

PREVALENCE OF HYPERTENSION AMONG PRIMARY SCHOOL PUPILS IN SABON GARI LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

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Abstract

Hypertension is by far the most common cardiovascular disease and one of the chronic non-communicable diseases that has been recognized as an emerging public health problem. A prospective, descriptive cross-sectional prevalence study of one thousand two hundred and forty-two (1242) seemingly healthy primary school children aged 6-12 years in Sabon Gari Local Government area, Kaduna

Introduction

Blood pressure, often known as BP, is one of the vital indicators that are measured in the course of a standard physical examination (Flynn *et al.*, 2017). The detection of hypertension and other risk factors for cardiovascular disease is the primary objective of

state was carried out, comprising 573 (46.1%) boys and 669 (53.9%) girls. Variables measured included blood pressure, weight, height and body mass index. Overall, the mean anthropometric values and blood pressure increased with age irrespective of sex. The mean weight for boys and girls was 22.4 ± 5.2 kg and 24.5 ± 6.0 kg respectively. Girls were heavier than boys. The mean height of the study population for boys and girls was 123.9 ± 11.5 cm and 128.4 ± 13.9 cm respectively. The mean body mass index for boys and girls was 14.4 ± 1.1 Kg/m² and 14.5 ± 1.9 Kg/m². Girls were significantly heavier than the boys at ages 11 and 12 years and taller at ages 9 to 12 years. The overall point prevalence of hypertension was 2.3% (29 of 1242) with sex specific prevalence for males being 1.9% (11 of 573 boys) and 2.7% (18 of 669 girls) for females. In view of 2.3% prevalence of hypertension in this study of apparently healthy children, it is recommended that blood pressure measurement should be included as part of medical evaluation at school entry and at least annually thereafter; especially for those found to be at risk of hypertension during school entry.

Keywords: Children, Hypertension, Prevalence, Sabon Gari.

Checking one's blood pressure. Hypertension, the by far most prevalent cardiovascular disease (CVD), is one of the chronic noncommunicable diseases identified as an emerging public health concern in developing countries such as Nigeria (Amadi *et al*, 2019). The growing commonness of hypertension in children is the primary drive behind the call for routine blood pressure monitoring in this group (Flynn *et al*, 2017). At present, the American Academy of Paediatrics recommends that asymptomatic children and adolescents

should undergo routine screening at their preventive care appointments. This type of screening will discover potential causes of hypertension that are treatable and preventable, and it will make it possible to commence treatment at an earlier stage in order to avert unfavourable effects (Flynn *et al.*, 2017). Over the course of the previous two decades, there has been a rise in the incidence of hypertension in children, a pattern that may continue into the foreseeable future (Song *et al.*, 2019).

A complete investigation of the association between measuring techniques and the prevalence of hypertension determined the influence of changes in cuff size, measurement number, methodology, and kind of equipment used. Measuring device utilised, the number of measurements obtained (single or multiple), and the categorization standard employed are among the reasons for discrepancies seen in blood pressure interpretations (2017 AAP Clinical Practice). Crouch *et al.* (2022) discovered that the prevalence of hypertension in studies that only measured blood pressure once was approximately double that of studies that measured blood pressure at least twice. The necessity of utilising paediatric cuffs is an additional obstacle for oscillometric and auscultatory procedures in children and adolescents. Costly paediatric cuffs may not be available in low-income areas. As with the use of approved devices, the size of the cuff is often not recorded. Frequency of readings is crucial while analysing BP. The American Academy of Paediatrics (AAP) released a revised version of the 2004 Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents in September 2017, with an emphasis on the newly developed Clinical Practice Guideline (CPG) for the screening and management of high blood pressure in children and adolescents (Flynn

et al., 2017). With respect to hypertension, the Fourth Report supplied normative blood pressure tables thrice and defined it as having a blood pressure greater than the 95th percentile when adjusting for age, gender, and height. However, the Fourth Report's normative blood pressure tables included data from overweight and obese children, which may have lowered the thresholds for increased blood pressure and led to underdiagnoses of hypertension (Ashraf *et al.*, 2020; Flynn *et al.*, 2017). The most recent edition of the AAP Clinical Practice Guideline features revised normative paediatric blood pressure tables that are mostly derived from data collected from children of normal weight (Flynn *et al.*, 2017).

According to the findings of recent research, BP demonstrates a tracking phenomenon over the course of its existence. When compared to other childhood predictors, the blood pressure of a child is by far the most accurate indicator of adult blood pressure. Therefore, in order to be able to prevent hypertension in adults beginning in childhood, it is necessary to have an understanding of the factors that determine childhood blood pressure as well as aspects of its short-term and long-term variability. This is because groups of children with higher initial values have the greatest risk of developing hypertension later in life (Sarganas *et al.*, 2018). The consequences of hypertension in children include a higher risk of morbidity as a result of the disease's complications, or treatment, as well as an increased risk of death. In addition, hypertension places an unnecessary financial burden on both the general population and the health care system, on scarce resources (Cooper *et al.*, 2017).

Therefore, the present study aimed at assessing the prevalence of hypertension in apparently healthy primary school children, aged 6 – 12 years of Sabon Gari Local Government area of Kaduna State.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Sabon Gari Local Government Area of Kaduna state, one of the most significant LGAs in the State. It is located in the Guinea Savannah zone of Northern Nigeria (in latitudes 11°6'0"N - 11°10'30"N and longitudes 7°37'30"E - 7°43'30"E) and a total land area of 263 km², based on 2006 census and national growth rate of 3.2% the estimated population of Sabon Gari Local Government Area in 2022 was 430,500 (Official Gazette). It is made up of eleven political wards namely; Hanwa, Dogarawa, Bomo, Chikaji, Muchia, angwan Gabas, Jushi, Basawa, Jama'a, Samaru and Zabi.

The study was a cross sectional conducted between July and November 2022 and the study population consisted of pupils in primary 1 to 6. Only children aged 6 to 12 years old were included in the study. Children that were apparently ill from medical history and or obvious skeletal abnormalities of the spine and legs, which can influence height and eventually, body mass index were excluded.

Sample Size Determination

The minimum sample size was calculated using the formula (Araoye, 2004):

$$N = Z^2 (pq) / E^2$$

Where N = minimum sample size when population is > 10,000

p = Prevalence of hypertension in primary school children. A prevalence of 3% (i.e 0.03), was used (Also *et al.*, 2016).

$$q = 1 - p$$

E = margin of error tolerated = 1%

Z = 1.96 at 95% confidence level

$$N = 1.96^2 \times 0.03 \times (1-0.03) / 0.01^2 = 1118$$

The non-response rate of 10% was used, making the sample size = 1242

Sampling Method

Participants were selected using a multi-stage sampling technique. Sabon Gari Local Government Area has 63 public primary schools spread across 11 political wards. Three wards were selected by simple random sampling (Muchia, Bomo, and Basawa) first, and then three schools were selected at random by balloting from each ward chosen and lastly selection of respondents.

Proportionate allocation of pupils was done according to the population of each of the selected schools as shown in Table 1.

The total number of pupils in the 9 selected schools were 14, 950. The calculated proportionate allocation was done using the formula $n=a/b \times c$, where a is total number of pupils in each school; b is total number of pupils in the 9 selected schools and c calculated total sample size.

The total number of pupils in each school was used as sampling frame and sample interval was calculated. Pupils in primary 1 to 6 were covered.

Table 1: Selected Primary Schools in Sabon Gari Local Government Area

Selected schools	Total No. of pupils in each school (a)	No. of pupils selected ($n=a/b \times c$)
Muchia Model primary school	5,560	462
Palladan Model primary school	2,015	167
Kallon Kura Model primary school	1,892	157

Iya Bashir Aminu primary school	1,338	111
Mile Goma LGEA	1,054	88
UBE Layin Zomo	961	80
Bomo Model primary school	806	67
Anguwan Makeri LEA	706	59
Tsugugi LEA	618	51
Total	14,950	1,242

Study Setting

The researcher made first contact with the pupils by visiting each of the selected schools and giving a discussion about blood pressure and the need of periodic blood pressure measurement to the pupils and teachers. They were able to make inquiries and receive satisfactory explanations. Next, pupils were given a permission slip to share with their parents and sign, if they consent their child or ward to participate in the study. Pupils were chosen in the aforementioned manner on day two. A proforma was used for each child who had been selected for further investigation. There was a fair amount of silence in the room where the research was done. To reassure the pupils and calm their nerves, the researcher demonstrated taking a blood pressure reading on either the research assistant or one of the school teachers. The study's proforma included participants' blood pressure and other anthropometric measurements. About 50-60 pupils per day were seen by the researcher and an assistant for eight hours (8 am – 4 pm) Mondays to Thursdays. Some of the selected schools operated morning and afternoon sessions due to limitation of space.

Blood pressure measurement

The researcher and an assistant measured this. According to the seventh report on the diagnosis, evaluation, and management of hypertension in children, the standard auscultation method was used with an aneroid

sphygmomanometer (SURGILAC®) and a standard Littmann® Paediatric stethoscope. Every child sat quietly for five minutes before having their blood pressure measured. A cuff was placed around the participant's arm about 2 centimetres above the antecubital fossa while he or she sat with the right arm resting on a table at heart level. To conduct this research, two different sized cuffs 10 x 24cm and 10 x 33cm were employed, with the smaller cuff being used for the younger child. The bladder cuff was inflated until the brachial artery could no longer be felt, plus 20 to 30 mmHg more. Then, the stethoscope's bell was placed over the brachial artery, and the cuff was deflated slowly. The first and fifth phases of the Korotkoff sounds were used to determine the systolic and diastolic blood pressures respectively (Flynn *et al.*, 2017). Three different measurements were averaged to arrive at the child's blood pressure readings in mmHg, which was taken at regular intervals of one to two minutes. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents from the American Academy of Paediatrics was utilised in the analysis of the blood pressure readings (Flynn *et al.*, 2017). When a child's systolic blood pressure and diastolic blood pressure are both less than the 90th percentile for his or her age, gender, and height, the child is said to have normal blood pressure. Blood pressure in the 90th to 95th percentiles is elevated blood pressure. Levels of blood pressure between the 95th and 99th percentiles plus 12 mmHg are considered to be in Stage 1 hypertension. A blood pressure reading of 12 mmHg or more over the 95th percentile indicates hypertension in stage 2. Children who had elevated blood pressure readings or hypertension were counselled on improving lifestyle and sent to Paediatric clinic of Ahmadu Bello University Teaching Hospital for further assessment, therapy, and follow-up. All of these were shared with the school administration and the child's parents or guardians.

Height measurement

A stadiometer was used to measure the heights of the pupils in centimetres. These were measured while they were barefooted, ensuring the child's body parts: heel, back and occiput were in contact with the stadiometer. The external auditory meatus and lower rim of the eye socket were kept in a horizontal plane. The stadiometer's moveable component was positioned such that it rested on the apex of the head, and the resulting value was read to the nearest 0.1 centimetre.

Weight and Body Mass Index (BMI)

Using a bathroom scale, the total kilogrammes were read (CAMRY®). Children's weight was measured while wearing the school's official uniform but without any outerwear (such as hats, scarves, or cardigans) or footwear. Each day, before each session began and at the session's midpoint, a standard calibrated weight was used to verify the scale's accuracy. Pupils' masses were calculated to the closest 0.1 kg.

The formula, $BMI = \text{Weight (kg)} / \text{Height (m}^2\text{)}$ was used in determining the child's body mass index. Those with a BMI for age and sex below the 5th percentile were classified as being underweight, between the 5th and below 85th percentiles were considered to be of a healthy weight. Whereas those with a BMI between the 85th and less than 95th percentiles are thought to be at risk of obesity those with 95th or more as obese (WHO, 2021).

ETHICAL CONSIDERATION

Institutional approval for the study was obtained from Kaduna State Universal Basic Education Board (KSUBEB). Ethical clearance was also obtained from the Human Research and Ethical Committee of Ahmadu Bello University Teaching Hospital, Zaria with reference number ABUTHZ/HREC/W50/2022. Permission was also obtained from the various school authorities. Written informed consent/assent was obtained from parents/guardians of each child.

Data analysis

The collected data was cleaned and entered into SPSS software version 26. The results were presented in tables and charts. The average systolic blood pressure of the pupils was the dependent variable and the socio-demographic characteristics as independent variables. Mean and standard deviations were used to compile a summary of the statistical data, which included blood pressure, weight, height, and body mass index. Chi-square test was utilised in order to investigate the importance of the connections that may be made between categorical variables. Student's t-test was utilised for the purpose of determining which of two continuous and nominal variables how they relate to each other. The degree of relationship between BP and the anthropometries was analysed using Pearson's correlation coefficient and Regression analysis. The statistically significant probability value was chosen at $p < 0.05$.

RESULTS

The purpose of this study was to determine the prevalence of hypertension among apparently healthy 6–12-year-old primary school pupils in Sabon Gari Local Government Area of Kaduna State.

Socio-demographic Characteristics of the pupils (n=1242)

One thousand two hundred and forty-two pupils (1242) took part in the study to look at the pattern of blood pressure (BP) with a male to female ratio (M: F) of 1:1.2. Five hundred and seventy-three (46.1%) of these participants were boys, and 669 (53.9%) being girls. The ages of the children in the study ranged from 6 to 12, with a mean age of 9.5 years and a standard deviation of 9.5 ± 2.2 years (Table 2).

Table 2: Distribution of Study Subjects in Sabon Gari Local Government Area Based on Age and Gender

Age (Years)	Boys	Girls	Total
	n (%)	n (%)	n (%)
6	67(11.7)	37(5.5)	104(8.4)
7	148(25.8)	44(6.6)	192(15.5)
8	47(8.2)	104(15.5)	151(12.2)
9	21(3.7)	95(14.3)	116(9.3)
10	79(13.8)	118(17.6)	197(15.9)
11	94(16.4)	37(5.5)	131(10.4)
12	117(20.4)	234(35.0)	351(28.3)
Total	573(100)	669(100)	1242(100)

Table 3 showed distribution of hypertension by age. The total number of pupils with hypertension were 29 giving an overall prevalence of 2.3%.

Table 3: Distribution of Hypertension Based on Age

Age	Hypertension	Normal BP	Total
	No. (%)	No. (%)	No. (%)
6	3(2.9)	101(97.1)	104(100.0)
7	3(1.6)	189(98.4)	192(100.0)
8	3(2.0)	148(98.0)	151(100.0)
9	2(1.7)	114(98.3)	116(100.0)
10	4(2.0)	193(98.0)	197(100.0)
11	5(3.8)	126(96.2)	131(100.0)
12	9(2.6)	342(97.4)	351(100.0)
Total (%)	29(2.3)	1213(97.7)	1242(100.0)

Twenty-nine (2.3%) of the subjects had hypertension. Of these, 25 (86.2%) had elevated blood pressure, three (10.3%) had stage 1 hypertension and one (3.5%) stage 2 hypertension (figure 1). The gender specific prevalence for boys and girls were 1.9% (11/573) and 2.7% (18/669) respectively ($\chi^2 = 1.06$, $p = 0.304$).

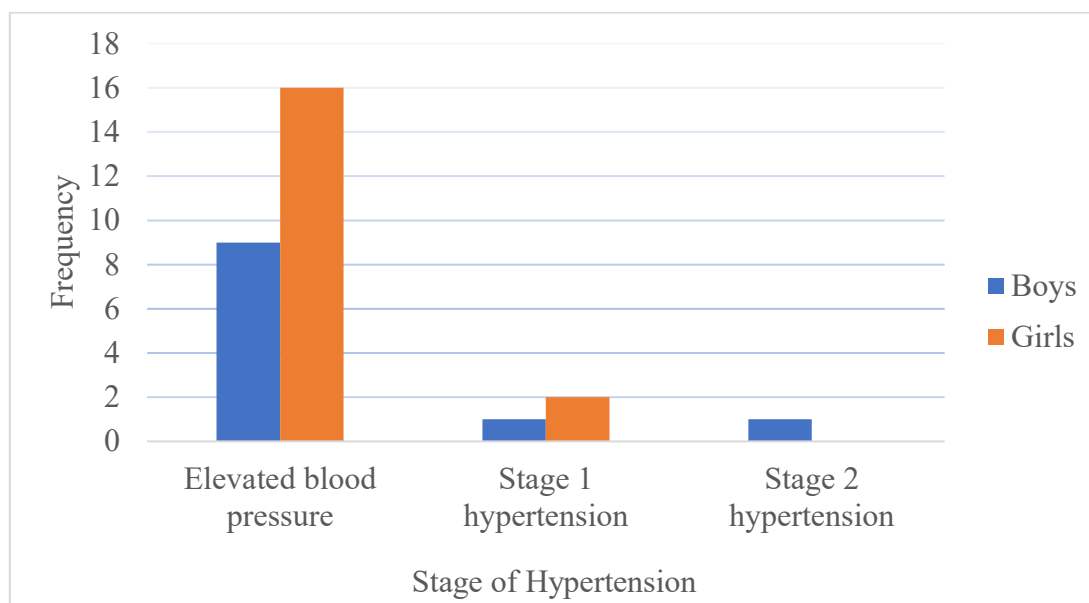


Figure 1: Distribution of Hypertension Based on Gender

Table 4 shows the categories of blood pressure by age. Hypertension was recorded in all the age groups with no significant difference ($\chi^2 = 2.46$, $p = 0.879$).

Table 4: Categories of Blood Pressure Based on Age

Categories	Age (Years)						
	6	7	8	9	10	11	12
Normal	101	189	148	114	193	126	342
Hypertension	3	3	3	2	4	5	9
$\chi^2 = 2.46$, $p = 0.879$							

Table 5 shows the overall blood pressure pattern according to sex. Twenty-nine (29) pupils were diagnosed with hypertension, with a prevalence rate of 2.3%. Twenty-five (25) of the hypertensive pupils exhibited elevated BP while stages 1 and 2 hypertension were found in three and one, respectively. Giving the prevalence of 86.2% elevated blood pressure among the hypertensive group of the studied population. Of this, 9 were boys and 16 girls. Hypertension is more prevalent in girls than boys though not statistically significant ($\chi^2=3.75$, $p=0.290$).

Table 5: Overall Blood Pressure Pattern Based on Gender of Pupils in Sabon Gari Local Government Area

Blood pressure	Boys	Girls
Pattern	n (%)	n (%)
Normal	562(46.3)	651(53.7)
Elevated	9(36.0)	16(64.0)
Stage 1	1(33.3)	2(66.7)
Stage 2	1(100.0)	0(0.0)
Total	573(100.0)	669(100.0)
$\chi^2 = 3.75$, $p = 0.290$		

DISCUSSION

In this study, 2.3% of seemingly healthy children had hypertension at the point prevalence level which is similar to that of Kano, 3% (Also *et al.*, 2016). This is lower than the prevalence of hypertension in adolescent found in Zaria 3.7% (Bugaje *et al.*, 2005) and the 9% reported among children in Enugu (Amadi *et al.*, 2019). When compared to the average BP of children in Jos (Akor *et al.*, 2010) and Egypt (El-Shafie *et al.*, 2018), the mean values were lower across board. The

reason for the discrepancies in the reported prevalence of hypertension could be due to the different criteria used by researchers in defining hypertension. This study utilises the 2017 AAP criteria and found a lower prevalence of hypertension, which is surprising given that the new guidelines had lower cut-offs. Low body mass index (BMI) as reflected by a reduced prevalence of overweight and obesity in this study is likely to blame. Only 0.2% were at risk of obesity and zero percent had obesity. Sabon Gari pupils may have had lower mean anthropometry (weight, height, and body mass index) than children from Egypt, which might explain why their mean BP was lower in this study. New clinical practise guideline was used in this study which categorized blood pressure below the 90th percentile for age, gender, and height only as normal BP (Flynn *et al.*, 2017). The study also employed average of three blood pressure measurements performed all at once and the fifth Korotkoff sound for diastolic blood pressure may have played a role in the overall prevalence (Flynn *et al.*, 2016; Ashraf *et al.*, 2020). Different researchers have employed either the 4th or 5th Korotkoff sounds, with varying results for diastolic blood pressure. It is reported that there is a pressure difference of about 5-10 mmHg between the fourth and fifth Korotkoff sounds (Flynn *et al.*, 2016). Because of the use of the 5th Korotkoff sound in this study, the blood pressure average is shown to be lower than the studies that used 4th sound.

This study showed that 2.3% of apparently healthy primary school age children are already hypertensive. Of these, 86.2% had an elevated blood pressure and likely to increase as they become adults, which is consistent with the clinical practise recommendation for screening and treatment of high blood pressure in children by the American Academy

of Paediatrics. Therefore, routine screening of this previously believed healthy population is crucial for the early detection of hypertension and intervention, including lifestyle adjustments and therapy.

CONCLUSION

Utilising the American Academy of Paediatrics' clinical practice guideline for diagnosing and treating high blood pressure in children, 2.3% was found to be the point prevalence of hypertension in children of Sabon Gari LGA of Kaduna state. Hypertension was recorded among all age groups with no significant difference. This implies that children's blood pressure should be monitored upon school entry to aid in the early identification of individuals with abnormal BP in need of intervention which is in line with school health programme including places where it does not exist.

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