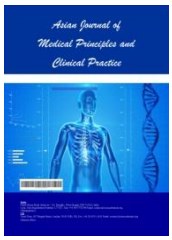

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# Point Prevalence of High Blood Pressure among Students of University of Port Harcourt

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

**Introduction:** Hypertension is a long term medical condition in which the blood pressure in the arteries is persistently elevated. Over the last decade, it has been demonstrated that the prevalence of mild hypertension in youth aged from 18-30 years is more common than expected and is progressively rising.
**Methods:** This study documented the point prevalence of high blood pressure among the student population of the University of Port Harcourt by determining the body mass index, level of physical activities and socioeconomic status. A cross sectional study was conducted among the University of Port Harcourt students within a period of two weeks. A total of 300 students were sampled and anthropometric data such as height, weight and age were collected. Participants were aged 19-30 years. 48.7% were observed to be female while 51.3% were of the male gender.
**Result:** The point prevalence of pre-hypertension and hypertension was observed to be high among the students 11.3% and 31.7% respectively. It was observed that 36.3% of the male students had normal blood pressure while 76.6% of the female students had normal blood pressure, this accounted to be 22.3±0.14years for the mean age normotensive, 22.6±0.37years for pre-hypertensive and 23.2±0.14years for hypertensive. The body mass index (BMI) of the

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normotensive, pre-hypertensive and hypertensive were observed to be 18.3±0.19kg/m$^2$, 24.21±0.19 kg/m$^2$ and 32.5±0.32 kg/m$^2$ respectively. There was significant difference between the body mass indexes (P<0.05).

**Conclusion:** From the survey carried out, it was observed that the physical activity of the students was low. Though not statistically evaluated for significance, a high percentage prevalence of hypertension in males was observed when compared with females. Considering the correlation between the anthropometric measurements and the hypertensive status of the participants, it was discovered that the age did not affect the condition significantly (P>0.05) but a significant correlation between hypertension and age as well as BMI of students exist.

**Recommendation:** Regular screening is recommended to improve awareness and help mitigate the complications of this condition. Finally, routine screening should be undertaken by health care managements and the university's health service.

*Keywords: Point prevalence; high blood pressure; University of Port Harcourt; normative.*

## 1. INTRODUCTION

Hypertension is a long term medical condition in which the blood pressure in the arteries is persistently elevated [1]. It is a major risk factor for stroke, coronary artery disease, heart failure, atrial fibrillation, peripheral arterial disease etc.[2]. Hypertension is an important public health problem in both economically developed and developing nations [1]. Hypertension is the single most important risk factor for cardiovascular diseases (CVD) and a key driver of global disease burden [3]. It is also a high-yield target to reverse the epidemic of non-communicable diseases (NCDs) globally. Cardiovascular (CV) diseases represent the main cause of death in developed countries, being responsible of about one third of deaths worldwide [4]. Hypertension among students and youths is increasingly being seen in the University clinics, some who end organ abnormalities are already present. There has been a varied report on the prevalence of hypertension among youths aged from 18-30 years ranging from 0-36% [4]. This wide disparity may be related to sample size, race, age, and sex, environmental and social factors. Over the last decade, it has been demonstrated that the prevalence of mild hypertension in youth aged from 18-30 years is more common than expected and is progressively rising over the years [4]. This phenomenon has been mainly attributed to the increasing prevalence of obesity or unhealthy lifestyle habit (including poor physical activity, regular assumption of high salt-junk food and sedentary living. However, evidences on the burden of hypertension and associated factors are lacking among university students in resource-poor settings. It is suggested that hypertension has its origin in childhood through youth but goes undetected unless specifically looked for during this period. Thus early detection of hypertension and its precipitating or aggravating factors are important if one is to evolve measures so that complications of hypertension can be prevented [5].

The world is still recovering from the impact of the corona virus pandemic which had affected the lives of almost every nation and Nigeria is no different. Jobs have been lost and due to high cost of foods, the youths have turned to the unwholesome or inappropriate diets which are a risk factor for hypertension. Given the economic situation as well as the university difficult living conditions in addition to keeping up with packed school calendar, there is heightened stress level among students. This lifestyle can indeed expose students to risk factors of hypertension. From the aforementioned factors, it is important to determine the point prevalence of high blood pressure among the student population.

## 2. METHODOLOGY

### 2.1 Study Area

The study was conducted in three campuses located within the university of Port Harcourt namely Delta campus, Choba campus and Unipark campus.

### 2.2 Research Design

This study was a cross sectional type survey. The cross sectional study survey design involved data collection at one point in time to find out the prevalence of hypertension in the student population of the University of Port Harcourt.

### 2.3 Determination of Sample Size

The formula by Araoye [6] for determining sample size was used to draw the sample size from the relatively large population of the study area. The sample size was calculated using the formula for populations more than ten thousand. A minimum of three hundred (300) subjects were recruited for the study. The formula is given below;

$$N = \frac{Z^2 \text{ x P x } 1 - \text{P}}{d^2}$$

Where;

N = minimum sample size required
Z = Confidence level (95%)
P = Standard deviation
d = margin of error

### 2.4 Sampling Technique

Simple random sampling method was used for this study.. Procedures were explained to participants to allay anxiety.

### 2.5 Type and Source of Data

Data collected included demographic characteristics, anthropometric and blood pressure reading for the screening.

### 2.6 Blood Pressure Measurement

Blood pressure was taken by trained personnel using a mercury sphygmomanometer and stethoscope. Measurements were taken from the left upper arm after subjects had been sitting for >5 minutes. Participants were asked to sit on a chair for five minutes. Different cuff sizes were used for different body sizes and placed to cover the left arm at the heart level. Systolic and diastolic blood pressure was taken three times, with at least 5 minutes interval, using a digital sphygmomanometer. The average of the three readings was used for the analysis.

### 2.7 Physical Activity Data

Data on physical activity level was taken by adopting the WHO Global Physical Activity Questionnaire (GPAQ), version 2. Data on vigorous, moderate activity and sedentary behaviour were collected. Amount of time in (minutes) each participant spent in moderate and vigorous intensity activities was determined. The activities were given intensity, relating to the criteria provided in the WHO GPAQ, version 2 standards.

### 2.8 Anthropometric Data

Anthropometry is the measurement of weight and height (measured without shoes). The anthropometric measurements were taken according to methods described by [7]. The weight was measured using a calibrated bathroom weighing scale to the nearest 0.5kg. The bathroom has been recommended for the use in young adult where the beam balance is not available [7]. Subjects were asked to stand on the weighing scale without shoes while wearing light clothes. Height was measured using an erect meter rule placed against a perpendicular wall [7]. The body mass index (BMI) was also calculated from the height and weight already measured using the formula [7].

$$BMI\ (kg/m^2) = \frac{\text{Weight (kg)}}{Height\ (m)^2}$$

### 2.9 Statistical Analysis

Data was analyzed using IBM SPSS 22.0 (Chicago). Statistical significance was mainly tested using ANOVA (Analysis of Variance). Bivariate analysis (Chi-square test/Fisher's Exact test) was also used to test for association between socio-demographic factors at 95% CI. Descriptive statistics of mean and standard deviation, standard error was used to examine the data. The level of statistical significance was fixed at $p<0.05$.

## 3. RESULTS

### 3.1 Social-Demographic Characteristics of Study Population

Table 1 shows the gender distribution, the occupation of parents and benefactor for education. 147(48.7%) of the respondents were females and 153(51.3%) are males. Father's occupation to be unemployed 36(12%), public servant 54(18%), and self-employed 210(70%) while for the mothers, unemployed 50(16.7%), public servant 143(47.6%) and self-employed 107(35.7%). 87.7% of the subjects revealed to have a parent as a benefactor while 12.3% revealed to have themselves as their benefactor.

**Table 1. Socio-economic and demographic of subjects**

| Variables | Frequency (N) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 153 | 51.3 |
| Female | 147 | 48.7 |
| **Father's Occupation** | | |
| Unemployed | 36 | 12 |
| Public servant | 54 | 18 |
| Self-employed | 210 | 70 |
| **Mother's Occupation** | | |
| Unemployed | 50 | 16.7 |
| Public servant | 143 | 47.6 |
| Self-employed | 107 | 35.7 |

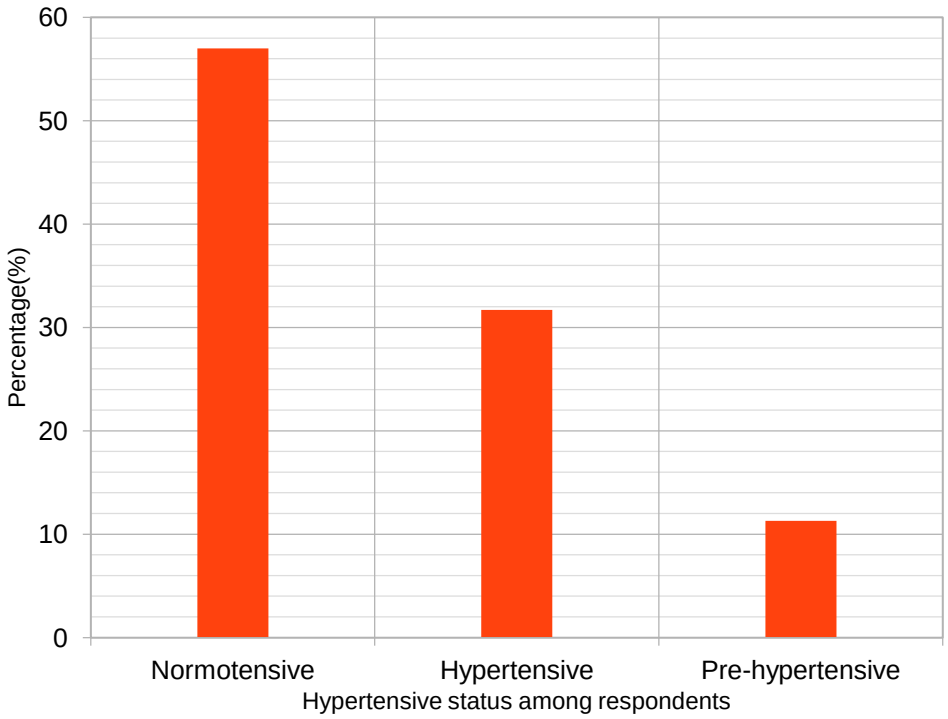


**Fig. 1. Hypertension status of participants after rescreening using systolic and diastolic measurements**

### 3.2 Prevalence of Hypertension within the Respondents

The prevalence of hypertension was determined using the systolic and diastolic blood pressure measurements taken during the anthropometric studies. It was found out that 31.7% (95) were hypertensive, whereas 11.3% (34) were found to be pre-hypertensive and 57% (171) were normotensives.

### 3.3 Prevalence of Hypertension within the Sex Distribution of Respondents

Considering the sex distribution, 50.7% of the male participants were diagnosed to be hypertensive with 13.0% and 36.3% as pre-hypertensive and normotensives respectively. The females recorded 76.6% for normotensives, 9.8% and 13.6% as pre-hypertensive and hypertensive respectively.

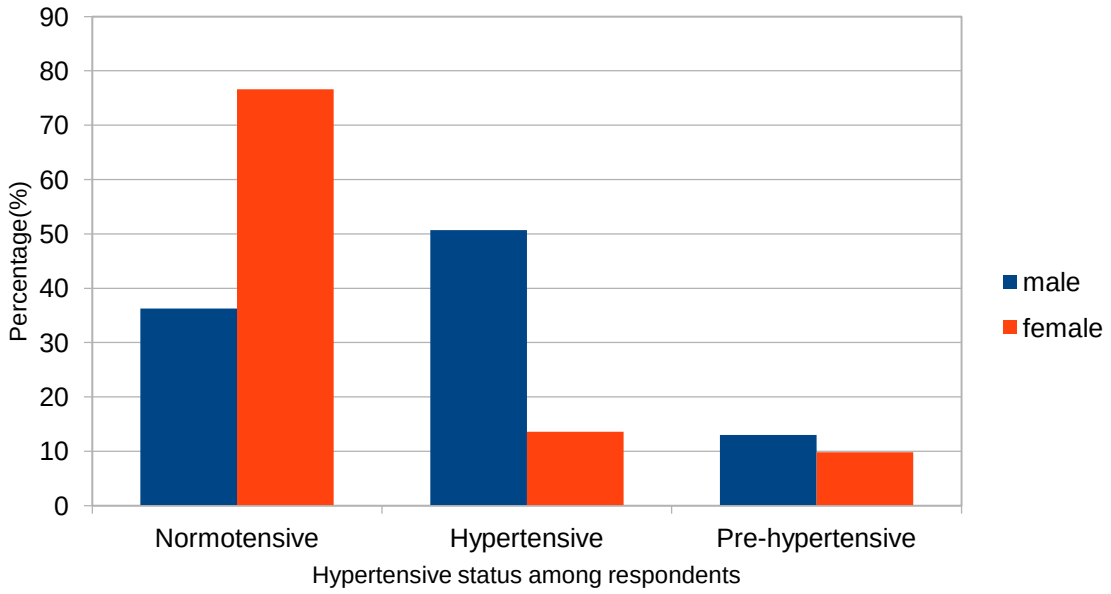


**Fig. 2. Hypertension status of participants with respect to sex distribution after screening using systolic and diastolic measurements**

**Table 2. Age and Anthropometric of Normotensive, Pre-hypertensive and Hypertensive respondents**

| Parameter | Normotensive | Pre-hypertensive | Hypertensive | *P* – value |
|---|---|---|---|---|
| Age | 22.3 ± 0.14 | 22.6 ±0.37 | 23.2±0.14 | **0.31** |
| Body Mass Index | 18.3 ± 0.19 | 24.21 ± 0.19 | 32.5 ±0.32 | **0.0015** |

*Values are Means ± SEM. Significant at p < 0.05*

**Table 3. Physical activity profile of participants and hypertension status**

| Physical Activity | Normotensive (%) | Pre-hypertensive (5) | Hypertensive (%) | *P*-value |
|---|---|---|---|---|
| None | 145 (84.8) | 27 (79.4) | 93 (97.9) | |
| Once per week | 22 (12.9) | 1 (2.94) | 2 (2.1) | |
| Twice per week | 4 (2.3) | 6 (17.6) | 0 | |
| Thrice per week | 0 | 0 | 0 | 0.052 |
| Four times a week | 0 | 0 | 0 | |
| Five times a week | 0 | 0 | 0 | |

### 3.4 Age and Anthropometric and Hypertension Prevalence of Respondents

The age and BMI were determined and evaluated for their correlation with the hypertensive status of the participants. The ages of the participants who were categorized as hypertensive were averagely 23.2±0.14years with that of the pre-hypertensive participants being 22.6±0.37years, followed by the normal participants being 22.3±0.14years in a decreasing order, though the difference is not statistically significant at p>0.05. The hypertensive class recorded BMI of averagely 32.5±0.32kg/m$^2$, followed by the pre-hypertensive and the normotensive group recording 24.21±0.19kg/m$^2$ and 18.3±0.19kg/m$^2$ respectively. There was a significant difference between the groups at p < 0.05, (Table 2).

### 3.5 Physical Activity and Hypertensive Status of Participants

According to Table 3, 97.9% of the participants diagnosed as hypertensive did not undertake any routine exercise or physical activity. The result also indicated 84.8% of the normotensive

students were sedentary, likewise 79.4% of the pre-hypertensive.

## 4. DISCUSSION

Results from the screening showed that the point prevalence of hypertension among adolescents in the University of Port Harcourt was 31.7%, while 11.3% of them were pre-hypertensive. Similar but higher prevalence (38.3%) of hypertension among adolescents was found in a study by Kumar *et al*. [8]. On the other hand, study by Tadesse and Alemu [9] in Ethiopia found lower prevalence of hypertension (7.7%) among youths and University students. An observed high prevalence of pre-hypertension and hypertension among youths and students raises alarm that this disease is gradually emerging among young adults. High prevalence of hypertension among youths would affect the public health system in the University if appropriate measures are not put in place. According to Amma *et al*. [10] and Widjaja *et al*. [11], hypertension was associated with low socio-economic status, waist circumference, overweight/obesity, high soft drinks consumption, low fruit consumption and physical inactivity. It could also be that the listed associated risk factors might be present in these adolescents, hence contributing to high prevalence of hypertension. From the present study, 50.7% of the male participants were diagnosed to be hypertensive with 13.0% and 36.3% as pre-hypertensive and normotensives respectively. The females recorded 76.6% for normotensives, 9.8% and 13.6% as pre-hypertensive and hypertensive respectively. Though not statistically evaluated for significance, a high percentage prevalence of hypertension in males was observed when compared with females.

The higher percentage prevalence in males is similar to the finding by Goncalves *et al*. [12], who conducted a study on the prevalence of hypertension among adolescents and recruited 14,000 adolescents for the study and a realized a prevalence of 9.3% in males as against 6.5% in females. Moselakgomo *et al*. [13] also reported a higher prevalence of 4.1% in males, as opposed to 2.8% in females. They attributed the cause of the increasing prevalence of the condition to the changing lifestyles of the population, following the rural-urban drift, particularly in sub-Saharan Africa with the primary causes being diet, salt intake and physical inactivity. Although not assessed in this study, Babwah *et al*. [14] opined that the high prevalence of hypertension in males, as opposed to females could be attributed to the higher tendency of males to eat more and resort to unhealthy lifestyle practices, such as alcoholism and smoking. Studies have shown that sedentary lifestyles, use of tobacco and alcohol, lack of physical exercises, and unhealthy diet are mostly found among young adults with 67 % of premature death and 33 % of disease burden being associated with these lifestyles [15]. Many studies have found the relationship between blood pressure and age to be significant [16], and this could be due to lack of physical activities as they grow in age, hence the significance. In general, blood pressure rises as people get older. Age is known risk factor for high blood pressure [17]. In all ethnic groups, men tend to have higher mean SBP (Systolic Blood Pressure).

Considering the correlation between the anthropometric measurements and the hypertensive status of the participants, it was discovered that the age did not affect the condition significantly ($P>0.05$) as seen in Table 1. In this study showed a statistical significant difference between age, BMI and hypertension. Studies in various populations also showed strong relationship between different anthropometric indicators and blood pressure levels [18]. The participants diagnosed as hypertensive and pre-hypertensive recorded higher BMIs ($32.5 \pm 0.32$ and $24.2 \pm 0.19$, respectively), while the normotensives recorded a BMI of $18.3 \pm 0.19$ (Table 2). BMI was a significant predictor of both diastolic and systolic blood pressure. The BMI obtained is this study supports the findings of Goncalves *et al.* [12] who did a systematic review and meta-analysis of prevalence of hypertension among adolescents, where a BMI of $21.1 \pm 5.3$ was recorded which is within the normal BMI range (18.5-24.9 kg/m$^2$). These findings are in agreement with other studies [19] which support a strong relationship between BMI and blood pressure across developed and developing countries [18]. Body mass index is reported to be positively and independently associated with morbidity and mortality from hypertension, cardiovascular disease, type II diabetes mellitus, and other chronic diseases [20]. In Caucasian populations, a strong association has been depicted between BMI and mortality, and positive relationship between BMI and BP has also been reported among African and Asian populations [21]. In West Africa, a meta-analysis conducted on 55 articles from 5 countries includes obesity, age, and gender as significant predictors and is

similar to studies of adults in Sierra Leone [22]. Significant relationships have also been reported between age and BMI among adolescents in northeast Nigeria [23], in which BMI was found to be a significant factor in predicting hypertension in rural Nigeria. The importance of BMI has been recognized for estimating cardiovascular disease (CVD) risk factors, particularly due to their positive association with hypertension [24]. It is said that an active lifestyle is required for one to stay healthy and prevent conditions like obesity and related complications such as hypertension [25]. According to Diaz and Shambo [26], one of the recommended guidelines in preventing the risk of hypertension is by increasing physical activity level. This implies sedentary lifestyle may be associated with risk of hypertension. A study by [27] showed that sedentary behaviour was associated with likelihood of developing hypertension, independent of leisure-time physical activity. This makes the activity profile of the participants an essential component of the study in establishing the link between hypertension and the level of activity. The results obtained from the study showed a very low activity profile which can be a predisposing factor to hypertension. It was found that 97.9% of the participants with raised blood pressure had a lifestyle of no physical activity, while 84.8% and 79.4% of the normotensive and pre-hypertensive participants also had no active lifestyles. Physical activity and exercise are known to demand energy and thus the rapid utilization of blood glucose and the breakdown of glucose resulting in the reduction of body and visceral fat. This reduces the risk of atherosclerosis by fat deposits and ultimately reducing the risk of cardiovascular diseases [28]. The study showed very low activity levels with only none of the participants having a recorded profile of five times weekly exercise sessions. This means that majority of the students' population were not physically active and this might have influenced the prevalence of hypertension. Physical inactivity is a risk factor for developing hypertension. This could be due to lack of understanding of the benefits of an active lifestyle.

A study by [29] reported a wide range of stressful experiences, including money, exams and essays, noise, health of family members and themselves, water supply, and relationships. Whitworth [29] suggested that stress related to lack of money is more prevalent among male and female students, given that most of them have to finance their own education, feeding, transportation for getting around the campus, and paying for educational materials and medical treatment when they are sick, this has possible lead to depression, an increase in blood pressure, lack of physical activities and hence hypertension.

## 5. CONCLUSION

From the study carried out, it was revealed that the prevalence of pre-hypertension (11.3%) and hypertension (31.7%) was relatively high among the student population in the University of Port Harcourt. BMI is a significant factor in predicting hypertension in rural Nigeria. Though the study area is urban in setting, the BMI of students from this study showed a significant correlation between BMI and hypertension among students in the University of Port Harcourt. The study also revealed that the majority of the students' population were not physically active. Classification as pre-hypertension or even at the risk of hypertension may cause subjects to take notice. Appropriate diet and lifestyle management are needed to prevent the progression of pre-hypertension and hypertension to stages where they can cause target organ damage

## 6. RECOMMENDATIONS

The prevalence of youth hypertension is increasingly and fast becoming a global health problem, therefore, it is recommended that routine screening should be undertaken by the University's Health Service to checkmate this trend amongst students of the University. Lifestyle modification and management programs should be put in place for the students.

## CONSENT

Written consent was obtained from respondents

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Kaerney PM, Whelton M, Reynolds SK, Muntner P, Whelton PK, He J. Global

burden of hypertension: analysis of worldwide data. Lancet. 2005;365: 217-223.
2. Lackland DT, Weber MA. "Global burden of cardiovascular disease and stroke: hypertension at the core". The Canadian Journal of Cardiology. 2015;31(5):569-571.
3. Njideka D, Basquill C, Aderemi AV, Thompson JY,Obi FA. An estimate of the prevalence of hypertension in Nigeria: a systematic review and meta analysis. Journal of Hypertension. 2015;33:230-42.
4. Muntner P, He J, Cutler JA, Wildman RP, and Whelton PK. Trends in blood pressure among children and adolescents. JAMA. 2004;291(17): 2107-13.
5. Sundar JS, Adaikalam JMS, Parameswari S, Valarmarthi S, Kalpana S. Prevalence and determinants of hypertension among urban school children in the age group of 13-17 years in Chennai, Tamilnadu. Epidemiology. 2013;3(130):1-5.
6. Araoye MO. Research methodology with statistics for health and social sciences. Florin: Nathadex Publishers. 2003:117.
7. Paynter AS, Parkin M. Growth in childhood. In: Stanfield P, Brueton M, Chan M, Parkin M, Waterston T. (editors). Diseases of children in the subtropics and tropics. London: Edward Arnold. 1991:254-270.
8. Kumar P, Elsaidi HR, Zorniak B, Laurens E, Yang J, Bacchu V, Wiebe LI. Synthesis and Biological Evaluation of Iodoglucoazomycin (I-GAZ), an Azomycin-Glucose Adduct with Putative Applications in Diagnostic Imaging and Radiotherapy of Hypoxic Tumors. Chemistry and Medical Chemistry. 2016;11(15):1638-1645
9. Tadesse T, Alemu H. Hypertension and associated factors among university students in Gondar, Ethiopia: a cross-sectional study. BMC Public Health. 2014;14(937):2-5
10. Amma GM, Vasudevan B, Akshayakumar S. Prevalence and determinants of prehypertension and hypertension among adolescents: a school based study in a rural area of Kerala, India. International Journal of Research in Medical Sciences. 2015;3(1):58-64
11. Widjaja FF, Santoso LA, Barns NRV, Pradana GA, Estetika C. Prehypertension and hypertension among young Indonesian adults at a primary health care in a rural area. Medicinal Journal of Indones. 2013;22(1):39-45
12. Gonsalves VSS, Galva TF, Cordeiro de Andrade KR, Dutra SI, Bertolin MNTI, Baiocchi de Carvalho KMI, and Pereira MG, Prevalence of hypertension among adolescents: systematic review and meta-analysis. Rev SaUde Pfiblica. 2016;16;50:27
13. Moselakgomo VK, Toriola AI, Shaw BS, Goon DT, Akinyemi O. Body mass index, overweight, and blood pressure among adolescent schoolchildren in Limpopo province, South Africa Revised Paul Pediatrics. 2012;30(4):562-9.
14. Babwah F, Baksh S, Blake L, Cupid-Thuesday J, Hosein I, Sookhai A, Poon-King C, and Hutchinson G. The role of gender in compliance and attendance at an outpatient clinic for type 2 diabetes mellitus in Trinidad. Revista Panamericana de Salud Ptiblica; 2006;19(2):79-84
15. McNiece KL, Poffenbargei TS, Turner JL, Franco KD, Sorof JM, Portman RJ. Prevalence of hypertension and pre-hypertension among adolescents. Journal of Pediatrics. 2007;150(6):640-644
16. World Health Organization. International society of hypertension (ISH), statement on management of hypertension. Journal of Hypertension. 2004;21(11):1983-1992
17. Mungreiphy NK, Kapoor S, and Sinha R. Association between BMI, Blood Pressure and Age: Study among Tangkhul Naga Tribal Males of North east India. Journal of Anthropology. Article ID 748147; 2010.
18. Jervase E, Barnabas D, Emela AG, Osondu N. Sex differences and Relationship between blood pressure and age among the Igbos of Nigeria. Internet Journal of Biological Anthropology. 2009:3-2.
19. Gupta S, Kapoor S. Sex differences in blood pressure levels and its association with obesity indices: Who is at greater risk? Ethnological Diseases. 2010;20:370-374
20. Pi-Sunyer FX. "Medical Hazards of Obesity," Annual International Medicine. 1993;119 (7):655-660,
21. Kidy F, Rutebarika D, Lule SA. "Blood pressure in primary school children in Uganda: a cross-sectional survey". BMC Public Health. 2014;14:1223.
22. Meehan KA, Bankoski AJ, Tejan E, Ansumana R, Bangura U, Stenger DA, Jacobsen KH. Hypertension in Bo, Sierra Leone. Ethnicity and Disease. 2011;21(2):237–242.

23. Odunaiya NA, Louw QA, Grimmer KA. "Are lifestyle cardiovascular disease risk factors associated with pre-hypertension in 15-18 years rural Nigerian youth? A cross sectional study," BMC Cardiovascular Disorders. 2015;15:144.
24. Dua S, Kapoor S. Blood pressure, waist to hip ratio and body massindex among affluent Punjabi girls of Delhi. Acta Med Auxology. 2000;32:153-157.
25. Eriksson J, Taimela S. K oivisto VA. Exercise and the metabolic syndrome: Review. Diab..Itologia. 2005;40:125-135
26. Diaz Keith M, Daichi Shimbo. Physical Activity and the Prevention of Hypertension**.** CurrHypertens Rep. 2013;15(6):659–668.
DOI: 10.1007/s11906-013-0386-8
27. Beunza JJ, Martinez-Gonzalez MA, Ebrahim S, Bes-Rastrollo M, Nunez J, Martinez JA. Sedentary behaviors and the risk of incident hypertension and prehypertension in adolescents and young adults: the Strong Heart Study. Circulation. 2007;115: 221-227
28. Durrani Anisa M, Waseem Fatima. Effect of Physical Activity on Blood Pressure Distribution among School Children. Advances in Public Health; 2015.
|Article ID 379314 |
Available:https://doi.org/10.1155/2015/379314
29. Whitworth J. "Cardiovascular Consequences of Cortisol Excess". Vascular Health Risk Management. 2015;1(4):291-299.



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