

Proteinuria and Blood Pressure Profile of Lagos School Children

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SUMMARY

Ekunwe EO and Odujinrin OMT. Proteinuria and Blood Pressure Profile of Lagos School Children. Nigerian Journal of Paediatrics, 1989; 15:0. Nine hundred and five clinically healthy school children aged 7 – 17 years, attending five primary and three secondary schools within Lagos metropolis were surveyed for the prevalence of hypertension and proteinuria and to determine the relationship between hypertension and proteinuria. Analysis of the findings shows that 26.1% of the study population had varying degrees of proteinuria which were not related to the sex of the subjects. Blood pressure readings were generally higher among the girls. Seventeen pupils whose diastolic blood pressure readings were above the 97th percentile derived from the study data, were considered hypertensive and only 9 of these had proteinuria. There was thus, no significant difference between normotensive and hypertensive children, with reference to proteinuria. It is recommended that routine urinalysis and blood pressure measurements should be part of the school health service.

Introduction

HYPERTENSION was believed to be rare in the African¹ but studies carried out in the recent past have shown that it may

not be quite as rare as was once believed.^{2 3} Studies carried out on clinically health African children^{4 5} have had to be compared with standards derived from blood pressure readings measured in other continents,^{6 7} because there were no African standards. A few studies however, exist on blood pressure readings in Nigerian children but these are in those already diagnosed as suffering from hypertension.^{8 9}

Hypertension has been attributed to the presence of parenchymal renal disease^{8 9} which in turn, has been associated with asymptomatic proteinuria.^{10 11}

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These studies have postulated that proteinuria may be an early finding in the clinical course of chronic renal disease. This has led some workers to suggest that urinalysis should be routinely carried out in children to screen for early kidney disease.^{1,2} The prevalence of proteinuria in apparently healthy children ranges from 8.6%^{1,2} to 43%^{1,3} but is high enough to support the suggestion. The actual association between proteinuria and hypertension in children has not been elucidated.

This study was undertaken to serve as an additional step in the definition of a national blood pressure standard for children of school age and to determine the relationship, if any, that exist between elevated blood pressure and proteinuria in children.

Materials and Methods

The study was undertaken in May 1986 under the auspices of the school health services during which an annual comprehensive physical examination of school children was carried out in the Lagos metropolis. In addition to the physical examination which included blood pressure measurements, urinalysis was carried out on a 10% sample drawn by systematic random sampling.

Measurements of blood pressure were taken with an *Accoson* (R) sphygmomanometer utilizing a mercury column which has been shown to give valid blood pressure readings in children aged seven years and above.⁷ The subjects were drawn from five primary and three secondary schools located in two local Government Areas, representative of urban Lagos State. The pupils whose ages ranged from 6 to 17 years were clinically healthy. In order to ensure that blood pressure readings approximated to basal values as closely as possible, measurements were taken with the following precautions. Examiners refrained

from wearing a white coat, took measurements in the presence of other children and in the middle of a normal physical examination, with the child in the sitting position and after voiding urine.⁷

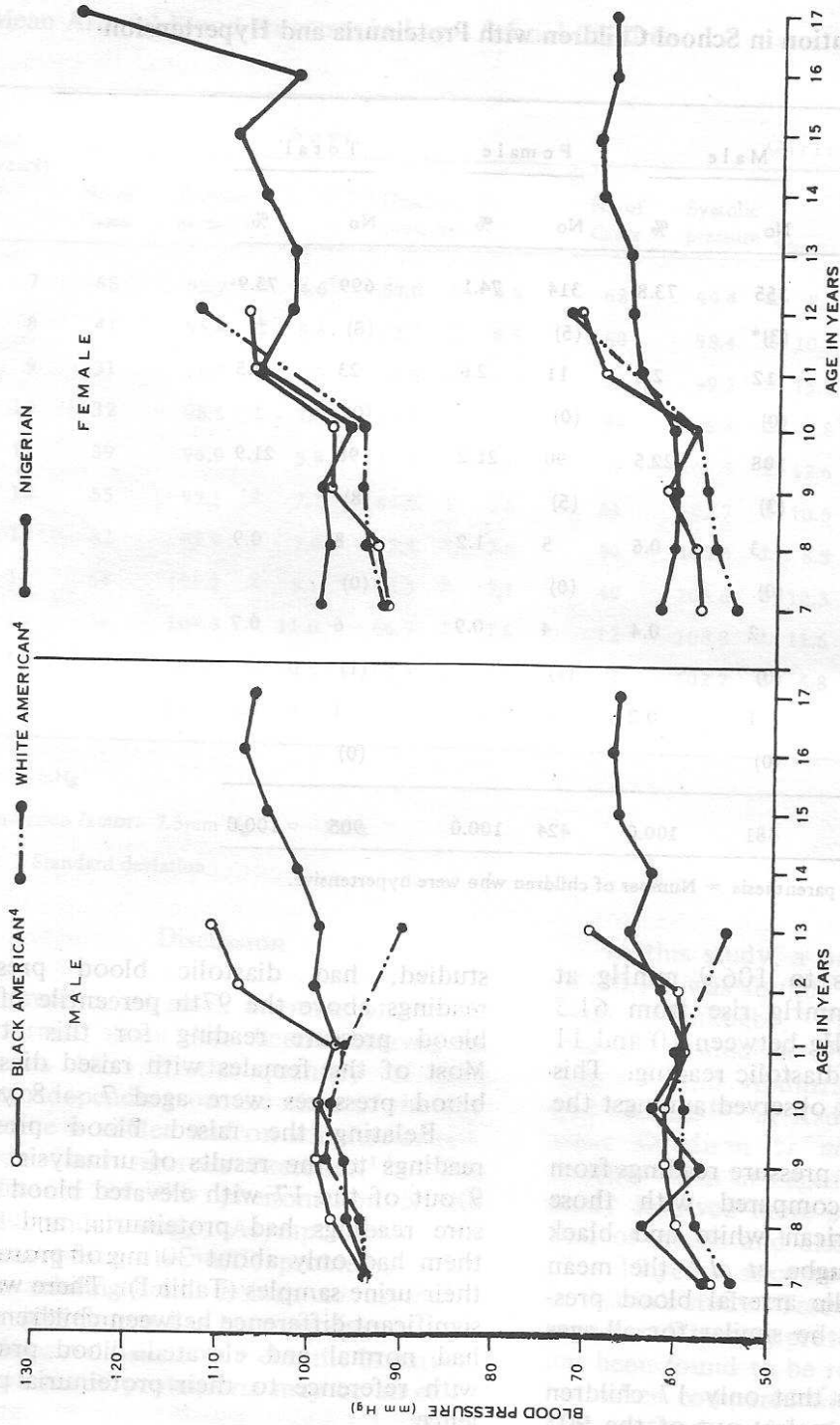
Urine samples were collected into clean bottles just prior to the examination and tested within 15 minutes of voiding^{1,4} using the *N-multistix*(R)^{1,5} to survey the study population for the prevalence of proteinuria.

In view of the fact that validity of blood pressure readings in children younger than seven years has not been shown with the sphygmomanometer used in the study, values obtained in children aged six years were excluded from further analysis. Mean systolic and diastolic blood pressure readings with standard deviations were computed for each age and sex. Elevated blood pressure was defined as any diastolic blood pressure reading above the 97th percentile derived from the study data for each age and sex. With reference to the second objective of the study, the prevalence of proteinuria in normotensive pupils was compared with its prevalence in pupils with elevated blood pressure using two tests of statistical significance.

Results

Blood pressure measurements and urinalysis were carried out on 905 (481 males and 424 females) apparently healthy school children aged 7 – 17 years. Two hundred and thirty six (126 males and 110 females) (25.1%) of the 905 children had varying degrees of proteinuria (Table I). Out of these 236, 23 (2.6%) had only traces of proteinuria.

Generally, the mean systolic and diastolic blood pressure readings advanced with age but the girls had higher readings in most age groups than the boys (Table II). The girls demonstrated a sharp rise in mean systolic blood pressure from 96.4



Legend to Figure

Mean arterial pressures of Nigerian, Black and White American School children.

Mean arterial pressures of Nigerian, Black and White American School children.

Table I
Sex Distribution in School Children with Proteinuria and Hypertension

Degree of Proteinuria	Male		Female		Total	
	No	%	No	%	No	%
Negative	355 (3)*	73.8	314 (5)	74.1	699 (8)	73.9
Trace	12 (0)	2.5	11 (0)	2.6	23 (0)	2.5
+	108 (3)	22.5	90 (5)	21.2	198 (8)	21.9
++	3 (0)	0.6	5 (0)	1.2	8 (0)	0.9
+++	2 (0)	0.4	4 (1)	0.9	6 (1)	0.7
++++	1 (0)	0.2	— (0)	—	1 (0)	0.1
Total	481	100.0	424	100.0	905	100.0

*Figures in parenthesis = Number of children who were hypertensive.

mmHg at 10 years to 106.9 mmHg at 11 years and a 4mmHg rise from 61.5 mmHg to 65.1 mmHg between 10 and 11 years of age in the diastolic reading. This type of rise was not observed amongst the boys.

When the blood pressure readings from this study were compared with those reported for American white and black children by Akinkugbe *et al.*,⁴ the mean systolic and diastolic arterial blood pressure were found to be similar for all ages (Fig. 1).

Table III shows that only 17 children (11 females and 6 males) out of the 905

studied, had diastolic blood pressure readings above the 97th percentile of the blood pressure reading for this study. Most of the females with raised diastolic blood pressures were aged 7 – 8 years.

Relating the raised blood pressure readings to the results of urinalysis, only 9 out of the 17 with elevated blood pressure readings had proteinuria, and 8 of them had only about 30 mg of protein in their urine samples (Table I). There was no significant difference between children who had normal and elevated blood pressure with reference to their proteinuria prevalence.

Table II

Mean Arterial Blood Pressures in Lagos School Children

Age (years)	Boys			Girls		
	No of Cases	Systolic pressure	Diastolic pressure	No of Cases	Systolic pressure	Diastolic pressure
7	68	92.9* \pm 4.6 ⁺	57.0 \pm 4.8	68	99.4 \pm 8.2	62.3 \pm 5.8
8	41	95.4 \pm 5.6	63.7 \pm 8.5	58	98.4 \pm 10.3	62.2 \pm 7.8
9	31	95.9 \pm 7.6	57.5 \pm 7.6	32	99.2 \pm 15.1	61.0 \pm 7.8
10	32	98.5 \pm 7.5	62.8 \pm 7.1	34	96.4 \pm 7.8	61.5 \pm 8.7
11	39	96.9 \pm 5.8	59.2 \pm 6.6	29	106.9 \pm 12.6	65.1 \pm 9.7
12	55	99.5 \pm 7.7	62.0 \pm 7.6	61	102.7 \pm 10.5	66.1 \pm 7.9
13	82	98.9 \pm 7.8	65.4 \pm 7.6	86	102.5 \pm 8.8	66.1 \pm 7.0
14	54	101.3 \pm 8.1	63.3 \pm 7.1	40	105.8 \pm 10.3	69.1 \pm 7.8
15	38	104.8 \pm 11.0	66.7 \pm 7.6	12	108.8 \pm 11.6	69.8 \pm 7.1
16	30	107.1 \pm 10.5	67.3 \pm 7.7	3	102.2 \pm 5.8	68.0 \pm 0.0
17	11	106.8 \pm 9.6	66.6 \pm 9.7	1	125.5	68.0

* = mmHg

Conversion factor: 7.5mm Hg = 1kPa

+ = 1 Standard deviation

Discussion

The presence of small amounts of protein in normal urine has been observed as early as 1895,¹⁶ the quantity of such protein depending on the time of the day the urine is voided and on whether or not, one has had rigorous exercises.¹⁴ The significance of this phenomenon is still poorly understood. Asymptomatic proteinuria poses diagnostic problems. Evidence relating renal lesions to asymptomatic proteinuria has been produced^{10, 11} and since renal diases are chronic in nature, asymptomatic proteinuria may be an early finding.

In this study, a proteinuria prevalence of 26.1% was found; this was higher than what Akinkugbe, Familusi and Akinkugbe¹⁷ found in Oyo State, Ajasin in Lagos¹² and Abdurrahman, Chakrabarty and Ochago¹⁸ in Kaduna but lower than what Oyediran *et al*¹³ found in Epe, another town in Lagos State. The present study involved more school children than that of Ajasin and also had a wider range (7 – 17 years) as compared with 6–9 years in Ajasin's study. Test stix has been widely used for detecting proteinuria^{19–21} and it has been found to be reliably precise^{14, 15} but when compared with the sulfosalicylic acid methods, a few false negative results

Table III

Age and Sex Distribution of Children with Hypertension using the Derived 97th Percentile of Diastolic Blood Pressures of the Study Group

Age (years)	Male		Female	
	Normotensive	Hypertensive	Normotensive	Hypertensive
7	68	—	65	3
8	41	—	53	5
9	31	—	32	—
10	32	—	34	—
11	39	—	29	—
12	55	—	61	—
13	82	—	85	1
14	51	3	39	1
15	38	—	11	1
16	28	2	3	—
17	10	1	1	—
Total	475	6	413	11

have been attributed to the test stix method.¹⁴ Proteinuria could be orthostatic or intermittent in nature. Wagner and his colleagues¹⁴ found significant differences in the 12 hours day urine specimens and 12 hours night urine specimens in the positive group in their study. This further lends support to the fact that proteinuria is a variable phenomenon, especially in those with 1+ (30mg per decilitre) proteinuria.

Wagner and his colleagues¹⁴ have reported that the prevalence of proteinuria increases gradually with age, with a marked temporary increase in girls between 8 and 16 years and in boys between 13 and 17 years of age.¹⁴ They were also able to demonstrate a relationship between protei-

nuria and puberty; most of the children in our study fell within this age range. All these help to explain our high prevalence rate. Time lag between collection and testing of urine samples should not affect the result significantly as demonstrated by Vehaskari and Rapola¹⁵ in their study.

However, the proteinuria prevalence of 1.65% at 2+ level and more, found in this study agrees with the findings of Ajasin¹² in his study of school children in Mushin in Lagos, where he found the prevalence to be 1.6%. It contrasts with the findings of Abdurrahman, Chakrobarty and Ochaga¹⁸ in their study of school children in the northern part of Nigeria where they found a higher prevalence of 3.6%.

Many studies have disproved the previously held view that hypertension is

not common in African.¹⁻⁴ In particular, it has been shown that hypotension in African children is not rare.⁹ For the diagnosis of hypertension to be made, it is important to know the normal range for the age and sex of those being examined and other criteria such as standard method of measurement,²² pre-examination condition of the individual and number of readings taken under basal conditions. The major studies on arterial blood pressures in American children 4 years and above have uniformly alluded to the difficulties inherent in measuring blood pressures in the young child.²³⁻²⁶ Different sizes of cuffs were used depending on which more closely approximated to two-thirds of the arm. In this study, the cuffs used covered two-thirds of the arms of the children and only results obtained in children 7 years and above were analysed.

Donnison²⁷ reported that the blood pressures of Africans in his survey closely resembled those found in Europeans up to age 40 years. Abrahams, Alade and Barnard²⁸ also showed that blood pressures in West-Africans were generally similar to those of Europeans and white Americans.

Using the derived 97th percentiles of readings from this study to determine "elevated blood pressure", only 17 children had such readings and 11 of these were girls. Nine of these children had proteinuria. Renal diseases have been found to account for the vast majority of cases of hypertension in African children and the age incidence spans 1-14 years with more cases in the older age group.²⁹ The majority of our study population were in this older age group.

In view of the fact that renal diseases are often chronic and asymptomatic and proteinuria is presumptive evidence of an underlying parenchymal disease, routine

urinalysis should be part of school health service. In addition, since there is now no doubt that hypertension exists in African children⁹ as elsewhere,⁶ blood pressure readings of school children is an important service that should be incorporated into the routine health examination of school children.

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Accepted 26 January, 1988.