BLOOD PRESSURE PATTERN AND ITS CORRELATES AMONG PRIMARY SCHOOL CHILDREN IN JOS, NIGERIA.

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ABSTRACT

Objective: To determine the blood pressure pattern and the factors that correlate with BP among primary school children in Jos metropolis.

Study population / Methods: The blood pressures of one thousand, eight hundred and seven (1807) apparently healthy school pupils aged six (6) to fourteen (14) years (mean 10.1 ± 2.14 years) were measured using a standard mercury sphygmomanometer after obtaining parental consent. The subjects were primary school children of Jos North Local Government area of Plateau state. One school was randomly selected from each geographic ward of the Local Government Area. The subjects' weights and heights were also measured using standard techniques.

Results: The study population consisted of 906 girls and 901 boys (M: F = 1:1) ranging in age from 6 to 14 years (mean 10.1±2.14years). The overall mean systolic and diastolic blood pressures were 94.5±12.59mmHg and 67.5±10.98 mmHg respectively. The mean systolic and diastolic blood pressures of the girls (96.2 ±12.82mmHg and 68.7±11.0mmHg respectively) were significantly higher than those of boys (92.9 ±12.23mmHg and 66.3 ±10.92mmHg respectively), $p< 0.001$. The systolic and diastolic blood pressure in both sexes exhibited significant positive correlation with age, weight and height ($r = 0.24-0.42$, $P< 0.05$). One hundred and seventy two (9.52%) of the 1807 pupils had elevated blood pressure using the criteria of the 2nd task force on blood pressure control.

Conclusion: The blood pressure levels of school children aged between 6 – 14 years in Jos metropolis while being similar to values obtained in previous studies from other parts of the country, correlate positively with age, weight and height. Anthropometric parameters, specifically weight and height, should be taken into consideration when determining the appropriate blood pressure for age in children. It is suggested that the blood pressures of school children should be routinely measured and that health workers should be educated on the importance of routine blood pressure measurement in children.

Keywords: Blood pressure, children.

INTRODUCTION

Hypertension is the commonest cardiovascular disease in black Africans[1]. Even newborns are not spared[2]. The prevalence of hypertension among adults in urban communities ranges from 9 to 17 percent[3,4] while hypertension and its complications account for between 9 and 16% of patients of all adult medical admissions in the West African sub region[5,6].

The value of childhood blood pressure measurements in predicting future blood pressure status has been demonstrated in various studies [7,8] which show tracking – the tendency of children to maintain their blood pressure ranking over time compared to their peers. As a result, the best childhood predictor of future (adult) blood pressure level is said to be the actual blood pressure level and the most recent blood pressure measurement[9].

To study and prevent the development of hypertension, there is a growing interest in measuring blood pressures in children, because the nature of essential hypertension may be more clearly understood if it could be studied early in the course of its natural history[9].

Environmental and familial factors are known to affect arterial blood pressure levels and it may not be suitable to apply uniform standards to diverse populations[10]. There is therefore the need to measure the blood pressure levels of children in different populations and localities in order to establish the appropriate standards and also to facilitate early and effective interventions. The present study was designed to determine the blood pressure profiles of primary school children in Jos metropolis and its correlation with various factors.

STUDY DESIGN AND METHODS

This was a cross-sectional study, the subjects being asymptomatic primary school children between the ages of six (6) and fourteen (14) years in Jos, the capital city of Plateau State, North Central Nigeria. The study was conducted between January 1999 and March 2000.

Approval from the Jos University Teaching Hospital ethical committee and the permission from the Local Education and School Authorities were obtained. Consent forms attached to self-administered questionnaires were sent through the selected pupils to their parents or guardians. Basic information such as personal biodata, symptoms (if any), drug history, past medical history and family history was obtained from these questionnaires. For those who were not literate, it was requested that the consent form and questionnaire be read by a literate relation or neighbour and communicated to them in the language best understood. A total of 3300 primary care givers were contacted and 2020 (61.2%) subjects returned the signed consents forms. Another 200 (6.1%) forms were incorrectly filled so these subjects were eventually excluded.

One school was randomly selected from each of the geographic wards in the LGA. Pupils were recruited from each school based on proportional allocation depending on its population. Each subject was initially subjected to a general examination and those with abnormal findings were excluded. One thousand, eight hundred and seven pupils were eventually recruited into the study.

The weight, height, pulse rate and blood pressure of each subject were then recorded. Weight and height were measured using standard techniques. The pulse rates were counted over sixty seconds by palpation of the radial artery after all quickening due to nervousness had subsided and the rate and rhythm were steady.

The procedure for blood pressure measurement was initially demonstrated on the class teacher in front of all the pupils in order to allay anxiety. After each pupil was quiet, cooperative and comfortably seated for five (5) minutes with the right arm placed on a table at the level of the heart, the blood pressure was recorded. A cuff size of 8 x 22 cm was used for pupils less than 12 years of age while a cuff size of 12 x 36 cm was used for those aged 12 years and above. In each case it was ensured that the cuff covered at least two–thirds of the upper arm length. The first sound of Korotkow (K1) was taken as the systolic blood pressure and the fourth sound of Korotkow (K4) as the diastolic blood pressure(11). All the BP measurements were done between 0800 and 1630 hours and by one of the authors (AMO) to avoid inter–observer error. Three (3) measurements were made at an interval of 1-2 minutes apart for each pupil and the mean determined.

The data were analyzed using Microsoft Excel 2000. Correlation coefficients of systolic and diastolic blood pressure with weight, height and pulse rate respectively were calculated using the Pearson Product Moment Correlation Coefficient Test. Statistical significance for analysis of differences was settled at P = 0.05. Subjects with elevated blood pressure were referred to the Paediatric Out–Patients Department of Jos University Teaching Hospital, for further management and follow–up.

RESULTS

The 1807 subjects of this study comprised of 906 girls and 901 boys, giving a sex (M: F) ratio of about 1: 1. The mean age of the subjects was 10.1± 2.14 years.

The mean ages of the male and female subjects were similar – 10.1 ± 2.13 years for the boys and 10.1 ± 2.15 years for the girls (P > 0.05).

The mean values of weight and height show a gradual increase with age for both sexes (Table 1). Before the age of 7 years, the boys were heavier than the girls though the difference was not statistically significant. The mean weight for both genders was about the same at the age of 7 years. Thereafter girls were heavier than the boys with the difference being statistically significant at the age of 9 years and from the age of 11 years and above. Similarly, the younger boys were taller than the girls with the difference not being statistically significant. At the age of 9 years and from age 11 and above, girls were taller than boys with the difference being statistically significant from ages 11 to 13 years.

The mean systolic blood pressure for the girls and the boys were 96.2 ± 12.82 and 92.9 ± 12.23 mmHg respectively while the mean diastolic blood pressure for the girls was also higher than the boys, i.e., 68.7 ± 11.0 and 66.3 ± 10.92 mmHg respectively. The differences in both cases were statistically significant, $P < 0.05$. The overall (for both sexes combined) mean systolic blood pressure was 94.5 ± 12.59 mmHg, and the mean diastolic blood pressure 67.5 ±10.98mmHg.

Blood pressure values generally followed a similar pattern as for weight and height. Mean systolic BP was approximately the same in 6 year old boys and girls, slightly (but not significantly) higher in 7 year old girls compared with boys, but significantly higher in girls from the age of 8 years upwards (except at age 9 years when the difference was not statistically significant) – Table 2. The age-specific percentiles for systolic and diastolic blood pressures in boys and girls respectively are shown in figures 1 and 2.

Both systolic and diastolic BP showed significant positive correlation with age, weight and height, but correlated poorly with pulse rate. DBP showed a negative but non–statistically significant correlation with pulse rate – Table 3.

TABLE 1

MEAN WEIGHT (kg) and HEIGHT (cm) BY AGE AND GENDER

AGE (Years)	WEIGHT(kg) MALE	FEMALE	P-value	HEIGHT(cm) MALE	FEMALE	P-value
6-< 7	20.3±2.11 (32)	19.3±20.8	>0.05	116.2±7.35 (32)	113.2±6.42 (41)	>0.05
7-<8	21.2±2.53 (78)	21.2±2.96 (81)	>0.05	118.7±5.25 (78)	116.8±6.22 (81)	>0.05
8-<9	22.8±2.78 (124)	23.3±3.08 (126)	>0.05	121.5±6.18 (124)	122.6±6.64 (126)	>0.05
9-<10	24.1±3.46 (140)	25.1±3.59 (118)	<0.05*	124.2±6.31 (140)	126.6±6.96 (118)	<0.01*
10-<11	25.8±3.46 (144)	27.4±3.86 (140)	>0.05	129.6±6.33 (144)	130.5±6.64 (140)	>0.05
11-<12	28.2±3.90 (99)	29.8±4.90 (137)	<0.01*	132.6±6.13 (99)	135.0±7.74 (137)	<0.01*
12-<13	29.9±4.93 (149)	31.8±5.93 (118)	<0.01*	135.3±7.51 (149)	138.2±7.68 (118)	<0.01*
13-<14	32.1±5.43 (85)	36.0±6.35 (103	<0.001*	138.5±7.78 (85)	142.6±7.68 (103	<0.001*
14-<15	35.2±5.29 (50)	39.3±6.99 (42)	<0.05*	143.6±8.36 (50)	146.0±6.73 (42)	>0.05

*Statistically significant.
Numbers in Parenthesis represent the number of subjects in each age interval.

TABLE 2

SYSTOLIC AND DIASTOLIC BLOOD PRESSURE LEVELS ACCORDING TO AGE AND GENDER

AGE (Years)	SBP(mmHg) Male	Female	p-value	DBP(mmHg) Male	Female	p-value
6-<7	86.8±9.93	86.2±10.16	>0.05	59.0±7.40	60.2±9.03	>0.05
7-<8	87.3±12.43	89.7±12.94	>0.05	59.0±10.46	62.6±10.93	>0.05
8-<9	89.5±12.41	92.9±10.53	<0.05*	61.9±11.32	65.1±9.70	<0.05*
9-<10	91.9±12.06	93.8±13.24	>0.05	65.6±10.28	66.9±10.85	>0.05
10-<11	94.5±12.64	97.1±12.18	<0.05*	67.3±11.50	70.5±10.18	<0.05*
11-<12	95.1±11.91	98.8±11.95	<0.05*	68.9±9.53	70.6±10.64	>0.05
12-<13	94.3±10.67	99.0±13.17	<0.001*	68.7±9.09	69.6±10.84	>0.05
13-<14	96.5±12.27	100.9±12.06	<0.05*	70.4±9.58	73.9±10.13	<0.05*
14-<15	98.3±10.54	104.5±11.26	<0.05*	72.2±9.75	76.5±8.59	<0.05*

*** = Statistically Significant**
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure

TABLE 3

CORRELATION OF SYSTOLIC AND DIASTOLIC BLOOD PRESURES WITH VARIOUS PARAMETERS

Parameter	*Pearson's correlation coefficient* MALE SBP	MALE DBP	FEMALE SBP	FEMALE DBP
AGE	0.24*	0.33*	0.32*	0.33*
WEIGHT	0.38*	0.41*	0.43*	0.42*
HEIGHT	0.33*	0.36*	0.37*	0.33
PULSE RATE	0.03	-0.07	0.07	-0.03

SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
* = Statistically significant correlation

FIGURE 1A

AGE-SPECIFIC PERCENTILES OF BLOOD PRESSURE MEASUREMENTS IN BOYS AGED 6 TO 14 YEARS

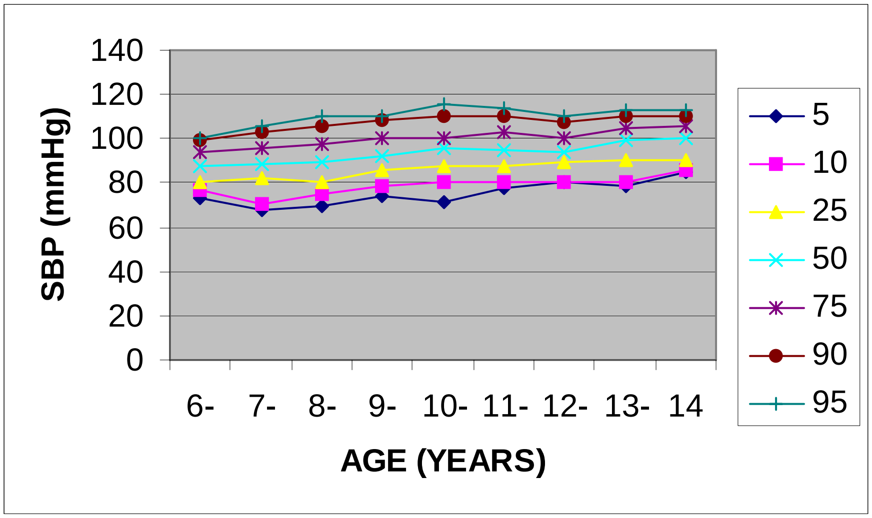
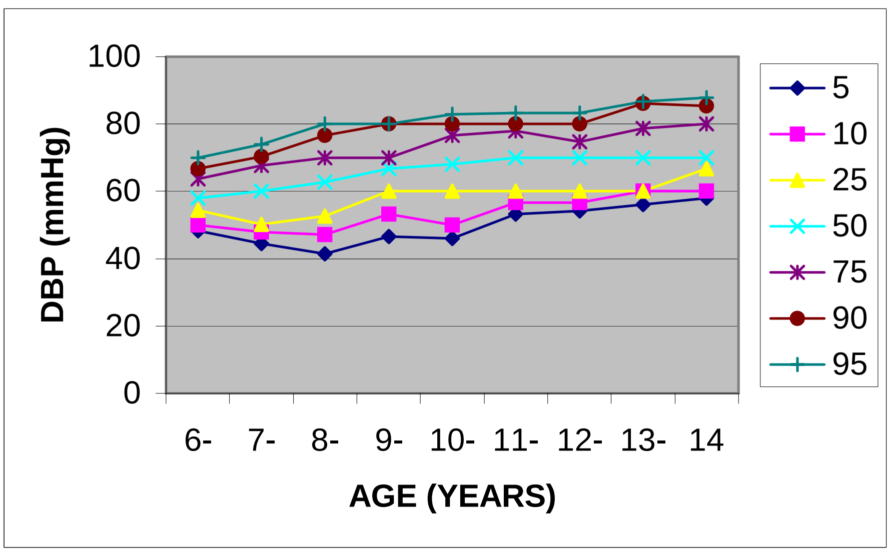


FIGURE IB



AGE-SPECIFIC PERCENTILES OF BLOOD PRESSURE MEASUREMENTS IN GIRLS AGED 6 TO 14 YEARS

FIGURE IIA

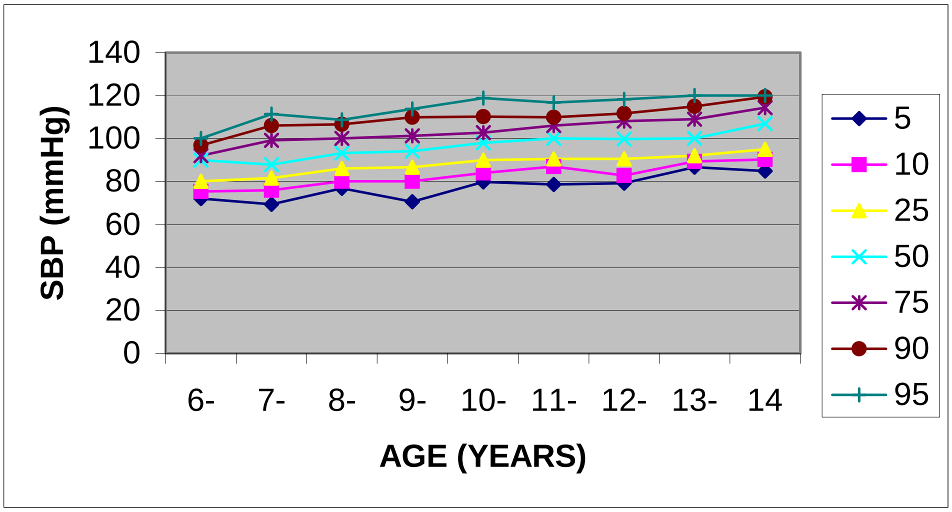
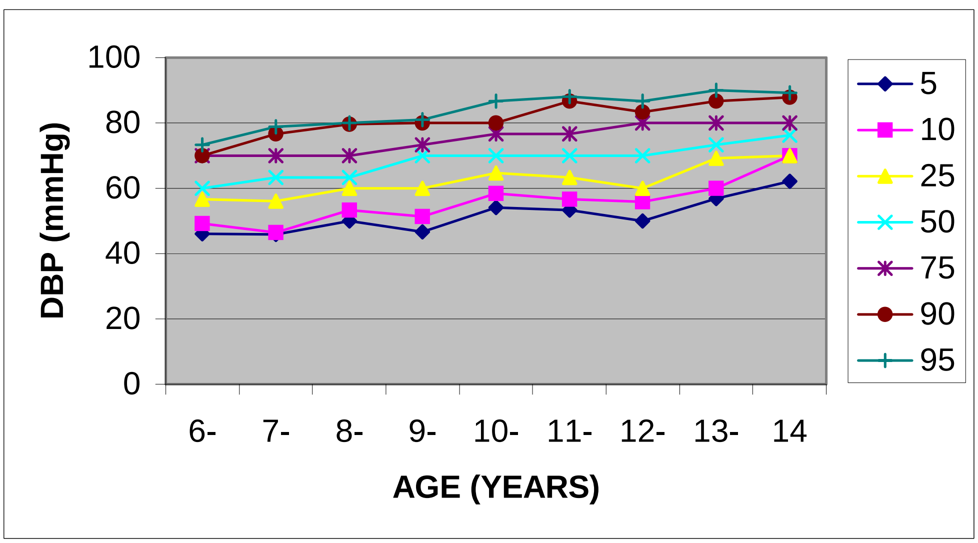


FIGURE IIB



DISCUSSION

The overall mean systolic blood pressure of 94.5±12.59mHg and mean diastolic blood pressure of 67.5±10.98mmHg obtained in this study are lower than the values obtained by Oli[12] in their study of 1850 Ethiopian children. Although the Ethiopian children were lighter than the children in this study, they were on average taller and this may partly explain the differences in their blood pressure values. Similar studies on blood profiles done in this part of the West African subregion[10,13] did not state the overall (both sexes combined) mean systolic and diastolic blood pressure values; this would have been desirable for better comparison.

The mean weights and heights of girls were significantly higher than those of boys from the age of 9-<10 years in this study. This finding is similar to that obtained by Antia-Obong and Antia-Obong[10] in Oyo, Western Nigeria where girls from the age of 9 years were heavier than their male counterparts. Similarly Ayoola[14] who studied adolescents in Ile-Ife, Nigeria, showed that girls were heavier than boys between the ages of 12 and 15 years. The relatively higher anthropometric indices of girls compared to boys at this age could be due to the effect of the earlier onset of puberty (seen in girls) on growth. Weight and Height were found to correlate significantly with systolic and diastolic blood pressure in both sexes in this study. This is in agreement with several earlier studies[10,13,14]. High blood pressure has been known to be associated with obesity, Lauer et al[15] demonstrated that 30% of the children whose body weights were in the upper deciles have either systolic or diastolic hypertension. The hypothesis of selective insulin resistance may partly explain the correlation of weight with blood pressure, it is said that obese adolescents are sensitive to the renal sodium retaining effect of insulin[15]. In the Camerouns however, Youmbissi et al [16] who studied children and adolescents did not observe any correlation between blood pressure and weight.

The observation of an increase in mean blood pressure levels with age in the present study is in agreement with findings from previous studies among children[13,14,17]. This may be because with increasing age, blood volume and stroke volume gradually increase toward the adult level, with a resultant rise in cardiac output.

The mean pulse rate was observed to have a negative correlation with the diastolic blood pressure in both sexes. Although not statistically significant, this may reflect the fact that with increasing age, the mean pulse rate falls[18] while the mean blood pressure rises.

In this study, the mean systolic and diastolic blood pressures were significantly higher in girls than in boys. These findings contrast with what has been reported by several authors[12,16] who found a higher mean blood pressure among males as compared to females. The findings of the present study are however similar to those of previous reports from Lagos, Nigeria[13]. The higher mean systolic and diastolic B.P. observed among girls in this study may be a reflection of the higher mean anthropometric parameters among the girls.

In conclusion, Anthropometric parameters specifically, weight and height which vary at all ages, need to be taken into consideration when determining the appropriate blood pressure for age in children.

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