PREVALENCE OF PERSISTENT PROTEINURIA IN OVERWEIGHT AND OBESE PRIMARY SCHOOL CHILDREN IN CALABAR, NIGERIA.

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ABSTRACT

BACKGROUND: There is a dearth of information on the relationship between persistent proteinuria with overweight and obesity in Nigerian children. Therefore, this study is aimed at evaluating this relationship.

MATERIALS AND METHODS: This was a descriptive cross-sectional study of 275 overweight and obese primary school children aged 5 to 12 years derived from an initial screening of the Body Mass Index of 1,600 apparently healthy primary school pupils recruited by multi-stage sampling. Subjects early morning urine was collected and urinalysis done. Those with proteinuria ≥ 1+, had urinalysis repeated after two weeks and those with persistent proteinuria, were quantitated using the modified Biuret and urine creatinine with the modified Jaffe Kinetic methods. Urine protein:creatinine ratios > 0.20 were confirmed as persistent proteinuria. Data were analyzed using SPSS version 22.0 and P-value ≤ 0.05 was significant.

RESULTS: Overweight were 192 (69.8%) and obese 83 (30.2%). Five Children (1.8%) had persistent proteinuria consisting of four (1.4%) of overweight and one (0.4%) of Obese though not statistically significant.

CONCLUSION: Prevalence of persistent proteinuria among overweight and obese primary school children was 1.4% and 0.4% respectively. More studies are needed to evaluate the impact of overweight and obesity on the kidneys of Nigerian children.

KEY WORDS: Persistent Proteinuria, Overweight, Obesity, Children.

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INTRODUCTION

Proteinuria is significantly higher in overweight and obese children.[1] It is an early and sensitive marker of kidney damage and an important risk factor of progression to chronic kidney disease (CKD).[2,3] In view of the increasing epidemic of overweight and obesity worldwide, proteinuria among them becomes more important.[4]

Persistent Proteinuria is defined as protein excretion of more than 4mg/m^2 /hour or ≥ 1+ by dipstick or Spot urine Protein Creatinine Ratio > 0.2mg/mg in two or more samples of urine collected at least one or two weeks apart.[2,5,6] Overweight is defined by World Health Organization (WHO) as WHO body mass index z-score >+1SD to +2SD while obesity as z-score > +2SD.[7]

The prevalence of proteinuria in overweight children is increasing, for instance, Solarin et al [8] in South West, Nigeria recorded a prevalence of 5.2% while Khatri and Shah in the capital of Nepal recorded 11.9%. [9]

Overweight/Obesity is an independent risk factor for development and progression of renal damage leading to chronic kidney disease.[10] Proteinuria is one of the recognised co-morbidities of obesity in children.[11] It was reported in 11.3% of obese Turkish children in a study by Gul et al. [12] Chu et al[13] in Taiwan reported prevalence of 2.4% and 1.4% for overweight and obese children respectively aged 7 to 14 years while Malla et al[14] in India found a prevalence of 3.7% for overweight and none for obese children.

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In Nigeria, very few studies have been done on the relationship between overweight, obesity and proteinuria. Solarin et al[8] in Lagos, reported a prevalence of 5.2% for overweight children with proteinuria and none of the 0.3% obese children aged 2 to 17 years had proteinuria. Therefore, this study is aimed at knowing the relationship between overweight, obesity and persistent proteinuria among primary school children in Calabar, Nigeria.

MATERIALS AND METHODOLOGY

This was a descriptive cross-sectional study of 275 overweight and obese primary school children aged 5 to 12 years carried out in Calabar, Niger delta region, Nigeria. The subjects were gotten from an initial screening of the height, weight and calculation of the Body mass index of 1,600 apparently healthy primary school children aged 5 to 12 selected by multi-stage sampling method from 15 primary schools (3 public and 12 private out of 23 public and 80 private schools in a ratio of 1:4) in the study area. The study was carried out between May and July, 2014.

Pretested semi-structured questionnaires with both closed and open ended questions were distributed to the initial 1,600 students to be filled by consented parents. The questionnaire contains demographic data of student, presence or absence of urinary symptoms, facial and/or leg swelling, fever in the previous two weeks, menstruation history for girls, sickle cell disease and diabetes. Subjects with the above symptoms/history were excluded from the study.

Each of the 1,600 children had clinical examination, weight and height measurements done. Weight and height were measured to the nearest 0.5kg and 0.5cm respectively using a stadiometer manufactured by Techmel and Techmel USA (ZT-160) following standard procedures of measurement.[15] Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2).[16] The BMI number was plotted against age on the WHO BMI-for-age growth chart (for boys or girls)[7] to obtain a z-score. Overweight was defined as z-score >+1SD to +2SD and obesity as z-score > +2SD.[7] Hence, 275 children were selected as overweight or obese after the initial screening.

Each of the 275 selected children had their blood pressures measured using the auscultatory method. This was carried out using a standard mercury sphygmomanometer (Accoson) and a stethoscope following the recommendations of the National High Blood Pressure Education Programme Working Group on High Blood Pressure in children and Adolescents fourth report.[17] Systolic blood pressure and/or diastolic blood pressure equal to or greater than the 95th percentile for sex, age and height was defined as high blood pressure in this study.[17]

Early morning mid-stream urine was collected from each of the 275 selected subjects on waking up from sleep with the help of their parents/guardians. The urine samples were tested the same day of collection for proteinuria using dipstick combi-10 urinalysis strip (Combi-uriscreen 10SL Axiom Medical Ltd, UK, 2014, LOT NO: 56140218). Proteinuria of 1+ and above was noted as significant. Two weeks later, children with significant proteinuria had urinalysis repeated and those still having proteinuria of 1+ and above were taken as persistent proteinuria and the same urine samples were tested for urine protein and creatinine using the modified Biuret method and modified Jaffe Kinetic methods (using Biolabo creatinine kit) respectively.

The urine protein was measured and expressed in g/L and then converted to mg/dl by multiplying by 100.[18] The urine creatinine concentration was measured and expressed in µmol/L and was converted to mg/dl by dividing by 88.4.[18] The urine protein: creatinine ratio was calculated by dividing urine protein concentration in mg/dl with urine creatinine concentration in mg/dl to obtain a whole integer. Subjects with ratios > 0.20 were confirmed as having persistent proteinuria. Data were analyzed using SPSS version 22.0 and P-value ≤ 0.05 was significant.

Ethics: Ethical approvals were obtained from the University of Calabar Teaching Hospital and Cross River State Health Research Ethics Committees. Permissions were obtained from the Cross River State Universal Basic Education Board, as well as the authorities of the participating schools. In addition, their parents gave consents and assent gotten from those above seven years.

RESULTS

Out of the 275 children, 121 (44.0%) were males and 154 (56.0%) females, giving a male to female ratio of 1:1.3. The age ranged between 5 to 12 years with a mean of 8.4 ± 1.9 years, and age group 9-10years had the highest frequency. Majority of the children attended private schools. One hundred and ninety-two thousand (69.8%) were overweight and 83 (30.2%) obese (Table 1).

Table 1: Socio-demographic characteristics of the study population.

Characteristics	Frequency(n)	Percentage (%)
Age		
5 – 6	49	17.8
7-8	99	36.0
9-10	103	37.5
11-12	24	8.7
Total	**275**	**100.0**
Gender		
Male	121	44.0
Female	154	56.0
Total	**275**	**100.0**
Social Class		
Upper	112	40.7
Middle	125	45.5
Lower	38	13.8
Total	**275**	**100.0**
Type of School		
Public	57	20.7
Private	218	79.3
Total	**275**	**100.0**
BMI-for-Age Category		
Overweight	192	69.8
Obese	83	30.2
Total	**275**	**100.0**

Five children (1.8%) had persistent proteinuria consisting of four (1.4%) of overweight and one (0.4%) of obese children.

These were not statistically significant (p>0.05) (Table 2). High blood pressure was noted in 18 (6.5%) of overweight and 5 (1.8%) of obese children. This was not statistically significant (p > 0.05) Table 3. Most of the obese children in this study were from the upper social class and the relationship was statistically significant (p< 0.05) Table 4.

Table 2: Relationship between persistent proteinuria, overweight and obesity.

BMI-for-Age Category	Persistent Proteinuria		Total (n)	Test of Statistics	P-value
	Negative n (%)	Positive n (%)			
Overweight	188(68.4)	4(1.4)	192(69.8)	Fisher's Exact Test	1.000
Obese	82(29.8)	1(0.4)	83(30.2)		
Total	**270(98.2)**	**5(1.8)**	**275(100.0)**		

Table 3: Relationship between blood pressure, overweight and obesity.

BMI-for-Age Category	Blood Pressure		Total (n)	Test of Statistics	P-value
	Normal n (%)	High n (%)			
Overweight	174(63.3)	18(6.5)	192(69.8)	Chi - Square	0.357
Obese	78(28.4)	5(1.8)	83(30.2)		
Total	**252(91.6)**	**23(8.4)**	**275(100.0)**		

Table 4: Social class, overweight and obesity

Social Class	BMI-for-Age Category		Total (n)	Test of Statistics	P-value
	Overweight n (%)	Obese n (%)			
Upper Class	63(22.9)	49(17.8)	112(40.7)	Chi-Square	0.000*
Middle Class	96(34.9)	29(10.6)	125(45.5)		
Lower Class	33(12.0)	5(1.8)	38(13.8)		
Total	**192(69.8)**	**83(30.2)**	**275(100.0)**		

* Statistically Significant

DISCUSSION

The prevalence of persistent proteinuria among overweight children in this study was 1.4%. This value is lower compared to the findings by Khatri and Shah [9] in Nepal and Solarin et al [8] in Lagos, Nigeria despite their small sample sizes. This difference may be due to the frequency of measuring proteinuria. In the current study, proteinuria was measured twice two weeks apart while in the other studies,[8,9] it was measured once. Proteinuria, in this study was measured using spot urine protein/ creatinine ratio which is a quantitative test while the other studies used urine dipstick which is a qualitative test. Quantitative measurement of protein is the hallmark in diagnosis, treatment and prognosis of renal disease.[19]

The prevalence of persistent proteinuria in obese subjects in this study was 0.4%. This result is low compared with higher values of 11.3% and 1.4% reported from studies among school children at Turkey[12] and Taiwan[13] respectively. This difference may be due to higher sample size of obese children in these studies.[12,13] However, our finding of 0.4% among obese children though not statistically significant (p-value = 1.000) is remarkable. A similar study in Lagos, South western Nigeria by Solarin et al[8] did not record any proteinuria for

obese children. Hence, more studies across the country are needed in this area to fully evaluate the impact of overweight and obesity on the kidneys of Nigerian children.

There was no statistically significant relationship between overweight, obesity and persistent proteinuria using urine protein/creatinine ratio in this study. This is at variant with other studies in other parts of the globe[11,20,21] which showed massive proteinuria with obesity. Proteinuria had been reported as a co-morbidity of obesity in children.[11] Obesity induces several pathophysiologic disturbances that contribute to renal injury. They include, activation of the renin-angiotensin-aldosterone system, plasminogen activator inhibitor-1, hyperlipidaemia and high serum levels of adipocyte-specific metabolites such as leptin, adiponectin and resistin.[11,22] These may cause a form of nephropathy called obesity-related glomerulopathy (ORG).[22] There is need for further research into these pathophysiological mechanisms in our environment.

High Blood pressure was noted in 6.5% and 1.8% of the overweight and obese children in this study respectively. But these were not statistically significant. This may be due to the small number of cases of overweight or obesity with raised blood pressure in this study (Table III). However, many studies have reported high blood pressures and / or higher prevalence of hypertension in overweight and obese children among many ethnic and racial groups.[23,24,25,26] But, the result from this study is higher than that obtained in a similar study by Adam and Isah[27] in Benin, South-south, Nigeria in which none of the obese children had raised blood pressure. As in adults, a combination of factors including over activity of the sympathetic nervous system (SNS), insulin resistance, and abnormalities in vascular structure and function may contribute to obesity-related hypertension in children. [28] Although this study did not show many subjects with raised blood pressure, they should have their blood pressure tracked. [29] Tracking blood pressure in these children will help to detect those with hypertension early and treat them.

Over half of the obese children in this study were from upper social class and it was statistically significant. This may be explained by the lifestyle exhibited by children in the upper social class namely: sedentarism, high energy and fat diets. Increasing BMI resulting in overweight and obesity is directly related to this lifestyle.[30]

CONCLUSION AND RECOMMENDATION

The prevalence of persistent proteinuria among overweight and obese primary school children in this study was 1.4% and 0.4% respectively. Although this study did not show many subjects with raised blood pressure having persistent proteinuria, it is recommended that all subjects with persistent proteinuria should have their blood pressure tracked. Tracking blood pressure in these children will help to detect those with hypertension early and treat them. Hence, more studies across the country are needed to evaluate the impact of overweight and obesity on the kidneys of Nigerian children. Obesity occurs more in the upper social class and tracking blood pressure in overweight and obese children is recommended.

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