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Prevalence and determinants of overweight and obesity among school children in Morogoro region, Tanzania

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Abstract

Background: Being overweight and obese involve health risks as well as possible consequences for individuals' and communities' social and economic well-being. It was previously considered an adult health concern, but it is now seen among children. This study aimed to determine the prevalence and determinants of overweight and obesity among school children in rural and urban areas of Morogoro region, Tanzania.

Methods: A cross-sectional study was conducted on a total of 335 parent/caregiver-child pairs, of whom 165 were from Kilosa (rural) and 170 from Morogoro (urban) districts. The main sampling unit was registered primary schools which were stratified according to ownership, whether private or government, and sampled separately. A total of four private and four public schools were sampled, two of each of the categories in each of the locations. Weight and height were measured using standard procedures and Body Mass Index (BMI) was determined. Socio-demographic information was collected using a questionnaire with structured questions. A statistical package for social sciences version 21 was used to analyze data and a regression model was used to explore the determinants of overweight and obesity.

Results: The ages of the studied children ranged from 7 to 12 years, while those of the parents/caregivers ranged from 18 to 72 years. About 19% (n=63) of the school children were overweight or obese, while 3.9% (n=13) were underweight. The prevalence of overweight/obesity was higher among private school students than in public schools 36(24.8%) vs 27(14.2%) and more or less similar prevalence's were observed among rural (17.6%, n=34) and urban (20.0%, n=29) settings. In a multivariate analysis, eating breakfast before going to school is associated with overweight/obesity (AOR 2.23, 95% CI: 1.06-4.68). Other factors associated with overweight/obesity were school type (AOR 1.19, 95% CI: 1.55-2.60), household daily income (AOR 1.88, 95% CI: 1.68-3.15), and provided with money to spend at school (AOR 2.89, 95% CI: 1.76-4.11).

Conclusion: In conclusion, the prevalence of overweight and obesity among school children was high, while underweight was very low. The prevalence of overweight/obesity was similar in rural and urban children, indicating a nutritional transition. The potential risk factors associated with being overweight or obese were school type, household daily income, provision of breakfast and being given money to buy something to eat at school. Therefore, nutrition and healthy lifestyle education should be integrated into school programs to reduce the risk of developing diseases associated with being overweight or obese.

Keywords: overweight, obesity, determinants, school children, Tanzania

Background

Obesity and being overweight continue to be major societal problems which represent a rapidly growing risk to the health of people in several countries (WHO, 2018). According to World Health Organization (2016), the prevalence of overweight and obesity among children and adolescents (aged 5-19) has risen dramatically from 4% in 1975 to over 18% in 2016, and the rise has occurred equally to both boys and girls. This trend is rising with urbanization, changes in lifestyles and social economic transition, which is associated with increased purchasing power and overconsumption of cheap, palatable, more-energy dense foods and nutrients poor foods with high levels of sugar and saturated fats (Desalew *et al.*, 2017).

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Recently, several studies have reported a high and growing prevalence `of more than 20% of childhood obesity across some African countries (Umar *et al.,* 2018; Asante *et al.,* 2017; Elizabeth *et al.,* 2014). This high prevalence was associated with rapid changes in dietary practices and sedentary lifestyles. Tanzania is one of the African countries currently experiencing rapid economic growth, urbanization and nutrition transition. This has increased the prevalence of overweight/obesity among school-aged children as it was reported to be 22.6% in Dar es Salaam (Pangani *et al.,* 2016), and 9.2% in the Babati sub-rural region (Tluway *et al*, 2018). Another study conducted by Chomba *et al.* (2019) found that the prevalence of overweight and obesity among children aged 7-17 years in urban areas of Arusha region was 17.7%, of which 5.1% were overweight and 12.6% were obese.

Furthermore, Tanzanian researchers reported rural-urban variations in the prevalence of overweight and obesity among school-aged children in other regions (Chomba *et al.,* 2019; Tluway *et al.,* 2018; Pangani *et al.,* 2016). The variations observed could be due to regional differences in food consumption patterns and/or physical activity levels. According to TNNS (2018), the prevalence of overweight and obesity among women of reproductive age in Morogoro is 37.5%. Hence, it is most likely that there is a high prevalence of overweight and obesity among children because parents will promote the same lifestyle habits to their children, which is rarely reported. The current study was conducted to determine the prevalence and determinants of overweight and obesity among school children aged 7-12 years in urban and rural areas in the Morogoro region.

Methodology

Study design

The study adopted a cross-sectional research design, which is considered suitable due to the nature of the study, which involved gathering and analysis of the information at a single point in time from a sample to represent a large population and is also appropriate for descriptive study.

Description of the study area

This study was conducted in the Morogoro region in two districts; Morogoro municipality, representing an urbanized population, and Kilosa district, representing a rural area. The region was selected due to the growing rate of overweight and obesity among women of reproductive age (TNNS, 2018). Morogoro is one of the regions in Tanzania Mainland which occupies a total of 72,939 square kilometres, approximately 8.2% of the total area of Tanzania Mainland. Administratively, Morogoro region has seven districts that are Ulanga, Gairo, Kilombero, Kilosa, Mvomero, Morogoro rural and Morogoro urban. The region has a population of 2,218,492 people, where 1,093,302 are males and about 41% are children aged 0 to 14 years (NBS, 2012). The main economic activity in this region is Agriculture. A total number of 101 primary schools in Morogoro municipality and 165 primary schools in Kilosa district served as a sampling frame from which the sample was drawn.

Description of the study population

This descriptive cross-sectional study included parent/caregiver-child pairs. The included children had an age range of 7-12 years old and attended selected private or public day primary schools in urban Morogoro municipality and Kilosa district. The study population was selected because the majority of students who are enrolled in primary schools start at the age of 7 years. Therefore, they fall within the Ministry of Education Science, Technology and Vocational Training age range for school-aged children in Tanzania. There was no age specification for parents or caregivers.

Sample size

The sample size was calculated according to Hajian-Tilaki K (2011)) using the formula; $N=Z^2p\ (1-p)\ d^2$ Whereby: N= Sample size, z= 1.96 for a confidence limit of 95%, P= Prevalence of overweight/obesity among school-aged children in Dar es Salaam, Tanzania (22.6%) (Pangani et al., 2016) and the level

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of precision was 5%. The sample size obtained was 272 and the non-response was assumed to be 15% making a total sample size of 320.

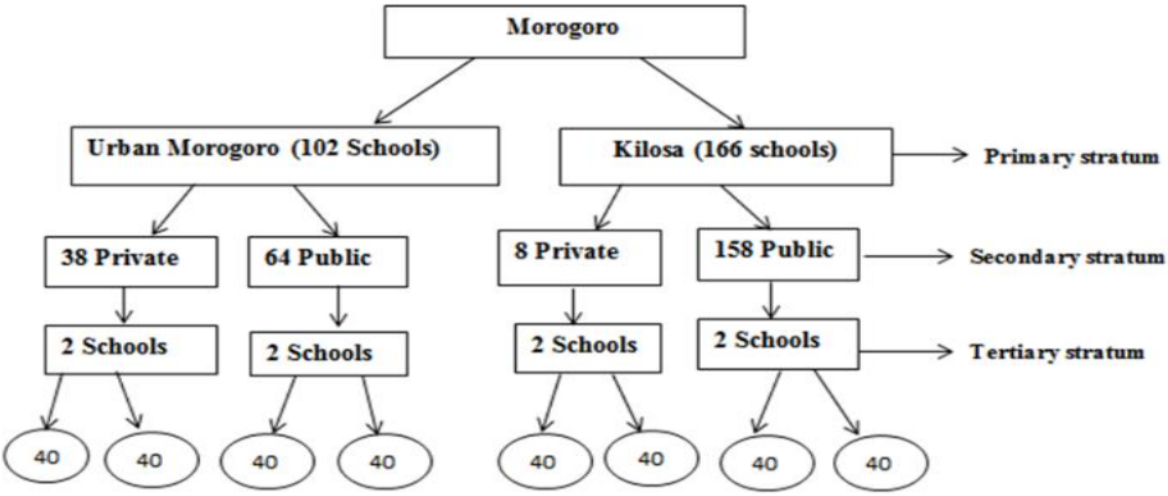

Figure 1: sampling procedure

Sampling procedure

A stratified sampling technique was used to acquire a total sample of 335 children. The main sampling unit was registered primary schools. The schools were stratified into districts based on location and were sampled separately. Through this probability sampling technique, the population of school children in each school was divided into strata based

on school ownership and area of residence. A total of eight primary schools, that is, four government and four private schools located in urban and rural areas, were randomly selected. Averages of 48 children were selected from each of the selected government primary schools and about 36 children from each of the private primary schools. Approximately 5 to 7 students were randomly selected from each class.

Data collection

Information on socio-demographics

Age of parents and children, parent's education level, marital status, household daily income, number of children each parent has, number of people in the household and food consumption data were collected using a pretested questionnaire with structured questions which was administered to the Mothers and children separately by trained research assistants. Pre-testing was carried out in one of the governments and private primary schools located in Morogoro region after the completion of formal training of research assistants.

Anthropometry measurements

Weight, height and Mid-Upper Arm Circumference were measured using standard procedures. Weight was measured using a standard weighting scale (digital electronic SECA scale; (Model 8811021659, Germany) that was kept on a firm horizontal surface. The subject was weighed without shoes and with light clothing by ensuring the removal of heavy-worn clothing such as sweaters, and the weight was recorded to the nearest 0.1kg. Height was measured using a stadiometer (Model No PE-AIM-101-USA) and recorded to the nearest 0.1cm. Subjects were requested to stand upright without shoes on with their back kept against the wall and heels put together in a V-shape while looking forward. The Mid-Upper Arm Circumference (MUAC) was measured using non-stretchable MUAC tape (Model S145620, UNICEF) on the left upper arm at the mid-point between the tip of the shoulder and elbow. Children were required to bend the left arm, followed by finding and marking the mid-point between the olecranon process and acromium. Then, with the arm hanging straight down, a MUAC tape was wrapped around the arm at the midpoint mark and measured to the nearest 1mm. Each measurement was measured twice to find an average.

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Data analysis

Data were analyzed using Statistical Package for Social Sciences (version 21.0) and WHO AnthroPlus software. Sex, weight and height information were entered into WHO AnthroPlus software and provided the BMI for age percentiles. The standard cut-off points for children as per WHO guidelines were used to interpret the data for BMI for age are shown in Table 1. Descriptive statistics such as frequencies and percentages were calculated. In addition to descriptive analysis, the Chi-square (X^2) test was used to compare the prevalence of overweight/obesity in different categories, and the differences were considered significant at $p \leq 0.05$. Multivariate logistic regression analysis was performed following bivariate analysis to adjust for Confounders in which all the variables which are assumed and reported in the literature associated with overweight/obesity were entered into the model using the enter method, where both crude (COR) and adjusted odds ratio (AOR) with 95% CI were reported.

Table 1: The standard cut-off points for children and adolescents 5-19 years of age

Weight status	Body mass index percentiles
Underweight	Less than the 5^{th} percentile
Normal	5^{th}-85^{th} percentile
Overweight	85^{th}-<95^{th} percentile
Obesity	≥95^{th} percentile

Source: WHO, 2009

Ethical considerations

The study commenced after receiving ethical approval from the National Institute for Medical Research with reference number NIMR/HQ/R.8a/Vol.IX/3667 and from Sokoine University of Agriculture with reference number SUA/MHN/D/2019/0010/03. Permission to conduct the study was also sought from the Regional Administrative Officer, the respective District Executive Officers and the head teachers of the selected schools. Parents were informed in detail about the aim and procedure of the study, and parental consent and child assent were sought before commencing research activities. Confidentiality of the information was ensured when all participants were identified by numbers.

Results

Boarding (n=10) and special schools for children with special needs (n=7) were excluded. Children with mental impairment and physical deformities that prohibit accurate height or weight measurements were also excluded. The majority of the selected children were enrolled in public schools (190) because most public schools had more students than private ones.

Socio-demographic characteristics of participants (N=335)

A total of 335 primary school children aged 7 to 12 years old participated in this study, of which about half 172 (51.3 %) were females. Slightly more than half of the children, 188 (56.1%), were aged 10-12 years. The majority of the parents/caregivers 237 (71%) were middle-aged adults, most of them married and about half (52.5%) were self-employed (Table 2).

 https://dx.doi.org/10.4314/thrb.v24i1.3

Table 2: Socio-Demographic characteristics of participants (N=335)

Variable	Category		N	%
Age of the child	7 - 9 Years		147	43.9
	10 - 12 Years		188	56.1
Sex of the child	Male		163	48.7
	Female		172	51.3
Type of School	Public		190	56.7
	Private		145	43.3
Residence of child	Rural		165	49.3
	Urban		170	50.7
Age of parents	Young adults (18-35 years)		44	13.1
	Middle-aged adults (36-55)		237	70.7
	Older adults (56+ years)		54	16.1
Sex of parents	Male		141	42.1
	Female		194	57.9
Marital status of parents	Single		87	26
	Married		248	74
Education level of parents	Post-secondary education/ collage		103	30.7
	Secondary education		111	33.1
	Primary education		78	23.3
	No formal education		43	12.8
Employment of parents	Unemployed		41	12.2
	Self-employed		176	52.5
	Formal Employment		118	35.2
Household Daily Income of parents	<5000Tsh		67	20
	5000-10000Tsh		89	26.6
	>10000Tsh		179	53.4
No people in the household	1 -3		179	53.4
	4-7	4.17±2.27	134	40
	≥ 8	Mean±SD	22	6.6
No of children	1-2		141	42.1
	3-5		186	55.5
	≥ 5		8	2.4

Prevalence of overweight/obesity among children

The study found that 63 (18.8%) of the school children were overweight or obese, while 13 (3.9%) were underweight. A Significantly higher proportion of overweight or obese children were in private schools, while the prevalence of underweight was higher in public schools. A similar prevalence of overweight/obesity and underweight was noted among rural and urban children. About 29 (17.6%) and 34 (20.0%) were overweight or obese and 5 (3.0%) and 8 (4.7%) were underweight in rural and urban areas, respectively (Table 3).

https://dx.doi.org/10.4314/thrb.v24i1.3

Table 3: Comparison of BMI for Age according to Sex, Location and School type

Characteristics	Underweight	Normal	Overweight/obese	P-value
Age				
7 - 9 Years	3 (2.0%)	113 (76.9%)	31 (21.1%)	0.22
10 - 12 Years	10 (5.3%)	146 (77.7%)	32 (17.0%)	
Sex				
Male	10 (6.1%)	123 (76.4%)	28 (17.4%)	0.10
Female	3 (1.7%)	136 (78.2%)	35 (20.1%)	
Location				
Rural	5 (3.0%)	131 (79.4%)	29 (17.6%)	0.59
Urban	8 (4.7%)	128 (75.3%)	34(20.0%)	
School type				
Public	12 (6.3%)	151 (79.5%)	27 (14.2%)	0.00*
Private	1 (0.7%)	108 (74.5%)	36 (24.8%)	
Total	**13 (3.9%)**	**259(77.3%)**	**63 (18.8%)**	

*Significant at P≤ 0.05

Determinants of overweight/obesity

Children in private schools were more likely to be overweight or obese compared to those in public schools (AOR 1.19, CI: 1.55-2.60). Children who had breakfast before going to school were associated with being overweight or obese compared to those who missed their breakfast (AOR 2.23, CI: 1.06-4.68). Other factors that were associated with overweight/obesity include the high income of the parents (AOR 1.88, CI: 1.68-3.15) and being given money to spend at school (AOR 2.89, CI: 1.76-4.11) (Table 4.

Table 4: Determinants of Overweight/Obesity in children (Crude OR and Adjusted OR)

Characteristics	Crude OR(CI)	Adjusted OR(CI)	P-Value
School type			
Public	Ref	Ref	
Private	2.07 (1.19 – 3.59)	1.19 (1.55 – 2.60) *	0.03
Location			
Rural	Ref	Ref	
Urban	1.13 (0.65 - 1.94)	1.26 (0.68 – 2.31)	0.42
Sex			
Male	Ref	Ref	
Female	1.15 (0.66 – 1.98)	1.04 (0.57 – 1.89)	0.31
Age (years)			
7-9	Ref	Ref	
10-12	0.80 (0.46 - 1.38)	0.95 (0.52 - 1.75)	0.06
Household daily income			
Less than 5000	Ref	Ref	
5000-10000	0.73 (0.26 - 2.05)	0.60 (0.19 - 1.79)	
Above 10000	2.70 (1.20 - 6.07)	1.88 (1.68 - 3.15) *	0.00
Employment status			
Unemployed	Ref	Ref	

Self-employed	1.42 (0.51 - 3.93)	1.66 (0.50 - 5.55)	
Employed	2.46 (0.88 - 6.83)	1.99 (0.52 - 7.58)	0.57
Parent's education level			
Post/colleges	Ref	Ref	
Secondary	0.63 (0.33 - 1.19)	1.06 (0.46 - 2.45)	
Education	0.35 (0.15 - 0.79)	0.73 (0.23 – 2.36)	0.65
No formal education	0.43 (0.17 – 1.14)	1.10 (0.28 - 4.39)	
Provision of school lunch			
No	Ref	Ref	
Yes	2.78 (1.21–6.39)	1.94 (0.74 – 5.06)	0.22
Provision of breakfast at home			
No	Ref	Ref	
Yes	2.13 (1.06–4.28)	2.23(1.06 – 4.68) *	0.04
Packed lunch from home			
No	Ref	Ref	
Yes	0.62 (0.30 – 1.30)	0.75 (0.33 – 1.69)	0.13
Given money to take to school			
No	Ref	Ref	
Yes	1.53 (0.44 – 5.35)	2.89 (1.76 – 4.11)*	0.02

*Significant at p<0.05; N= total number of respondents.

Discussion

Prevalence of overweight and obesity among children

This study reports the prevalence of overweight and obesity among primary school children in two districts of the Morogoro region. Generally, the prevalence of overweight and obesity among school children has increased. The possible reasons are changes in lifestyle and eating behaviours among all population groups in the country and other environmental aspects e.g., the availability of a large number of fast food outlets in different areas, an increase in children's purchasing autonomy and the use of motorized transport. This study found a higher prevalence than what was reported in similar studies conducted in the country. For example, a previous study in Tanzania showed that the prevalence of overweight/obesity among school children aged 9-11 years was 15% (Vincent *et al*.., 2021). Another study conducted among primary school children aged 7-17 years in urban Arusha, Tanzania (Chomba *et al.,* 2019) reported that the prevalence of overweight and obesity was about 18%.

This study reports a slight but not significant difference in sex distribution in the prevalence of overweight/obesity, where girls had a higher prevalence than boys. The slightly higher prevalence among girls could be linked to the children's sedentary lifestyle and age, as girls experience menarche at this age (Mosha *et al.*,2010), and factors suggested to play a role in this include; differences in energy needs between boys and girls due to timing of sexual maturation; levels of physical activity and cultural aspects in which male children play more than female children who are supposed to stay indoors helping with household chores (Arcan *et al.,* 2017; Hannay *et al.,*

2013). The findings were different to the other studies done in Tanzania, where more females were found to be overweight or obese than males(Tluway *et al.,* 2018; Pangani et al., 2016).

On contrary, the present study found no significant difference in the prevalence of overweight/obesity among children in rural and urban schools. The possible reasons could be due to the presence of a large number of fast food outlets in both rural and urban areas, changes in consumption patterns and an increase in sedentary life among rural and urban populations, indicating nutrition transition. A study by Gurdrun and colleagues (2013) reported that overweight/obesity among women is on the increase even in rural settings hence; there is a possibility of increased prevalence among school children. On the other hand, other studies conducted in different regions in Tanzania and other countries in Africa reported a higher proportion of children from urban areas being overweight or obese than children from rural areas (Samwel *et al.,* 2022; Vincent *et al..,* 2021; Tluway *et al.,* 2018; George *et al.,* 2017). Furthermore, our findings appear to contradict the findings of a study conducted in Dar es Salaam with 446 children (Muhihi *et al.*, 2013), which found that reported female gender, age above 10 years and urban residence were the most significant determinants of obesity in primary school children. The difference observed among studies could be due to a variation in the geographical location of the studies.

Determinants of overweight and obesity in children

In our study school type, household daily income, provision of breakfast before going to school and being given money to spend at school were all significant determinants of overweight/obesity. Children enrolled in private schools were more susceptible to overweight and obesity compared to those enrolled in government schools. The variation in the socio-economic status (SES) of the families could be a contributing factor since only children whose parents can afford the fees charged can enrol their children in private schools. In addition, children in private schools are more prone to sedentary lifestyles due to the system of organized transport and limited time to do physical activities like walking and cycling. However, physical activity was not assessed in this study. These findings are similar to those of previous studies done in Dar es Salaam and Kilimanjaro, Tanzania among primary school children (Pangani *et al.,* 2016; Vincent *et al.,* 2021).

The current study reported that household daily income was associated with childhood overweight and obesity. The possible reasons could be exposure to motorized transport, sedentary recreations and high purchasing power that lead to increased calorie accessibility, mostly from fat and high-sugar foods (Bhuiyan *et al.,* 2013). Since the foods purchased are shared by all the members of the family, children are more likely to be affected by high fat, sugar and calories. The findings are similar to that of a systematic review conducted by Choukem *et al.,* (2020) in Sub-Saharan Africa (SSA) among children and adolescents aged 5-19 years which reported a positive association between overweight/obesity and higher socio-economic status.

Children who had breakfast at home were found to be overweight/ obese compared to those who missed their breakfast. The reasons could be that most prepared breakfasts are energy-dense and less nutritious snacks like porridge, white bread or rice leftovers. Similarly, a study conducted by Elmanssury (2020) in Saudi Arabia among school students aged 13 to 16 years old reported that a significant association exists between obesity and breakfast intake due to an increase in total daily calories and consumption of fast foods during school hours among children. On the other hand, children who received some money to spend at school were overweight or obese compared to those who didn't have any money to spend at school. Most children who had money to spend at school were likely to increase their purchasing autonomy from foods sold around the school. These findings are in line with previous studies conducted in Tanzania (Muhihi *et al.,* 2013; Mwaikambo *et al.,* 2015).

Conclusion and recommendations

The prevalence of overweight and obesity among primary school students in Morogoro has increased, particularly among children studying in private primary schools. The findings also show that household daily income, provision of breakfast before going to school and being given money to spend at school were determinants of overweight and obesity.

The study highlights important correlates between overweight and obesity, therefore, monitoring children's nutrition status in schools is very crucial. Efforts should be made to raise awareness about the consequences of being overweight or obese to reduce the risk of lifestyle-related diseases associated with being overweight and obese. Parents should be educated on the importance of providing a healthy breakfast to protect their children from eating unhealthy snacks sold around schools. Further studies should be conducted to assess the influence of other factors such as consumption patterns and physical activity levels on overweight and obesity among school children.

Competing Interests

None.

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