

# Prevalence of Hypertension Among Adolescents in Benue South, Nigeria

Rose Okwunu Abah<sup>1,\*</sup>, Daniel Ejeh Ukpabi<sup>2</sup>, Juliana Ajuma Okoko<sup>3</sup>

<sup>1</sup>Department of Paediatrics, College of Medicine, Federal University of Health Sciences Otuokpo, Benue State, Nigeria

<sup>2</sup>Department of Community Medicine, College of Health Science, Benue State University, Makurdi, Benue State, Nigeria

<sup>3</sup>Department of Pharmacology & Therapeutics, College of Medicine, Federal University of Health Sciences Otuokpo, Benue State Nigeria

## Abstract

### *Background*

Hypertension in adolescents has been shown to tracks into adulthood, as well as causing premature cardiovascular and renal diseases.

### *Objectives*

To determine the prevalence of elevated blood pressure and hypertension among adolescents of ages 10-19 years old attending secondary schools in Benue South, Nigeria; characterise their demographics and determine factors associated with the development of high blood pressure.

### *Materials and Methods*

A cross-sectional descriptive study of secondary school adolescents selected through multistage sampling from across three Local Government Areas of Benue South, Nigeria. All the participants had their blood pressure measured using mercury sphygmomanometer and their height and weight taken for the calculation of their body mass index. A dipstick urinalysis with was carried out on their urine samples. Data analysis was with SPSS version 25.

### *Results*

A total of 260 adolescents were studied, males were 132 (50.8%) and the mean age was 13.65 ±2.01 years. The prevalence of elevated blood pressure and hypertension was 5.4% and 2.3% respectively. Fifteen females (75.0%) had elevated blood pressure/hypertension as against five males (25%) and it was statistically significant. Adolescents in mid-adolescence age (60.0%) and lower social class (70.0%) had higher rate of high blood pressure. Significant proteinuria (+) was found among eleven (55.0%) of those with high blood pressure.

### *Conclusion*

The prevalence of elevated blood pressure and hypertension among the adolescents was 5.4% and 2.3% respectively; being female, within mid-adolescence age and from lower social class are associated factors.

## Research Article

## Open Access &

## Peer-Reviewed Article

DOI: 10.14302/issn.2329-9487.jhc-25-5726

## Corresponding author:

Rose Okwunu Abah, Department of Paediatrics, College of Medicine, Federal University of Health Sciences Otuokpo, Benue State, Nigeria.

## Keywords:

Adolescents, Elevated BP, Hypertension, Proteinuria

**Received:** September 02, 2025

**Accepted:** September 23, 2025

**Published:** October 18, 2025

## Academic Editor:

Sasho Stoleski, Institute of Occupational Health of R. Macedonia, WHO CC and Ga2len CC

## Citation:

Rose Okwunu Abah, Daniel Ejeh Ukpabi, Juliana Ajuma Okoko (2025) Prevalence of Hypertension Among Adolescents in Benue South, Nigeria. Journal of Hypertension and Cardiology - 3(4):27-37. <https://doi.org/10.14302/issn.2329-9487.jhc-25-5726>

### *Recommendation*

Regular blood pressure measurement should be part of school health programme.

### **Introduction**

Hypertension is recognized as one of the major risk factors for preventable deaths worldwide. It has been described as a disease of global poverty rather than “disease of affluence”, evident by its high prevalence in low- and middle-income countries (LMICs) compared with the high-income countries.<sup>1</sup> The prevalence of pediatric hypertension is rising; especially in low- and middle-income countries (LMICs), and its effect is far reaching as it has been shown that elevated blood pressure (BP) and hypertension in adolescent is associated with lower neurocognitive test scores, tracks into adulthood and is also associated with premature cardiovascular and renal diseases.<sup>2,3,4</sup> The prevalence of pediatric hypertension in the United States is approximately 3.5% and that of elevated BP approximately 2.2% to 3.5%.<sup>5</sup> The prevalence among African children from the systemic review carried out by Crouch et.al<sup>6</sup> is 7.5%, 11.4% and 21.7% for hypertension, elevated BP and combined hypertension and elevated BP respectively. The prevalence of adolescent hypertension from across Nigeria ranges from 0.1% in South-west to 17.5% in North-central.<sup>7,8,9,10,11</sup>

Literature has shown that childhood and adolescent hypertension tracks into adulthood with associated complications that could only be prevented if early interventions were instituted.<sup>12,2,13,14</sup> Yet, the proportion of awareness, treatment and blood pressure control in LMICs, even among adults, is low.<sup>15</sup> The lack of routine BP check among the paediatrics population in resource constrained settings like ours, due among others factors, to unavailability of appropriate size cuffs for the paediatrics age groups<sup>6</sup> and the notion that hypertension is an adult disease makes the true burden of it not to be known.

According to the 2017 clinical practice guidelines of American Academy of Paediatrics (AAP), paediatric hypertension is defined as “blood pressure  $\geq$ 95th percentile for age, sex and height for children from 1-13 years of age, and for adolescent above 13 years of age it is blood pressure of  $\geq$ 130/80 mmHg”. Also added to the guideline is “Elevated blood pressure” which is blood pressure  $>$ 90th percentile to  $<$ 95th percentile or 120/80 mmHg to  $<$ 95th percentile (whichever is lower) for children aged 1-13 years; and for adolescent above 13 years, it is blood pressure of 120/ $<$ 80 mmHg to 129/ $<$ 80 mmHg.<sup>5</sup>

The study was carried out to determine the prevalence of elevated BP and hypertension among 10-19 years old adolescents attending secondary school across Benue South, Nigeria; to characterise their demographics as well as determine factors associated with the development of high blood pressure among them.

### **Materials and Methods**

#### *Study Location*

Benue south is one of the three senatorial districts of Benue State and is the indigenous home of the Idoma people. It is comprise of nine local government area. The population of Benue south senatorial district from the 2006 National population census was 1,307,647. Otukpo town which is the seat of power of the paramount ruler of Idomaland, the Och'idoma, is located in the senatorial district and serves as its headquarter.

### *Study Design and Population*

It was a cross sectional descriptive study that was carried out among 10-19 year old adolescents in Secondary schools within Benue South Senatorial district.

### *Sample Size*

The sample size for the study was determined using the Fischer's formula<sup>16</sup> given as  $N = Z^2PQ/D^2$ , where N is the minimum sample size; Z is the standard normal deviate at 95% confidence interval (1.96); P is the prevalence of hypertension among Nigerian adolescents from a previous study (17.5%);<sup>11</sup> Q is the complimentary probability (1-P) and D is the allowed margin of error at 5%. Attrition rate of 15% was allowed in case of incomplete data.

Hence  $N = 1.96 \times 1.96 (0.175 \times 0.825) / 0.0025$

$N = 255$ .

The participants were recruited via multistage sampling techniques. Three Local Government areas (LGA) were selected through random sampling from the nine LGAs in Benue South senatorial zone. The list of government approved secondary schools within each of the LGA was obtained from their respective Education Authority unit. From the list of schools, participating schools were selected by random sampling and the number of participants per school was based on proportional sampling according to the school population.

### *Data Collection*

A total of 260 adolescents were recruited for the study from the three selected Local Government Areas (LGA) namely Ogbadibo, Ohimini and Otukpo LGA. The data collection was done using an interviewer administered questionnaire on Kobocollect toolbox by trained research assistants. The sociodemographic information of the adolescents as well as information on the educational level, occupation and history of hypertension of their parents were obtained. The weight, height and blood pressure of the adolescents were measured following standard procedures and documented. Each participant was provided with sample bottle for urine sample and a dipstick urinalysis was carried out using Combi-9 test strips on the spot and the results documented.

The weight of each participant was taken with a digital scale to the nearest 0.1 kg in light clothing and barefooted while their height was measured with a portable stadiometer to the nearest 0.1 cm also while barefooted. The body mass index (BMI) was calculated for each participant using the formula of weight (kg)/height (m<sup>2</sup>). The World Health Organization (WHO) BMI-for-age percentile classification guideline was adopted for the determination of underweight, normal weight and overweight.

The blood pressure was measured in the right arm using a standard mercury sphygmomanometer (Accoson®, England) according to the standard protocol for BP measurement as described by the AAP 2017 clinical practice guideline.<sup>5</sup> (Flynn et.al, 2017). Each participant's BP was measured in the right arm after resting for 10 mins in a sitting position with the arm on a table. The systolic and diastolic blood pressure was read off at the 1st and 5th Korotkoff sound respectively. The AAP 2017 clinical practice guideline definition of elevated BP and hypertension was adopted.

The socioeconomic classes of the participants were determined using the revised scoring scheme for classifications of socioeconomic status developed by Ibadin. et.al.<sup>17</sup>

### *Ethical Issues*

The ethical clearance for the study was obtained from the Federal University of Health Sciences Otuokpo (FUHSO) Research and ethics committee (reference number: FUHSO-HREC/02/05/2023). Approval was obtained from the Benue State Ministry of Education while informed consent and assent was obtained from the parents and the participants respectively. Confidentiality of the participants' details was maintained throughout the study.

The inclusion criteria were adolescents within the age bracket of 10-19 years old attending secondary schools in Benue South who assented and their parents/guardians gave consent for the study. Exclusion criteria were history of being on chronic medications known to affect blood pressure, for example steroids and refusal of the adolescents to give assent or parents to give consent.

#### *Data Analysis*

The data was analysed using IBM Cooperation Statistical Package for Social Sciences (SPSS) version 25.0 software. Results are presented in frequency tables. Chi-square test was used for testing association between variables while logistic regression was employed to identify predictors of high blood pressure. A probability value (P-value) of <0.05 was set as being statistically significant.

#### **Results**

A total of 260 adolescents were recruited with the males making up 50.8% and those of Idoma ethnic group accounting for 91.2%. The mean age was 13.65±2.01 years. The early adolescence group (10-13 year) accounted for 46.5% followed by the middle adolescence group with 45.4%. The mean weight, height and BMI of the participants were 42.9±9.34, 153.4±10.95 and 18.08±2.37 respectively. Table 1 shows the sociodemographic characteristics. None of the participants had ever smoked cigarette and only one (0.4%) agreed to have ever taken alcohol.

Table 1. Sociodemographic Characteristics of Participants

Variables	Frequency(N=260)	Percent
<b>Age(years)</b>		
10-13	121	46.5
14-16	118	45.4
17-19	21	8.1
Mean(Standard Deviation)	13.65(2.01)	
<b>Sex</b>		
Male	132	50.8
Female	128	49.2
<b>Ethnicity</b>		
Idoma	237	91.2
Others	23	8.8
<b>Class</b>		
JSS1	77	29.6
JSS2	47	18.1

JSS3	38	14.6
SS1	35	13.5
SS2	35	13.5
SS3	28	10.8
<b>Socioeconomic Class</b>		
Lower Class	218	83.8
Middle Class	42	16.2
Upper Class	0	0
<b>BMI for Age Percentile</b>		
Underweight	29	11.2
Normal/Healthy	228	87.7
At Risk of Overweight	3	1.2

Elevated blood pressure was found among 14(5.4%) of the respondents while 6(2.3%) had hypertension. The highest prevalence of elevated blood pressure/hypertension 12(60%) was among the middle adolescence age group of 14-16 years with the females being more prone (75%) and this was statistically significant at a p-value of 0.02. Table 2 depicts the prevalence of elevated blood pressure and hypertension.

The prevalence of high blood pressure (elevated BP/hypertension) was found to be higher, 15(75%) among the adolescents from Ogbadibo local government area and the difference was statistically significant. The adolescents from the lower socioeconomic class and those with normal BMI percentile had higher prevalence of high blood pressure, 14(70%) and 19(95%) respectively but neither was statistically significant. Eighty-seven (33.5%) of all the adolescents had protein in urine, (+) of protein ( $\geq 30$  mg/dl) on dipstick urinalysis. Eleven out of the adolescents with high blood pressure (55.0%) had proteinuria but this was statistically significant at a p-value of 0.047. Table 3 shows the sociodemographic factors associated with elevated blood pressure/hypertension.

Table 2. Prevalence of Elevated Blood Pressure (BP) and Hypertension

Variables	Frequency	Percent
Normal	240	92.3
Elevated BP	14	5.4
Hypertension	6	2.3
<b>Total</b>	260	100.0

Table 3. The Sociodemographic factors associated with Elevated BP/Hypertension (HTN)

Variables	Normal BP Freq(%)	Elevated BP/ HTN Freq(%)	Total	Chi-square test	P- value
<b>Age (years)</b>					
10-13	116 (48.3)	5 (25.0)	121 (46.5)	4.465	0.091
14-16	106 (44.2)	12 (60.0)	118 (45.4)		
17-19	18 (7.5)	3 (15.0)	21 (8.1)		
<b>Sex</b>					
Female	113 (47.1)	15(75.0)	128 (49.2)	5.756	0.020*
Male	127 (52.9)	5(25.0)	132 (50.8)		
<b>Class</b>					
JSS 1	74 (38.5)	3 (15.0)	77 (29.6)	17.163	0.004*
JSS 2	47 (19.6)	0 (0.0)	47 (18.1)		
JSS 3	32 (13.3)	6 (30.0)	38 (14.6)		
SS 1	32 (13.3)	3 (15.0)	35 (13.5)		
SS 2	28 (11.7)	7 (35.0)	35 (13.5)		
SS 3	27 (11.3)	1 (5.0)	28 (10.8)		
<b>Local Govt Area</b>					
Otukpo	114 (47.5)	4 (20.0)	118 (45.4)	27.033	<0.001*
Ogbadibo	53 (22.1)	15 (75.0)	68 (26.2)		
Ohimini	73 (30.4)	1 (5.0)	74 (28.5)		
<b>Socioeconomic Class</b>					
Lower Class	204 (85.0)	14 (70.0)	218 (83.8)	3.067	0.107
Middle Class	36 (15.0)	6 (30)	42 (16.2)		
Upper Class	0 (0.0)	0 (0.0)	0 (0.0)		
<b>BMI for Age Percentile</b>					
Underweight	29 (12.1)	0 (0.0)	29 (11.2)	5.326	0.056
Normal/Healthy	209 (87.1)	19 (95.0)	228 (87.7)		
At Risk of Overweight	2 (0.8)	1 (5.0)	3 (1.2)		
<b>Parental History of HTN</b>					
No	214 (89.2)	15 (75.0)	229 (88.1)	3.528	0.073
Yes	26 (10.8)	5 (25.0)	31 (11.9)		
<b>Protein in Urine</b>					
Absent	164 (68.3)	9 (45.0)	173 (66.5)	4.514	0.047
Present	76 (31.7)	11 (55.0)	87 (33.5)		

\* Statistically significant P-value

## Discussion

The prevalence of hypertension of 2.3% among the adolescents in Benue South Senatorial zone falls within the documented prevalence range of 0.1-17.5%<sup>7,8,9,10,11</sup> among adolescents across Nigeria. It is however lower than the 17.5% recorded by Ejike et al.<sup>11</sup> from neighbouring Kogi State in North Central Nigeria and the 5.4% from Enugu State in South-east Nigeria.<sup>18</sup> The wide range of prevalence from different region of the country could be attributable to different methodologies and definition of hypertension adapted by the various authors. There is no national guideline for the diagnosis of hypertension among children hence various authors use different international guidelines that is prevalent at the time of their study. The obvious fact from this finding is that hypertension is a health problem among adolescents in Benue South as reported from other parts of the country but it requires intentionally seeking for it. This underscores the need to incorporate regular blood pressure monitoring among adolescent into school health programme for early detection and intervention, knowing the deleterious effects of long standing hypertension on the health of adolescents.<sup>2,3</sup>

The prevalence of elevated blood pressure (pre-hypertension) of 5.4% among the adolescents in Benue South Senatorial zone is similar to the 5% Ezeudu et al<sup>9</sup> found in their study from South-east Nigeria but lower than the 22.2% & 25% findings of Ejike et al<sup>11</sup> from neighbouring Kogi State in North-central Nigeria, the global prevalence of 9.67% documented by Song et al<sup>19</sup> from a systemic review and meta-analysis carried out in 2019. The lower prevalence of elevated blood pressure in the present study as against the findings from the neighbouring State of Kogi might be due to differences in the age groups and methods of blood pressure measurement used. The Kogi study was among 13-18 years old and the blood pressure was measured using an automated device. It has been documented that oscillometric (automated) method of blood pressure measurement tend to overestimate the blood pressure when compared with the standard blood pressure measuring method of using mercury sphygmomanometer which was used in the present study. Also the definition of elevated blood pressure in that study was based on the 2004 fourth report whereas in this study it was based on the 2017 AAP guidelines.

The sociodemographic characteristics of those with elevated BP or hypertension also showed variations from other studies. The participants in mid-adolescence had the highest proportion of those with elevated BP/HTN, and this is similar to the findings of the study done by Ator et al.<sup>20</sup> and by Okagua et al.<sup>21</sup> while it is at variance with Odunaiya et al.,<sup>22</sup> where hypertension was more common in late adolescence. The mid-adolescence period coincides with the peak of puberty with its rapid physical changes as well as emotional and hormonal fluctuations. These pubertal changes could be responsible for the higher prevalence of high blood pressure observed among the group. Nonetheless, there is need for routine blood pressure monitoring across the various age groups.

Three-quarters of those with high blood pressure (elevated BP/HTN) were females; this is similar to the report by Ezeudu et al.,<sup>9</sup> Ujunwa et al.,<sup>19</sup> and Uwaezouke et al.<sup>23</sup> where females had a higher prevalence of hypertension compared to males. Females generally tend to have earlier onset of puberty than males, and this could contribute to why the females have higher prevalence of high blood pressure. Okpokowuruk et al<sup>8</sup> however, found that gender was not significantly associated with development of hypertension. The lower socioeconomic class also have the highest proportion of adolescents with high blood pressure compared to the middle socioeconomic class and this is similar to what Akinkugbe et al.<sup>24</sup> and Kacsmarek et al.<sup>25</sup> reported in their respective studies. Low socioeconomic class is linked to poor nutrition, chronic stress and poor access to healthcare, which ultimately leads to prehypertension/

hypertension. However, Mahlati et al.<sup>26</sup> from South Africa, did not find any association between socio-economic status and prevalence of hypertension among adolescents in their work.

Almost all of the respondents that have elevated BP/hypertension have a normal BMI for age, a finding that is in contrast to earlier studies which showed that obesity is a predictor for elevated BP/hypertension.<sup>23,27,28,29</sup> It is however consistent with the findings of Ajite et al<sup>30</sup> and Rosner et al.<sup>31</sup> who found that at lower BMI, black adolescents have higher BP and more prevalence of hypertension than white adolescents. This underscores the importance of screening for elevated blood pressure among all adolescents, irrespective of whether the adolescent appears healthy, underweight or obese.

The presence of significant proteinuria (+), { $\geq 30$  mg/dl} among the adolescents had a correlation with elevated BP/hypertension just as demonstrated by Adekanubi et al<sup>32</sup> and Rahama et al<sup>33</sup> who found proteinuria to be an independent risk factor for elevated BP and hypertension. It is however in contrast with the findings of Ezeudu et al<sup>34</sup> and Ajite et al<sup>30</sup> among adolescents from Eastern and Western Nigeria respectively; and Battaglia et al<sup>35</sup> among Italian adolescents. They found no correlation between proteinuria and high blood pressure.

### Conclusion

The prevalence of hypertension and elevated blood pressure among the adolescents in Benue South was 2.3% and 5.4% respectively. Being a female, in mid-adolescence age group, from the lower socioeconomic class and Ogbadibo LGA predisposes to higher prevalence of high blood pressure. High blood pressure was also found to be associated with presence of significant proteinuria.

### Recommendation

Regular blood pressure measurement should be incorporated into school health programmes and at every opportunity that brings an adolescent in contact with health facility.

### Conflicts of Interest

None

### Funding

The study was supported by the 2023 TETFUND Institutional Based Research (IBR) funding(FX302-IBR)

### References

1. Zhou B, Perel P, Mensah G, Ezzati M. (2021) Global epidemiology, health burden and effective interventions for elevated blood pressure and hypertension. *Nature Reviews/cardio*; 18:786-802 <https://doi.org/10.1038/s41569-021-00559-8>
2. Gartlehner G, Vander Schanf EB, Orr C, Kennedy SM, Clark R et al. (2020) Screening for hypertension in children and adolescents: systematic review for the US Preventive services Task Force. Rockville(MD): Agency for Healthcare Research and Quality(US); Nov Report #: 20-05261-EF-1



3. Lande MB, Adams H, Falkner B, Waldstein SR, Schwartz GJ et al. (2009) Parental assessment of internalizing and externalizing behaviour and executive function in children with primary hypertension. *J Ped*;154:207-212
4. Robinson CH, Chanchlani R. (2022) High blood pressure in children and adolescents: current perspectives and strategies to improve future kidney and cardiovascular health. *Kidney Int Rep*; 7:954-970 <https://doi.org/10.1016/j.ekir.2022.02.018>
5. Flynn JT, Kaelber DC, Baker-Smith CM, Blwey D, Carroll AE et al. (2017) Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics*; 140(3):e20171904 <https://doi.org/10.1542/ped.2017-1904>
6. Crouch SH, Soepnel LM, Kolkenbeck-Ruh A, Maposa I, Naidoo S et al. (2022) Paediatric hypertension in Africa: A systematic review and meta-analysis. *EClinicalMedicine* 43:101229 <https://doi.org/10.1016/j.eclinm.2021.101229>
7. Oyewole OO, Oritogun KS. (2020) Pre-hypertension and hypertension in adolescence: How much does it occur in a Nigerian community. *West. Afr J Med* 32(2):71-72
8. Okpokowuruk FS, Akpan MU, Ikpeme EE. (2017) Prevalence of hypertension in a semi-urban and urban area of Uyo Metropolis, Nigeria *Pan Afr. Med J* 28:303 doi:10.11604/Pamj.2017.28.303.14396
9. Ezeudu CE, Chukwuka JO, Ebenebe JC, Igwe WC, Egbuonu I. (2018) Hypertension and pre-hypertension among adolescents attending secondary school in urban area of South-East, Nigeria. *Pan Afr. Med J* 2018; 13:145 doi:10.11604/Pamj.2018.31.145.15994
10. Mijinyawa MS, Illiyasu Z, Borodo MM. (2008) Prevalence of hypertension among teenage students in Kano, Nigeria *Nig. J Med* 17
11. Ejike CE, Ugwu CE, Ezeanyika IU. (2010) Variations in the prevalence of prehypertension in a Nigerian school-going adolescent population living in a semi-urban and an urban area. *BMC Pediatr* 2010;10:13-20
12. World Health Organization (WHO) Hypertension (2023): Available from <https://www.who.int/news-room/fact-sheets/detail/hypertension>
13. World Health Organization (WHO) Cardiovascular diseases (CVD) (2017): [https://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-disease-\(cvds\)](https://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-disease-(cvds))
14. Lande MB, Adams H, Falkner B, Waldstein SR, Schwartz GJ et al. (2010) Parental assessment of executive functions and internalizing and externalizing behaviour in primary hypertension after anti-hypertensive therapy. *J Pediatr* 157(1):114-119
15. Mills KT, Stefanescu A, He J. (2020) The global epidemiology of hypertension. *Nature Reviews Nephrology* 16:223-237
16. Ibrahim T. (2009) Sample size determination. In: *Research Methodology and dissertation writing for health and applied health professionals*. Cress Global Link Limited; 1<sup>st</sup> edition 74
17. Ibadin MO, Akpede GO. (2021) A revised scoring scheme for the classification of socioeconomic status in Nigeria. *Niger J Paediatr* 48(1):26-33 <http://dx.doi.org/10.4314/njp.v48i1.5>
18. Ujunwa FA, Ikefuna AW, Nwokocha ARC, Chinawa JM. (2013) Hypertension and pre-hypertension among adolescents in secondary schools in Enugu, South-East Nigeria. *Italian Journal of Pediatrics* 39:70 <http://www.ijponline.net/content/39/1/70>

19. Song P, Zhang Y, Yu J, Zha M, Zhu Y et al. (2019) Global prevalence of hypertension in children: A systemic review and meta-analysis. *JAMA Pediatr* 173(12):1154-1163
20. Ator I, Ezeogu J, Okeke CV, Umeh SI, Ekure E et al. (2023) High blood pressure pattern amongst adolescents in Lagos, South-west Nigeria. *Pan Afr Med J* doi:10.11604/pamj.2023.44.206.38670
21. Okagua, J., & Akani, N. (2015). Prevalence of Hypertension in School going Adolescents in Rural Areas of Rivers State, South-South Nigeria. *The Nigerian Health Journal*, 14(4), 157–164. <https://www.ajol.info/index.php/nhj/article/view/133235>
22. Odunaiya, NA., Louw, Q., & Grimmer, K. (2015). Are lifestyle cardiovascular disease risk factors associated with pre-hypertension in 15–18 years rural Nigerian youth? A cross sectional study. *BMC Cardiovascular Disorders*, 15(1), 144. <https://doi.org/10.1186/S12872-015-0134-X>
23. Uwaezuoke SN, Okoli CV, Ubesie AC, Ikefuna AN. (2016) Primary hypertension among a population of Nigerian secondary school adolescents; prevalence and correlation with anthropometric indices. *Niger J Clin Pract* 19(5):649-654
24. Akinkugbe FM, Akinwolere OA, Kayode CM. (1999) Blood pressure pattern in Nigeria adolescents. *West Afr J Med* 18:196–202.
25. Kaczmarek M, Stawińska-Witoszyńska B, Krzyżaniak A, Krzywińska-Wiewiorowska M, Siwińska A. (2015) Who is at higher risk of hypertension? Socioeconomic status differences in blood pressure among Polish adolescents: a population-based ADOPOLNOR study. *Eur J Pediatr*. Nov;174(11):1461-73. doi:10.1007/s00431-015-2554-0. Epub 2015 May 9. PMID: 25956273; PMCID: PMC4623093.
26. Mahlati Z, Mall S, Kagura J. (2024) Socioeconomic status and hypertension in South African adolescents. *South Afr J Child Health* 18(1):53-58
27. Oyeyemi AY, Usman MA, Oyeyemi, AL, Jaiyeola OA. (2015) Casual blood pressure of adolescents attending public secondary schools in Maiduguri, Nigeria. *Clinical Hypertension*, 21 (1),16. <https://doi.org/10.1186/S40885-015-0026-5>
28. Ajayi IO, Soyannwo MAO, Asinobi AO, Afolabi NB, Ayede AI et al. (2017) Blood pressure pattern and hypertension related risk factors in an urban community in Southwest Nigeria: The Mokola hypertension initiative project, Ibadan, Nigeria. *Journal of Public Health and Epidemiology*, 9(4),51–64. <https://doi.org/10.5897/JPHE2017.0908>
29. Abiodun O, Ladele A, Olu-Abiodun O, Ashipa, T. (2021) Hypertension among adolescents in Nigeria: a retrospective study of adolescent university freshmen. *International Journal of Adolescent Medicine and Health*, 33(5). <https://doi.org/10.1515/IJAMH-2018-0287>
30. Ajite AB, Aladekomo TA, Aderounmu T, Olowu WA. (2016) Burden of hypertension and abnormal glomerular permeability in hypertensive school children. *Nephrourol mon* 8(4):e37568 doi.10.5812/numonthly.37568
31. Rosner B, Prineas R, Daniels SR, Loggie J. (2000) Blood pressure differences between blacks and whites in relation to body size among US children and adolescents. *Am J Epidemiol*. 150(10):1009-1009
32. Adekanubi AF, Obadina OO, Oba-Daini OO, Fatuga MB et al. (2015) Elevated blood pressure, abnormal urinalysis and body mass index as screening tools for latent kidney diseases among adolescents in Sagamu. *Annal Med Res*. 1(1)

33. Rahama AJ, Qamar FN, Ashraf S, Khowaja ZA, Tariq SB, et al. (2013) Prevalence of hypertension in healthy school children in Pakistan and its relationship with body mass index, proteinuria and haematuria. *Saudi J kidney Dis Transpl.* 24(2):408-412 doi:10.4103/1319-2442.109619
34. Ezeudu CE, Chukwuka JO, Ebenebe JC, Igwe WC, Egbuonu I et al. (2017) Asymptomatic proteinuria and elevated blood pressure among adolescents in urban secondary schools of South-East Nigeria. *Orient J Med* 29(34):112-118 [www.orientjom.com](http://www.orientjom.com)
35. Battaglia Y, Esposito P, Corrao S, Russo L, Balducci A et al. (2020) Evaluation of hypertension, proteinuria and abnormalities of body weight in Italian adolescents participating in the World Kidney Days. *Kidney Blood Press Res* 45(2):286-296 doi:10.1159/000502547