

Research Article

Prevalence and Associated Factors of Overweight and Obesity among Primary School Children Aged 7–17 Years in Urban Mbarara, Uganda

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Globally, overweight and obesity among children have been acknowledged as a growing public health concern. In sub-Saharan Africa, the prevalence of overweight and obesity is high. In Uganda, there is a significant burden of overweight and obesity. This study was conducted to determine the prevalence and associated factors that influence overweight and obesity among primary school children in Southwestern Uganda. A cross-sectional study utilized a self-administered questionnaire and anthropometric tools to collect data. A three-stage sampling procedure was used to select four schools that participated in this study. A total of 422 children participated in our study. Participant's weight and height were measured using SECA Scale, Model 885, and a wall-mounted stadiometer, respectively. Data were analyzed using STATA v11.0. The prevalence of overweight/obesity was descriptively analyzed. Associated factors were determined using bivariate and multivariate analysis. Findings revealed that 54.3% of participants were walking to school compared to 45.7% that were cycling/bicycling and 76.3% playing and doing household chores as opposed to 23.7% that spent their leisure time through reading and watching TV, 74.2% took more than two meals per day, and 79.4% often took vegetables and fruits compared to 20.6% that took them most of the time. The study found an overall prevalence of 20% for overweight/obesity. There was a statistical association between overweight/obesity and ownership of residence (O.R.: 0.4, 95% C.I.: 0.2–0.8), modes of transport (O.R.: 8.2, 95% C.I.: 3.4–20.0), leisure time activities (O.R.: 0.4, 95% C.I.: 0.2–0.7), frequency of consuming vegetables and fruits (O.R.: 2.8, 95% C.I.: 1.4–5.5), and the type of school attended (O.R.: 0.2, 95% C.I.: 0.1–0.4). However, only the mode of transport (A.O.R.: 5.0, 95% C.I.: 1.9–13.0) was independently associated with overweight/obesity on multivariate logistic regression analysis. Girls who participated in our study were more overweight than boys. Overweight/obesity existed more in private schools than public schools. Modes of transport were only found to be strongly associated with overweight/obesity. There is a need to establish evidence-based strategies to inform policy on prevention of childhood overweight/obesity.

1. Background

Overweight and obesity amongst children have been acknowledged as a growing major public health concern of the twenty-first century. Globally, the prevalence of overweight and obesity among primary school children has been explored and reported with a significant increase in both developed and developing countries [1–6]. For instance, in 2016, 124 million children aged 5–19 were estimated to suffer from obesity worldwide [7]. In the USA, a study conducted among children

found that 31.0% were overweight [8]. In the UK, obesity prevalence among school-age children increased from 21% in 2019/2020 to 25% in 2020/2021 [9]. In Italy, the prevalence rate of overweight/obesity among children was as high as 25.2% [10]. In India, the prevalence of overweight was 18% for boys and 16% for girls [11]. On the other hand, the global fundamental cause of obesity and overweight is energy imbalance between calories consumed and calories expended [12]. According to the World Health Organization [13, 14], there has been an increased intake of energy-dense foods that are high in sugars

and fat and an increase in physical inactivity due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization. Several factors can play a role in gaining and retaining excess weight including diet, lack of exercise, environmental factors, and genetics [12]. In France, female gender, low/medium parental socioeconomic status, never/sometimes having breakfast, never/sometimes eating at school canteen, never/sometimes having a morning snack, never/sometimes having a light afternoon meal, and having high sedentary activity were significantly associated with higher overweight/obesity [15]. In Bangladesh, positive energy balance with higher fat intake, lack of participation in outdoor sports, sedentary lifestyle, and fast food culture were found to be among major factors for the increasing prevalence of overweight/obesity among primary school children [16]. In Pakistan, factors associated with overweight and obesity included higher parental education, both parents working, fewer siblings, fewer persons in child's living room, and residence in high-income neighborhoods [17]. Also, in Kuwait, having one/more brother with obesity, unemployed father, high number of persons living at home, increased age, and chronic disease were significantly associated with higher risk of overweight/obesity [18].

In sub-Saharan Africa (SSA), the prevalence of overweight/obesity is substantially high, becoming a growing problem in the region [19]. Obesity has been increasing in many SSA countries since 1999 [20]. A study in SSA reported the prevalence of overweight/obesity in children between 5 and 17 years old at 10.6% and 2.5%, respectively [21]. A study among school children aged 13–15 years in Ghana found the prevalence of overweight/obesity at 16.4% [22]. In Tunisia, a study among primary school children aged 6–12 years reported the prevalence of overweight and obesity to be 19.7% and 5.7%, respectively [23]. Similarly, a study conducted in Tanzania among primary school children aged 8–13 years showed that the prevalence of overweight and obesity was 15.9% and 6.7%, respectively [24]. Slightly lower, a study in northwestern Ethiopia revealed the prevalence of overweight and obesity as 9.6% and 4.2%, respectively [25]. Conversely, in regard to the associated factors in the SSA region, a study conducted in semi-urban areas of mid-western Nigeria found that the higher prevalence of overweight and obesity was significantly associated with female gender, attendance at private schools, higher socioeconomic status families, and the presence of a television in the pupil's bedrooms [26]. A similar study conducted in Ethiopia demonstrated that vehicle availability, preferring sweet foods, eating breakfast irregularly, watching television (TV) while eating, and physical inactivity as factors that were significantly associated with overweight/obesity among primary school children [27]. Nevertheless, numerous factors account for physical inactivity among children in SSA including urbanization of towns that lead to limited open playgrounds in schools and persistent emphasis on academic excellence [28].

In Uganda, there is a significant burden of overweight in urban areas and in wealthier regions of the country [29]. A study conducted in Uganda and Ghana by Peltzer and Pengpid [30] found the prevalence of overweight and obesity to be

10.4% (in girls) and 3.2% (in boys) and 0.9% (in girls) and 0.5% (in boys), respectively. Another study conducted among primary school children aged 8–12 in Kampala city found the prevalence of overweight and obesity at 32.3% and 21.7%, respectively [31]. On the contrary, a recent collaborative study conducted in urban Uganda among primary school children found overweight and obesity to be 5.4% and 1.8%, respectively [32]. Utilizing data from the Uganda Demographic Health Survey 2016, Sserwanja, Mutisya [33] found the prevalence of overweight and obesity to be 3.9% and 1.1%, respectively. These estimates have important public health consequences because overweight children tend to become overweight adults [34, 35], perhaps due to a number of associated factors. Another recent study conducted in Uganda found male sex, older age of children, nutritional status of mothers, and the region of residence to be associated with overweight and obesity among children [33]. However, a study conducted in Uganda and Ghana found that overweight/obesity was not associated with the intake of fruits and vegetables and sedentary behavior [30]. According to Arwanire and Amaniyo [36], factors associated with overweight and obesity include physical inactivity, sedentary behaviors, dietary intake, female gender, inaccurate perceptions about dieting, weight, and health.

On the other hand, sedentary behaviors and dietary practices that are in most cases learned during childhood have a negative effect of increased mortality and morbidity during adulthood [37, 38]. For instance, a study conducted in China among school children aged 7–12 years found an obesity group with high blood pressure compared to the normal group. Studies have indicated that children classified as obese in primary schools experience more bullying, stigma, mother discrimination, etc. and may require special needs for studying and usually undergo serious family crisis [39–41].

Based on literature search, there is limited data about overweight and obesity among primary school children in Uganda. Therefore, the main purpose of this study was to determine the prevalence and risk factors associated with overweight and obesity among primary school children in an effort to close the identified knowledge gap [42].

2. Methods

2.1. Study Design and Site. This study used a cross-sectional survey design utilizing a quantitative approach. A cross-sectional study design was chosen because not only does the data collected relate to a single specified time but also it saves time, various groups can be studied at the same point in time, and it is relatively cheap [43]. Quantitative research approach was desired in this study due to the fact that it is well suited to establishing cause-and-effect relationships, generating factual, reliable outcome data that are usually generalizable to some larger populations [44, 45]. The study was conducted in Kamukuzi division, Mbarara district (now Mbarara City). Kamukuzi division was purposively selected because of its township (urban) that harbors most primary schools in the city.

2.2. Study Population and Sample Selection. Our target population was all primary school children in Mbarara City, and

our study unit was a child aged 7–17 years with a parent/guardian. We applied a three-stage sampling procedure to select primary school children to participate in the study. In a three-stage sampling design, a sample of primary units was selected, and then a sample of secondary units was chosen from each of the selected primary units, and finally, a sample of tertiary units was chosen from each selected secondary unit [46]. At stage 1, a list of all day primary schools in Kamukuzi division was obtained from the District Education Office (DEO). A total of 18 primary schools were located in the division, and these included 10 private and 8 public schools [47]. Of the 8 public schools, 4 were purely day, and out of the 10 private schools, 5 were purely day leaving the 9 mixed schools to constitute our sampling frame. The nine schools were taken as clusters and hence subjected to a simple random sampling process. Each of the schools in the sampling frame was assigned a code number printed on a piece of paper and then placed in a basket. At stage 2, clusters were selected by simple random technique so that each cluster had an equal chance of being selected until the desired number of schools was obtained. The four schools were then chosen, i.e., two public/government-aided (*Mbarara Parents P/S and Kokonjeru P/S*) and two private schools (*Mbarara Preparatory P/S and Little Stars Nursery and P/S*). Class registers containing eligible prospective participants were accessed from school administration. The total number of eligible participants in each school was used to constitute a ratio (according to size) which was then used to calculate the appropriate number of children to be selected from each school/strata and then from each class. Participants expected from selected schools were then stratified according to their classes. A final list of those eligible to participate per school/strata was obtained. At stage 3, eligible participants were systematically selected by choosing the n th number from each class list until the desired number from every class and school was attained. For example, in a class of 95 pupils where we had to select 24 pupils, every fourth pupil would be selected from the register, but the starting point had to be selected at random by closing the eyes and then pointing at a specific name in the class register.

Using the Yamane's Formula [48], the total sample size expected was 433 participants. However, a total of 422 participants participated in the study. Yamane's formula is as follows:

$$n = \frac{N}{1 + N(e)^2}, \quad (1)$$

where:

n is the sample size,

N is the population size, and

e is the acceptable sampling error (precision level).

Note that 95% confidence interval and $p = 0.05$ are assumed.

The estimated number of school going children from P.1 up to P.7 is 25,500, with females contributing 51% and males 39% [47].

Therefore, using the above figure, at a sampling error of 5%,

$$N = \frac{25,500}{1 + 25,500(0.05)^2} = 393.82 = 394. \quad (2)$$

Taking into account 10% for non-response = 39.

Therefore, the expected total sample size was 433 participants. However, a total of 422 participants participated in the study.

2.3. Inclusion and Exclusion Criteria. In Uganda, the recommended age for joining Primary One (P.1) is 6 years, and the average age of children who attend Primary Seven (P.7) is 14.7 years [49]. Therefore, only children aged between 7 and 17 were included in our study. We only considered day and mixed primary schools (boys and girls) that were registered and licensed by the Ministry of Education and Sports (MoES). The included primary schools were in operation for at least 7 years with classes running from P.1 to P.7. Considering the issue of walking to and from school, we excluded boarding schools, special needs, and nursery schools. Sick children at the time of data collection were excluded. With our interest in finding out the prevalence per sex, single primary schools (boys or girls only) were excluded too.

2.4. Data Collection Procedures. Upon each participant fulfilling the eligibility criteria, data was obtained using a pre-tested self-administered questionnaire and anthropometric measurement tools. Consent was sought from 433 parents/guardians before seeking assent from children. Besides 11 parents that did not consent, assent was sought from 422 children whose parents/guardians consented. Children who assented to participate in our study completed a self-administered questionnaire containing 29 items/questions on socio-demographics, physical activity, and food consumption patterns' factors. The anthropometric data sheet was used to record the measured weight and height. The code used on the questionnaire for each participant was again used for the data sheet. Teachers in respective schools helped us to mobilize school children. We measured weight and height of the participants using a weighing scale (SECA Scale, Model 885) and a wall-mounted stadiometer, respectively. Participants' weight and height were taken by the first author (AMB) from their respective classrooms during break time. Pupils were told to put off their shoes before recording their weight and height. Our data collection exercise lasted for a period of 8 weeks between February 2016 and April 2016.

2.5. Study Variables. In this study, we measured factors including sociodemographics, physical activity, and food consumption patterns.

2.5.1. Sociodemographics. These included age (categorized as 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17 years), sex (categorized as girl, boy), school type (categorized as public and private), and guardian/parent (categorized as staying with both parents, staying with a single parent and staying with relatives). Likewise, socioeconomic factors were measured including residence ownership (categorized as owned, rented), employment of the guardian/parent (categorized as employed guardian, unemployed guardian), education level of mother (categorized as completed > primary school, never completed < primary), and education level of father (categorized as completed > primary school, never completed < primary).

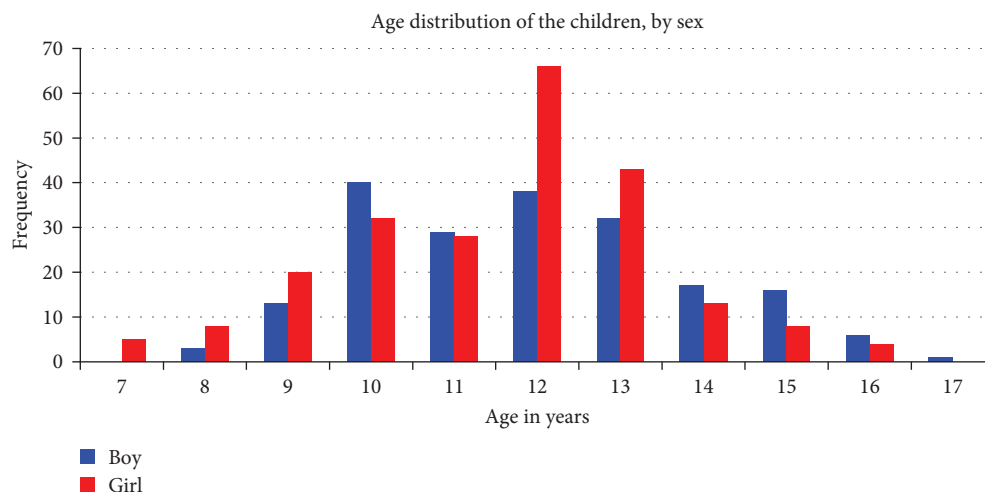


FIGURE 1: Age distribution of primary school children in urban mbarara by sex.

2.5.2. Physical Activity. We defined physical activity as engaging in at least 20 min of physical exercise/activity per day for at least 5 days per week and modes of transport to and from school. Physical activity was assessed using modes of transport to school (categorized as walking and others like use of motorcar, motorcycle, and bicycle), participating in exercise per week (categorized as no, yes), number of times of exercising per week (categorized as <3 times per week, >3 times per week), type of exercises (categorized as running, playing football, jumping, aerobics), and spending leisure time (categorized as watching TV, others like playing, reading, performing house chores). In this study, sedentary behavior was defined by how the child spent their leisure time like watching television, playing, performing house chores, and reading.

2.5.3. Food Consumption Pattern. This was assessed through reported number of meals in 24 hr (categorized as >2 meals, <2 meals), consumption of snacks in between meals (categorized as no, yes), common type of food at home (categorized as beans/ground nuts, meat/fish), and frequency of consuming vegetables/fruits (categorized as most of the time/always, others such as often, and never).

2.6. Data Analysis. Data collected using the questionnaire was entered into Microsoft Excel and exported to STATA v11.0 for analysis. The prevalence of overweight and obesity was determined by use of an Excel body mass index (BMI) calculator for school children. Data on the participant's birth date, sex, weight, height, and date when measurements were taken were entered into the measurement worksheet. Summaries of BMI were generated for age, prevalence of overweight and obesity by sex, and school type in the form of tables and graphs. Independent variables included sociodemographic factors, physical activity, and food consumption patterns of school children. The descriptive analysis of the independent variables and the prevalence of overweight and obesity among school children were done by generation of frequency tables. Chi square tests were calculated to determine the association between independent and dependent variables. The final

analysis of the association between the independent variables and dependent variables was adjusted for factors that were statistically significant at bivariate analysis. Bivariate level analysis of variables was tested using logistic regression model followed by a multivariate logistic regression analysis.

3. Results

3.1. Characteristics of Study Participants. A total of 422 primary school children from four [4] primary schools in Mbarara participated in our study. The participants' minimum and maximum age was 7 and 17 years, respectively. The mean age was 11.7 years with median and mode of 12 years and standard deviation at 1.892. Our study participants had a normal distribution as displayed in Figure 1.

Findings in Table 1 indicate that girls constituted more than half of participants (53.8%) compared to boys (46.2%). In regard to school type, more of the participants were from public/government-aided schools (53.8%) compared to those from private schools (46.2%). Most participants were living with both parents (61.4%) by the time of our fieldwork. More than half of our participants were from residences owned by their parents/guardians (61.6%) compared to those that were renting (38.4%). The majority of our participants' parents/guardians were employed (83.6%) compared to those with unemployed guardians (16.4%). More of our participants' mothers and fathers had completed primary school education (66.2%) and (88.9%), respectively. It was revealed that a significant percentage of participants (54.3%) were walking to their respective schools compared to those that were using another non-motorized modes of transport such as cycling/bicycling (45.7%). Almost all participants (95.7%) participated in exercise per week. However, less than half of the participants (47.6%) exercised more than three times per week. About leisure time, a vast percentage of participants spent their leisure time through playing physical games and doing house chores such as washing utensils, cleaning their homes of residences, and washing clothes (76.3%) compared to watching television and reading text books, novels, etc. (23.7%). Based on findings presented in Table 1, 74.2% of

TABLE 1: Sociodemographics, physical activities, and food consumption patterns of participants.

Variable	Category	Frequency (N= 422)	Percentage (%)
Sex	Girls	227	53.8
	Boys	195	46.2
School type	Government	227	53.8
	Private	195	46.2
Parent/guardian	Both parents	259	61.4
	Single parent	107	25.4
	Relatives	56	13.27
Residence ownership	Owned	260	61.6
	Rented	162	38.4
Employment of parent/guardian	Parent/guardian employed	352	83.6
	Parent/guardian employed	69	16.4
Education level of mother	Completed > primary	261	66.2
	Completed < primary	133	33.8
Education level of father	Completed > primary	375	88.9
	Completed < primary	47	11.1
<i>Physical activities</i>			
Modes of transport to and from school	Walking	229	54.3
	Others (motorized, bicycle)	193	45.7
Participating in exercise per week	Yes	404	95.7
	No	18	4.3
Number of times of exercising per week	<3 times per week	221	52.4
	>3 times per week	201	47.6
How leisure time is spent	Watching TV, reading	100	23.7
	Others (playing, doing house chores)	322	76.3
<i>Food consumption patterns</i>			
Number of meals in 24 hr	>2 meals	313	74.2
	<2 meals	109	25.8
Consumption of snacks in between meals	Yes	278	66.2
	No	142	33.8
Common type of food at home	Beans/ground nuts	256	60.8
	Meat/fish	165	39.2
Frequency of consuming vegetables and fruits	Most of the time/always	87	20.6
	Others (some of the time)	335	79.4

the participants ate more than two meals per day. Equally, a significant number of participants (66.2%) reported to have consumed a snack in between their meals. Besides, 60.8% reported their common type of food at home as beans and ground nuts. On other hand, a smaller percentage of participants (20.6%) testified to have always consumed vegetables and fruits compared to 79.4% that had never taken them.

3.2. Prevalence of Overweight and Obesity among Primary School Children. The prevalence of obesity and overweight by sex and type of school is shown in Table 2 and Figure 2. Findings revealed an overall prevalence of 10% for overweight and obesity. Girls were overweight (12%) compared to boys (8%). According to findings in Figure 2, more children in private schools than those in public schools were more overweight (13.3% versus 2.6%).

3.3. Bivariate Analysis for Associated Factors of Overweight and Obesity among School Children. In the bivariate analysis, all children with BMI percentile of >85th percentile were considered overweight. The predictor variables (sociodemographics such as sex and school type) were entered into bivariate logistic regression analysis as shown in Table 3. Findings showed that there was a statistical association between the type of school attended and overweight. Public primary school pupils had 80% reduced risk of becoming overweight (O.R.: 0.2, 95% C.I.: 0.1–0.4) compared to private primary school pupils. There was a statistical association between residence ownership and overweight (O.R.: 0.4, 95% C.I.: 0.2–0.8). Children whose parents/guardians were renting residences were 60% less likely to be overweight compared to those whose guardians owned the residence. Also the mother's level of education (O.R.: 6.7, 95%

TABLE 2: Prevalence of overweight and obesity by sex.

Variable	Sex		Total
	Boys	Girls	
Number of children assessed	195	227	422
Underweight (<5th percentile), (n)%	(19) 10%	(11) 5%	(30) 7%
Normal BMI (5th–85th percentile) (n)%	(161) 82%	(190) 84%	(351) 83%
Overweight (\geq 85th percentile) (n)%	(11) 6%	(21) 9%	(32) 8%
Obese (\geq 95th percentile) (n)%	(04)2%	(05)2%	(09)2%
Overweight and obesity (85th percentile to 100th percentile) (n)%	(15)8%	(26)12%	(41)10%

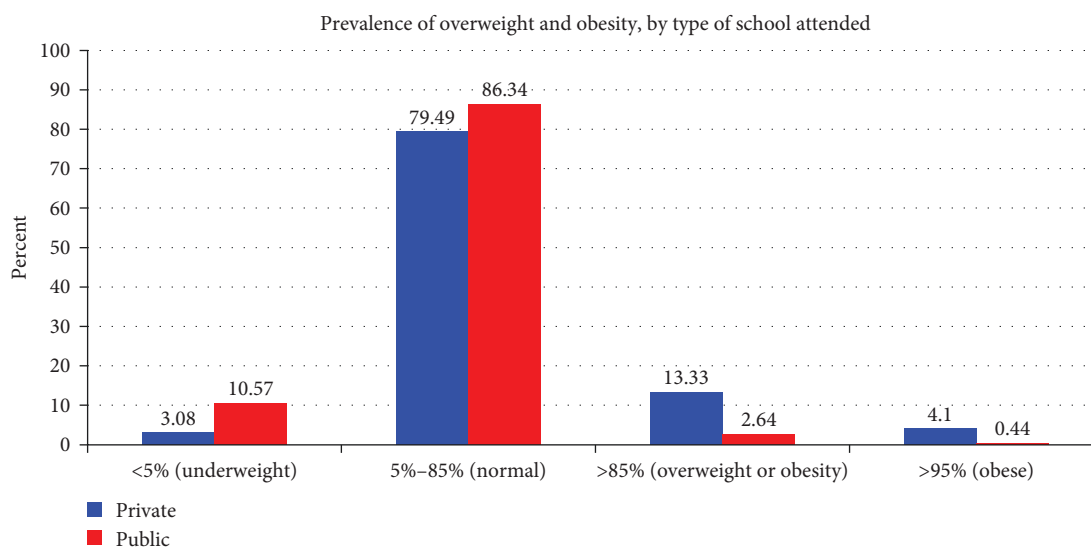


FIGURE 2: The prevalence of overweight and obesity by type of the school.

C.I.: 2.0–22.3) showed a statistical association with overweight. Children whose mothers had acquired education beyond primary school level were 6.7 times more likely to be overweight compared to their counterparts. In regard to physical activity, findings revealed a statistical association between modes of transport to and from school and overweight/obesity (O.R.: 8.2, 95% C.I.: 3.4–20.0). Children who did not walk to school daily were 8.2 times more likely to be overweight compared to those who walked to and from school daily. There was a statistical association between how children spent their leisure time and overweight/obesity (O.R.: 0.4, 95% C.I.: 0.2–0.7). Children who spent their leisure time doing something like playing, reading, and doing home chores were 60% less likely to become overweight compared to those watching TV. Our findings revealed a number of food consumption patterns that were found to be statistically associated with overweight/obesity including number of meals consumed in 24 hr (O.R.: 7.6, 95% C.I.: 1.8–32), consumption of snacks in between meals (O.R.: 0.3, 95% C.I.: 0.1–0.7), the common type of food consumed at home (O.R.: 0.4, 95% C.I.: 0.2–0.8), and the frequency of consuming vegetables and fruits (O.R.: 2.8, 95% C.I.: 1.4–5.5). Children who consumed more than two meals in a day were 7.6 times more likely to be overweight, those who never ate any snack in between meals were 70% less likely to be overweight, those who commonly

ate beans or ground nuts were 60% less likely to be overweight, and children who reported to eat fruits and vegetable always were 2.8 times likely to be overweight compared to those who ate them less often.

3.4. Multivariate Analysis for the Associated Factors of Overweight and Obesity. The independent predictor variables with p -value ≤ 0.05 at binary logistic regression analysis were therefore eligible to be included in the multivariate logistic regression analysis as shown in Table 4. The final analysis of the association between the independent variables and dependent variables was adjusted for factors that were statistically significant at bivariate analysis, and these included modes of transport to school, the number of meals consumed in 24 hr, the frequency of consuming vegetables and fruits, and different ways of spending leisure time. Consumption of snacks and the common type of food consumed at home were not included in the final analysis model though they were statistically significant at the bivariate analysis because they were more or less synonymous with the number of meals consumed in 24 hr. Adjusted findings of our study showed that modes of transport to and from school was the only factor significantly associated (A.O.R.: 5.0, 95% C.I.: 1.9–13.0) with overweight/obesity. Compared to children who normally walk to and from school, those who used other

TABLE 3: Bivariate logistic regression analysis for the associated factors of overweight and obesity.

Variable	Category	Overweight and obesity, n (%)	Nonoverweight, n (%)	OR (95% CI)	p-Value
<i>Sociodemographics</i>					
Sex	Girls	26 (11.5)	201 (88.5)	1.6 (0.8–3.0)	0.196
	Boys	10 (7.7)	185 (92.3)	Ref	
School type	Public/government	07 (3.1)	220 (96.9)	0.2 (0.1–0.4)	0.000*
	Private	34 (17.4)	161 (82.3)	Ref	
Parent/guardian	Both parents (mother and father)	28 (10.8)	231 (89.2)	Ref	
	Single parent	08 (7.5)	99 (92.5)	0.7 (0.3–1.5)	0.333
	Relatives	05 (8.9)	51 (91.1)	0.8 (0.2–2.2)	0.677
Income (employment of parent/guardian)	Guardian unemployed	04 (5.8)	65 (94.2)	1.9 (0.6–5.5)	0.234
	Guardian employed	37 (10.5)	315 (89.5)	Ref	
Residence ownership	Rented	8 (4.9)	154 (95.1)	0.4 (0.2–0.8)	0.012*
	Owned	33 (12.7)	227 (87.3)	Ref	
Education level of mother	Completed > primary	35 (13.4)	226 (86.6)	6.7 (2.0–22.3)	0.002*
	Completed < primary	03 (2.3)	130 (97.7)	Ref	
Education level of father	Completed > primary	46 (18)	210 (82)	6.6 (0.9–49)	0.067
	Completed < primary	01 (3.2)	30 (96.8)	Ref	
<i>Physical activity</i>					
Modes of transport to school	Walking	6 (2.6)	223 (97.4)	8.2 (3.4–20.0)	0.000*
	Others (motorcar, motorcycle, bicycle)	35 (18.1)	158 (81.9)	Ref	
Participating in exercise	No	1 (5.6)	17 (94.4)	0.5 (0.1–4.1)	0.549
	Yes	40 (9.9)	364 (90.1)	Ref	
Number of times of exercising/week	<3 times/week	17 (7.7)	204 (92.3)	1.6 (0.8–3.1)	0.144
	≥3 times/week	24 (11.9)	177 (88.1)	Ref	
How leisure time is spent	Others (playing, reading, house chores)	23 (7.1)	299 (92.9)	0.4 (0.2–0.7)	0.002*
	Watching TV	18 (18)	82 (82)	Ref	
<i>Food consumption patterns</i>					
Number of meals in 24 hr	>2 meals	39 (12.5)	274 (87.5)	7.6 (1.8–32)	0.006*
	≤2 meals	2 (1.8)	107 (98.2)	Ref	
Consumption of snacks in between meals	No	6 (4.2)	136 (95.8)	0.3 (0.1–0.7)	0.009*
	Yes	35 (12.6)	243 (87.4)	Ref	
Common type of food at home	Beans/G. nuts	17 (6.6)	239 (93.4)	0.4 (0.2–0.8)	0.009*
	Meat/fish	24 (14.6)	141 (85.4)	Ref	
Frequency of consuming vegetables and fruits	Always	16 (18.4)	71 (81.6)	2.8 (1.4–5.5)	0.003*
	Others (some of the time)	25 (7.5)	310 (92.5)	Ref	

NB: Ref, refers to the reference variable/group; * p-value is less than 5% significance level.

TABLE 4: Multivariate logistic regression analysis for the associated factors of overweight and obesity.

Variable	Participant characteristic	Overweight and obesity, <i>n</i> (%)	Nonoverweight, <i>n</i> (%)	OR (95%CI) (adjusted OR)	<i>p</i> -Value (adjusted <i>p</i>)
Modes of transport to and from school	Not walking to school	6 (2.6)	223 (97.4)	5 (1.9–13)	0.001*
	Walking to school	35 (18.1)	158 (81.9)	Ref	
Number of meals in 24 hr	>2 meals	39 (12.5)	274 (87.5)	2.3 (0.5–10.8)	0.300
	≤2 meals	2 (1.8)	107 (98.2)	Ref	
Frequency of consuming vegetables and fruits	Always	16 (18.4)	71 (81.6)	1.8 (0.9–3.7)	0.105
	Sometimes	25 (7.5)	310 (92.5)	Ref	
How leisure time is spent	Others (playing, reading, house chores)	23 (7.1)	299 (92.9)	0.6 (0.3–1.2)	0.150
	Watching TV	18 (18)	82 (82)	Ref	

NB: Ref, refers to the reference variable/group; **p*-value is less than 5% significance level.

modes of transport were 5 times more likely to become overweight after controlling for the number of meals taken in 24 hr, vegetables and fruits consumed, and leisure time activities utilized.

4. Discussion

This study determined the prevalence and associated factors of overweight/obesity among primary school children in Mbarara city. The prevalence of overweight/obesity among primary school children in this study was 20%. Similarly, a study conducted in Tunisia among primary school children aged 6–12 years found the prevalence at 19.7% [23]. Also, in Malaysia, the prevalence of overweight/obesity among children aged 7–12 years was found at 19.9% [50]. However, the prevalence of overweight/obesity in this study is much lower than the one reported among primary school children aged 8–12 years in Kampala, Uganda, at 32.3% [31]. In relation to sex, the prevalence of overweight/obesity in this study was higher among girls compared to boys. Our findings are consistent with other studies conducted in Uganda and other parts of the world where girls were found to be overweight than boys [51–53]. Contrariwise, a study in 21 European countries established the prevalence of overweight/obesity as higher among boys compared to girls [54]. Furthermore, in Dhaka, Bangladesh, higher prevalence of overweight/obesity was observed among boys compared to girls [16]. Additionally, a similar study conducted in Uganda also revealed that boys were more likely to be overweight compared to girls [33]. Therefore, this study demonstrates that interventions are needed among all school-age children irrespective of their gender/sex.

Our study found associations between overweight/obesity and the type of school attended, parent's ownership of residence, parent's level of education, modes of transportation, leisure time activities, and frequency of consuming fruits and vegetables. Considering ownership of residence, children whose parents were renting residences were less likely to be overweight compared to those whose parents owned residences. In line with a study conducted in Denmark, weight loss tended to be lower if the family owned a residence rather than renting [55]. Children whose mothers had acquired education beyond primary school level were more likely to be overweight compared to their counterparts. Similarly, Feng et al. [56] found that school-age children whose mothers had a higher education level were more likely to be overweight. Our study also found that overweight/obesity was more likely in children who ate more than two meals in 24 hr. These findings are in agreement with previous studies which revealed that increased number of meals for children were significantly associated with overweight/obesity [23, 30, 57, 58].

More so, primary school children who spent their leisure time through playing physical games and doing home chores had a high reduced risk of becoming overweight compared to those who spent their leisure time reading text books, novels, etc. and watching TV. Like in other countries, sedentary behaviors such as watching TV has become part and parcel of some children in Mbarara city, hence leading to overweight/obesity. Our findings concur with several previous studies

which revealed a significant association between watching television and overweight among primary school children [59–62]. The frequency of consuming vegetables and fruits was also found to be statistically associated with overweight/obesity. That is, children who reported that they ate fruits and vegetables always were likely to be overweight compared to those who ate them less often. In contrast, other findings assert that children with normal weight always eat vegetables and fruits more than overweight children [63]. Besides, our study found that children who were in public schools had a high reduced risk of becoming overweight compared to those that were attending private schools. In the same way, a study conducted in Nigeria found a significant association between overweight/obesity and children's attendance in private schools [24, 26].

After controlling for the number of meals taken in a day, the frequency of consuming vegetables and fruits, and leisure time activities, only mode of transportation was found to be strongly associated with overweight/obesity. That is, compared to pupils who normally walk to and from school, those who used other modes of transportation were more likely to be overweight. This implies that health promotion interventions to address childhood overweight and obesity ought to promote a culture of walking as a good practice among primary school children. One strategy is to sensitize both parents and children about the health benefits of walking compared to motorized modes such as use of vehicles and motorcycles. This is because children who regularly walk to and from school are less likely to be overweight than those who travel by car or public transport [64]. In addition, roads should have pedestrian lanes, a situation that will enable children to safely walk to and from school without interferences from other road users such as motor cyclists. Our findings correspond with previous studies conducted in Ghana [59] and in Tianjin City of Northeast China [65] which concluded that the use of motorized/mechanized modes of transport to schools decreases the chances of walking and leads to overweight/obesity. Similarly, a study in Ethiopia found vehicle availability, watching TV, physical inactivity, etc. to be significantly associated with overweight/obesity among primary school children [27]. On the contrary, previous studies carried out in Ghana and Egypt found no significant relationship between modes of transportation to school and overweight/obesity among primary school children [60, 66].

5. Conclusion

This study has indicated the prevalence of overweight and obesity among primary school children aged 7–17 years to be 10%. The study found a significant association between overweight and obesity and the modes of transport. These findings support the need to design evidence-based strategies to inform policy on road infrastructure that favor the installation of pedestrian lanes.

Abbreviations

A.O.R.: Adjusted odds ratio
OR: Odds ratio
BMI: Body mass index

CI: Confidence intervals

SD: Standard deviation.

Data Availability

The quantitative data used to support the findings of this study are available from the corresponding author upon request.

Additional Points

Study Limitations. The differences in the prevalence of overweight and obesity reflected in our study and other studies could be as a result of topography, location, or distance between home and school which our study was unable to assess. Our study defined overweight using the IOTF cut-off points which makes use of BMI-for-age percentile curves instead of the WHO BMI-for-age Z-scores used in other studies. In this study, only day schools were involved unlike other studies in which boarding school children participate in the studies. Therefore, our findings are limited to only day schools. More so, the number of girls that participated in our study exceeded that of boys, a condition that might be responsible for the high prevalence levels of overweight and obesity among girls than boys.

Ethical Approval

We obtained an approval from the International Health Sciences University (IHUS) research ethical committee. We got a written permission from the DEO Mbarara Municipality that further confirmed the approval of our study. We presented an introductory letter (of AMB) and a study approval to all the head teachers in the selected schools.

Consent

Consent was sought from participants' parents/guardians and then assent from the participants before their enrollment in the study. Information about the participating schools, the participants' guardians, and the participants were kept anonymous to ensure confidentiality.

Conflicts of Interest

The authors declare that they have no competing interests.

Authors' Contributions

AMB designed the study and collected, analyzed, and interpreted data. BT drafted the original manuscript. BT and AMB revised the manuscript. BT and AMB read and approved the final manuscript.

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