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Childhood hypertension and family history of hypertension in primary school children in Port Harcourt

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Abstract *Objective:* To determine the relationship between childhood hypertension and family history of hypertension in primary school children in Port Harcourt.
Methods: A stratified multi-staged sampling technique was used to recruit pupils between 6-12 years of age, from thirteen primary schools located in three school districts. Data was collected using a pre-tested questionnaire completed by parents / guardians. The average of three blood pressure measurements, weight and height were taken for each pupil, using standardized techniques. Hypertension was defined as average systolic and / or diastolic blood pressure greater than or equal to the 95th percentile for age, gender and height using the standard blood pressure charts. Family history of hypertension was defined as either parent indicating on the submitted questionnaire that they were hypertensive (diagnosed by a physician and/or on antihypertensive drugs) or had a family history of hypertension.
Results: A total of 1302 pupils with 717 (55.1%) females and 585 (44.9%) males were studied, giving a female to male ratio of 1.2:1. The mean age of pupils studied was 8.82±1.91 years. Sixty one (4.7%) of the pupils examined had hypertension. Of the 1302 pupils, 316 (24.3%) had a family history of hypertension. The mean systolic ($p<0.001$) and diastolic ($p=0.220$) blood pressures were higher in children with a family history of hypertension than in those without. Of the pupils that had a family history of hypertension, 7.9% had hypertension, while 3.7% of those that did not have a family history, were found to be hypertensive ($p=0.001$).
Conclusion: A family history of hypertension was associated with a higher prevalence of childhood hypertension than was seen in children without a family history of hypertension.

Key words: Childhood Hypertension, Family history.

Introduction

Family history of hypertension, independent of other factors such as age and weight, is a major risk factor for hypertension.[1] Blood pressure (BP) tracking studies[2-4] suggest that hypertension in adulthood often has its origin in childhood. The Bogalusa Heart Study[2] found that children in the top quintile of systolic BP were 3.6 times more likely to develop clinical hypertension by age 31 than their peers. Similarly, 48% of hypertensive adults had shown elevated childhood systolic BP. Besides BP tracking, various observations[3,4] suggest a genetic susceptibility to high BP and cardiovascular disease. Two population studies[3,4] have confirmed a predictive power of family history of hypertension (particularly maternal hypertension) on higher BP levels in childhood and overt hypertension in later life. The tracking phenomenon as well as the familial aggregation of (high) blood pressure forms a possible basis for early detection of hypertension-prone children. Routine BP measurement in childhood will therefore give an opportunity for the early prevention of adult hypertension starting from the childhood years.

High BP aggregating in families is associated with shared family environment and genetics.[1] Not only does the occurrence of two hypertensive parents increase the genetic component of elevated BP in offspring, but a shared environment (health habits inducive to hypertension) could further increase a child's tendency to become hypertensive. Heritability measures how much of family aggregation is due to genetic factors. Children from families with hypertension tend to have higher blood pressures than do children from normotensive families.[3] Siblings of children with high BP have significantly higher BP than do siblings of children with low BP.[5]

In a study in Lagos, Nigeria,[6] adolescents with a family history of hypertension had significantly higher systolic and diastolic BPs than controls (those with no family history of hypertension). In a similar study in Kano, Nigeria, Mijinyawa et al[7] noted that adolescent hypertensives were twice more likely to have a family history of hypertension than their normotensive counterparts.

Early prevention of hypertension is of public health importance as cardiovascular disease, of which hypertension is a major risk factor, has been found to be the leading cause of death in the United States and other developed countries.[8] Hypertension is also a risk factor for renal damage and stroke which are major causes of morbidity and mortality.[9,10] Although leading causes of morbidity and mortality in Nigeria and other developing countries are presently preventable factors like infectious diseases, with improved health care that comes with development, a shift in the trend is expected to less -obviously preventable causes like cardiovascular disease in adults.

Despite the few studies[6,7] that have been conducted in Nigeria, there is still paucity of information on the relationship between childhood hypertension and a family history of hypertension in Nigeria. This study was undertaken to determine the relationship, if any, between childhood hypertension and family history of hypertension in primary school children in Port Harcourt.

Materials and methods

The study was carried out in Port Harcourt city (PHC), capital of Rivers State of Nigeria. Rivers State is located in the south-south geo-political zone of Nigeria. Port Harcourt is a cosmopolitan city with diverse Nigerian ethnic groups and foreigners living in the city. Port Harcourt is the nerve center of the oil industry. The urban nature of the area and oil exploration and production activities has caused a great influx of people from all over Rivers State, neighbouring states and indeed, the entire country.

The study was a cross-sectional population-based study carried out from 1st February to 31st May 2010. A stratified multi-staged sampling technique was used to recruit pupils between 6-12 years of age, from thirteen primary schools located in the three school districts in Port Harcourt. A minimum sample size of 1300 was calculated at a confidence interval of 98.5%. Data was collected using a pre-tested questionnaire completed by parents / guardians. A total of 1302 questionnaires were retrieved.

The schools were first stratified into 3 school districts. They were also stratified according to school proprietorship into private and public. The thirteen schools were then selected by simple random method from the three school districts according to the ratio of schools in these districts. Six (3 public and 3 private) schools were selected from Diobu, 5 (3 public and 2 private) from Township and 2 (1 public and 1 private) from Trans-Amadi school districts. In schools with more than one arm of a class, one arm was selected randomly to represent the others, while in schools with only one arm of a class, that arm was chosen. Arms were selected from all six classes in all the selected schools. In each selected school an average of 100 pupils aged 6- 12 years were recruited. Sixteen to seventeen pupils were selected randomly from each class using the class register.

Blood pressure was measured using the mercury gravity sphygmomanometer. The measurements were taken in the sitting position with exposed outstretched right arm on a table, using appropriate cuff size for age, the cuff bladder completely encircling the arm covering 75% of the arm between the acromion and olecranon. The bell of the stethoscope was placed over the brachial pulse at the proximal medial part of the anti-cubital fossa. For each measurement, the cuff was rapidly inflated to occlude the brachial artery, and then deflated slowly allowing the mercury column of the sphygmomanometer to fall at a rate of approximately 2 - 5 mm Hg per second. The first Korotkoff sound was taken as systolic BP and the fifth Korotkoff sound as the diastolic BP. Blood pressure was measured three times for each child in the same visit with at least two minutes interval between measurements. The average was then estimated as the blood pressure level of the subject. The charts on BP levels for boys and girls by age and height percentiles[11] were used to classify hypertension in the subjects after determining their height percentiles from the CDC growth charts. For children with a raised BP, two additional BP measurements were made at least a week apart.

Data was collated and analyzed using the Epi-info version 3.5.1 statistical software. In this study, hypertension was defined as average of 3 measured systolic and/or diastolic BP that is greater than or equal to the 95th percentile for gender, age, and height using the standard BP charts developed by the National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, United States of America.[11] Pre-hypertension was defined as an average of three measured systolic and/or diastolic BP greater than the 90th percentile but less than the 95th percentile; stage one hypertension as that greater than or equal to the 95th percentile but less than the 99th percentile; and stage two hypertension as that greater than or equal to the 99th percentile.

Ethical consideration

Ethical clearance was obtained from the Ethics Committee of the University of Port Harcourt Teaching Hospital. Permission was obtained from the Rivers State Ministry of Education, the Head teachers of the index schools and the parents / guardians of the pupils. Parents of children that were found to be pre-hypertensive or hypertensive were counseled and the children referred to the paediatric clinic of the University of Port Harcourt Teaching hospital for expert management.

Results

A total of 1302 pupils participated in the study. Seven hundred and seventeen (55.1%) were females and 585 (44.9%) males giving a female to male ratio of 1.2:1. The age range of the pupils was from 6 to 12 years, with a mean age of 8.82±1.91 years and mode of 9years (17.7%). The systolic blood pressure of the subjects ranged from 70 to 153mm Hg with a mean of 98.09±10.21 mm Hg while the diastolic blood pressure ranged from 39 to 97mm Hg with a mean of 61.84±10.73 mm Hg. Sixty one (4.7%) of the pupils examined had hypertension. Thirty eight (5.3%) of the 717 females in the study were found to be hypertensive while 23 (3.9%) of the 585 males were hypertensive. The study subjects were grouped into two almost equal age groups; 6 – 8 years and 9 – 12 years. Thirty five (6%) of the 588 children in 6 to 8 year age group had hypertension while 26 (3.6%) of the 714 in the 9 to 12 year age group had hypertension. The observation however, did not reach statistical significance ($\chi^2 = 3.85$, df = 1, p = 0.05).

All respondents that had either parent indicate in the submitted questionnaire, that he / she was hypertensive (diagnosed by a physician and/or on antihypertensive drugs) or had a family history of hypertension, were considered to have a family history of hypertension. Of the 1302 pupils, 318 (24.4%) had a family history of hypertension.

The mean systolic blood pressure of 100.11±10.97mm Hg for children with a family history of hypertension was significantly higher than 97.44±9.87mm Hg for those with no family history of hypertension (t = 4.07, df = 1, p < 0.001). The mean diastolic blood pressure of 62.30±8.33mm Hg for children with a family history of hypertension was also higher than that of 61.69±7.49mm Hg, for those with no family history of hypertension. The difference observed was however, not statistically significant (t = 1.23, df = 1, p = 0.220).
Of the 318 pupils that had a family history of hypertension, 25 (7.9%) had hypertension, while 36 (3.7%) of the 984 that did not have a family history, had hypertension (Table 1). The difference in the two groups was statistically significant ($\chi^2 = 8.59$, df = 1, p = 0.001). The relative risk of having hypertension in children with a positive family history of hypertension was 1.05.

Table 1: Relationship between hypertension and family history of hypertension

Family history of ypertension	Hypertension No. (%)	Normal BP No. (%)	Total No.
Present	25 (7.9)	293 (92.1)	318
Absent	36 (3.7)	948 (96.3)	984
Total	61 (4.7)	1241 (95.3)	1302 (100)

$\chi^2 = 8.59$, df = 1, p = 0.001

Table 2 shows that among the female pupils, 17 (10%) of the 170 that had a positive family history of hypertension were found to be hypertensive compared to 21 (3.8%) of the 547 that did not have a positive family history of hypertension. The difference was statistically significant ($\chi^2 = 8.62$, df = 1, p = 0.001) and the relative risk for having hypertension in female pupils with a positive family history of hypertension was 1.07. Among the male pupils, 8 (5.4%) of the 148 that had a positive family history of hypertension were found to be hypertensive compared to 15 (3.4%) of the 437 that did not have a positive family history of hypertension. The observed difference however did not reach statistical significance ($\chi^2 = 0.68$, df = 1, p = 0.15) but the relative risk for having hypertension in male pupils with a positive family history of hypertension was 1.02.

Among pupils aged 6 – 8 years, 16 (9%) of 178 that had a positive family history of hypertension were found to be hypertensive compared to 19 (4.6%) of 410 that did not have a positive family history of hypertension. The difference was statistically significant ($\chi^2 = 3.46$, df = 1, p = 0.02) and the relative risk for having hypertension in pupils aged 6 – 8 years with a positive family history of hypertension was 1.05. Among pupils aged 9 – 12 years, 9 (6.4%) of the 140 that had a positive family history of hypertension were found to be hypertensive compared to 17 (3%) of the 574 that did not have a positive family history of hypertension. The difference was also statistically significant ($\chi^2 = 2.93$, df = 1, p = 0.03) and the relative risk for having hypertension in pupils aged 9 – 12 years with a positive family history of hypertension was 1.04 (Table 2).

Table 2: Relationship between hypertension and family history of hypertension among gender and age groups

Family history of hypertension	Hypertension No. (%)	Normal BP No. (%)	Total No.	p value
Females				
Present	17 (10)	153 (90)	170	p = 0.001
Absent	21 (3.8)	526 (96.2)	547	
Males				
Present	8 (5.4)	140 (94.6)	148	p = 0.150
Absent	15 (3.4)	422 (96.6)	437	
6 – 8 years				
Present	16 (9)	162 (91)	178	p = 0.02
Absent	19 (4.6)	391 (95.4)	410	
9 – 12 years				
Present	9 (6.4)	131 (93.6)	140	p = 0.03
Absent	17 (3)	557 (97)	574	

Two hundred and three (15.6%) pupils had a paternal history of hypertension while 236 (18.1%) had a maternal history of hypertension. Nineteen (9.4%) of the 203 pupils with a paternal history of hypertension (father or father's parents hypertensive) were hypertensive, compared to 42 (3.8%) of the 1099 pupils with no paternal history of hypertension. This difference was statistically significant ($\chi^2 = 10.560$, df = 1, p < 0.001). Eighteen (7.6%) of the 236 pupils with a maternal history of hypertension (mother or mother's parents hypertensive) were hypertensive, compared to 43 (4%) of 1066 pupils

with no maternal history of hypertension. The difference was also statistically significant (χ^2 = 4.811, df = 1, p = 0.013) (Table 3).

Table 3: Relationship between hypertension and paternal/ maternal history of hypertension

Family history of hypertension	Hypertension No. (%)	Normal BP No. (%)	Total No.	p value
Paternal				
Present	19 (9.4)	184 (90.6)	203	p < 0.001
Absent	42 (3.8)	1057 (96.2)	1099	
Maternal				
Present	18 (7.6)	218 (92.4)	236	p = 0.013
Absent	43 (4)	1023 (96)	1066	

Two (8.3%) of the 24 pupils that reported hypertension in both parents where hypertensive, while 15 (8.9%) of the 168 pupils that reported hypertension in only one of their two parents were hypertensive. The difference between the two groups was not statistically significant (Fisher exact = 0.641)

Discussion

The higher mean systolic and diastolic BP in children with a positive family history of hypertension found in this study is similar to findings of other studies.[6,12-14] In a study in Lagos, Nigeria,[6] adolescents with a family history of hypertension had significantly higher systolic and diastolic BPs than controls (those with no family history of hypertension). A study in Finland[12] showed that children whose parents were hypertensive had 4- to 6-mm Hg higher systolic and 3- to 4-mm Hg higher diastolic blood pressures than children of normotensive parents (P<0.001). van Hooft[13] showed that no clear differences existed in BPs between 8-year-old children of parents with relatively high BP compared with those of children with no family history of high BP. However, at 20 years of age, a 7-mm Hg difference in both systolic and diastolic BPs was found. Also, an Indian study[14] showed that young normotensives with a positive family history of hypertension had significantly higher blood pressure (P<0.05) and also increased resting heart rate (P<0.05) than young normotensives with a negative family history of hypertension.

Similarly, the higher prevalence of hypertension (7.9%) in children with a family history of hypertension found in this study is in keeping with previous studies.[7,15,16] Mijinyawa et al[7] noted that adolescent hypertensives in Kano, Nigeria were twice more likely to have a family history of hypertension than their normotensive counterparts. In a study conducted among urban Asian Indian adolescents,[15] systolic (statistically not significant) and diastolic hypertension were associated with a history of clinical hypertension in either of the parents. In a similar study in Indian children,[16] the incidence of hypertension in children with hypertensive families was as high as 30% as against none of the children from the control group (from normotensive families). An additional 27% in the study group had prehypertension as compared to none in controls.

Contrary to findings in this study, a study conducted on children in Italy[17] did not show a significant association between family history of hypertension and childhood hypertension. The fact that the Italian study was on sample of 377 children identified by primary care referral and sent for further investigation for cardiovascular risk in children for either elevated BP values and/or family history of cardiovascular disease, defined as the presence of at least one among hypertension, type 2 diabetes, dyslipidemia, early ischemic heart and cerebrovascular disease, and not a random study of the general population may account for the different findings in the two studies.

This study showed a higher prevalence of hypertension in both female (10%) and male (5.4%) pupils with a positive family history of hypertension. However, only that observed among the females was statistically significant. The opposite was observed among adult males and females by Goldstein et al.[18] The fact that their study was among adults, while the present study was in children aged 6 – 12 years may account for this difference.

This study showed a higher (not statistically significant) prevalence of hypertension in children with two hypertensive parents than those with one hypertensive parent. This is similar to findings by Goldstein et al[18] who found that healthy men with two hypertensive parents had higher daytime and night-time ambulatory BP than men with normotensive parents, and with one hypertensive parent had intermediate BP levels.

The increased blood pressure and prevalence of hypertension observed in this study in the offspring of hypertensive parents emphasize the importance of genetic influence on hypertension in children. Children belonging to hypertensive families should therefore, be targeted for primary prevention in a vigorous manner (blood pressure monitoring) along with dietary and lifestyle modification. It is also imperative to screen these children to identify markers to assist in prediction of development of essential hypertension in adulthood.

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