

Prevalence of Hypertension in School going Adolescents in Rural areas of Rivers State, South-South Nigeria

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ABSTRACT

BACKGROUND

The prevalence of hypertension seems to be increasing in children and adults in urban areas of sub-Saharan Africa. Different studies have been carried out on the prevalence of hypertension amongst adolescents living in urban areas reflecting this seeming increase in the prevalence of hypertension. However, there is scarcity of studies on the prevalence of hypertension in children living in rural areas of Nigeria, and Rivers State in South-South Nigeria. This present study which will contribute to data on the subjects and form a reference for future studies in the region sought to determine the prevalence of hypertension in apparently healthy school going adolescents in two rural Local Government Areas of Rivers State.

METHODS

A cross sectional population based blood pressure survey was carried out on 1,080 apparently healthy school going adolescents, aged 10-18 years, selected from 18 secondary schools in two rural local government areas of Rivers State, using multi-stage stratified sampling technique. Blood pressure measurements were taken using auscultatory method. The average of three readings was taken as the blood pressure. Hypertension was defined by a systolic and or diastolic blood pressure greater than or equal to 2 standard deviation above the mean blood pressure for age and sex of the population studied.

RESULTS

The mean systolic blood pressure of the female subjects of 111.75 ± 13.91 mm Hg was higher than the 110.48 ± 15.45 mm Hg in the males, while the mean diastolic blood pressure of the female subjects of 67.07 ± 11.98 mm Hg was significantly ($p = 0.04$) higher than the 65.60 ± 11.42 mm Hg in the males. Hypertension was seen in 46 (4.3%) of the subjects with 3.6% in males and 4.9% in females respectively. This gender difference was however, not statistically significant ($p = 0.30$). Systolic and diastolic blood pressure increased with age.

CONCLUSION

The 4.3% prevalence rate of hypertension in adolescents in rural areas of Rivers State is high, and thus emphasizes the need for regular blood pressure surveillance in clinicians caring for these adolescents.

KEYWORDS: Hypertension, Adolescents, Rural areas, Nigeria.

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INTRODUCTION

Hypertension is a major public health problem¹ and the greatest risk factor for cardiovascular disease² responsible for 49% of ischaemic heart disease and 62% of cardiovascular accidents³. Hypertension once thought to be rare in rural Africa⁴, is now the commonest non-communicable disease in Nigeria⁵, accounting for at least 20% of all

deaths in Nigeria⁶. Although the burden of hypertension is of a lesser magnitude in adolescents than in adults⁷, studies have shown that essential hypertension begins in childhood and tracks into adulthood^{8,9}. Epidemiological studies across the globe have reported varying prevalence rates of hypertension among children and adolescents. In the developed countries, the prevalence of hypertension in children and adolescents has been reported to be between 5.4 -23.9%¹⁰⁻¹³. In the United States of America, Robinson et al¹⁴ reported a 14.9% prevalence among rural children in Alabama. In Africa, Monyekiet al¹⁵ reported a 1.0-5.8% and 3.1-11.4% prevalence among rural South African school aged boys and girls respectively. In Nigeria, the prevalence of hypertension has been reported to be between 1-17.5%¹⁶⁻¹⁸ in urban children and 4.5 – 6.3%^{19,20} in rural children. Antia-Obong and Antia-Obong¹⁹ reported a 4.5% prevalence of hypertension among school aged children in rural areas of Oyo State, South West Nigeria. Globally, the prevalence of hypertension in children and adolescents is increasing in rural and urban areas²¹ with an epidemiological shift from secondary hypertension mainly caused by renal diseases, to essential hypertension as the major cause of hypertension in adolescents^{22,23}.

In children, evidence suggests that even moderate increase in blood pressure could have a negative effect on vascular structure and function²⁴. Other reported complications of hypertension in children include target organ damage and retinal abnormalities^{25,26}. The awareness that essential hypertension begins in childhood and is strongly correlated with hypertension in adulthood^{8,9} has made it necessary to screen apparently healthy adolescents in order to identify those at risk and those with hypertension and improve cardiovascular health. Moreover, there are few studies on the prevalence of hypertension in adolescents living in rural areas of Nigeria^{19,20} and none in Rivers State, South-South Nigeria. Environmental and economic stressors could possibly have an influence on hypertension in children²⁷. This is especially

worrisome as children living in rural areas of Rivers State, South-South Nigeria have in the past decade been exposed to stressful life events including internal displacements from communal clashes and flooding in addition to poverty.

The present study intends to determine the prevalence of hypertension in apparently healthy school going adolescents in two rural local government areas of Rivers State, South-South Nigeria.

SUBJECTS AND METHODS

One thousand and eighty subjects aged 10-18 years for the present study were drawn from Emohua and Abua-Odual Local Government Areas (LGAs) of Rivers State in the South-South geopolitical zone of Nigeria. The two Local Government Areas were randomly selected and are mainly rural settlements, situated about 150km apart, subsistence farming, small scale trading and fishing dominates both areas. Ethical clearance was obtained from the Research and Ethics Committee of the University of Port Harcourt Teaching Hospital. Notification and permission to carry out the study was obtained from the Rivers State Ministry of Education, local government council, head teachers of the 18 selected schools, parents or guardians and assent from the selected students. The schools in each LGA were first stratified into public and private schools, and further stratified into co-educational (mixed), all boys and all girls schools respectively. The schools were finally selected by -simple random sampling. Eight schools (3 private, 5 public) were selected from EMOLGA and 10 schools (3 private, 7 public) from ABOLGA respectively. A total of 18 schools were selected for the present study. In each selected school, 60 students were recruited, 10 students were randomly selected from an arm of the six classes using the class register.

Apparently healthy secondary school students in the selected schools, who gave assent for the study, and whose parents/ guardians gave consent made up the study population.

Students on drugs known to affect blood pressure such as steroids or propranolol and those with histories or known chronic illnesses such as cardiac, renal and endocrine diseases were excluded. Each selected school was visited twice. Blood pressure was measured using the mercury sphygmomanometer (Accoson, London, England) with an appropriate cuff in conjunction with the bell of the Littmann stethoscope (USA).

The students had been seated for at least 5 minutes with their back supported on the chair and the upper arm bared without constrictive clothing. The right arm of each student was placed on a table with the cubital fossa supported at the level of the heart. The cuff size selected for each student had a bladder that covered at least 80% of the length of the right upper arm without obstructing the antecubital fossa and at least 40% of the circumference of the right arm. The centre of the inflation bladder was placed over the brachial artery, and the open bell of the stethoscope was then placed on the antecubital fossa over the brachial artery, which was ascertained by palpation. The mercury column of the sphygmomanometer was vertical and the meniscus was at the level of the eye of the investigator. The cuff was rapidly inflated to occlude the brachial artery to about 20-30 mmHg above the point where palpable impulse of the artery disappeared, then deflated slowly allowing the mercury column of the sphygmomanometer to fall at a rate of approximately 2-3 mmHg per second while listening for the korotkoff sounds. The first Korotkoff sound was recorded as the systolic BP (SBP) while the diastolic BP (DBP) was recorded at the point of disappearance of the sounds (phase V). Three readings were taken with at least 1 minute in between them while making sure that the cuff was completely deflated between readings. BP measurements were approximated to the nearest 2 mmHg. The three readings on each student were done by the same investigator. The average of the three readings was taken as the BP and recorded for each student. A student was considered hypertensive if his or

her average SBP and/or DBP was ≥ 2 SD above the mean BP for age and sex for the population studied. Subjects found to have elevated blood pressure were counseled and referred to the paediatric clinic of the University of Port Harcourt Teaching Hospital or their respective General Hospitals for expert management.

Data analysis

Data entry and analysis was done using SPSS software version 15 and EPI-INFO version 6.04. Distributions were described as means and standard deviations. These results are presented as tables and charts in simple proportions. The Chi-square (2) test, Fisher's exact test and one-way analysis of variance (F) were used where appropriate to test proportions. In all cases, a probability value (p value) of < 0.05 was regarded as statistically significant.

RESULTS

One thousand and eighty subjects were recruited for the present study. There were 551 males (51%) and 529 females (49%), giving a male to female ratio of 1:1. The mean age of the subjects was 14.55 ± 2.1 years. Table I shows that the mean systolic blood pressure of the subjects increased with age from 99.17 ± 13.79 mm Hg to 119.34 ± 14.91 mm Hg with a mean systolic BP of 110.10 ± 14.72 mm Hg (range 70 – 180 mm Hg). Systolic blood pressure was higher in females (111.75 ± 13.91 mm Hg) than in males (110.48 ± 15.45 mm Hg), though the difference was not statistically significant ($p = 0.209$). Figure 1 shows that the mean systolic blood pressure increased with age in both males and females with a more rapid rise at 10 – 12 years in females and 12 – 14 years in males. Table 1 also shows that the mean diastolic blood pressure of the study subjects increased with age with an overall mean diastolic blood pressure of 66.32 ± 11.71 mm Hg (range 40 – 110 mm Hg), being significantly higher in females (67.07 ± 11.98 mm Hg) than in males (65.60 ± 11.41 mm Hg) [$p = 0.04$]. A more rapid increase in mean diastolic blood pressure was noted between 13 – 15 years in females as shown in figure 1.

There was a significant positive correlation between age and systolic BP ($r = 0.350$; $p = 0.000$) as well as diastolic BP ($r = 0.305$; $p = 0.000$) as shown in figures 2 and 3.

Prevalence of hypertension

46 out of the 1,080 subjects had hypertension, giving a prevalence rate of 4.3%. Of those with hypertension, 26 (4.9%) were females, whilst 20 (3.6%) were males. This gender difference was not statistically significant ($\chi^2 = 1.09$, $p = 0.30$). The proportional prevalence of hypertension was higher in the 14 year olds (13.1%) as shown in Table II. Hypertension was not recorded in subjects aged 10 – 11 years.

Table 1: Mean systolic and diastolic blood pressure by age in the study subjects

| Age (years) | No. of Subjects | Mean \pm SD | |
|-------------|-----------------|--------------------|-------------------|
| | | Systolic mmHg | Diastolic mmHg |
| 10 | 13 | 99.17 \pm 13.79 | 60.36 \pm 10.55 |
| 11 | 84 | 102.12 \pm 12.10 | 61.67 \pm 11.93 |
| 12 | 97 | 104.09 \pm 13.25 | 61.87 \pm 10.20 |
| 13 | 176 | 105.61 \pm 11.60 | 62.93 \pm 10.77 |
| 14 | 153 | 111.79 \pm 15.06 | 66.02 \pm 11.76 |
| 15 | 183 | 112.66 \pm 12.21 | 66.80 \pm 11.37 |
| 16 | 142 | 115.05 \pm 15.40 | 68.12 \pm 11.67 |
| 17 | 127 | 117.04 \pm 14.88 | 71.68 \pm 11.13 |
| 18 | 105 | 119.34 \pm 14.91 | 72.20 \pm 10.95 |
| Total | 1080 | 111.10 \pm 14.72 | 66.32 \pm 11.71 |

$p = 0.000$

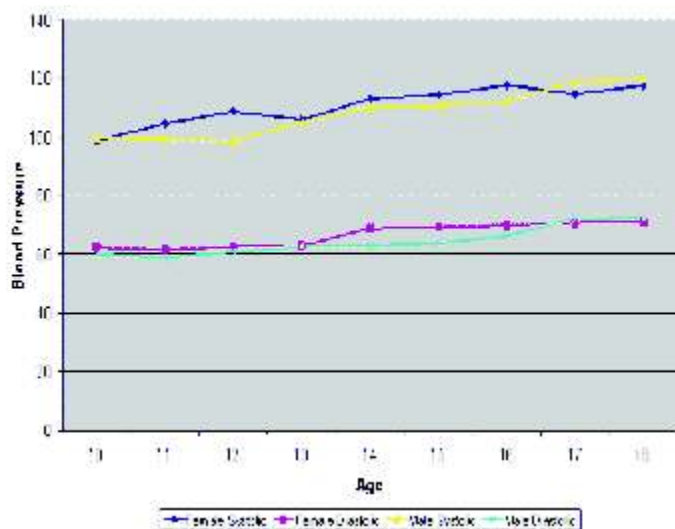


Figure 1: Mean systolic and diastolic BP by age and gender in the study subjects

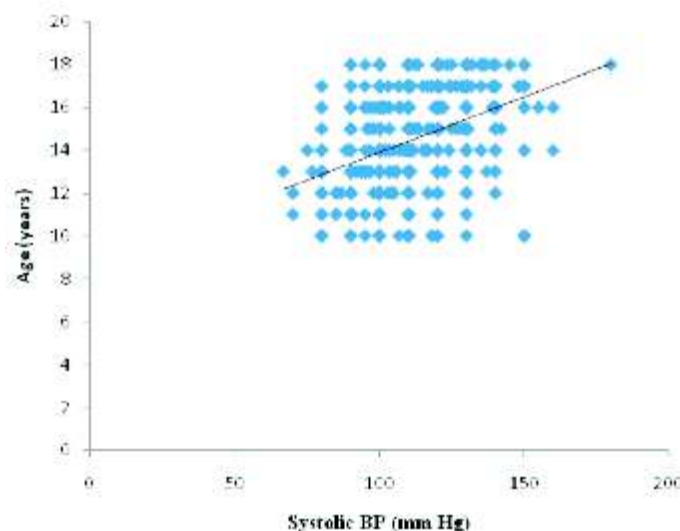


Figure 2: Correlation between age and systolic blood pressure in the study subjects

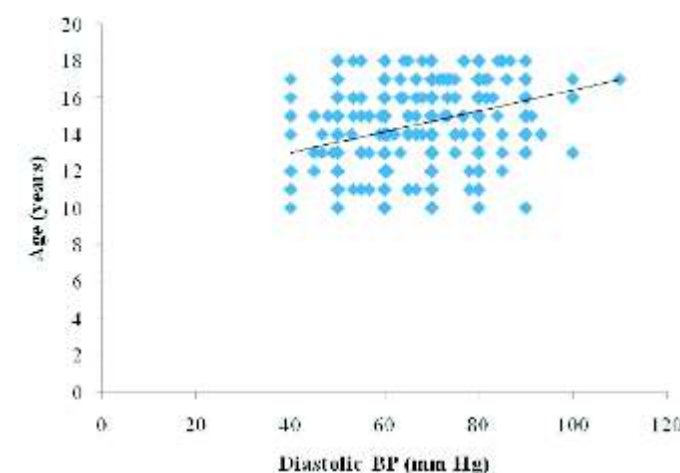


Figure 3: Correlation between age and diastolic blood pressure in the study subjects

Table 2: Age specific prevalence of Hypertension in the study subjects

| Age (years) | Hypertension | | Total |
|-------------|--------------|-------------|-------|
| | Yes (%) | No (%) | |
| 10 | 0(0.0) | 13 (100.0) | 13 |
| 11 | 0(0.0) | 84 (100.0) | 84 |
| 12 | 2(2.1) | 95 (97.9) | 97 |
| 13 | 6 (3.4) | 170 (96.6) | 176 |
| 14 | 20(13.1) | 133 (86.9) | 153 |
| 15 | 5 (2.7) | 178 (97.3) | 183 |
| 16 | 6 (4.2) | 136 (95.8) | 142 |
| 17 | 6 (4.7) | 121 (95.3) | 127 |
| 18 | 1 (1.0) | 104 (99.0) | 105 |
| Total | 46 (4.3) | 1034 (95.7) | 1080 |

(F) = 20.23, $p = 0.006$

DISCUSSION

The present study showed that blood pressure increased with age in both males and females. This increase was more marked for systolic than diastolic blood pressure. This finding is similar to reports by other researchers in USA¹⁰, South-Africa¹⁵ and Nigeria^{16,17}. Agyemang et al²⁸ and Antia-Obong and Antia-Obong¹⁹ reported a similar pattern among rural children in Ghana and Nigeria respectively. There was a more rapid increase in mean systolic blood pressure between the ages of 13 and 15 years which coincides with periods of rapid physical growth and hormonal changes in adolescents and has been reported by other researchers^{29,30}. In the present study, blood pressure pattern differed between males and females. The mean systolic and diastolic blood pressure was higher in females than males especially during the early and mid adolescent period. A similar trend has been reported by Jaddouet al³¹ and Ayoola³² in Jordanian and Nigerian adolescents respectively. This gender difference in blood pressure has been attributed to the psychosocial stress associated with menarche³³ and maybe the earlier attainment of puberty in females associated with hormonal changes than in males³⁰.

The reported prevalence of hypertension in children and adolescents varies, depending on methodology, method of blood pressure measurement and definition of hypertension. The 4.3% prevalence of hypertension in the present study is lower than the 7.4%³⁴ and 14.9%¹⁴ reported among children in rural Canada and Alabama, USA respectively. The difference in the prevalence between the Canadian study and the present study may be due to the fact that in the Canadian study, children aged 4 – 17 years were studied and thus, the inclusion of the younger children could account for the higher prevalence observed as hypertension in younger children is mainly due to secondary (renal) hypertension. The reported prevalence in the present study is also higher than the 2% reported by Narayanappa et al²¹ among adolescents aged 10 – 16 years in rural

Mysore, India, using similar method of blood pressure measurement as the present study. The higher prevalence reported in the present study may be attributed to the fact that the subjects in the present study were slightly older than the subjects in the study by Narayanappa et al²¹. Moreover, racial factors associated with diet and lifestyle may also be responsible for the disparity between the Indian study²¹ and the present study.

It is however, worrisome that the 4.3% prevalence of hypertension found in the present study is higher than the 3.2% prevalence reported by previous researchers^{16,35} in adolescents aged 10 – 19 years in Port Harcourt, the cosmopolitan capital city of Rivers State. These previous studies^{16,35} used the auscultatory method as the present study to measure blood pressure and hypertension was defined as blood pressure greater than or equal to the 95th percentile for age, sex and height, which is similar to the criteria used in the present study.

The prevalence of hypertension in the present study is however, similar to the 4.5% reported by Antia-Obong and Antia-Obong¹⁹ among children and adolescents in rural areas of Oyo State, South West Nigeria using the auscultatory method as in the present study to measure blood pressure and a similar criteria for the definition of hypertension as the present study. The present study showed a higher prevalence of hypertension among female adolescents than males. This finding is consistent with reports by Monyekiet al¹⁵ among rural South African adolescents but at variance with reports by Mohan et al³⁶ among rural Indian adolescents. Akinkugbe et al¹⁷ reported a higher prevalence of hypertension among female adolescents aged 11 – 19 years in Ibadan, South-West Nigeria, which is consistent with the findings of the present study. However, previous studies^{16,35} in Port Harcourt, the capital of Rivers State have showed varied reports. While Alabiet al³⁵ reported a higher prevalence of hypertension in females, Okpere et al¹⁶ reported no gender difference among adolescents aged 10 – 19

years. This varied position was not restricted to Nigeria. In America, while Urrutia-Rojas et al¹¹ reported a higher prevalence of hypertension in females, Sorof et al¹⁰ reported higher prevalence rates in males. Szklo³⁷ suggested that the different patterns of growth in boys and girls among various populations could be possible explanations for the inconsistency in the effect of gender on blood pressure in different populations. The higher proportional prevalence of hypertension in the 14 year olds (13.1%) found in the present study contrasts with findings by Urrutia-Rojas et al¹¹ who reported no age difference in the prevalence of hypertension in American children. The difference may be due to the fact that Urrutia-Rojas et al¹¹ studied children aged 10 – 12 years which is a younger age group, and a narrow age range, which may have made variations difficult to observe. It is however, similar to findings by Ejikeet al¹⁸ in semi-urban adolescents aged 13 – 18 years in Kogi State, North central Nigeria.

Since the risk of developing hypertensive cardiovascular complications is greater in younger than in older individuals³⁸, routine blood pressure measurements in these young ones should be advocated at all levels of care.

CONCLUSION

In conclusion, the 4.3% prevalence of hypertension found in these adolescents in rural areas of Rivers State is high. We therefore recommend that routine blood pressure measurements should be inculcated to form part of the School Health Programme for all secondary schools in rural areas, for early prevention and detection of hypertension. Also clinicians caring for these adolescents in rural areas should make blood pressure measurements part of the routine care for these children.

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