

ORIGINAL ARTICLE

Asymptomatic Proteinuria and Elevated Blood Pressure among Adolescents in Urban Secondary Schools of South-East Nigeria

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INTRODUCTION

Hypertension is a very important public health problem affecting a large number of

ABSTRACT

Background: Hypertension and proteinuria are known risk factors for cardiovascular disease and renal impairment. Early detection and treatment will reduce morbidity and mortality associated with them. **Objective:** To determine the prevalence of asymptomatic proteinuria with or without elevated blood pressure among secondary school adolescents in urban area of south-east Nigeria.

Methodology: This was a cross sectional study of 995 adolescents aged 10-19 years attending public and private secondary schools in Awka-South Local Government Area of Anambra state, south-east Nigeria. A multi-staged sampling method was used to select the subjects. All the participants had their urine examined for protein using the combo- 9 (Midi test) according to manufacturer's specification. Their blood pressure was measured after at least five minutes of rest in seated position using mercury sphygmomanometer, (Accoson® DEKAMET, MK.3 England). Data was analysed using SPSS version 16, (Chicago Illinois, USA).

Result: A total of 995 adolescents were recruited and studied. They comprised of 475 (47.7%) males and 520 (52.3%) females, giving a male to female ratio of 1:1.1. Their ages ranged from 10-19 years with a mean of 14.6±2.0 years. Prevalence of hypertension was 6.2%. Thirty-eight females (7.3%) compared to twenty-four males (5.0%) had hypertension, but this was not statistically significant. (*P*-value =0.14) Ninety-six (9.6%) of all the subjects had protein in urine. Eighty-five had one plus (+), while 11 had two pluses (++) of protein.

Conclusion: Asymptomatic proteinuria and hypertension exist among secondary school adolescents. There is need for periodic screening and intervention programme.

Key words: Hypertension, Urine, Protein, Renal Impairment

world's population. Studies have shown that hypertension can start during the childhood and adolescence, and progress to

adulthood.^{1,2} Childhood hypertension could be *essential* or due to secondary causes like renal diseases. It is a major risk factor for cardiovascular disease and can potentially affect the kidneys.³ One common mode of presentation of renal disease is proteinuria which is usually asymptomatic. Both hypertension and proteinuria are asymptomatic in the early stage and are only detected during routine screening or consultation for other conditions especially among adolescents.

Studies in Nigeria have shown that the prevalence of adolescent hypertension ranged from 1.8% to 17.5% while that of proteinuria ranged from 1% to 26.9%.^{4,5,6,7,8,9} Long standing hypertension could lead to renal impairment resulting in proteinuria, while kidney diseases can lead to hypertension. Proteinuria with or without hypertension in children and adolescents should be properly evaluated, treated and followed-up to forestall the possibility of further deterioration. Early detection of asymptomatic proteinuria have significantly played important role in the prevention of morbidity and mortality associated with renal diseases.^{10,11,12} Most studies in our environment on proteinuria with or without hypertension were done among pre-school and primary school children; hence there is paucity of data on proteinuria among adolescents.

This study was carried out to determine prevalence of asymptomatic proteinuria with or without elevated blood pressure among secondary school adolescents in Awka south local government area of Anambra state, and to determine the relationship between the two variables.

METHODOLOGY

Study Design

This was a cross-sectional study of apparently healthy adolescents aged 10-19 years attending public and private secondary schools in Awka- South Local Government

Area between the months of July 2013 and April 2014.

Study Setting

Awka South Local Government Area one of the 21 local government areas in Anambra state, South-Eastern region of Nigeria. Awka is an urban area which serves as the state capital, and is the third largest city in the state. Its population according to 2006 census is 189,049.¹³ The inhabitants are predominantly Igbo's, who are mainly civil servants and traders.

Ethical Consideration

Ethical approval was obtained from the Ethics Committee of the Nnamdi Azikiwe University Teaching Hospital Nnewi. Approval was also obtained from Anambra State Ministry of Education, and the principals of the selected schools. Written/oral consent was obtained from the students/parents before enrolling the selected subjects into the study.

Sampling Method

Multi-stage sampling method was used to select the subjects. All the secondary schools were grouped into public and private secondary schools. There were altogether 34 secondary schools comprising 18 public secondary schools with a population of 11,614 students and 16 private secondary schools with a population of 5,693. Out of these, nine (9) schools representing 25% of the total number of schools were selected. The ratio of population of public to private schools was approximately 2:1; based on this, 6 public schools and 3 private schools were selected by simple random sampling for the study. All the private schools were mixed, while all the public schools were also mixed except 3 that were single gender, (two for girls and one for boys). In the public section, 4 mixed schools and 2 single gender schools were selected, (one for boys and one for girls.) All the mixed schools were stratified into boys and girls using the class register; equal number of boys

and girls were selected (as much as possible) to ensure an even or a near even distribution of both genders. Students were selected from each class by simple random sampling.

Data Collection

All the participants had their urine examined for protein using the combi-9 (Medi test Germany) according to manufacturer's specifications. Proteinuria was graded as + (< 30mg/dl), ++ (30-100mg/dl), +++ (300mg/dl) and ++++ (1000mg/dl and above) Proteinuria of + or above was accepted as significant.

The blood pressure was measured after at least five minutes of rest in seated position using mercury in glass sphygmomanometer (Accoson® model DEKAMET, MK.3, Made in England). The measurement was taken between 8.30am and 12noon before the students went on break. Measurement was done as recommended in the 7th Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7) with the subjects sitting quietly and the right arm on a table at the level of the heart.¹⁴

An appropriately sized cuff, covering about two-thirds of the upper arm with the lower border not less than 2.5 cm from the cubital fossa, was applied after any restricting clothing had been removed. The manometer was at the level of the cuff. The brachial artery was palpated and its position noted. The cuff was then inflated to a pressure of 30 mmHg above the level at which the radial pulse was no longer palpable. The stethoscope was placed over the brachial artery in the cubital fossa and the pressure in the cuff was deflated at 2 mmHg every second until the first Korotkoff sound is heard. This was recorded as the systolic blood pressure (SBP). The pressure in the cuff was continued to be lowered until the sounds disappear completely. This is the fifth Korotkoff sound, and the pressure here was recorded as the diastolic blood pressure (DBP). The blood

pressure was measured twice at an interval of 1-2 minutes and the mean recorded.

Normal blood pressure (NBP) was defined as systolic and diastolic blood pressure that is <90th percentile for gender, age and height.³ Pre-hypertension was defined as systolic and diastolic blood pressure ≥90th percentile, but <95th percentile for gender, age and height. Hypertension is defined as systolic and diastolic blood pressure ≥95th percentile for gender, age and height.¹⁵ All the subjects with proteinuria and elevated blood pressure were referred to Anambra State University Teaching Hospital for proper evaluation and treatment.

Data analysis

Data was analysed using Statistical Package for Social Science, (SPSS) version 16, (Chicago Illinois, USA). The comparison of categorical variables and tests for association was by means of chi-square test (χ^2). *P*-values < 0.05 were regarded as statistically significant.

RESULTS

A total of 995 adolescents were recruited and studied. They comprised of 475 (47.7%) males and 520 (52.3%) females, giving a male:female ratio of 1:1.1. Their ages ranged from 10-19 years. Four hundred and seventy seven (47.9%) were aged 13-15 years, while 163 (16.4%) were aged 10-12 years. The overall mean age of the subjects was 14.6±2.0, (female =14.7±2.1; male = 14.4±1.9. There was no statistically significant difference between the male and female population (*p*-value = 0.09, as shown in Table 1).

Ninety-six (9.6%) of all the subjects had protein in urine. Eighty-five had one plus (+), while 11 had two pluses (++) of proteinuria. There was no statistically significant difference in the distribution of proteinuria among the different age groups, Table 2. Proteinuria was statistically significant in females than males, *P*-value = 0.017 (Table 3).

Blood pressure distribution among the students showed that 62 (6.2%) were

hypertensive, of which 1.4% and 2.1 % were systolic and diastolic hypertension respectively. Twenty-seven (2.7%) had mixed systolic and diastolic hypertension. Of this, nine were males while 18 were females. More of females (7.3%) than males (5.0%) had hypertension, but this was not statistically

significant, as depicted in Table 4. Only six of the adolescents with hypertension had proteinuria.

There was no significant association between the presence of proteinuria and hypertension among the subjects, *P*-value = 0.919, as shown in Table 5.

Table 1. Age and gender distribution of the subjects

Age (years)	Male n=475(%)	Female n=520 (%)	Total n=995 (%)	X ²	P -value
10 -12	74 (15.6)	89 (17.1)	163 (16.4)	4.80	0.09
13 -15	215 (45.3)	262 (50.4)	477 (47.9)		
16 - 19	186 (39.2)	169 (32.5)	355 (35.7)		
Mean ±SD	14.7± 2.1	14.4±1.9	14.6 ±2.0		
Total	475 (47.7)	520 (52.3)	995 (100)		

Table 2. Age distribution of proteinuria among the subjects

Age (years)	Proteinuria			Total	X ²	P- value
	Absent (%)	+ (%)	++ (%)			
10–12	147 (90.2)	15(9.2)	1 (0.6)	163 (100)	5.334	0.254
13–15	424(88.9)	47(9.9)	6 (1.3)	477 (100)		
16–19	330 (92.9)	22 (6.1)	4 (1.1)	355 (100)		
Total	899(90.3)	85 (8.5)	11 (1.1)	995 (100)		

Table 3. Gender distribution of proteinuria among the subjects

	Proteinuria		Total (%)	χ ²	P – value
	Absent (%)	Present (%)			
Male	441 (92.5)	34 (7.5)	475 (100)	5.706	0.017
Female	458 (88.1%)	62 (11.9)	520 (100)		
Total	899 (90.3)	96 (9.7)	995 (100)		

Table 4. Pattern of distribution of Blood Pressure among the Subjects

Gender	Systolic BP (%)	Diastolic BP (%)	Mixed Systolic & Diastolic BP (%)	Total HTN (%)	Normal BP (%)	Total (%)
Male (%)	6 (1.3)	9 (1.9)	9 (1.9)	24 (5.0)	451 (94.9)	475 (100)
Female (%)	8 (1.5)	12 (2.3)	18 (3.5)	38 (7.3)	482 (92.7)	520 (100)
Total (%)	14 (1.4)	21 (2.1)	27 (2.7)	62 (6.3)	933 (93.8)	995 (100)

χ² = 2.714; P -value = 0.50; HTN =Hypertension

Table 5. Relationship between Proteinuria and Hypertension among the subjects

Proteinuria	Blood pressure		Total	χ^2	P-value
Absent (%)	842 (90.3)	56 (90.4)	899 (90.4)	0.01	0.919
Positive (%)	90 (9.7)	6 (6.6)	96 (9.6)		
Total (%)	932 (100)	62 (100)	995 (100)		

DISCUSSION

Previous Studies of asymptomatic proteinuria with or without elevated blood pressure among children and adolescents documented varying prevalence rates.^{9,16} In the present study, the prevalence of proteinuria was 9.6%. This is comparable with the range of 6-10% documented by other studies.^{17,18} Odetunde, *et al.* had documented a prevalence of 2.7% which is lower than the current study.⁸ The reason may be due to the difference in study population. Whereas the present study was among adolescents, Odetunde, *et al.* focused on preschool children. Our finding is also higher than the report by Jafar, *et al.* who documented a prevalence of 3.3% among school children in Pakistan.¹⁹ Most studies in the past had observed an increase in the prevalence of proteinuria with age.^{17,20} Adekanmbi, *et al.* noted a prevalence of 26.9% in a study among adolescents in Shagamu South-West Nigeria, however differences in methodology could explain this disparity.⁹

As noted earlier, asymptomatic proteinuria could be a sign of hidden renal problem, and the implication is that apparently healthy adolescent could have proteinuria without any obvious symptoms, and this calls for the need for regular screening for proteinuria among apparently healthy adolescents.

In this study, the prevalence of hypertension was 6.2% (5.0% for boys and 7.3% for girls). Mijinyawa, *et al* reported similar prevalence of 7.2% (6.7% for boys and 7.7% for girls) in Kano State in a similar population of 1000 teenagers aged 13-19 years.²¹ Kehishadi, *et al.*

in Iran documented similar finding where they reported a prevalence of 7.7% among students from 23 provinces aged between 6-18 years.²² Several other studies also documented similar findings.^{23,24} This implies that apparently healthy adolescents could be hypertensive without knowing, and underscores the need for regular check of blood pressure among these adolescents. Adams-Campbell, *et al.*⁴ had documented a lower prevalence of 1.8% and 2% for boys and girls respectively, while a study by Hothan, *et al.*, reported a prevalence of 17.2% which is much higher than the finding of this study.²⁵

The possible reason for these disparities could be due to differences in methodology. Whereas hypertension was defined as $\geq 95^{\text{th}}$ percentile in the present study, Adam Campbell, *et al.* used 140mmHg and 90 mmHg as defining criteria for systolic and diastolic hypertension, respectively. This may have affected their result and could explain the lower prevalence documented in their study.

The present study did not show any significant relationship between elevated blood pressure and proteinuria. This is in agreement with a study in Nigeria.²⁶ This is not surprising since this a cross sectional study, however follow up of those adolescents with hypertension may reveal possible underlying renal pathology. As opposed to the findings of this study, Rahman, *et al.* demonstrated a strong correlation between hypertension and proteinuria among school children in Pakistan.²⁷ Another study in Nigeria equally

demonstrated an association between elevated blood pressure and proteinuria.⁹ The possibility is that the subjects in the present study may not have had hypertension long enough to have progressed to renal impairment since it is known that hypertension is a risk factor for kidney disease with proteinuria and vice versa.

Another important finding of this study is the fact that proteinuria was significantly higher in females than males. Even though the

reason for this is not clear, however similar finding has been reported by other studies.^{20,25}

CONCLUSION

Proteinuria and elevated blood pressure exist among these adolescents. Periodic screening and interventional programme is recommended. This would reduce the morbidity and mortality associated with hypertension as well as the possibility of early development of chronic kidney disease (CKD).

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