ORIGINAL ARTICLE

# Epidemiological survey of hypertension in Anambra state, Nigeria

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## Abstract

**Background:** Hypertension is a major public health problem worldwide. Estimating the prevalence of disease in populations of Nigeria would be useful in developing intervention programs to control it and prevent its consequences.

**Objective:** This survey was carried out to assess the prevalence, awareness, treatment, detection and risk factors of hypertension in three major populations - Onitsha, Nnewi and Awka cities of Anambra State.

**Methods:** The study was a church based cross sectional study involving 912 participants randomly selected from the three major zones in Anambra State. The age range of the participants was 17-79 years. Participants were administered with a well-structured questionnaire and their blood pressures (BP) as well as anthropometric measurements were taken using standard instruments.

**Results:** The study population ($n$ = 912) consists, 476 (52.16%) females and 436 (47.81%) males; sampled randomly from Awka, Onitsha and Nnewi. The overall crude prevalence of hypertension and prehypertension in the study population were 22.81% and 42.54% respectively. The crude prevalence of hypertension in the three cities - Onitsha, Awka and Nnewi were 32.56%, 19.665 and 16.40% respectively. The prevalence of hypertension was significantly higher in Onitsha ($P$ = 0.0001). The prevalence of hypertension in both sexes was not statistically different (male, 22.01% and female, 23.5% $P$ = 0.587). Mean BMI, Systolic, and Diastolic BP for the study population was 25.43 ± 4.2, 120.7 ± 18.39 and 78.21 ± 12.57 respectively. Systolic and diastolic BP correlated with age and anthropometric measures such as waist circumference, BMI, Hip circumference, weight and height. The following factors were strongly associated with the prevalence of hypertension in our study population: Age ($\chi^2$ = 110.87, $P$ = 0.000); Zone ($\chi^2$ = 25.19, $P$ = 0.000); BMI ($\chi^2$ = 45.51, $P$ = 0.000); Physical Activity($\chi^2$ = 58.08, $P$ = 0.000); Alcohol Consumption ($\chi^2$ = 32.27, $P$ = 0.000); Smoking ($\chi^2$ = 7.892, $P$ = 0.000); General Health status ($\chi^2$ = 46,62, $P$ = 0.000); Consumption of fatty food ($\chi^2$ = 29.35, $P$ = 0.000). A low percentage of the population, 9.76% reported previous diagnosis of high BP and 34.59% of 910 of the participants also reported previous BP diagnosis of any relative. Our result shows that the prevalence of hypertension and prehypertension in this population was high and associated with some modifiable risk factors. In addition, poor detection, treatment and control of hypertension in this population were observed. This underscores the need for comprehensive evaluation of the prevalence of hypertension and other cardiovascular diseases in Nigeria.

**Key words:** Anambra state, epidemiology, hypertension, prevalence, risk factors

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## Introduction

Hypertension is a major public health problem worldwide. The global prevalence of hypertension is on the increase.



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It was estimated in 2002 that 972 million people had hypertension with a prevalence rate of 26.4%. This figure have been projected to rise to 1.54 billion (prevalence of 29.4%) in 2025.[1,2] It causes about 7.1 million deaths per year and 4.5% of the disease burden, which translates to 64 million disability-adjusted life years.[3] The relationship between blood pressure (BP) and risk of cardiovascular disease events is continuous, consistent, and independent of other risk factors. The higher the BP, the greater is the chance of heart attack, heart failure, stroke, and kidney diseases.[1,3-5] Noncommunicable diseases (NCDs) such as hypertension had been thought to be rare in rural Africa; however, it has been shown to be increasing in alarming proportion. According to the World Health Report 2001, NCDs accounted for 22% of the total deaths in the region in the year 2000; cardiovascular diseases alone accounted for 9.2% of the total deaths, killing even more than malaria.[3,6] Although hypertension is usually asymptomatic, it may be associated with considerable morbidity and mortality.[5] Uncontrolled hypertension is associated with serious end-organ damage and complications, such as left ventricular hypertrophy, diastolic dysfunction, congestive heart failure, ischemic heart disease, stroke, and renal failure which have been established by various researchers in Nigeria.[3,5,7,8]

The cost of hypertension is alarming; it was estimated to be $30 billion in the United States in 1997 alone. Drug treatment covers nearly a third or $7 billion of the $22 billion in direct costs, which also includes the cost for hospitalizations and doctor visits.[9] The prevention and control of hypertension have not received due attention in many developing countries despite the fact that it is a modifiable risk factor for cardiovascular diseases. This could be attributed to one of the following factors; dearth of data on the prevalence and control levels of hypertension, which is sometimes perceived as nonexistence of the problem;[3] other priorities include HIV/AIDS, tuberculosis, cholera, and malaria.[8] There is paucity of data on hypertension prevalence in many populations of Nigeria. Thus, the burden of hypertension in these populations might be underestimated and might leave the illness undiagnosed and untreated.

This present study assesses the hypertension prevalence, risk factors, and information about diagnosis and treatment in three major populations in Anambra State.

## Materials and Methods

### Study design and target population

The study was a cross-sectional, church-based survey carried out in three major cities in Anambra state. As it is impossible to interview all individuals within the age limit of 17–79 years in the state, a combination of cluster, strata, and random sampling technique was employed. Three major cities (cluster), Awka, Nnewi, and Onitsha were selected for this study. The cities were stratified by location (rural versus urban areas) to ensure good representation. As these populations are predominantly Christians, the survey was made church-based - the churches constituted the primary units from which individuals or participants were randomly sampled - 10 churches from each city.

### Inclusion criteria

- Age, 17–79 years
- Resident in the study area: Awka, Nnewi, and Onitsha city of Anambra state
- Selected by the random sampling procedure explained below
- Willing to participate and comply with the instructions of the study. For example, avoidance of alcohol, coffee, and exercise at least 30 min before the examination
- Informed consent.

### Sampling method and sample size calculation

Six churches were randomly selected from each of the urban strata and four churches from each of the rural strata of the three cities selected - the urban areas were more populated and as such were sampled more.

Information on the prevalence of hypertension in the adult and pediatric population of Anambra state was lacking, but based on literature data, the prevalence in Nigeria ranges from 8% to 30%.[10] Using the "StatCalc" function of Epi InfoTM by Centers for Disease Control and Prevention, (CDC) Atlanta, Georgia, USA (version 7) software, it was determined that a sample size of 900 was adequate to detect the prevalence of hypertension of 10%–30% with 3% precision and 95% confidence. However, a total of 912 participants were used for this study. A total of 912 participants were randomly selected from 30 primary sampling units (churches from the selected cities as described earlier in the method).

### Data collection

A well-structured and validated questionnaire including demographic information such as age, sex, marital status, occupation, level of education, and hypertensive risk factors such as salt consumption, physical exercise, family history of disease, lifestyle and diet, diagnosis, treatment, and even awareness was administered to the participants or completed on their behalf. Anthropometric data which included weight, height, waist, and hip circumferences were also obtained. The weight was measured to the nearest 0.5 kg using a weighing scale with the participant removing their foot wears. Height was measured to the nearest 0.5 cm using a local stadiometer fixed to a wall. The body mass index (BMI) was calculated as weight in kilograms divided by the square of the height in meters. The waist circumference was measured at the level of the iliac crests,[11] using a flexible tape and passing along the umbilical level of the unclothed abdomen. The hip circumference

was measured around the widest portion of the buttocks, with the tape parallel to the floor. BP was taken from the nondominant arm after 15 min of rest using appropriate cuff size and Accoson brand of mercury sphygmomanometer. Systolic BP (SBP) and diastolic BP (DBP) were the first and the fifth Korotkoff sounds, respectively. Three consecutive measurements were made at an interval of 5 min after a 15 min rest. The mean SBP and DBP determined from the second and third measurements were used for the data analysis.

BMI and obesity index were calculated as follows:

$$\text{BMI} = \frac{\text{Weight in kg}}{(\text{Height in meters})^2}$$

And they were classified as follows:

| BMI | Female | Male |
|---|---|---|
| Underweight | <19 | <20 |
| Normal weight | 19-25 | 20-25 |
| Overweight | 25-30 | 25-30 |
| Obese | 30-40 | <30 |

$$\text{Waist to hip ratio (abdominal obesity index)} = \frac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}}$$

### Definitions

High BP was defined using the WHO/International Society of Hypertension criteria of SBP ≥140 mmHg and/or DBP ≥90 mmHg (participants were positive if their result fell within the ranges defined at baseline and follow-up).

Prehypertension was defined according to the Joint National Committee 7 criteria of SBP 120–139 mmHg or DBP 80–89 mmHg (participants were positive if their result fell within the ranges defined at baseline and follow-up).

Detection of hypertension was defined as any prior diagnosis of hypertension made by a health professional among the population.

Treatment of hypertension was defined as use of any anti-hypertensive medication among the population.[3]

Abdominal obesity index was defined as waist to hip ratio above 0.90 for male and above 0.85 for female.[12]

### Ethical considerations

This study was conducted with adherence to ethical standards. Ethical approval was obtained from the Ethical Committee of Nnamdi Azikiwe University, Awka, Nigeria. On a Sunday, prior to the day of the main test and interview, the objectives and nature of the study were duly explained to the congregation. Informed consent in written form or by a thumb print was obtained from the parish pastors/priests, parents (for children below the consenting age of 18), and all participants individually, and then baseline hypertension measurements was taken for all participants. Strict confidentiality was maintained in accordance with standard medical practices.

## Results

A total of 912 individuals aged 17 years and above from the three major cities participated in the study. Tables 1 and 2 show the demographic characteristics as well as the distribution of risk factors of the population. Out of 912 participants, 476 (52.16%) were females and 436 (47.81%) were males. Exactly, 300 (32.89%) of the respondents were from Awka, 301 (33%) were from Onitsha, and 311 (34.10%) were from Nnewi city. The overall crude prevalence of hypertension and prehypertension in the study population was 22.81% and 42.54%, respectively. The mean BMI, SBP, and DBP for the study population were 25.43 ± 4.2; 120.7 ± 18.39; and 78.21 (12.57), respectively. The study population had an averagely high BMI. The age groups were distributed as follows: ≤20 (10.86%); 21–25 (33.77%); 26–40 (36.73%); and ≥40 (18.64%). Our study population's education status was majorly secondary (25%) and tertiary institution undergraduates (23.12%). Fifty percent of the participants had a normal weight by BMI. Exactly, 9.76% of 902 of the participants reported previous diagnosis of BP and 34.59% of 910 of the participants also reported previous "BP diagnosis of any relative." The knowledge of BP values (normal and abnormal) was quite low in study population (16.7% of 910). The percentage of hypertensive patients on any drug was 22.60%.

Figures 1 and 2 show the prevalence of hypertension in both sexes and all three cities. The crude prevalence of hypertension (WHO definition) in the three cities such as Onitsha, Awka, and Nnewi were 32.56%, 19.66%, and 16.40%, respectively. The prevalence of hypertension was significantly higher in Onitsha ($P = 0.000$). The prevalence of hypertension in both sexes was slightly different (male,

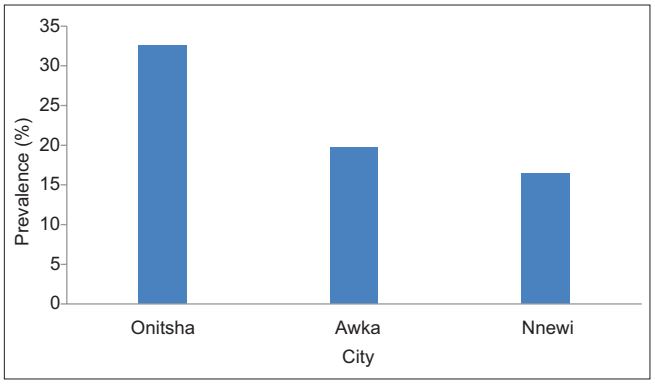


**Figure 1:** Prevalence of hypertension by location

**Table 1: Demographic characteristics of the population**

| Variable | Category | Frequency | Percentage | Mean (SD) | *n* |
|---|---|---|---|---|---|
| Age | ≤20 | 99 | 10.86 | | 912 |
| | 21-25 | 308 | 33.77 | | |
| | 26-40 | 335 | 36.73 | | |
| | ≥41 | 170 | 18.64 | | |
| Sex | Male | 436 | 47.81 | | 912 |
| | Female | 476 | 52.19 | | |
| City | Awka | 300 | 32.89 | | 912 |
| | Onitsha | 301 | 33.0 | | |
| | Nnewi | 311 | 34.1 | | |
| Education status | Primary | 48 | 5.29 | | 908 |
| | Secondary | 227 | 25.0 | | |
| | Professional/technical | 140 | 15.42 | | |
| | Undergraduate/incomplete university | 210 | 23.13 | | |
| | University complete | 283 | 31.17 | | |
| Employment status | Employed | 322 | 35.42 | | 908 |
| | Unemployed | 208 | 22.88 | | |
| | Retired | 37 | 4.07 | | |
| | Disabled | 3 | 0.33 | | |
| | Student | 339 | 37.29 | | |
| Source of livelihood | Civil servants | 177 | 19.49 | | 908 |
| | Business | 217 | 23.9 | | |
| | Trader | 103 | 11.43 | | |
| | Dependent | 411 | 45.26 | | |
| BMI | Underweight | 16 | 1.75 | | |
| | Normal weight | 458 | 50.22 | | |
| | Overweight | 311 | 34.1 | | |
| | Obesed | 127 | 13.93 | | |
| Previous BP diagnosis | Yes | 89 | 9.76 | | 912 |
| | No | 823 | 90.24 | | |
| Previous BP diagnosis of relative | Yes | 312 | 34.59 | | 902 |
| | No | 590 | 65.41 | | |
| Knowledge of BP value (awareness) | Yes | 152 | 16.7 | | 910 |
| | No | 624 | 68.57 | | |
| | Can't remember | 134 | 14.73 | | |
| Any hypertensive drugs prescription. (treatment) | Yes | 47 | 22.60 | | 208 |
| | No | 161 | 77.40 | | |
| BP status | Normal | 316 | 34.65 | | |
| | Prehypertensive | 388 | 42.54 | | |
| | Hypertensive | 208 | 22.81 | | |
| BMI | | | | 25.43 (4.2) | |
| Systolic BP | | | | 120.7 (18.39) | |
| Diastolic BP | | | | 78.21 (12.57) | |

BMI=Body mass index; SD=Standard deviation; BP=Blood pressure

22.01% and female, 23.5%), but this was not statistically significant ($P = 0.587$).

From Figure 3, the high prevalence of hypertension in Onitsha may be more attributable to factors such as overweight, abdominal obesity, educational status, and alcohol consumption than smoking, age, and sex.

Table 2 shows that the following factors were associated strongly with the prevalence of hypertension in our study population: Age ($\chi^2 = 110.87$, $P = 0.000$); city ($\chi^2 = 25.19$, $P = 0.000$); BMI ($\chi^2 = 45.51$, $P = 0.000$); consumption of processed/packaged food ($\chi^2 = 11.23$, $P = 0.004$); physical activity ($\chi^2 = 58.08$, $P = 0.000$); alcohol consumption ($\chi^2 = 32.27$, $P = 0.000$); alcohol category ($\chi^2 = 7.4316$, $P = 0.024$); smoking ($\chi^2 = 7.892$, $P = 0.000$); general health status ($\chi^2 = 46{,}62$, $P = 0.000$); consumption of red meat ($\chi^2 = 17.44$, $P = 0.000$); and consumption of fatty food ($\chi^2 = 29.35$, $P = 0.000$) whereas sex ($\chi^2 = 0.2951$, $P = 0.587$); use of caffeine-based drugs ($\chi^2 = 1.3137$, $P = 0.518$); and consumption of

**Table 2: Prevalence of hypertension and other risk factors**

| Variable | Category | Hypertension status (%) | | $\chi^2$ | *P* | *n* |
|---|---|---|---|---|---|---|
| | | No | Yes | | | |
| Age | ≤20 | 92 (10.09) | 7 (0.77) | 110.87 | 0.000 | 912 |
| | 21-25 | 279 (30.59) | 29 (3.18) | | | |
| | 26-40 | 245 (26.86) | 90 (9.87) | | | |
| | ≥41 | 88 (9.65) | 82 (8.99) | | | |
| City | Awka | 241 (26.43) | 59 (6.47) | 25.19 | 0.000 | 912 |
| | Onitsha | 203 (22.26) | 98 (10.75) | | | |
| | Nnewi | 260 (28.51) | 51 (5.59) | | | |
| Sex | Male | 340 (37.28) | 96 (10.53) | 0.30 | 0.587 | 912 |
| | Female | 364 (39.91) | 112 (12.28) | | | |
| Use of caffeine-based drugs | Never | 75 (8.24) | 19 (2.09) | 1.31 | 0.518 | 910 |
| | Rarely | 463 (50.88) | 133 (14.62) | | | |
| | Often | 164 (18.02) | 56 (6.15) | | | |
| Consumption of fatty food | Avoid | 170 (1.64) | 88 (9.65) | 29.35 | 0.000 | 912 |
| | Rare | 496 (54.39) | 105 (11.51) | | | |
| | Often | 38 (4.17) | 15 (1.64) | | | |
| Consumption of salt | Avoid | 269 (29.66) | 92 (10.14) | 2.71 | 0.258 | 907 |
| | Rare | 407 (44.87) | 107 (11.80) | | | |
| | Often | 24 (2.65) | 8 (0.88) | | | |
| BMI | Underweight | 13 (1.43) | 3 (0.33) | 46.50 | 0.000 | 912 |
| | Normal weight | 394 (43.20) | 64 (7.02) | | | |
| | Overweight | 219 (24.01) | 92 (10.09) | | | |
| | Obesed | 78 (8.55) | 49 (5.37) | | | |
| Consumption of processed and packaged food | Avoid | 195 (21.52) | 81 (8.94) | 11.23 | 0.004 | 906 |
| | Rare | 442 (48.79) | 116 (12.80) | | | |
| | Often | 62 (6.84) | 10 (1.10) | | | |
| General health status | Excellent | 5 (0.55) | 2 (0.22) | 46.62 | 0.000 | 912 |
| | Very good | 51 (5.59) | 40 (4.39) | | | |
| | Good | 271 (29.71) | 96 (10.53) | | | |
| | Fair | 269 (29.5) | 63 (6.91) | | | |
| | Poor | 108 (11.84) | 7 (0.77) | | | |
| Consumption of red meat | avoid | 152 (16.72) | 74 (8.14) | 17.44 | 0.000 | 909 |
| | Rare | 465 (51.16) | 118 (12.98) | | | |
| | Often | 84 (9.24) | 16 (1.76) | | | |
| Smoking | No | 683 (75.64) | 192 (21.26) | 7.89 | 0.005 | 903 |
| | Yes | 15 (1.66) | 13 (1.44) | | | |
| Physical activity | Not physical active | 25 (2.75) | 31 (3.41) | 58.80 | 0 | 909 |
| | Moderately active | 385 (42.35) | 136 (14.96) | | | |
| | Physically active | 292 (32.12) | 40 (4.40) | | | |
| Alcohol consumption | Not at all | 314 (35.01) | 89 (9.92) | 32.27 | 0.000 | 897 |
| | ≤1 per month | 265 (29.54) | 51 (5.69) | | | |
| | 1-3 times per week | 83 (9.25) | 36 (4.01) | | | |
| | Everyday | 31 (3.46) | 28 (3.12) | | | |
| Alcohol category | Any brand | 105 (21.43) | 18 (3.67) | 7.43 | 0.024 | 490 |
| | Red wine | 95 (19.39) | 35 (7.14) | | | |
| | Beer | 174 (35.51) | 63 (12.86) | | | |
| Abdominal obesity index (waist: hip circumference) | Normal | 259 (28.40) | 47 (5.15) | 14.5085 | 0.000 | 912 |
| | High | 445 (48.79) | 161 (17.65) | | | |

BMI=Body mass index; ORs=Odds ratios; CI=Confidence interval; SE=Standard error

salt ($\chi^2 = 2.7123$, $P = 0.258$) were not associated with the prevalence of the disease.

Table 3 shows the risk (odds ratio [OR]) of hypertension, given some associated risk factors. The prevalence of

**Table 3: Univariate logistic analysis of associated risk factors of hypertension**

| Variable | Category | ORs | SE | *P* | CI | *n* |
|---|---|---|---|---|---|---|
| Age | ≤20 | 1 (reference) | | | | 912 |
| | 21-25 | 1.37 | 0.598 | 0.476 | 0.58-3.22 | |
| | 26-40 | 4.82 | 1.984 | 0.000 | 2.16-10.80 | |
| | ≥41 | 12.25 | 5.156 | 0.000 | 5.36-27.95 | |
| City | Awka | 1 (reference) | | 0.000 | | 912 |
| | Onitsha | 1.97 | 0.38 | 0.000 | | |
| | Nnewi | 0.8 | 0.17 | 0.294 | | |
| Sex | Male | 1 | | | | 912 |
| | Female | 1.1 | 0.172 | 0.587 | | |
| Use of caffeine-based drugs | Never | 1 (reference) | | | | 910 |
| | Rarely | 1.13 | 0.3 | 0.648 | 0.66-1.94 | |
| | Often | 1.35 | 0.4 | 0.319 | 0.748-2.43 | |
| Consumption of fatty food | Avoid | 1 (reference) | | 0.000 | | 912 |
| | Rare | 0.41 | 0.069 | 0.000 | 0.29-0.57 | |
| | Often | 0.76 | 0.25 | 0.414 | 0.398-1.461 | |
| Consumption of salt | Avoid | 1 (reference) | | 0.258 | 0.56-1.06 | 907 |
| | Rare | 0.768695 | 0.12 | 0.105 | 0.42-2.25 | |
| | Often | 0.974638 | 0.415 | 0.952 | 0.27-0.43 | |
| BMI | Underweight | 1 (reference) | | | | 912 |
| | Normal weight | 0.7 | 0.46 | 0.592 | 0.195-2.54 | |
| | Overweight | 1.82 | 1.19 | 0.359 | 0.51-6.5 | |
| | Obesed | 2.72 | 1.81 | 0.133 | 0.738-10.04 | |
| Consumption of processed and packaged food | Avoid | 1 (reference) | | | | 906 |
| | Rare | 0.631808 | 0.11 | 0.006 | 0.45-0.88 | |
| | Often | 0.388291 | 0.14 | 0.01 | 0.19-0.79 | |
| General health status | Excellent | 1 (reference) | | | | 912 |
| | Very good | 3.61338 | 1.497 | 0.002 | 1.6-8.14 | |
| | Good | 5.465467 | 2.23 | 0.000 | 2.5-12.15 | |
| | Fair | 12.10083 | 5.367 | 0.000 | 5.01-28.86 | |
| | Poor | 6.171423 | 5.69 | 0.049 | 1.01-37.68 | |
| Abdominal obesity index (waist: hip circumference) | Normal | 1 (reference) | | | | 909 |
| | High | 1.993 | 0.365 | 0.000 | 1.39-2.86 | |
| Smoking | No | 1 (reference) | | | | 903 |
| | Yes | 3.083 | 1.195 | 0.004 | 1.44-6.591 | |
| Physical activity | Not physical active | 1 (reference) | | | | 909 |
| | Moderately active | 0.28 | 0.081 | 0.000 | 0.162-0.499 | |
| | Physically active | 0.11 | 0.035 | 0.000 | 0.05-0.02 | |
| Alcohol consumption | Not at all | 1 (reference) | | 0 | | 897 |
| | ≤1 a month | 0.67 | 0.132 | 0.046 | 0.464-0.994 | |
| | 1–3 times a week | 1.53 | 0.356 | 0.068 | 0.969-2.42 | |
| | Everyday | 3.19 | 0.915 | 0.000 | 1.82-5.59 | |
| Alcohol category | Any brand | 1 (reference) | | | | 490 |
| | Red wine | 2.15 | 0.693 | 0.018 | 1.141-4.046 | |
| | Beer | 2.11 | 0.622 | 0.011 | 1.18-3.761 | |

BMI=Body mass index; ORs=Odds ratios; CI=Confidence interval; SE=Standard error

hypertension was strongly associated with age. The highest odds of the disease (OR = 4.82, *P* = 0.000 and OR = 12.25, *P* = 0.000) was observed in age categories of 26–40 and ≥41, respectively. A higher odds of the disease was observed in participants from Onitsha (OR = 1.97, *P* = 0.000) relative to Awka and Nnewi. Smoking status was also strongly associated with the prevalence of the disease. There was a higher odds of the disease (OR = 3.08, *P* = 0.004) among participants who smoked compared to the nonsmokers. Physical activity was strongly associated with the prevalence of the disease in the study population. A lower odds of the disease was observed in the category of participants classified as moderately active (OR = 0.28, *P* = 0.000) and Physically active (OR = 0.11, *P* = 0.000) relative to those who lived a more less sedentary life (not active category). Strong association was also observed with alcohol consumption and category of alcohol consumed. There was a higher odds of the disease in the group that drank every day (OR = 3.19, *P* = 0.000) and

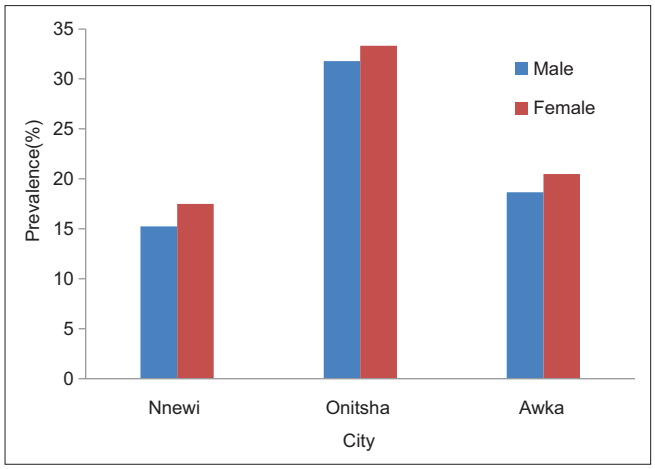


**Figure 2:** Prevalence of hypertension of cities by sex

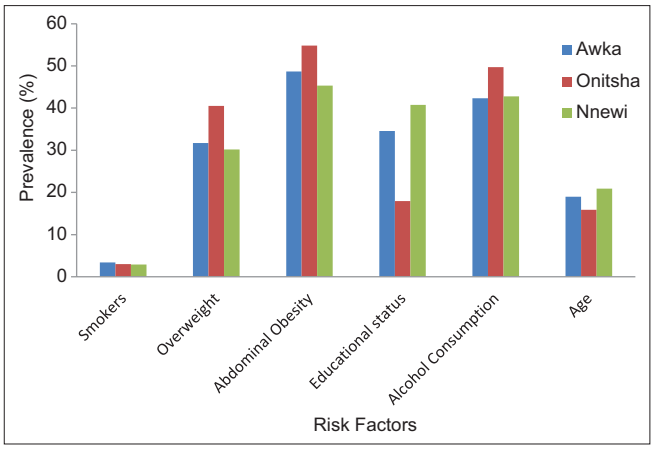


**Figure 3:** Prevalence of strongly associated risk factors by location

**Table 4: Correlation between blood pressure, age, and anthropometric variables**

| Variable | *r* (*P*) | |
|---|---|---|
| | Systolic BP | Diastolic BP |
| Age | 0.4123 (0.0000) | 0.3849 (0.0000) |
| Waist circumference | 0.3232 (0.0000) | 0.2624 (0.0000) |
| BMI | 0.3176 (0.0000) | 0.2674 (0.0000) |
| Hip circumference | 0.2416 (0.0000) | 0.1851 (0.0000) |
| Weight | 0.3379 (0.0000) | 0.2896 (0.0000) |
| Height | 0.0673 (0.0422) | 0.0424 (0.2005) |

BMI=Body mass index; BP=Blood pressure

1–3 times a week (OR = 1.53, *P* = 0.0068) compared to those teetotalers; however, the odds of the disease was lowered in the group that drank occasionally (OR = 0.67, *P* = 0.046). The category of drink consumed (bear, wine, or any) also showed a strong association with the disease outcome or prevalence. Those who drank strictly beer (OR = 2.15, *P* = 0.018) or wine (OR = 2.11, *P* = 0.011) had higher odds of the disease compared to those who had no preference for a particular brand or category of drink. Anthropometric measurements such as BMI and abdominal obesity index associated strongly with the prevalence of the disease. Those with abnormally high BMI index (OR = 2.72, *P* = 0.133) and abdominal obesity (OR = 1.99, *P* = 0.000) showed higher odds of the disease relative to normal BMI and abdominal obesity index. Analysis of the association of the disease prevalence and general state of health revealed a higher odds of the disease among those that reported good (OR = 5.46, *P* = 0.000), fair (OR = 12.10, *P* = 0.000), and poor (OR = 6.17, *P* = 0.049) state of health with the highest in group "fair" and "poor."

Table 4 shows the result of the correlation analysis between BP (Systolic and Diastolic), age and anthropometric variables-waist circumference, BMI, hip circumference, weight and height. Height did not correlate with Systolic BP and Diastolic BP.

## Discussion

This study revealed a very high overall prevalence of prehypertension and hypertension in the study population and was associated with quite a lot of factors.

The overall prevalence falls within the ranges reported earlier.[3,8,13] Sola *et al.* had reported an overall prevalence of 21.7% in a population in Federal Capital Territory, Abuja. Ekwunife *et al.* and Erhun *et al.* reported a similar prevalence of 21.1% and 21% in a population in Enugu and a Federal University in South-West Nigeria, respectively. This is an indication that the disturbingly high prevalence rate of hypertension in populations in Nigeria has remained fairly constant. In an ever-growing population Nigeria, a fairly constant prevalence rate suggests that more people are becoming hypertensive for the trend to remain fairly constant amidst a growing population. Prehypertension has been identified as a critical population for the intervention to prevent progression to hypertension; however, this has been neglected in a lot of studies in Nigerian population. Our study showed a very high prevalence of the borderline condition. The crude prevalence of hypertension by city showed that Onitsha had the highest prevalence (32.56%) with twice higher odd of the disease. This scenario might be attributable to factors such as overweight, abdominal obesity, educational status, alcohol consumption (not smoking and age and sex), and urban layout of Onitsha [Figure 3]. The town is highly populated, characterized by high level of pollution of different sorts and magnitude, of which noise is not an exception. High vehicular movement, generator use, social vices, just to mention a few of some social/environmental issues peculiar to Onitsha in magnitude. This in different ways could affect one's psyche and psychological serenity, and consequently impact adversely on BP.

The knowledge of BP values (normal and abnormal) and treatment level was low in our study population. Only 16.1% of our entire study population had knowledge of the normal and abnormal BP values and 9.76% had been diagnosed

of BP previously. Out of 208 of the participants with hypertension in the study, only 22.60% was on any known hypertensive drug. This is really a worrisome situation considering the health damages this condition could cause.

The association of hypertension with sex is still an issue of debate in a lot of epidemiological studies. Varying results have been reported in different populations.[3,8] Our own finding showed that there was no significant difference in the prevalence of hypertension in both sexes (male, 22.01% and female, 23.5%; $P = 0.587$).

BP was significantly correlated with age and anthropometric indicators of obesity and overweight. BMI, abdominal obesity, and age by category were statistically associated with hypertension. The prevalence of hypertension showed an increasing trend with advancing age from 21 years and above - age category 21–25 (3.18%), 26–40 (9.87%), and ≥41 (8.99%). There was a significant ($P = 0.0000$) 12.25 times higher odds of the disease in the age category, ≥41 years compared to the younger age categories (10–15, 16–20, and 21–25). BMI showed low odds ratio of the disease in normal weight category and higher odds ratio in overweight and obesed BMI category whereas abdominal obesity revealed a statistical ($P = 0.000$) 2 times odds of hypertension. Our result is consistent with previous studies.[3,8,14,15] BP tends to increase with increasing age, BMI, and abdominal obesity. The age relationship could be explained partly by the hemodynamics and cardiovascular changes in the body as one grows older.[16,17] It has also been reported that fat mass could lead to hypertension associated with aging such as stiffening and dilation of the proximal aorta by different mechanisms, namely by activating the renin-angiotensin-aldosterone system, increasing sympathetic activity, promoting insulin resistance and leptin resistance, and increasing procoagulatory activity and endothelial dysfunction.[16]

Consumption of fatty food, salty food, and red meat associated strongly with the prevalence of the disease, but looking at the nature of the association using logistic regression, there seems to be higher odds of the disease in the group that avoids consumption of fatty food, salty food, and red meat relative to those who show little or no caution in the consumption of the aforementioned food classes; however, some studies have reported an association of high fat and salt intake to higher risk of hypertension.[18] This discrepancy could be due to our study not been able to quantitatively distinguish how much intake could be regarded as high intake or low intake. There might actually be no difference in the consumption rate of those that reported high frequency of intake and those that reported low frequency or never. This is one limitation of the study.

Smoking status was also statistically ($P = 0.0000$) associated with hypertension in this study. The odds of hypertension was statistically ($P = 0.004$) higher by a factor of three among smoking participants when compared to non-smokers. This finding has been reported extensively by other independent researches. However, the interpretations could differ. Primatesta *et al.* opined that the effect of smoking on BP is usually acute and transient, but any independent chronic effect of smoking on BP found will be small and might be amplified by complex inter-relationship between other risk factors such as BMI, age, sex, and alcohol intake.[19] Alcohol consumption in our survey was associated with more than thrice the risk of being hypertensive. Strong association was observed with alcohol consumption frequency and pattern of drinking. There was a higher odds of the disease among group that drank everyday (OR = 3.19, $P = 0.000$) and 1–3 times a week (OR = 1.53, $P = 0.0068$) compared to the teetotalers; however, the odds of the disease was lowered in the group that drank occasionally - 1–3 times a month (OR = 0.67, $P = 0.046$). This is an indication that the heavy drinkers have a higher risk of the disease whereas the occasional drinkers have a grossly reduced risk of hypertension compared to the teetotalers, i.e. a little alcohol might be beneficial health wise. This finding has been reported by other independent epidemiological studies.[20-22] However, the beneficial effect of moderate alcohol consumption is still being challenged by some researches.[23] For the proponents of the beneficial effects, it is related to its effect on fat plaque development in the blood vessels, particularly the coronary arteries that supply the heart. Alcohol consumption pattern also showed a significant association with the disease. Lower risk of hypertension was revealed among those who paid no particular interest to the brand of alcohol they drank. This finding has not been reported elsewhere, but some studies have suggested that some brands, especially wine may be of particular benefit. Our finding suggests that variety in alcohol brands might be beneficial.

Physical activity showed a reduced risk to the disease when compared to sedentary life style. Physically active participants had a 10 times reduced risk of hypertension. This is consistent with several studies done previously.[24] Padilla *et al.* reported that accumulation of physical activity reduces BP in both prehypertensive and hypertensive patients, but not in normotensive patients.[25] Physical activity generally helps to improve other risk factors such as overweight and obesity.

This study also showed an association between hypertension and self-reported "general health status" on a 5-point scale, with the highest prevalence observed in individual who reported "fair" and "poor" general health status. The lowest prevalence was observed in those who reported "excellent" and "very good health" status [Tables 2 and 3]. It may be possible that the disease was beginning to cause some mild health inadequacies. Hypertension could be asymptomatic.

This survey strengthens the fact that hypertension is a major health challenge that demands attention in this population. The prevalence of pre- and hypertension is quite high and the level of knowledge or awareness, detection, and treatment of the disease is unacceptably low in Anambra state. More worrisome is the percentage of those with hypertension or prehypertension who are not aware of the condition or on any form of treatment or preventive measure. As Anambra is a state in epidemiological transition, it faces the daunting challenge of even higher prevalence in the future. Based on the premise and baseline information provided by this survey, a comprehensive program and concerted effort needs to be put in place if improvement is to be achieved. It is worthy of note that all the strongly associated risk factors are modifiable risk factors.

Health policy makers should consider coming up with a comprehensive, integrated population-based intervention program to ameliorate the growing problem of hypertension in Anambra state. This should include subsidized diagnosis and treatment options. National program including nutrition education, BP awareness campaign, promotion of health-benefiting life style and practice such as physical exercise and controlled drug/substance use (e.g., tobacco, alcohol etc.) should be implemented.

Further work should look at carrying out this study in a cohort design using a larger population to estimate the incidence of the disease as well as give better insight on the causal relationship between the disease and risk factors.

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## Conflicts of interest
There are no conflicts of interest.

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