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Prevalence of high blood pressure, overweight, and obesity in Ghanaian school children

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Abstract

Background: Obesity is excessive fat accumulation in adipose tissue to the extent that health is impaired. As the body weight increases, the frequency of blood pressure shifts to higher levels. This combination is associated with a greater risk of disability, reduced quality of life and premature death in early adulthood.

Objective: This study aimed to determine the prevalence of overweight, obesity and associated hypertension in school children.

Methods: School children aged 5 to 14 years from six schools in Greater Accra, Ghana, were randomly recruited into the study. Weight, height and blood pressure were measured. Body mass index was generated and plotted using the WHO Anthroplus software. The association between BMI percentile and blood pressure was also analysed.

Results: Six hundred school children were recruited for the study. Of these 59.7% (n = 358) were females, and 40.3% (n = 242) were males. The prevalence of overweight and obesity were 11.16% and 11.01%, respectively. Overweight (12.8% vs 8.7%) and obesity (11.7% vs. 9.9%) were relatively common among females as compared to males (p = 0.083). Overall, 8.5% (n = 51) of children out of the 600 had elevated blood pressure. Elevated blood pressure was significantly prevalent among obese children 18.2% (n = 12), followed by overweight 13.4% (n = 9) and the normal weight of 6.4% (n= 30) for school children (p = 0.002).

Conclusion: Hypertension was found among the school children studied and was significantly associated with overweight and obesity. This calls for the promotion of school health education and physical activities to curb hypertension in this population.

Keywords: children, overweight, obesity, hypertension, high blood pressure paediatrics

INTRODUCTION

Obesity is excessive fat accumulation in adipose tissue to the extent that health is impaired [1]. It is a common but often underestimated condition of clinical and public health importance [2]. It is associated with a greater risk of disability, reduced quality of life and premature death due to cardiovascular diseases like hypertension, stroke, diabetes mellitus and osteoarthritis. As it is in adults, established obesity in children is difficult to reverse [3]. Various institutions have developed definitions and cut-offs for measuring overweight and obesity in children. These institutions include the Centre for Disease Control and Prevention (CDC) [4], the International Obesity Task Force (IOTF) [5], and the World Health Organization (WHO) [6]. In this study, the WHO reference chart was used for categorising the different weight groups. The WHO reference childhood population included children from an African country, including Ghana, so it would be more representative of this childhood population. Recent studies have shown a trend of increasing obesity in many parts of the world. Global data on the prevalence of overweight and obesity indicated that the prevalence of overweight and obesity had risen significantly over the past three decades in both developed and developing nations in all regions of the world [7]. Blood pressure is positively related to body mass index (BMI). As the body weight increases, the frequency of blood pressure shifts to higher levels [8]. Obesity and hypertension are independently associated

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with increased risk of cardiovascular disease in children, and both (obesity and hypertension) track into adulthood, thus increasing the prevalence of heart disease and its related morbidity and mortality [9]. The relationship between BMI and blood pressure depends on the degree of excess body weight [10]. Seventy percent of obese children have at least one cardiovascular risk factor, while 39% have two or more. This study aimed to determine the prevalence of overweight, obesity and associated hypertension in school children.

MATERIALS AND METHODS

Study design and sites

This crossectional study was conducted in six first-cycle schools in the Ayawaso West Wuogon sub-metropolitan area of Greater Accra, Ghana. School children between the ages of 5 - 14 years were eligible for inclusion in the study, while those on medications known to influence blood pressure, such as corticosteroid and antihypertensive drugs, were excluded.

Sample size and patient population

Based on the maximum prevalence of hypertension of 48% in the general population [11], with a design effect of 1.5, 95% confidence level, 5% margin of error and a non-response rate of 5%. A statistical two-tailed study of $N = (z^2pq)/d^2$ was used. Six hundred school children were recruited for the study. A multistage sampling method was used for school selection and recruitment of eligible school children. Out of the 13 sub-metropolitan areas (SMA) in Accra metropolitan area (AMA), one SMA (Ayawaso West Wuogon) was randomly selected through balloting. Schools in Ayawaso West Wuogon SMA were grouped into circuits, with each circuit containing six schools, and one circuit was balloted for. The list of students for each year was obtained from the schools, and this was used to recruit participants using systematic sampling. Study procedures were explained to parents or guardians at parent-teachers association meetings.

Data collection

An automated sphygmomanometer (Welch Allyn® Blood Pressure Monitor) was used for blood pressure measurements. Each child was seated and made comfortable for 5 minutes, after which the blood pressure was taken using an age-appropriate blood pressure cuff with the right arm placed at the level of the heart. Three blood pressure measurements were taken for each child, and the mean was calculated and rounded to the whole number. Children with systolic and/ or diastolic blood pressure at or above the 90th percentile for age, sex and height using the Centers for Disease Control and Prevention (CDC) reference charts were re-evaluated with a mercury sphygmomanometer. The height was measured using a vertical stadiometer (Seca® Instruments Ltd, Hamburg, Germany). Weight was measured with an electronic weighing scale (Seca® Instruments Ltd, Hamburg, Germany). Body mass index was calculated using the formula, BMI = weight (kg) /height^2 (m^2). BMI percentile was then plotted for each subject accordingly using the WHO reference chart obtained from the WHO Anthroplus version 3.2.2 Jan 2011 software.

Children with BMI below the 85th percentile were considered normal. Those with BMI equal to and above the 85th – 95th percentile were overweight, and ≥ 95th percentile was classified as obese. The three main tools used for the classification of body weight were compared to each other in this population.

Data processing and statistical analysis

Data were analysed using Statistical Package for the Social Sciences (SPSS) version 23.1. Mean values with standard deviations were calculated. Pearson's chi-square test was used to assess the association between dependent and independent variables. A $p < 0.05$ was interpreted as statistically significant.

RESULTS

Of the 600 schoolchildren recruited from six schools, 59.7% (n = 358) were females and 40.3% (n = 242) were males. The male-to-female ratio was 1:1.5. Figure 1 shows the association between BMI categories and sex. Overweight and obesity were relatively common among females compared to males, but the difference was not statistically significant ($p = 0.083$).

There is a similar prevalence of overweight and obesity of

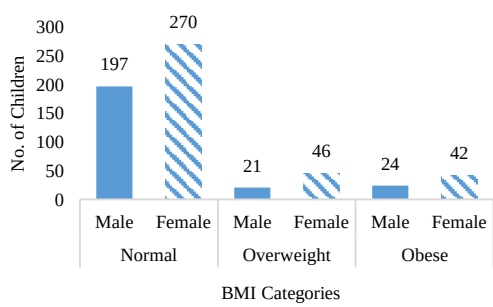

Figure I: BMI categories by sex of school children in Ayawaso West

Table 1: Association of BMI categories and age of the school children in Ayawaso West Wuogon Metropolitan area

Age (yrs)	Population n	Normal weight n (%)	Overweight n (%)	Obesity n (%)
5 to < 7	64	45 (70.31)	7 (10.94)	12 (18.75)
7 to < 9	103	69 (66.98)	17 (16.51)	17 (16.51)
9 to < 11	155	125 (80.64)	14 (9.04)	16 (10.32)
11 to < 13	159	127 (79.86)	16 (10.07)	16 (10.07)
13 to 14	119	101 (84.87)	13 (10.92)	5 (4.21)
Total	600	467 (77.83)	67 (11.16)	66 (11.01)

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11.16% and 11.01%, respectively. The highest prevalence of overweight was found among and within the age group 7 < 9 years. Obesity was highest among the youngest age group and least among the oldest group, as shown in Table 1.

Comparison of WHO, IOTF and CDC BMI reference categories

Table 2: Comparison of different BMI reference standard

	BMI Percentages		
BMI categories	WHO	IOTF	CDC
Normal	77.8	94.2	81.2
Overweight	11.2	3.0	8.0
Obesity	11.0	2.8	10.8

Table 3: Relationship between BMI percentile and BP levels

BMI category	Normal BP n (%)	Prehptn n (%)	Hptn n (%)	Elevated BP n (%)
Normal	437 (93.6)	21(4.3)	12(2.5)	30 (6.4)
Overweight	58 (86.6)	5(10.4)	1(2.1)	9 (13.4)
Obese	54 (81.8)	10(15.4)	2(3.1)	12 (18.2)
Total	549 (91.5)	36(6.0)	15(2.5)	51(8.5)

The three main types of Body Mass Index (BMI) references were compared in this population. The highest prevalence of overweight and obesity was obtained from the WHO reference standard, while the lowest was from the IOTF standard, as shown in Table 2.

The relationship between BMI percentile and blood pressure is shown in Table 3. Elevated blood pressure includes both prehypertension and hypertension. The highest prevalence of elevated blood pressure was found in the obese, followed by the overweight and the normal weight school children. Elevated BP was significantly common among obese children, followed by overweight and children with normal BMI (p = 0.002).

DISCUSSION

The highest prevalence of obesity (18.8%) was found in the youngest age (5 to 6 years) group, while the least (4.2%) was recorded in the oldest (13 to 14 years) group. The high prevalence of obesity amongst the youngest age group is not surprising, as physical education is not a priority in some Ghanaian schools. In many schools, only one-hour session per week was allocated to physical education, which is done in the classrooms [12]. Such an approach to physical education will only worsen the prevalence of obesity. Other factors that contribute to the prevalence of obesity in Ghanaian school children include the intake of high sugar-containing drinks and poor physical activities [13]. Adolescents with the least prevalence of obesity are more likely to be engaged in outdoor activities. Females in this study were found to be more overweight and obese than their male counterparts. This finding is in keeping with other studies done on school children in Ghana [13], South Africa [14], Nigeria [15], and Sudan [16]. Similarly, African American adolescent females are also more likely to be overweight and obese [17], while more male children from 21 European countries were more overweight and obese compared to females [18]. The racial and gender similarities in the trends of overweight and obesity, even in childhood, indicate that genetics play a significant role in body stature regardless of one's geographic location [19]. Also, the female hormone, oestradiol, increases body fat deposition contributing to higher body fat among adolescent females as compared to males [20]. Obesity in females is cherished in Ghana because of the cultural predisposition to view obesity in females as a sign of wealth, well-being, and beauty [21].

The methods (WHO, CDC, IOTF reference standards) used for categorising weight measurements in children are quite well described. When the different reference standards were compared among this study participants, more overweight and obese children were identified with the WHO reference compared to the CDC and the IOTF reference standards. This is similar to the findings in Europe [18], where children in the same cohort had higher proportions of overweight and obesity when the WHO reference was used compared to the IOTF reference. The lower threshold for identifying overweight and obesity using the WHO tool allows early interventions to reverse excessive weight gain and its consequences. This study also highlights the importance of ascertaining and verifying the source and method of data collection when interpreting results of obesity and overweight. While this study had a prevalence of 10.9% and 4.2 % for overweight and obesity, respectively, among adolescents between 13 to 14 years, the Global School-Based Health Survey (GSHS) from Ghana and Uganda reported a prevalence of 5.7% for overweight and 1.8% for obesity [22] in a similar age group. This gross discrepancy may be due to the fact that the children in this study were measured and the results documented, while the survey information was self-reported by the students and may be prone to errors since no verification was done.

The prevalence of hypertension increased with increasing BMI percentile. Obese children had the highest prevalence of elevated BP, followed by overweight and normal-weight children in that order. This is in keeping with other reports, which showed a strong positive relationship between BMI and elevated BP in children and adolescents [13-15,23]. The similarities among all the studies show that obesity plays a very important role in the

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development of childhood hypertension. It is important to note that obesity and hypertension are independently associated with increased cardiovascular disease, and both tracks into adulthood and are related to high morbidity and mortality [10]. The appearance of obesity-associated hypertension in children may signal that developing countries are likely to face similar difficulties as developed countries in overcoming lifestyle choices [23].

Conclusion

This study has shown that school children in Ghana have a high prevalence of overweight and obesity when the WHO reference standards are used. Obese children have the highest prevalence of elevated BP compared to overweight and normal-weight children. This finding indicates that health education and physical activities in schools should be promoted, as these activities will positively impact the lifestyles of these children into adulthood. Routine blood pressure checks should also be conducted for school children at hospital visits.

DECLARATIONS

Ethical considerations

The study was conducted in accordance with the principles of the Helsinki Declaration with good clinical and laboratory practice guidelines. Ethical approval to conduct this study was obtained from the Ethical and Protocol Review Committee of the College of Health Sciences (CHS-Et/M.7-4.15/2018-2019), University of Ghana. Permission was obtained from the Ghana Education Service, Ayawaso West Wuogon Sub-metropolitan Director of Education and Heads of the individual schools. Informed written consent was obtained from selected students' parents or legal guardians, and verbal assent was obtained from children eight years and above. Children who had high blood pressure were referred to the Teaching Hospital for further investigations and management.

Consent to publish

All authors agreed to the content of the final paper.

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Competing Interests

No potential conflict of interest was reported by the authors.

Author contributions

The study was conceived by TJA, OPR and YAA. TJA, NAHS and KHA were involved with data collection, analysis and initial drafting of the manuscript. TJA, All authors were involved in the final drafting of the manuscript and approved it for publication.

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None

Availability of data

Data is available upon request to the corresponding author.

REFERENCES

1. World Health Organization Report of the commission on ending childhood obesity. (2016) World Health Organization (WHO), 2016. Geneva, Switzerland
2. Williams A, Ge B, Petroski G, Kruse R, McElroy J, Koopman R (2018) Socioeconomic Status and Other Factors Associated with Childhood Obesity. J Am Board Fam Med 31:514–521
3. Afshin A, Forouzanfar M, Reitsma M, Sur P, Estep K, Estep K, Marczak L, Mokdad A (2017) Health Effects of Overweight and Obesity in 195 Countries over 25 Years. N Engl J Med 377:13–27
4. Kuczmarski R, Ogden C, Grummer-Strawn L, Flegal K, Guo S, Wei R (2000) CDC growth charts. Adv Data 314:1–27
5. Cole T, Bellizzi M, Flegal K, Dietz W (2000) Establishing a standard definition for child overweight and obesity worldwide. International survey Br Med J 320:1240–1243
6. de Onis M, Onyango A, Borghi E, Siyam A, Nishida C, Siekmann J (2007) Development of a WHO growth reference for school-aged children and adolescent. Bull World Health Organ 85:649–732
7. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C (2014) Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 384:766–781
8. Leggio M, Lombardi M, Caldarone E, Severi P, D'Emidio S, Armeni M (2017) The relationship between obesity hypertension: an updated comprehensive overview on vicious twins. Hypertens Res. 40:947–963
9. Brady TM (2017) Obesity-Related Hypertension in Children. Frontiers in Pediatrics 5:197 https://doi.org/10.3389/-fped.2017.00197
10. Juonala M, Costan G, Berenson G, Venn A, Burns T (2011) Childhood obesity, adult obesity and cardiovascular risk factors. N Eng J Med 365:1876-1885.
11. Bosu WK (2010) Epidemic of hypertension in Ghana: a systematic review. BMC Public Health 10:418. https://doi.org/10.1186/1471-2458-10-418
12. Mogre V, Aneyire E, Gyamfi E (2013) Physical Activity and BMI Status of School-Age Children in Tamale, Northern Ghana. . Pakistan J Nutr 12:484–490
13. Ganle JK, Boakye PP, Baatiema L (2019) Childhood obesity in urban Ghana: evidence from a cross-sectional survey of in-school children aged 5–16 years. BMC Public Health 19:1561. https://doi.org/10.1186/s12889-019-7898-3
14. Bhimma R, Naicker E, Gounden V, Nandlal L, Connolly C, Hariparshad S (2018) Prevalence of Primary Hypertension and Risk Factors in Grade XII Learners in KwaZulu-Natal, South Africa. Int J Hypertens. 2018:1–9. https://doi.org-/10.1155/2018/3848591
15. Oduwole A, Ladapo T, Fajolu I, Ekure E, Adeniyi OF (2012) Obesity and elevated blood pressure among adolescents in Lagos, Nigeria: a cross-sectional study. BMC Public Health

12:616–622

16. Salman Z, Kirk G, de Boer M (2010) High rate of obesity related hypertension among primary school children in Sudan. Int J Hypertens 22(629492):629492
17. Huh D, Stice E, Shaw H, Boutelle K (2012) Female Overweight and Obesity in Adolescence: Developmental Trends and Ethnic Differences in Prevalence, Incidence, and Remission. J Youth Adolescence 41:76–85. https://doi.org-/10.1007/s10964-011-9664-4
18. Spinelli A, Buoncristiano M, Kovacs V (2019) Prevalence of Severe Obesity among Primary School Children in 21 European Countries. Obes Facts 12:244-258.
19. Thaker V (2017) Genetic And Epigenetic Causes Of Obesity. Adolesc Med State Art Rev 28:379–405
20. Gupta S, Kapoor S (2010) Sex differences in blood pressure levels and its association with obesity indices: Who is at greater risk? Ethn Dis 20:370–375
21. Amoah A (2003) Obesity in adult residents in Accra, Ghana. Ethn Dis 13:97-101.
22. Peltzer K, Pengpid S (2011) Overweight and obesity and associated factors among school-aged adolescents in Ghana and Uganda. Int J Environ Res Public Health 8:3859-3870.
23. Negash S, Agyemang C, Matsha TE, Peer N, Erasmus RT, Kengne AP (2017) Differential prevalence and associations of overweight and obesity by gender and population group among school learners in South Africa: a cross-sectional study. BMC Obesity 4:29. https://doi.org/10.1186/s40608-017-0165