5.6) 32 (9.1) [2.57 (0.59, 10.65) 0.206]
- Farming: 64 (24.5) 22 (24.7) 86 (24.6) [1.86 (0.64, 5.41) 0.257]
- Trading: 66 (25.3) 35 (39.3) 101 (28.9) [9.21 (0.056) 2.86 (1.01, 8.09) 0.047]
- Artisan: 68 (26.1) 14 (15.7) 82 (23.4) [1.11 (0.36, 3.39) 0.852]
- Civil servants: 36 (13.8) 13 (14.6) 49 (14.0) [1.95 (0.62, 6.13) 0.253]

**Religion**

- Christian: 237 (90.8) 77 (86.5) 314 (89.7) [1.46 (0.482) 1.47 (0.49, 6.07) 0.346]
- Muslim: 21 (8.0) 10 (11.2) 31 (8.9) [1.46 (0.482) 1.47 (0.49, 6.07) 0.346]
- Traditionalist: 3 (1.2) 2 (2.3) 5 (1.4) [2.05 (0.49, 2.71) 0.436]

**BMI**

- Normal: 162 (62.1) 41 (46.1) 203 (58.0) [0.52 (0.15, 1.80) 0.299 0.44 (0.11, 1.75) 0.250]
- Underweight: 23 (8.8) 3 (3.3) 26 (7.4) [0.52 (0.15, 1.80) 0.299 0.44 (0.11, 1.75) 0.250]
|                                      |       |       |       |       |       |       |
|--------------------------------------|-------|-------|-------|-------|-------|-------|
| Overweight                           | 60 (23.0) | 29 (32.6) | 89 (25.4) | 18.18 (<0.001) | 1.91 (1.09, 3.34) 0.024 | 1.64 (0.87, 3.11) 0.126 |
| Obese                                | 16 (6.1) | 16 (18.0) | 32 (9.1) | 3.95 (1.82, 8.56) <0.001 | 3.42 (1.32, 8.91) 0.012 |
| **Family history of hypertension**   |       |       |       |       |       |       |
| No                                   | 176 (67.4) | 49 (55.1) | 225 (64.3) |       |       |       |
| Yes                                  | 85 (32.6) | 40 (44.9) | 125 (35.7) | 4.42 (0.035) |       |       |
| **Awareness**                        |       |       |       |       |       |       |
| No                                   | 212 (81.2) | 48 (53.9) | 260 (74.3) |       |       |       |
| Yes                                  | 49 (18.8) | 41 (46.1) | 90 (25.7) | 25.88(<0.001) | 3.70 (2.20, 6.22) <0.001 | 2.31 (1.24, 4.27) 0.008 |
| **Smoking status**                   |       |       |       |       |       |       |
| Never smoke                          | 233 (89.3) | 77 (86.5) | 310 (88.6) |       |       |       |
| Current smoker                       | 7 (2.7) | 4 (4.5) | 11 (3.1) | 0.82 (0.663) | 1.73 (0.49, 6.07) 0.392 | 3.21 (0.74, 12.83) 0.121 |
| Ex-smoker                            | 21 (8.0) | 8 (9.0) | 29 (8.3) | 1.15 (0.49, 2.71) 0.744 | 2.00 (0.70, 5.69) 0.192 |
| **Drinking status**                  |       |       |       |       |       |       |
| Never drink                          | 131 (50.2) | 45 (50.6) | 176 (50.3) |       |       |       |
| Current drinker                      | 107 (41.0) | 37 (41.6) | 144 (41.1) | 0.08 (0.0962) | 1.01 (0.61, 1.67) 0.979 |
| Ex-drinker                           | 23 (8.8) | 7 (7.9) | 30 (8.6) | 0.89 (0.36, 2.20) 0.795 |       |       |
| **Exercise per week**                |       |       |       |       |       |       |
| One day                              | 30 (11.5) | 11 (12.4) | 41 (11.7) |       |       |       |
| Two days                             | 19 (7.5) | 10 (11.2) | 29 (8.3) | 1.44 (0.51, 4.03) 0.492 |       |       |
| Three days                           | 28 (10.7) | 13 (14.6) | 41 (11.7) | 5.83 (0.212) | 1.27 (0.49, 3.29) 0.628 |
| Four days                            | 36 (13.8) | 17 (19.1) | 17 (19.1) | 1.29 (0.52, 3.17) 0.582 |       |       |
| All days                             | 148 (56.7) | 38 (42.7) | 38 (42.7) | 0.70 (0.32, 1.52) 0.369 |       |       |
| **Location**                         |       |       |       |       |       |       |
| Urban                                | 124 (47.5) | 38 (42.7) | 162(46.3) |       |       |       |
| Rural                                | 137 (52.5) | 51 (57.3) | 188(53.7) | 0.62(0.432) | 1.21 (0.75, 1.97) 0.432 |
Overall undiagnosed and uncontrolled HPT were high among the adults (18.5% vs. 45.6%) respectively. Undiagnosed HPT was similar among urban and rural adults, however, uncontrolled HPT was higher in rural (53.2%) than in urban (37.2%). This could partly explain why HPT is higher among rural than urban adults.

The current study revealed that age, educational level, obesity and awareness were the most important predictors of hypertension in both rural and urban communities. Increasing age has been found to be a single predictor of hypertension [19,21] and is an important cause of morbidity and mortality worldwide.

The findings of the current study showed an overall prevalence of 39.2% HPT cases among adults including those on treatment. At the time of the survey, the prevalence of HPT was 25.4%, with 27.1% in the rural and 23.5% in the urban areas. This also agrees with previous findings, which revealed that the prevalence of HPT ranged from 19% to 48% [21].

A significant association existed between age older than 40 years and having HPT [22]. The current study also found that in both urban and rural areas, the prevalence of HPT increases with age, with the highest prevalence among the age group of 40-49 in urban (29.8%) and rural (28.7%).

The current study also found a statistically significant association between HPT and increasing age, attainment of tertiary education, obesity and awareness. Participants aged 40-49, 50-59 and 60 years and above were 3.96, 5.49 and 4.54 times more likely to become hypertensive. This agrees with the findings of a study conducted in China, where the prevalence of hypertension increases with increase in the age group 18-44 years (19.30%), 45-59 years (39.80%), and 60-78 years age group (62.10%) [23].

Those who attained tertiary level of education were 0.31 times less likely to have HPT [OR=0.31 (95% CI: 0.10, 0.99); p=0.048]. This corresponds to a population-based cross-sectional study conducted in Dehui City of Jilin Province in China, where a lower educational level was significantly associated with hypertension [23]. The lower levels of education could result in less awareness of the risk and protective factors for hypertension, and therefore individuals may be more likely to engage in unhealthy lifestyles such as smoking, high consumption of alcohol, high salt intake and physical inactivity. Other studies conducted in Liaoning Province of China also showed that higher levels of education produced the lowest risks of blood pressures and was protective against hypertension [24,25].

The current study also revealed that HPT was significantly higher among those who were obese. This agrees with the results of a study conducted in Benin, which revealed that people who were overweight or obese were at risk to have hypertension as compared to the normal people, which significantly increased the cardiovascular risk compared to those who were not. HPT was found to be significantly higher among those who were aware of their status. Findings from the current study are in contrast with the results obtained from a previous study, which reported no significant association between those who were aware and the disease.

Limitations

The diagnosis of hypertension was based on a mean of three blood pressure measurements at one sitting and this may have affected the overall prevalence of hypertension in this study. The study also identified bias on the part of the respondents as one of the limitations.

CONCLUSION

There is a high prevalence of HPT among adults in this study in both urban and rural settings. Uncontrolled HPT was higher among rural than urban adults. Over a quarter of the adult population were walking about with HPT and were not aware in both urban and rural communities. Prevalence was higher in the rural than the urban area and this could be attributable to higher uncontrolled HPT.

Recommendation

It is therefore recommended that health education should be intensified among the rural adult population as a crucial weapon in reducing the prevalence of HPT. It is also essential to provide information about how to control HPT. Large-scale population screening for HPT and pre-HPT is needed and adequate BP control is imperative to mitigate the mortality and morbidity associated with HPT. During screening programmes, information must be provided to alert people to seek timely medical attention as needed to reduce complications associated with HPT. This requires health education in public places and institutions and via the media to curb the impending global epidemic of hypertension.

List of abbreviations

BP-Blood Pressure, VRHD - Volta Regional Health Directorate, mmHg - Millimeters Of Mercury, OPD- Out-Patient Department, NCDS-Non-Communicable Diseases, ISH- International Society of Hypertension, GHS - Ghana Health Service, HBP- High Blood Pressure, PI- Principal Investigator, NIH - National Institute of Health, RCH- Reproductive and Child Health, WHO-World Health Organization, DALYs- Disability-Adjusted Life-Years, BMI- Body Mass Index, CHPS- Community Health Planning and Services, CI-Confidence Interval, WC- Waist Circumference, HC- Hip Circumference, WHR-Hip-Waist Ratio, HMHD-Hohoe Municipal Health Directorate, GHS ERC- Ghana Health Service Ethical Review Committee.

Availability of data and material

Available upon request.

Conflict of interests

The authors declare that they have no competing interests.

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Nill.

Authors' contributions

SI and MK conceived the study, SI, MK, WT, MA, WA and RO did the data analysis and wrote the methods section. SI, MK, FB, MT and ET were responsible for the initial draft of the manuscript. All authors reviewed and approved the final version of the manuscript.

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