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THE PREVALENCE OF CHILDHOOD OBESITY AND LIFESTYLE-ASSOCIATED RISK FACTORS USING ANTHROPOMETRIC MEASUREMENTS AMONG PRIMARY SCHOOLS IN THE KUMASI METROPOLIS, GHANA

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ABSTRACT

This cross-sectional study was aimed at determining the prevalence of childhood obesity and the risk factors in primary school children within the Kumasi metropolis. A total of 303 children aged 6-12 years were recruited from six schools, from both private and Government, using simple randomized sampling. Anthropometric parameters including BMI, waist circumference, height, weight and hip circumference were measured. A self-administered, semi quantitative questionnaire on demography, diet, physical activity and socioeconomic status of subject's parents/guardians were also determined. The prevalence of childhood obesity was 2.3%. Children from the private schools were more likely to be overweight (20.9% vs. 3.7%; p<0.0001) and obese (4.3% vs. 0.61%; p<0.0001) than those from government schools. Central adipocity was associated with children who went to school by car, Private Schools, children from low income parents, low physical activity, and fast food intake (p<0.05). Overall prevalence of central obesity was 6.3%. Prevalence of Obesity using Percentage body fat was 7.6%. A significant and high mean Body Mass Index, Waist Circumference, Hip Circumference, Waist to Height Ratio and Percentage Body Fat was observed in private schools than government schools (p<0.0001). Multinomial logistic regression indicated that children from private schools (aOR 5.741, 95% CI (1.97-17.01), children from high income earned parents (aOR 9.895, 95% CI (1.188-82.39) and fast food intake (aOR 2.002, 95% CI (0.321-12.49) are independent risk factors of obesity. This study showed that primary school children in the Kumasi city of Ghana are more likely to be overweight and obese and the need to monitor their food and physical activity would be helpful.

Keywords: Childhood, Obesity, overweight, risk factors, private school, government school

INTRODUCTION

Obesity epidemic across the globe is affecting an estimated ten percent of school-aged children being overweight and one quarter of these being obese[1]. Childhood obesity was considered a problem of affluent countries, but today this problem is appearing even in developing countries including Ghana, especially in the affluent urban population[2]. The prevalence however, varies from country to country depending on the lifestyle, kind of diet and environmental factors[3]. A study conducted[4] in Nigeria identified the prevalence of overweight, obesity and thinness as 11.4%, 2.8% and 13.0% respectively among children aged 5 to 18 years. Similar findings have been reported in South Africa, Tanzania, Pakistan, Mexico, Australia and Brazil[5, 6]. In Ghana varying prevalence have been reported by different authors[2,7].

Although the mechanism of obesity development is not fully understood, it has been established that obesity is a result of excess energy intake over expenditure. There are multiple etiologies for this imbalance and hence the rising prevalence of obesity cannot be addressed by a single etiological factor. Genetic factors, environmental factors, lifestyle preference and cultural influence play key roles in a child's susceptibility to obesity[8].

The definition of obesity and overweight has changed over time[9]. Over reliance on the BMI alone in determining body adiposity by the Ministry of Health and Ghana Health Service, and

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its wrong interpretation in Ghana has led to the underutilization of other appropriate techniques such as waist circumference, percentage body fat, hip circumference and waist-to-height-ratio and this has consequently resulted in controversies in published data on childhood obesity. Although childhood obesity defined by BMI percentile have been extensively explored by previous studies in Ghana, data on the combination of BMI and central obesity measurement such as WC and WHtR in children is scarce. To the best of our knowledge no data on childhood obesity and its determinant have been reported in the Kumasi metropolis, thus necessitating this study. This study was aimed at determining the prevalence and risk factors of childhood obesity among primary school children in the Kumasi metropolis, paying particular attention to those in Government and Private school. In Ghana most children attending private schools come from parents of high or middle income earners as opposed to low income earners whose wards attend public schools where the fees are relatively cheaper.

MATERIALS AND METHODS

Study design/settings

This comparative cross-sectional study was conducted in the Kumasi metropolis from September, 2013 to March, 2014

Study population/Subjects selection

Children aged 6-12 years attending government and private schools in the Kumasi metropolis were recruited for this study. A total of three hundred and three (303) children were recruited, of these participants 139 from private and 169 from government schools) were recruited using simple randomized sampling. Selected children completed a self-administered, semi quantitative questionnaire on demography, diet, physical activity and socioeconomic status of subject's parents/guardians. Ethical approval was sought for and granted by the Committee on Human Research, Publications and Ethics (CHRPE), Kwame Nkrumah University of Science & Technology (KNUST). Written informed consent was obtained from all the school authorities, parents/guardian of all subjects.

Inclusion and Exclusion criteria

The study included school going children who are between the ages of 6 and 12 years. Children who were less than 6 years old or more than 12 years old, and those who were physically deformed or challenged were excluded from the study.

Anthropometric measurements

Body weights were measured (to the nearest 0.5 kilogram), with the subject standing on a weighing scale (wearing light clothing) after the weighing scale was adjusted to zero kilogram, and calibrated using known weights. Heights were measured (to the nearest 1.0 centimeter), with the subject standing in an erect position against a vertical scale of a standiometer (Fischer Scientific) and an L-square placed on the head, and the head positioned so that the top of the external auditory meatus was in level with the inferior margin of the bony orbit. Waist circumference (WC) was measured to the nearest 0.1 cm horizontally at the narrowest point between lower end of the rib cage and iliac crest. Hip circumference was measured to the nearest 0.1 cm at the greatest horizontal circumference below the iliac crest at the level of greater trochanter (the widest portion on the buttocks). Waist and hip circumference were measured with an inelastic tape measure.

Definition of anthropometric terms

The children were categorized into four groups: underweight (<5th percentile), normal (>5th percentile, <85th percentile), overweight (≥85th percentile) and obese (>95th percentile) using age- and sex-specific percentiles of BMI. Percentage of body fat (%BF) was calculated by using the formula: (1.51 × BMI) − (0.70 × Age) − (3.6 × Sex) + 1.4, where sex was coded as 1 for males and 0 for females[10] Males with % BF <24 were classified as normal and those with %BF ≥25 were classified being obese. Females with %BF<29 were classified as normal and those with %BF≥29 were classified as being obese. Central obesity was defined as having both age- and gender-specific WC percentile ≥90th and WHtR≥0.5 [11, 12].

Statistical analysis

Data were entered into Microsoft Excel 2010 and statistical analyses performed using GraphPad Prism 6.0 (GraphPad software, San Diego California USA, www.graphpad.com). Categorical variables are presented in frequency (proportion) and test of association between proportions was done using Fischer's exact test. Unpaired sample t-test was used in comparison between two continuous variables, which were expressed as means ± SD. $p<0.05$ was considered as statistically significant level.

RESULTS

General characteristics of study population are shown in Table 1. Most of the participants were within age group 9-11years. High proportions of

the subjects were from government (54.1%) and the rest from private schools (45.9%). Females (51.2%) were more prevalent than male (48.8%) (p=0.7295). A significant and high proportion of the children who stayed with both parents were from private school (69.1% vs. 59.8%) though little percentage of them had guardians (5.8% vs. 22.0%). High percentage of fathers and mothers with formal occupation had children in private (25.9% and 13.7%) than in government school (15.9% and 6.1%) respectively (p<0.05). Conversely, children whose fathers and mothers had informal occupation were more prevalent in the government schools (84.1% and 93.9%) than in

TABLE 1. GENERAL CHARACTERISTICS OF STUDY POPULATION STRATIFIED BY TYPE OF SCHOOL

Variables	Overall (n=303)	Type of primary school		P-value
		Government (n=164)	Private (n=139)	
Age range (years)				
6-8	124 (40.9)	48 (29.3)	76 (54.7)	< 0.0001
9-11	144 (44.2)	85 (51.8)	49 (35.3)	< 0.0001
≥12	45 (14.9)	31 (18.9)	14 (10.1)	< 0.0001
Gender				
Male	148 (48.8)	82 (50.0)	66 (47.5)	0.7295
Female	155 (51.2)	82 (50.0)	73 (52.5)	0.7295
Parenting				
Single	65 (21.5)	30 (18.3)	35 (25.2)	< 0.0001
Both	194 (64.0)	98 (59.8)	96 (69.1)	< 0.0001
Guardian	44 (14.5)	36 (22.0)	8 (5.8)	< 0.0001
Father Occupation				
Formal	62 (20.5)	26 (15.9)	36 (25.9)	0.033
informal	240 (79.2)	138 (84.1)	102 (73.4)	0.0235
Unemployed	1 (0.3)	0 (0.0)	1 (0.7)	0.4587
Mother Occupation				
Formal	29 (9.6)	10 (6.1)	19 (13.7)	0.0168
informal	272 (89.8)	153 (93.3)	118 (84.9)	0.0472
Unemployed	2 (0.7)	1 (0.6)	1 (0.7)	1.0000
Parent economic income				
<500.00	230 (75.9)	135 (82.3)	95 (68.3)	0.0068
501-999.00	61 (20.1)	22 (13.4)	39 (28.1)	0.0024
≥1000.00	12 (4.0)	7 (4.3)	5 (3.6)	1.0000
School-going mode				
Foot	174 (57.4)	125 (76.2)	49 (35.3)	< 0.0001
Car/vehicle	129 (42.6)	39 (23.8)	90 (64.7)	< 0.0001
Physical activity (time per wk.)				
Once	29 (9.6)	9 (5.5)	20 (14.4)	0.0105
1-2	77 (23.1)	29 (17.7)	48 (34.5)	< 0.0001
≥3	197 (65.0)	126 (76.8)	71 (51.1)	< 0.0001
Sedentary activity (hrs. per day)				
<1	108 (35.6)	44 (26.8)	64 (46.0)	0.0007
1-2	167 (52.5)	93 (56.7)	74 (53.2)	0.8184
≥3	28 (9.2)	27 (16.5)	1 (0.7)	< 0.0001

Data are presented as frequency (proportion) and compared using Fischer's exact test.

private school (p<0.05). Most of the children whose parents earned less than GHS 500.0 income per month were in government schools (82.3% vs. 68.3%). However, higher proportion of children were observed among private schools, whose parents earned between GHS 501-999. 00 and GHS ≥1000.00 (28.1% and 3.6% respectively) than government school children (13.4% and 4.3%). A significant (p<0.0001) increased percentage was observed among government children (76.2%) than private school children (35.3%) who went to school on foot. On the other hand, most of the children from private schools boarded cars to school (64.7% vs. 23.8%) (p<0.0001). Children in government schools (76.8%) were involved in physical activities for more than 3 times per week than privates school children (51.1%) (p<0.0001). Similarly, less of the government school children (16.5%) did sedentary activity for more than 3 hours per week than private school children (0.7%) (p<0.001) (**Table 1).**

Table 2 shows demographic and anthropometric measurements of the studied population. The mean age of all enrolled population was 9.2 ± 0.11years. Children from government school were older (9.6 ± 0.147) than their private school counterparts (8.7 ± 0.156) (p<0.0001). A significant (p=0.005) and higher number of siblings were observed among government (3.41 ± 0.15) than private school children (2.83 ± 0.13). Children from private schools were heavier (33.45 ± 1.10kg) and taller (1.35 ± 0.09m) than their government school mates (27.55 ± 0.72kg and 1.34 ± 0.01m). A statistical significant difference (p<0.001) was observed between the mean weights, though no significance difference between mean height of the two schools was observed (p=0.611). A significant and high mean BMI, WC, HC, WHtR and %BF was observed among children from private schools compared to their government school counterparts (p<0.0001). Though increased mean WHR was observed in private school than government schools, there were no statistical significant difference between their means (p=0.814) **(Table 2).**

TABLE 2: DEMOGRAPHIC AND ANTHROPOMETRIC MEASUREMENTS OF THE STUDIED POPULATION STRATIFIED BY TYPE OF SCHOOL

Variables		Type of primary school		
	Total (n=303)	Government (n=164)	Private (n=139)	P-value
Age	9.2 ± 0.11	9.6 ± 0.147	8.7 ± 0.156	< 0.0001
Number of siblings	3.14 ± 0.105	3.41 ± 0.15	2.83 ± 0.134	0.005
Weight	30.26 ± 0.69	27.55 ± 0.72	33.45 ± 1.10	< 0.0001
Height	1.35 ± 0.007	1.34 ± 0.013	1.35 ± 0.099	0.611
BMI	16.21 ± 0.24	14.95 ± 0.24	17.7 ± 0.42	< 0.0001
Waist circumference	60.80 ± 0.52	58.42 ± 0.52	63.61 ± 0.90	< 0.0001
Hip circumference	72.69 ± 0.7	69.77 ± 0.70	76.14 ± 1.10	< 0.0001
Waist/Hip ratio	0.791 ± 0.003	0.792 ± 0.004	0.794 ± 0.004	0.814
Waist / height ratio	0.538 ± 0.003	0.519 ± 0.004	0.562 ± 0.005	< 0.0001
% Body fat	14.89 ± 0.38	12.67 ± 0.36	17.54 ± 0.64	< 0.0001

Data are expressed as means ± SD. P-value defines the level of significance when private was compared to public (unpaired t-test)

A statistical significant difference and greater proportion of the children in the private schools (20.9%) (Fig 1iii) were more likely to be overweight compared to their counterparts from the government schools (3.7%)(p < 0.0001). The prevalence of obesity (Fig 1iv) and underweight (Fig 1i) was significantly higher in the private schools (4.3%) and 5.3%) respectively than in government school (0.61% vs 2.4%; p < 0.0001). The overall prevalence of overweight and obesity among the school children was 11.6% (35/303) and 2.3% (7/303) respectively.

Comparison of children who are Normal weight and Obese to type of school as determined by % body fat (BF). Comparison between proportions was analyzed using Fischer's exact test.

Most of the children from the government schools had normal weight (98.2%) than those from private school (86.6%) (p<0.0001) (Fig 2i).

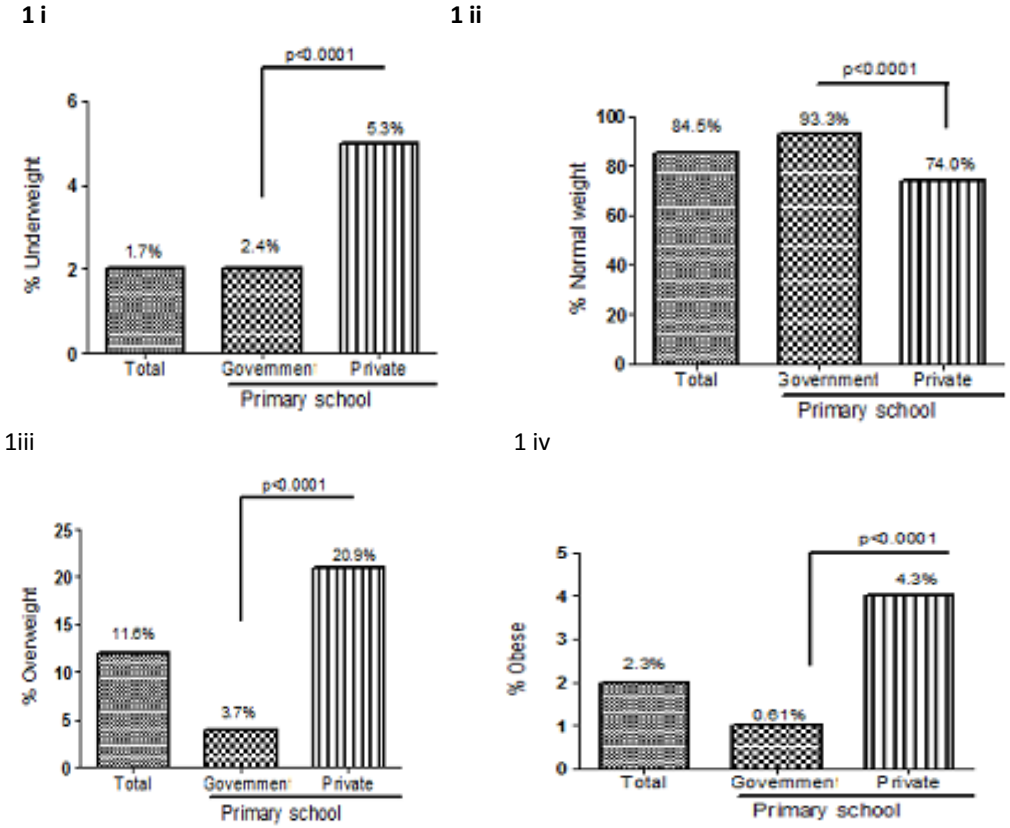

Fig 1. Comparative analysis of BMI classification based on age-and-sex specific percentiles and type of school. Comparison between proportions was analyzed using Fischer's exact test.

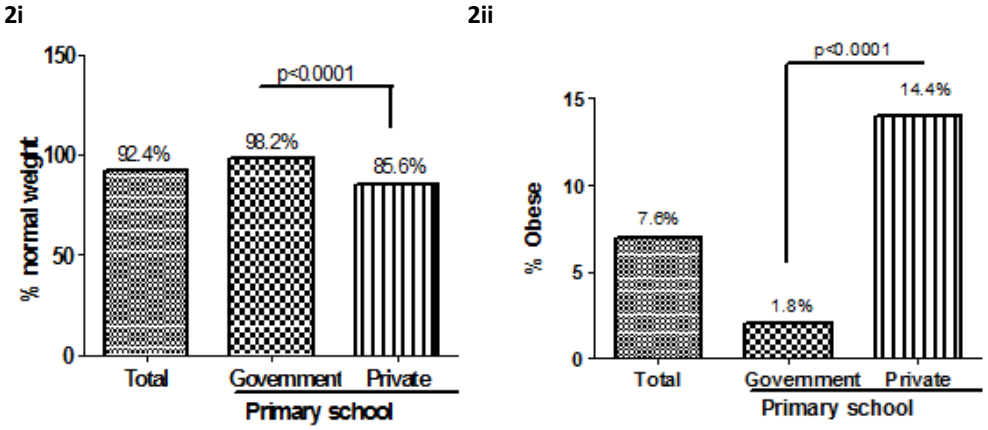

Fig. 2 : A comparison of body weight in children based on the percentage body fat in different schools

However, a significant and increased proportion of children from the private schools were obese (14.4% vs. 1.8%, p<0.0001) (Fig. 2ii). The overall prevalence of obesity using % BF was 7.6% (23/303).

Table 3 presents the general characteristics of the enrolled children stratified by BMI classifications based on age-and-sex specific percentiles. High proportion of overweight (48.6%) and obese (42.9%) children were within aged group 9-11years. Most of the females were overweight and obese (57.1% and 57.1%) than their male counterpart (42.9% and 42.9%). Similar to overweight children (88.6% vs. 85.7%) a greater proportion of obesity (100% vs. 85.7%) was observed among children whose mothers and fathers had informal occupation. A higher percentage of the children whose parents earned less than GHS 500.0 income per month were obese

(85.7%) and overweight (82.9%) than those who earn GHS ≥1000.00 (0.0% vs. 8.6%). A significant (p<0.0001) and increased proportion of children who went to school by foot were obese than overweight (57.1% vs. 25.7%). However, those who went by car were less likely to be obese (42.9%) but high percentage of them were overweight (74.3%) (p=0.001). Children who exercised once per week, work for 1-2hr per day and eat fast foods were more likely to be obese (57.1%; 100.0%; 71.4%) **(Table 3).**

Table 3: General characteristic of the studied population stratified by BMI classifications

Variables	BMI status				
	Underweight (n= 5)	normal (n=256)	overweight (n=35)	Obese (n=7)	p-value
Age Mean ± SD	9.40 ± 0.924	9.17 ± 0.121	9.29 ± 0.31	9.14 ± 0.17	0.980
Age range (years)					
6-8	2 (40.0%)	106 (41.4%)	13 (37.1%)	3 (42.9%)	0.938
9-11	2 (40.0%)	112 (43.8%)	17 (48.6%)	3 (42.9%)	0.876
≥12	1 (20.0%)	38 (14.8%)	5 (14.3%)	1 (14.3%)	0.943
Gender					
Male	2 (40.0%)	128 (50.0%)	15 (42.9%)	3 (42.9%)	0.832
Female	3 (60.0%)	128 (50.0%)	20 (57.1%)	4 (57.1%)	0.826
Father Occupation					
Formal	1 (20.0%)	55 (21.5%)	15 (14.3%)	1 (14.3%)	0.998
informal	4 (80.0%)	201 (78.5%)	30 (85.7%)	6 (85.7%)	0.797
Unemployed	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
Mother Occupation					
Formal	0 (0.0%)	24 (9.4%)	4 (11.4%)	0 (0.0%)	0.7431
informal	5 (100.0%)	230 (89.8%)	31 (88.6%)	7 (100.0%)	0.899
Unemployed	0 (0.0%)	2 (0.8%)	0 (0.0%)	0 (0.0%)	-
Parent economic income					
<500.00	4 (80.0%)	191 (74.6%)	29 (82.9%)	6 (85.7%)	0.459
501-999.00	1 (20.0%)	56 (21.9%)	3 (8.6%)	1 (14.3%)	0.0578
≥1000.00	0 (0.0%)	9 (3.5%)	3 (8.6%)	0 (0.0%)	0.187
School-going mode					
Foot	3 (60.0%)	158 (61.7%)	9 (25.7%)	4 (57.1%)	<0.0001
Car/vehicle	2 (40.0%)	98 (38.3%)	26 (74.3%)	3 (42.9%)	0.001
Physical activity (time per week)					
1	1 (20.0%)	12 (4.7%)	12 (34.3%)	4 (57.1%)	0.0012
1-2	0 (0.0%)	56 (21.9%)	12 (34.3%)	2 (28.6%)	0.0482
≥3	4 (80.0%)	188 (73.4%)	11 (31.4%)	1 (14.3%)	<0.0001
Sedentary activity (hrs. per day)					
<1	2 (40.0%)	93 (36.3%)	13 (37.1%)	0 (0.0%)	0.286
1-2	2 (40.0%)	137 (53.5%)	21 (60.0%)	7 (100.0%)	0.0117
≥3	1 (20.0%)	26 (10.2%)	1 (2.9%)	0 (0.0%)	0.0159
Fast food intake					
Yes	2 (40.0%)	73 (28.5%)	22 (62.9%)	5 (71.4%)	0.0391

Data are presented as frequency (proportion) and compared using Fischer's exact test.

Central obesity was highly prevalent among private school children (12.2%) than among their

counterparts at government school (1.2%) (p<0.0001). Children whose parents earned GHS <500.00 recorded the highest prevalence of central obesity compared to those who earned GHS 501-999.00 (7.4% vs. 3.4%) (p<0.0001). A significant (p<0.0001) and increased prevalence were recorded for children who went to school by car than in their counterpart came on foot (13.2% vs. 1.1%). Increased prevalence of central obesity was associated with decreased duration of physical activities per week (once (34%); 1-2 times (7.1%); ≥3 time 2.0%) (p=0.0076). Fast food intake (14.7%) was significantly associated with central obesity compared to children who did not eat fast foods (1.9%) (p<0.0001). Overall prevalence of central obesity was 6.3% **(Table 4).**

5.741, 95% CI (1.97-17.01), children from high income earned parents (aOR 9.895, 95% CI (1.188-82.39) and those who eat fast food (aOR 2.002, 95% CI (0.321-12.49) (**Table 5).**

DISCUSSION

Overweight and obesity have been proven to be predisposing factors for the development of type 2 diabetes mellitus and other cardiovascular related diseases even among children [13]. In recent times focus has been, not only the amount of fat associated with obesity but its distribution. Waist circumference, waist-to-hip ratio and waist-to-thigh ratio; indicators of visceral adiposity have been implicated as makers of obesity[14]. Childhood obesity is becoming a global concern because of the

TABLE 4. PREVALENCE OF CENTRAL OBESITY AMONG PRIMARY SCHOOL CHILDREN AGED 6-12 YEARS

Variables	WC≥ 90th percentile		WHtR ≥ 0.5		Central Obesity	
	n= 27(%)	p-value	n= 223 (%)	p-value	n= 19 (%)	p-value
Gender						
Male	14 (4.6)	0.8411	110 (36.3)	0.7966	9 (2.9)	0.8411
Female	13 (4.3)		113 (37.3)		10 (3.3)	
Primary school						
Government (n=164)	4 (2.4)	<0.0001	104 (63.4)	<0.0001	2 (1.2)	<0.0001
private (n=139)	23 (16.5)		119 (85.6)		17 (12.2)	
Parent income						
<500.00 (n=230)	22 (9.5)	<0.0001	167 (72.6)	<0.0001	17 (7.4)	<0.0001
501-999.00 (n=61)	3 (4.9)		47 (77.0)		2 (3.2)	
≥1000.00 (n=12)	2 (16.7)		9 (75.0)		0 (0.0)	
School-going mode						
Foot (n=174)	5 (2.9)	<0.0001	113 (64.9)	<0.0001	2 (1.1)	<0.0001
Car/vehicle (n=129)	22 (17.1)		110 (85.3)		17 (13.2)	
Physical activity (time per week)						
once (n=29)	12 (41.3)	0.006	27 (93.1)	0.001	10 (34.0)	0.0076
1-2 (n=70)	8 (11.4)		58 (82.6)		5 (7.1)	
≥3 (n=197)	7 (3.6)		133 (67.5)		4 (2.0)	
Fast food intake						
Yes (n=102)	18 (17.6)	<0.001	82 (80.4)	<0.0001	15 (14.7)	<0.0001
No (n=201)	9 (4.5)		141(70.1)		4 (1.9%)	

Central obesity or adiposity was defined as children with both WC ≥ 90th percentile and WHtR ≥ 0.5.

Multivariate logistic regression analysis was adjusted simultaneously for socio-demographic and lifestyle-related factors significantly associated with central obesity and controlled for age and gender. Significant independent predictors of obesity included private school children (aOR

associated risk factors**.** No published data is available on the prevalence and associated risk factors of childhood obesity in the Kumasi population. We investigated the prevalence of childhood obesity and its lifestyle-associated risk

TABLE 5. Logistic regression analysis of socio-demographic and life-style related factors associated with obesity based on age-and-sex specific percentile among primary school children aged 6-12 years

Variables	Adjusted OR (95% CI)	P-value
Primary school		
Private (n=164)	5.741 (1.97-17.01)	0.002
Government (n=139)	Reference (1.0)	
Parent income		
<500.00 (n=230)	Reference (1.0)	
501-999.00 (n=61)	2.121 (0.354-12.71)	0.410
≥1000.00 (n=12)	9.895 (1.188-82.39)	0.034
School-going mode		
Foot (n=174)	Reference (1.0)	
Car/vehicle (n=129)	1.745 (0.721-4.230)	0.217
Physical activity (time per week)		
once (n=29)	Reference (1.0)	
1-2t (n=70)	0.52 (0.014-0.187)	0.075
≥3 (n=197)	0.371 (0.141-0.975)	0.673
Fast food intake		
Yes (n=102)	2.002 (0.321-12.49)	0.038
No (n=201)	Reference (1.0)	

The model is controlled for age and gender

factors among basic school children aged 6-12 years in the Kumasi metropolis of Ghana.

The estimated prevalence of overweight and obesity among the enrolled children in this study was 11.6% and 2.3% respectively when BMI for age was used as the indicator for obesity. This prevalence rate compares well with the 4.98% and 2.24% quoted for overweight and obesity respectively[15] in children age 6 to 12 years in the Union territory of Puducherry. In a study in Kerala, the reported prevalence rates of overweight was 8.66% and that for obesity was 4.69% with other findings in the same region showing an increased prevalence of overweight and obesity from 4.94% and 1.26% in 2003 to 6.57% and 1.89% in 2005 with particular rise in the age group of 5 – 11 years[16]. These reported rates although giving an indication of a rise in prevalence rates were however lower compared to that estimated from this study.

The obesity prevalence from this study is lower than the 10.9% childhood obesity reported among Ghanaian children in a university primary school (private)[7] and the 7.5% reported among school children aged 6 to 12 years in the Tamale Metropolis (public)[2]. This might be probably due to the differences in the number of participants involved, genetics or geographical location. The findings from Mohamed and Vuvaor[7], where a majority of the children at the University primary school (Private) come from higher incomes earner parents is not surprising, because our data showed that children from more affluent parents were more likely to be obese. Notwithstanding, the fact that the estimated childhood obesity rate from this study compares well with the 4.98% and 2.24% quoted for over-weight and obesity[15] respectively indicates that, the evidence of childhood obesity emerging as a public health related problem in the Kumasi metropolis is imminent as related in some available literature[17]. The combined prevalence of overweight and obesity estimated from this study was 13.9% which is indeed indicative of an increased tendency of worsening future trends of childhood obesity with its associated problems within the Kumasi metropolis. More of the overweight children who are not yet obese are likely to become obese in the next few years if proper measures are not put in place to solve the problem.

Recruiting children from private and public schools in this study indicated clearly that children from the private schools are more likely to become overweight and obese compared to their counterparts from the public schools (Figure 1) as

related in the study of Al-Hazzaa[18] and Amidu[2] with associated factors being parents/guardians with either relatively high socio-economic status or going to school by car, reduced physical activity and fast food intake which has become a status of affluence in most Ghanaian societies (Table 3).

A greater proportion of the centrally obese children belonged to parents who had informal occupation. The study revealed a significant association between informal occupation of parents and the development of central obesity in children. This may be due to the fact that though they had informal occupation many of them had high economic income. Hence such parents are more likely to provide their children enough money to buy fizzy drinks and unhealthy foods considered to be "rich" but which in actual sense has little nutritional value and contain a lot of fat[2]. Education level of parents and guardians also significantly contribute to child obesity. Even though parental educational levels were not specifically spelled out in this study, it is assumed that a lot of the parent in formal jobs had formal higher education to at least secondary level and such parents may prepare balance meals at home and encourage their children to live healthy life-styles.

This study observed no direct and clear correlation between total body fat and risk for obesity and its related conditions. This makes BMI alone insufficient for determining the risk of obesity and its associated conditions. In this study for example, children who went to school on foot were found to be more likely obese than their counterparts who went to school by car when BMI specific for age and sex was used as an index for obesity. However, when other indicators of body fat distribution such as WC, WHR and WHtR were used, a greater percentage of children who went to school by car were more centrally obese than those who went to school on foot. Excess abdominal fat on the other hand predisposes one to obesity related disease regardless of overall body fat. This highlights the importance of measuring waist circumference (WC) and waist to height ratio (WHtR) as indicators of central obesity in children. The overall prevalence of central obesity in this study was 6.2% when WC and WHtR were used together to assess fat distribution in the children. This value is higher as compared to the 2.3% obtained when BMI for age alone was used. It is important to note that two children with very similar BMI's may have significant difference in the proportion of abdominal fat. Thus a child with a BMI in the normal weight range may exceed the safe range of abdominal fat. WC increased with age among both boys and girls consistent with previous literature [19]. There was no gender disparity in WC values in line with previous findings in children aged five to twelve years[20]. WC remains the simplest clinical measure of childhood central obesity and it provides a better estimate of visceral adipose tissue than body mass index (BMI) and it is significantly a better marker than BMI in predicting insulin resistance, blood pressure, and serum cholesterol and triglyceride levels[21] The results from this study compares well with previous studies which strongly correlated WHtR to the risk of central adiposity, cardiovascular and metabolic disease in children and it has been proposed as an alternative measure for assessing central fatness in children especially for pediatric primary care practice and epidemiological studies as it is a relatively age-independent measure[22].

Researchers have made suggestions that childhood obesity is largely the result of a decline in regular physical activity[2]. A review of other literature suggests that overweight among pre-school children, as well as older children, may be associated less with increased energy intake and more with low physical activity[23]. Previous studies hypothesized that playing games or watching television cause obesity by one or more of three mechanisms: displacement of physical activity, increased calorie consumption while playing games or watching TV and reduced basal metabolism[24, 25]. Although not the main focus of the study it is worth-mentioning that the estimated underweight prevalence rate from the study was 1.7%. It is therefore important to note that overweight/obesity and underweight co-exist in school going children within the Kumasi metropolis.

CONCLUSION

Overweight, obesity and underweight co-exist among children of school-going age within the Kumasi metropolis and reduced physical activity and high fast food intake are associated with the estimated prevalence rates of overweight, obesity and underweight observed among the children. Childhood obesity is on the increase but central obesity among children is a new emerging public health problem within the Kumasi metropolis and effective control measures must be put in place to avert the situation among children of this age group. The combined use of WC and WHtR is more sensitive in assessing excess fat distribution in children than BMI for age. The negative attitude of some parents towards outdoor physical activities and their lack of dietary control on a child's weight status should be addressed with proper public

education of parents on the effects of obesity on the health of children. Parents as well as school authorities should be advised not to make fizzy drinks available for children either at school or at home. In addition, the positive effects of cycling should be encouraged among the children even if not as a means of going to school but as a form of moderate to intense physical activity during their leisure periods.

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Conflict of interest

Authors have declared that no conflicting interests exist

Authors' contribution

RAN and CO designed the study and its coordination and participated in the drafting of the manuscript. EG carried out the administration of the questionnaire and measurement of all anthropometry. EOA performed the statistical analysis and helped in the drafting of the manuscript. All authors read and approved the manuscript

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