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ORIGINAL RESEARCH

Over-nutrition among primary school pupils in a semi-urban Local Government Area, Southwestern Nigeria

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Abstract

Background: Studies from the developing countries suggest that childhood obesity is more prevalent in the urban settings. The search for childhood overweight/obesity (over-nutrition) needs to go beyond the urban into the semi-urban and rural areas.
Objectives: To determine the prevalence of over-nutrition and the associated factors among primary school pupils in Ikenne Local Government Area of Ogun State, Nigeria.
Methods: This was a cross-sectional analytic study of pupils from 15 schools (10 public and 5 private) using the multistage random sampling and the proportionate sampling techniques. Data were collected using an interviewer-administered questionnaire, data on physical activity, household possessions, dietary practices and relevant physical findings were obtained.
***Results*:** A total of 422 pupils were studied; the age ranged between 18 and 192 months with a mean of 107.2 ± 36.4 months. The prevalence of Overweight/Obesity (Over-nutrition) was 6.4% with male predominance: 8.1% vs 4.4% without statistical significance ($p = 0.19$). Over-nutrition was significantly more prevalent among pupils aged <5 years and in the pupils of private schools ($p = 0.000$ and $p = 0.007$ respectively) and significantly related to the Dietary Diversity Score ($p = 0.0001$). Over-nutrition was more frequent among children whose parents had a university education and were middle level civil servants without statistical significance. ($p = 0.66, 0.19$ respectively). Group physical activity was low in 96.3% and Food Frequency Score was poor in 87.5% of the overweight/obese pupils. Female gender, longer duration of breastfeeding and the delay in weaning significantly correlated with childhood over-nutrition.
Conclusions: Over-nutrition is not uncommon in the semi-urban Nigerian setting. The early life feeding practices, the quality of the child's diet and physical activities appear to be important contributors to childhood over-nutrition in this setting.

Key words: Dietary Pattern, Food Frequency Score, Dietary Diversity Score, Over-nutrition, Primary school.

Introduction

Obesity is a recognized public health problem and an emerging global epidemic. [1] The Centre for Disease Prevention and Control (CDC) defined childhood obesity as Body Mass Index (BMI) at or above the 95th percentile for sex and age on the CDC (2000) Growth Chart [2] while overweight is defined as excess body weight at or above the 85th centile but less than 95th centile. [3] The complications of childhood obesity may occur early and these include obstructive sleep apnea, joint deformity, pre-diabetes, elevated blood pressure, stigmatization, psychological problems such as poor self-esteem and ultimately, poor school performances. [4] The late complications of childhood obesity include obesity in adulthood, hypertension, diabetes mellitus, osteoarthritis and malignancies. [1]

The major cause of obesity is caloric imbalance as lesser calories are expended for the amount of calories consumed. [4] The pathological process of obesity relies on genetic and environmental factors. [5] This explains the common findings of childhood obesity among certain ethnic and socioeconomic groups. A study among obese children and adolescents in the United States of America (USA) revealed that the Hispanics and Blacks were more obese than the Whites and Asians (22.4%, 20.2%, 15.1%, and 8.6%) respectively. [2] The environmental factors, when present, enhance the genetic predisposition to obesity. The environmental factors include the availability of food, attitude towards food and choice of diet. [4] Other factors associated with obesity include improved standard of living, lifestyle modifications [5] and educational level of parent or adult head. [2, 6]

The prevalence of childhood obesity in developing countries was often thought to be lower than that of developed countries. [7] However, recent findings seem to suggest that the developing countries are now faced with a double burden of increasing childhood obesity in addition to earlier known problems of underweight. [1] This has led to a shift in the earlier recognized major contributors to childhood mortality to include non-communicable diseases. [8] In Nigeria, the reported prevalence of childhood obesity is between 1.1% and 5.8% [1] with regional variations. [9-11] A higher prevalence (10.9%) of childhood obesity was reported in Ghana. [7] There are suggestions from studies conducted in the developing countries that childhood obesity is more prevalent in the urban settings and among the affluent. [12] Therefore, there is a tendency that all efforts geared towards a reduction in prevalence of obesity will be directed at the urban settings, leaving out the rural areas where underweight is known to be more prevalent. [13] However, in the face of significant urbanization and improvement in global communication technology, even in the developing nations, it is imperative to determine the presence and magnitude of over-nutrition in the rural/semi-urban settings in order to reduce the health implications of the double burden of disease. Therefore, this study sets out to determine the prevalence of childhood over-nutrition and factors that could be associated with it, among children attending primary schools in Ikenne Local Government Area of Ogun State, Nigeria.

Methods

Study Location

Ikenne Local Government Area is located in Ogun State and is situated at 6°52'N and 3°43'E. The Local Government Area is semi-urban and comprises of five major towns namely Iperu, Ilishan, Ogere, Irolu and Ikenne. The towns are, however, not homogenous as some of the towns are more cosmopolitan than others. The inhabitants are mainly Yorubas and traders who often travel for days in pursuit of their trade. The Local Government Area (LGA) is divided into ten (10) political wards with Iperu having three (3), Ikenne, Ilishan and Ogere have two (2) each and Irolu has one (1). Although there are 22 and 39 public and private primary schools respectively within the LGA, enrollment in public schools is about four times that of private schools (Source: Unpublished data obtained from the Ikenne Zonal Education Office).

Study Design

A cross-sectional analytic study was carried out among a representative sample of primary school pupils in Ikenne LGA between May and July 2016.

Study population

The pupils were between Kindergarten and Primary Six classes in fifteen Primary Schools (ten public and five private) from across all the political wards in the LGA.

Inclusion criteria

All the pupils in the selected primary schools without any known chronic ailment and whose parents consented.

Sample size calculation

Using the formula for descriptive studies ($N = Z^2pq/d^2$), [14] the minimum sample size was estimated to be 340. Considering the number of private primary schools and the number of pupils on enrollment in the LGA, only one pupil was

randomly selected from private school for every four (4) from public school. Therefore, the estimated total number of pupils for private school was 85 and the minimum total sample size was put at 425.

Sampling technique

Multistage random sampling and proportionate sampling techniques, where appropriate, were used to select the subjects per school and class.

Ethical considerations

Ethical clearance was obtained from the Ogun State Ministry of Health while further permission to conduct the study was given by the Ogun State Ministry of Education for the attention of the Ikenne-Remo Zonal Education Office. Thereafter, a written informed consent was obtained from parents/guardians of the prospective study subjects. The principles of good clinical practice were upheld throughout the course of the study.

Data Collection

Prior to the commencement of the study, the research assistants (who were all Ordinary Diploma holders), had three pre-field training sessions on the essential parts of data collection. They all spoke the local dialect. An interviewer-administered, semi-closed ended questionnaire was used to collect data from the study participants following a meeting in the school hall with their caregivers where the latter gave written informed consent. The questionnaire was divided into sections for: the sociodemographic characteristics of the caregiver, the socio-demographic characteristics of pupils, infant and young child feeding practices, 24-hour dietary recall and the food frequency consumption within the week prior to interview. The Household Goods Possession Index (a useful indicator of a household socioeconomic status) was assessed taking into consideration the household effects, means of transportation, agricultural land, livestock/farm animals as described in NDHS 2013. [13]

Anthropometric measurements were performed by the researchers aided by research assistants, as outlined in the International Standards for Anthropometric Assessments published by the International Society for the Advancement of Kinanthropometry. [15] The weight was measured in duplicate to the nearest one decimal point using a Seca® electronic digital scale and the average of the two measurements was recorded for each subject. The height/length was also measured in duplicate using locally fabricated stadiometer and infantometer respectively, to the nearest one decimal point and the average of the two measurements was recorded for each subject. The BMI was calculated using the formula: weight in kilogram divided by height/length in meter squared (kg/m^2). The BMI was classified using the appropriate WHO simplified tables (WHO 2007). [16] Each of the pupils was physically examined for some signs of micronutrient deficiency by one of the authors (RATI) and the research assistants. The research assistants also followed up the caregiver at home to collect information on 24-hour dietary recall and the food frequency consumption in the week preceding the interview in all pupils less than 6 years old.

Statistical analysis

The recorded data were entered into the Microsoft Excel® spreadsheet, checked for accuracy through double entry of data and analysed using the Epi-Info Statistical Software version 3.5.1.

The Dietary Diversity Score was derived from the 24-hour dietary recall as described by Jee-Seon *et al*.[17] The Dietary Diversity Score rated consumption of food groups 7-8 as high, 4-6-as medium and $\leq$ 3 as low. Food frequency Consumption was scored as "rarely" if none per week, "occasionally" if 1-3 per week and "regularly" if $\geq$ 4 times per week. The Food Frequency Score (FFS) was derived from the Food Frequency Consumption over the last one week from nine food groups adapted to the known local food consumption. These were weighted appropriately as described by WFP-VAM 2008 Guidelines. [18] Food Frequency Score was rated as either acceptable, borderline or poor. The Household Goods Possession Index was rated as high, medium or low if the family had scores 13-15/15, 9-12/15 and 0-8/15 respectively.

Group Physical Activity score

The Group Physical Activity Score was subjectively

determined for older children aged six years and above. [19] This included activity at leisure times, physical activity in school during physical education classes, during recess and at home.
Frequency tables were generated for all the continuous and categorical variables. Mean values and standard deviations were compared using Student's t test or Analysis of Variance (ANOVA) as appropriate while associations between categorical variables were tested using the Chi-Squared test. Using the SPSS Software version 20, multivariate logistic regression analysis was performed to determine the factors independently contributing to over-nutrition in the population studied. The level of statistical significance (p) was put at less than 0.05.

Results

A total of four hundred and thirty -five pupils in primary schools (348 pupils from public schools and 87 from private schools) were enrolled for the study. Out of the 435 pupils enrolled, 422 were available for anthropometric assessment and 394 (90.6%) of the caregivers could be reached at home.

Demographic characteristics of the study population

There were 208 males (47.8%) and 227 (52.2%) females. The male-to-female ratio was 1:1.1. The majority of the pupils (66.9%) were within the ages of 60 and 132 months. The age ranged between 18.0 and 192.0 months with a mean of 107.2 ± 36.4 months. The mean ages of pupils in the private and public schools were 92.9 ± 29.7 months and 110.7 ± 37.0 months, respectively (t = 4.15; p = 0.0000)
Among the 422 pupils available for anthropometric measurements, the nutritional status of 197 (46.7%), 198 (46.9%) and 27 (6.4%) pupils were categorized as normal, underweight and obese/overweight respectively. Almost a half (48.3%) of the pupils were within the first and second positions in their family, mainly of the Yoruba ethnic group (86.8%) while 7.6%, 2.9% and 2.7% were Igbo, Hausa and other ethnic groups respectively as shown in Table I.

Socio-demographic characteristics of caregivers (Tables IIa and IIb)

Although only 394 caregivers were accessed, the older pupils (16-18 year old) were able to give information on their caregivers' religion, ethnicity and their own positions in the family. The majority, 389/422 (92.2%) of the caregivers were biological mothers of the pupils. The age of the caregivers ranged between 28 and 59 years with a mean of 38.8 ± 6.7 years. The male-to-female ratio was 1: ≈ 12. Three quarters (298/394; 75.7%) had up to secondary school education and they were mainly (357/394; 90.6%) junior civil servants or artisans. The Household Goods Possession Index in the 410 households surveyed was medium and low in 20.4% and 79.6% respectively.

Demographic characteristics of Overweight/ Obese pupils and their Caregivers

The demographic characteristics of the pupils with over-nutrition are depicted in Table III. The prevalence of over-nutrition was 6.4% (27/422). The mean age of pupils with over-nutrition was 72.6 ± 36.7 months. Pupils aged less than 5 years and in the Kindergarten/Nursery classes had statistically significantly higher frequency of over-nutrition ($p < 0.0001$). More males in the study population (8.4%) were overweight/obese as compared to the females (4.6%) but this was not statistically significant (p = 0.19). More of the pupils with over-nutrition (7.3%) were in the second position in their families.
As shown in Table IV, although, only 23 caregivers out of the 27 parents with overweight/obese pupils could be directly accessed, demographic information on caregivers were also supplied by the older pupils. All the caregivers of the overweight/obese pupils were females. A higher percentage of the obese pupils were found with caregivers aged 20-30 years, among the Hausas and Moslems though without statistical significance (p =0.96, 0.06 and 0.55 respectively). Over-nutrition was more prevalent among the pupils of care givers with university education and middle level civil servants. None of the caregivers of the overweight/obese pupils had high household possessions score while 9.6% had medium score.
Neither the occupation nor the education of the caregiver was significantly associated with overweight/obesity (p = 0.19 and p = 0.66 respectively).

Table I: Demographic characteristics of the school pupils

Characteristics		*Frequencies*	*Percentages*
Age in Years (n = 325)	0-59	38	8.7
	60-132	289	66.9
	>132	108	24.8
Sex (n = 325)	Male	208	47.8
	Female	227	52.2
Class (n = 325)	Nursery/Kindergarten	105	24.1
	Junior Primary (Primary 1- 3)	159	36.6
	Senior Primary (Primary 4-6)	171	39.3
Nutritional status (n = 422)	Normal	197	46.7
	Underweight	198	46.9
	Overweight/Obese	27	6.4
Ethnicity (n = 410)	Yoruba	356	86.8
	Igbo	31	7.6
	Hausa	12	2.9
	Others	11	2.7
Position of child in family (n = 412)			
	1	86	20.9
	2	113	27.4
	>2	213	51.7

Factors associated with Overweight/Obesity

Type of School and Town

As shown in Table V, more of the pupils in private schools (7/85; 8.2%) were significantly overweight/obese compared to those in public schools (20/337; 5.9%) (p = 0.007). There was also a statistically significantly higher prevalence of obesity among children in Iperu town; the various prevalence rates of overweight/obesity among the pupils was in Iperu, Ilishan, Ogere, Ikenne and Irolu were 9.3%, 6.6%, 6.0%, 3.7% and 2.2% respectively (χ^2 = 87.08; p = 0.0001).

Table IIa: Demographic characteristics of the caregivers (age, sex, religion and ethnicity)

Characteristics		*Frequencies*	*Percentages*
Age (years) (n = 394)	20-30	54	13.7
	31-40	219	55.6
	41-50	97	24.6
	51-60	19	4.8
	Unknown	5	1.3
Sex (n = 394)	Male	31	7.9
	Female	363	92.1
Religion (n = 412)	Islam	156	37.9
	Christianity	249	60.4
	Traditional	7	1.7
Ethnicity (n = 410)	Yoruba	356	86.8
	Igbo	31	7.6
	Hausa	12	2.9
	Others	11	2.7

Group Physical Activity Score (GPA)

The Group Physical Activity score (GPA) ranged between 1.1 and 3.2 with a mean GPA score of 2.4 ± 0.5. GPA was less than 3.0 among 96.3% (26/27) of the obese pupils as compared to the 87.8% in the entire population of school pupils (p = 0.13).

Majority of the pupils 24/27 of the overweight/obese pupils walked to school and spent between 3 to 30 minutes walking to school each day. The mean duration of physical activity was 11.2 ± 6.8 minutes. Although there was a significant difference in the duration of walking (p = 0.02), there was no difference in the mode of transportation in those who were overweight/obese (p = 0.39)

Table IIb: Demographic characteristics of the caregivers (education, occupation, Household Goods Possession Index)

Characteristics		*Frequencies*	*Percentages*
Education (n = 394)	University	22	5.6
	Post-secondary	35	8.9
	Secondary	241	61.2
	Primary	86	21.8
	None formal	10	2.5
Occupation (n = 394)			
	Senior Civil Servant	6	1.5
	Middle level Civil Servant	25	6.3
	Junior Level Civil Servant/Petty Trader/Artisan	357	90.6
	Unemployed/Housewives/Students	6	1.5
Household Possession Index Score	High	5	1.2
	Medium	78	19.0
	Low	327	79.8

Table III: Demographic characteristics of the pupils with over -nutrition

Characteristics		*Frequencies (% of n)*	*Statistics*
Age	0-59 (n = 36)	11 (30.6)	$\chi^2 = 59.91$;
	60-132 (n = 284)	14 (4.9)	$p < 0.0001$
	>132 (n = 102)	2 (2.0)	
Sex	Male (n = 203)	17 (8.4)	$\chi^2 = 3.28$;
	Female (n = 219)	10 (4.6)	$p = 0.19$
Class	Nursery/Kindergarten (n = 99)	18 (18.2)	$\chi^2 = 39.47$;
	Junior Primary (Primary 1- 3) (n = 158)	6 (3.8)	$p < 0.0001$
	Senior Primary (Primary 4-6) (n = 165)	3 (1.8)	
Position of child in family			
	1 (n = 85)	4 (4.7)	$\chi^2 = 3.68$;
	2 (n = 110)	8 (7.3)	$p = 0.45$
	>2 (n = 205)	12 (5.9)	

Dietary Diversity Score

There was a statistically significant difference in the mean Dietary Diversity Score (DDS) for the overweight/Obese pupils and the study population; 4.8 ± 2.2 and 4.3 ± 1.8 respectively ($F = 12.75$; $p = 0.0001$). The DDS was borderline to poor among 19/27 (70.4%) of the overweight/obese pupils and was significantly related to the nutritional status of the pupils ($\chi^2 = 35.14$; $p = 0.003$).

Food Frequency Score (FDFS)

The mean Food Frequency Score for the study population was 48.7 ± 22.5 and 39.7 ± 22.0 in the overweight/obese pupils. Although the food frequency score was poor in 14/16 (87.5%) of the overweight/obese pupils, this lacked statistical significance ($p = 0.23$).

Household Good Possession Score

None of the households had high Goods Possession

Score. The score was medium and low among 20.4% and 79.6% of the population respectively. More (9.6%) of the overweight/obese pupils came from households with moderate Goods Possession Scores (p = 0.24). There was a statistically significant difference in the Household Goods Possession Score based on the type of school (χ^2 = 24.78; p = 0.0000).

Table VI depicts the Infant and Young child feeding pattern among the children with overweight/obesity. All the overweight/obese children were breastfed. Breast milk was the first drink in 91.3% of them. The duration of breastfeeding ranged between 12 and 24 months while the mean duration of breastfeeding for the normal, underweight and overweight/obese children were 16.3 ± 5.1, 15.6 ± 5.3 and 18.0 ± 3.9 months respectively (F = 2.85, p = 0.004).

Table IV: Socio-demographic characteristics of the caregivers of overweight/obese pupils

Characteristics		*Frequencies (%of n)*	*Statistics*
Age (Years)	20-30 (n = 53)	4 (7.5)	χ^2 = 1.42;
	31-40 (n = 219)	13 (6.2)	p = 0.96
	41-50 (n = 97)	5 (5.2)	
	51-60 (n = 19)	1 (5.6)	
Sex	Male (n = 31)	0 (0.0)	χ^2 = 8.49;
	Female (n = 363)	3 (6.3)	p = 0.01
Ethnicity	Yoruba (n = 341)	20 (5.9)	χ^2 = 12.03;
	Igbo (n = 29)	3 (10.3)	p = 0.06
	Hausa (n = 9)	2 (22.2)	
	Others (n = 11)	0 (0.0)	
Religion	Islam (n = 153)	12 (7.8)	χ^2 = 3.05;
	Christianity (n = 241)	14 (5.8)	p = 0.55
	Others (n = 7)	0 (0.0)	
Education	University (n = 21)	3 (14.3)	χ^2 = 5.86;
	Post-secondary (n = 35)	3 (8.6)	p = 0.66
	Secondary (n = 244)	13 (5.6)	
	Primary (n = 36)	4 (4.8)	
	None formal (n = 10)	1 (10.0)	
Occupation	Senior Civil Servants (n = 5)	0 (0.0)	χ^2 = 8.61;
	Middle Level Civil Servants (n = 25)	4 (16.0)	p = 0.19
	Junior Level Civil Servants/ Artisans (n = 347)	20 (5.8)	
	Unemployed/Housewives/Students (n = 6)	0 (0.0)	
Household Possession Index	Medium (n = 83)	8 (9.6)	χ^2 = 2.28; p = 0.24

Although, males were breastfed for shorter periods as compared to the females (15.9 ± 5.4 months and 16.3 ± 4.8 months respectively) the difference was not statistically significant (F = 0.36, p = 0.69). All the subjects received infant formula which was introduced at less than 6 months of age in about a half of them (43.5%).

Complementary feeds were started in more than a half of the overweight/obese children (56.9%) after 9 months. The starter complementary feed was the commercial pre-packed cereal preparation in over two-thirds of the pupils. Mothers who expressed inhibitions with breastfeeding in public were found in only a few

Table V: Nutritional status of study population by type of school, GPA, DDS and FFS

Variables	*Normal*	*Overweight*	*Underweight*	*Statistics*
Type of School				
Private (n =85)	51 (60.0)	7 (8.2)	27 (31.8)	χ^2= 9.82; p = 0.007
Public (n = 357)	146 (43.3)	20 (5.9)	171 (50.7)	
GPA Score				
High (n = 51)	20 (39.2)	1 (2.0)	30 (58.8)	χ^2= 4.07; p = 0.013
Low (n = 367)	175 (47.6)	26 (7.1)	167 (45.4)	
DD Score				
Good (n =75)	20 (26.7)	8 (10.7)	47 (62.7)	χ^2= 23.44; p = 0.0001
Borderline (n = 180)	79 (43.9)	11 (6.1)	90 (50.0)	
Poor (n = 164)	97 (59.1)	8 (4.9)	59 (36.0)	
FF Score				
Poor (n = 219)	100 (45.7)	14 (6.4)	105 (47.9)	χ^2= 3.59; p = 0.46
Borderline (n = 57)	32 (56.1)	1 (1.8)	24 (42.1)	
Acceptable (n = 33)	16 (51.6)	1 (3.2)	14 (45.2)	

of the children who were obese (8.7%).

Food Frequency Consumption Pattern

In the week prior to the study, 16/27 of the overweight/obese pupils consumed the main staples regularly. Majority of the overweight/obese pupils rarely consumed vegetables, fruits, beef and milk. Among the respondents, consumption of sugar and sugary products took place regularly in 7.4% (5/27) occasionally in 74.1% (20/27) and rarely in 18.5% (5/27) of the overweight/obese. There was no statistically significant association between intake of sugar or sugary products and over-nutrition (χ^2= 2.9, p = 0.57).

Physical examination findings

None of the children had pedal oedema, angular stomatitis or Bitot spots. However, 20.8% (5/24) of them had palmar pallor and 12.0% (3/25) of them had smooth tongue.

Multivariate regression analysis

As shown in Table VII, the female gender, age, long duration of breastfeeding and delay in the commencement of complimentary feeds were significantly associated with over-nutrition (p = 0.025, p = 0.000, p = 0.022 and p = 0.002 respectively).

While female pupils compared to male counterparts were more than 100% likely to be overweight/obese (OR = 5.35), an increase of one

Table VI: Infant and young child feeding pattern among the overweight/obese pupils

Infant and Young Child Feeding Pattern	*Frequencies (n = 23)**	*Percentages*
Child's first drink		
Breast milk	21	91.3
Water	2	8.7
Commencement of Infant Formula (months)		
<6	10	43.5
>6	13	56.5
Commencement of Complementary feeds (months)		
<6	2	8.7
6	8	34.8
>6	13	56.5
Nature of complementary feeds		
Commercial Cereal Preparation	17	73.9
Corn flour (Ogi)	4	17.4
Cereal (Rice)	2	8.7
Problems breastfeeding in public		
Yes	2	8.7
No	21	91.3

*Four caregivers could not recall the Infant and Young Child Feeding (IYCF) pattern

month in age had a 6.3% decrease in the odd of being overweight/obese, while an increase of one month duration of breastfeeding had a 16.6% increase in the odd of developing overweight/obesity. Pupils who started complementary feeds at 9 months compared to those who started same at 6 months were 2.8 times more likely to be overweight/obese. Children who commenced complementary feeds after 12 months compared to those who started at 6 months were 27 times more likely to be overweight/obese. Education, religion, and position of child in the family were not significantly associated with over-nutrition as shown in the Table VII.

Discussion

The strength of this study is in the fact that it studied overweight/obesity across the three spectra of age ranges in childhood and adolescence spanning 18 months through 16 years in a semi-urban setting. Previous studies on childhood obesity had focused on children within specific age groups; preschool, [20] school age [7, 21, 22] and adolescents [23] and there had been no attempt to look at childhood obesity across the three age groups in the same setting.

The study revealed a relatively higher prevalence of overweight/obesity within the semi-urban LGA and suggested an apparently rising trend within the locality. About seven years prior to this study, Fetuga *et al*. recorded a prevalence of 3.0% and 0.5% for overweight and obesity respectively in a neighbouring community. [22]

The findings in the present study should be a cause for concern considering the fact that the rate of underweight within the same community (46.9%) was also relatively high. Hitherto, several reports have identified changes in lifestyle, including diet and exercise as being mainly responsible for the increasing trend in childhood obesity in the developing countries. Therefore, the focus of research and interventions had been on cosmopolitan cities and among the higher socioeconomic groups. However, the majority of the populace in Sub-Saharan Africa (SSA) reside in the rural areas and the advent of modern day technologies have turned hitherto rural areas into semi-urban settings. Considering the huge population in these communities, coexistence of a condition like childhood obesity with underweight is worrisome.

Table VII: Multivariate Logistic Regression of factors associated with Over -nutrition

Variables	*Odd Ratio*	*P values*	*95% C I*	
			Lower	*Upper*
Male Gender (Ref)			1.229	23.282
Gender of Child (Female)	5.350	0.025	.910	.964
Age (Months)	0.937	0.000	1.023	1.329
Duration of Breastfeeding (Months)	1.166	0.022		
Start Complementary feeds<6 months (ref)		0.004	0.003	.257
Start Complementary feeds (9 months)	0.028	0.002	0.072	1.008
Start Complementary feeds (12 months)	0.270	0.051		
University Education (Ref)		0.666	0.000	.
Post- Secondary Education)	13270359.904	0.999	0.000	.
Secondary Education	39678811.210	0.999	0.000	.
Primary Education	14302791.004	0.999	0.000	.
No formal Education	43613786.827	0.999		
Islam		0.478	0.000	.
Christianity	76598563.509	0.999	0.000	.
Traditional	36047102.341	0.999	0.351	1.061
Position of child in family	0.611	0.080		
Constant	0.000	0.999		

CI = Confidence Interval

Although a previous study had observed, almost a decade earlier, that obesity was uncommon in semi-urban areas, [21] this study found a prevalence of overweight/obesity of 6.4%. This prevalence rate in the present study is much higher than that recorded in the same area eight years earlier, although the previous study involved public primary schools and older children compared to the present study. [22] The current prevalence rate is also higher than that found in Enugu [20] and Abeokuta. [23] However, it is lower than the figures recorded from Accra, in Ghana [7] and Benue State in Nigeria [24] in studies which were conducted in cosmopolitan settings.

In the present study, more males had over-nutrition compared to females. This is similar to reports by Moraeus [25] and Sjoberg. [26] This observation may be a reflection of the society where the male child is preferred and is likely to have preferential treatments; they were breastfed for a much shorter period (as observed in this study) and were started on breast milk substitute much earlier. Breastfeeding has been reported to protect against the risk of obesity. [27] In this study, the short duration of breastfeeding coupled and the delay in commencing complementary feeds were significantly related to the development of over-nutrition. This observation underscores the relevance of early life factors as compared with the environment in the evolution of childhood obesity. [24] Similar to other reports, the intake of sugar was not significantly related to over-nutrition. [28]

In spite of the fact that the present study took place in a semi-urban setting, there was a definite urban-rural difference among the study communities; over-nutrition was more prevalent in the most cosmopolitan of the communities (Iperu) and the higher socio-economic group typified by the Household Goods Possession scores. This is similar to observations of other workers [12, 24, 25] who reported that childhood over-nutrition was more prevalent in the urban settings and among the higher socioeconomic groups. [7] There was a higher prevalence of over-nutrition in the private schools (fee-paying) as compared to the public schools similar to the findings of El-Sabely *et al.* [29] It is expected that the socioeconomic status of the caregivers of pupils in private schools will be higher since they have to pay school fees. This study corroborated that assumption as the Household Goods Possession scores of caregivers of pupils in private schools was significantly better than those of public schools. However, this did not translate into a statistically significant difference in the development of over-nutrition among the pupils. This observation was earlier made by Vuvour in Accra. [7] This seems to suggest that the aetiology of over-nutrition in this community transcends the environmental factors (higher income to procure packaged, fast foods, increased sedentary activities) as suggested by Swinburn *et al*. [30] Early life factors appear to play a more important role in the evolution of childhood over-nutrition in this setting. This is similar to the observation of Megan *et al*. [31]

Ordinarily agrarian land for physical exercise within the communities would have been expected, given the semi-urban nature of the LGA, but this study found a low Group Physical Activity score (GPA score) within the communities and even a lower GPA among the overweight/obese pupils who were older than 5 years. Insufficient physical activity has been associated with an increased risk of obesity. [32, 33] The low GPA score recorded in the present study is similar to the observations made by Adeniyi *et al*. [34] As ages of the pupils increased, the prevalence of obesity, decreased due to increase in their physical activities either for leisure or at home.

Conclusion

This study showed that childhood over-nutrition is not quite as uncommon in the semi-urban areas any longer. In addition, the early life factors such as dietary diversity and physical activity are important contributors to childhood obesity even in semi-urban communities. The emergence of over-nutrition, being more prevalent among children aged less than 5 years who are also vulnerable to under-nutrition, will double the burden of diseases among that group of children.

The resultant morbidity from non-communicable diseases on a long term basis and mortality from complications from underweight on short term portends double jeopardy in this age group which must be rapidly stemmed.

The study recommends that more attention should be paid to the promotion, protection and support of breastfeeding within the communities and this should be followed by the commencement of appropriate complementary feeds from the age of six months. Breastfeeding promotion should be included in antenatal clinic activities in health clinics along with health education for mothers on nutritive diets for their children. The provision of playfields in schools and physical exercise even on the home front should be encouraged.

Limitations for the study

The assessment of the dietary practices was only qualitative rather than quantitative. The subjective method used for the determination of the group physical activity was prone to poor recall in the pupils.

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