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Contribution of Dietary Practices and Physical Activity to Overweight and Obesity Among Children 6-11 Years Attending Selected Public Schools in Nairobi City, Kenya

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ABSTRACT

Background: Childhood overweight & obesity have escalated to concerning proportions, with a growing number of lives being claimed from its complications annually, and an increasing GDP being used in treatment worldwide. The gravity of this issue lies in its potential long-term health ramifications, necessitating a profound understanding of the driving factors. A concerning prevalence continues to be documented not only in developed countries but also in developing economies. This study investigated contributors to obesity and overweight in 6–11-year-olds in Nairobi City County schools.
Method: A cross-sectional study design was used in this research. The sample size of 129 was from 4 randomly selected schools in Embakasi Sub-County, Nairobi, Kenya. The 6–11-year-olds were mainly from grades 1 to 6. Structured questionnaires and focused group discussions were used to collect data. Data analysis was done using SPSS version 20, ENA for SMART software (version 2010), and WHO AnthroPlus (BMI-for-Age Z-scores). Descriptive and inferential statistics were done. In inferential statistics, $P < 0.05$ was considered significant.
Results: Response rate was at 97%, with most of the children being female 65 (51.6%), while males were 61 (48.4%). From the ones who filled the questionnaire, majority were married 85 (67.5%), and were mothers, 102 (81%). 83.3% of the households purchased food, and over half, 71 (56.3%) spent KES 251-500 on food daily. The mean calorie consumption in a day was 2,260.58 Kcals, with females having slightly higher intake, 2271.01 Kcal. Most of the children, 68 (58.9%) consumed higher than the estimated energy requirement and had a medium food diversity score 93 (73%). The majority of the children had moderate physical activities (49.7%). Overweight and obesity were at 3 (2.38%). Dietary habits and physical activity were significantly linked to overweight/ obesity, statistical analysis ($P = 0.009 / 0.041$, respectively).
Conclusion: Overweight & obesity was uncovered to be related to children's dietary practices as well as physical activity levels, according to the results. Therefore, it is essential to implement thorough nutrition education for both parents and children, encourage a variety of recreational activities in schools, and uphold healthy nutrition standards for meals and canteen foods as vital measures in addressing overweight & obesity in Kenya and beyond.

Keywords: Obesity, Overweight, Physical activity, Children, Diet

INTRODUCTION

Childhood obesity remains a global health concern that impacts children's health in the long run, and, therefore, requires urgent attention. The World Health Organization declared a worldwide health crisis owing to the alarming rise of childhood obesity in 2023, at least 390 million kids plus teens (aged 5–19) are impacted internationally with overweight, and 160 million obese. [1] According to the statistics, being overweight directly causes the deaths of about 2.8 million people every year. [2]

Health issues like; cardiovascular diseases, diabetes, and inflammation are likely to be experienced in adulthood in those with overweight & obesity when young. [3] Sustained above normal weight from childhood to adult age causes a great load on the health care system because of the side effects. [4]

Overweight has spread from developed nations to countries with low or medium incomes. In line with, [5] the costs per capita range from $6 in economically disadvantaged nations to $1,110 in wealthy countries, with $20 in Africa and $872 in the Americas being the estimated figures. The impact on the economy differs across regions. Both industrialized and emerging nations have seen a surge in the occurrence of overweight children during recent decades.

In many industrialized sovereignties like the United States and various Eurozone nations, the commonness of surplus weight in minors has been escalating for an extended period. Reasons for this increase include: not getting enough exercise, eating poorly, and having ready access to foods that are high in energy density. [6] The prevalence of obesity varied among countries, with 26% in Turkey and 32% in the USA. [7]

The industrialized world is not the only place where children become overweight or obese. Extra weight among children has increased in developing continents, like Africa. In Ethiopia, the rapid pace of urbanization exacerbates the trend toward aggressive eating, as Western diets become more common and people become less active. [8] Keeping this in mind, it's crucial to acknowledge that childhood obesity and overweight represent a global epidemic that surpasses national boundaries and economic strata. Metabolic factors, lifestyle choices, variations in socioeconomic position, levels of maternal education, maternal age, age of children, and genetic factors are among the many risk indicators for weight addition. [9]

Malnutrition affects children in Kenya in two ways, according to studies. A survey in Nairobi revealed an obesity and overweight prevalence of 11.6% among children. [10] Among academically active children in Kisumu, 7.9% were obese and 14.4% overweight. [11] Within primary school-aged youngsters aged 9-11, in Nairobi, it was established that 20.8% were obese/overweight. In the study, eating fast food in front of the television contributed to increased obese/ overweight rates. [12]

Physical inactivity increased risk of having issues related to; cholesterol, glucose, and blood pressure, as well as mental health and respiratory problems (Hanifah et al., 2023). [13] Unhealthy eating habits and excessive screen time are increasingly impacting children in African cities. Thirty percent of urban 8–11-year-olds in eight African nations, including Kenya, were overweight, according to nutritional surveys. [14] Research indicates that obesity rates among children are significantly higher in urban schools compared to rural ones. [15]

In countries like Kenya, where both inadequate and surplus nutrition are prevalent, the seriousness of juvenile obesity is often underestimated. The current obesity data among school-aged children in Nairobi City County necessitate the implementation of a management and preventive plan. Given this, the ongoing study aims to gather data to assist in developing interventions by identifying the contribution of dietary practice and physical activity to overweight & obesity among children 6-11 years attending selected public schools in Nairobi City County.

Specific objective of this study

- To analyze the demographic and socioeconomic attributes of households with children 6-11 years enrolled in selected public schools in Nairobi.
- To figure out the dietary practice of children aged 6-11 years attending public schools in Nairobi.
- To look at the level of physical activity among 6-11-years-olds attending public schools in Nairobi.
- To review the nutritional state of children aged 6-11 years attending public schools in Nairobi.
- To scrutinized the relationship between dietary practices, physical activity, and overweight & obesity in 6-11-years-olds who attend public schools in Nairobi.

MATERIALS & METHODS

Research design

This study used an analytical, cross-sectional model to assess the contributors of overweight & obesity in childhood

Study location

The research was conducted in Embakasi Sub-County, located within Nairobi City County, Kenya. The study further focused on four selected public schools in the vast Embakasi Sub-County, namely Donholm, Embakasi, Mihango, and Edelvale primary schools.

Study population

Children aged 6 to 11 years attending public primary schools in Embakasi Sub-County

Inclusion criteria

The study enrolled 6-11-year-olds from Donholm, Embakasi, Edelvale, and Mihango primary schools. Those whose mothers had signed the informed consent and their children had assented. Children who had been in the school spanning at least two terms.

Exclusion criteria

Children with chronic illness and special needs, who had not given assent, those whose parents refused to sign the consent form, and those enrolled in school for less than two terms were eliminated from the study.

Sampling technique

The study specifically selected Nairobi City County due to its obesogenic environment and its status as Kenya's most populous capital city. Embakasi Sub-County was also purposively selected because of high poverty rates and various slums, which may affect school children's eating habits and nutrition. From the 37 public primary schools in Embakasi, 4 schools were randomly selected using a computerized random number generator. Simple random sampling was also used to choose the students from grade 1-6 (6-11years) as found in the school's database. This ensured all students had equal chance, and the distribution of the sample size depended on the population size of each school

Sample Size

Sample size was computed using the Fishers et al. (1998) formula, and 10% was added in case of none response. The sample was finally found to be 129, after applying the finite formula.

Data collection tools

Instruments used in this research were structured questionnaires and focused group discussions (FGDs). The structured questionnaire looked for information on: socio-demographics of households with 6-11year- olds, dietary practices and diversity of the children (the food frequency plus 24-hour dietary recall), their physical activity (Physical Activity Questionnaire for Children – PAQ-C), and anthropometric measurements

Data collection procedure

After the data collection tools were checked by a team of Kenyatta University nutrition experts, four university research assistants were enlisted and trained on data gathering. The pre-test was done in Umoja Primary School, 10% of actual sample size was used to check the data collection tools. The school management was informed and they provided a desk for data collection within the school compound, daily, from 8am to 5pm.

Before data collection commenced, the participants were taken through the study, consent forms were signed by caregivers and the children gave assent to the study. The bathroom scale was used to measure weight to within 0.1 kg and a height meter was used to record height to within 0.01 cm. Four FGDs representing each of the four schools were conducted to groups of 6-8 caregivers, within the school compound after taking the participants through the FGDs guidelines.

STATISTICAL ANALYSIS

Analyzing data, coding, and cleaning was carried out using SPSS version 20. ENA for SMART software (version 2010) and WHO AnthroPlus (BMI-for-Age Z-scores) were also utilized for nutrition and anthropometric data analysis. Descriptive and inferential statistics were done. In inferential statistics, $P < 0.05$ was considered significant. Chi-square test was used for categorical/nominal data analysis while logistic regression was used for predictors of childhood overweight/ obesity. The four FGDs were summarized and transcribed to get the participants' overall opinions.

RESULT

Response Rate

97% (126 out of 129) of the sample size provided sufficient data to be analysed in the study.

Demographic and Socio-economic Characteristics

Female children were 65 (51.6%) while males were 61 (48.4%) of the sample. Their mean age was 9.2±1.8 years. A third of children were 11 years old 42 (33.3%), while the least represented age group was 6 years old 12 (9.5%). The respondents in the study were mothers 102 (81.0%), fathers 13 (10.3 %) and caregivers 11 (8.7%). More than two-thirds, 85 (67.5%) of the respondents were married, while the least were widowed at 3 (2.3 %). Regarding the main occupation, for the mothers, close to half were involved in business 57 (45.6%) followed by about a third 29 (23.4) employed. For the fathers, over a third of the fathers were employed 49 (52.7%) followed by 30 (32.3%) in business. In this study, most of the fathers had secondary level of education at 62 (49.2%), while mothers mostly had a primary level of education 51 (40.4%), respectively. More than half of the households had five and above household members at 70 (55.6%). A chi-square analysis showed a significant relationship between father's occupation (p=0.02), count of household members (p=0.04), education level belonging to the mother (0.04) with prevalence of those overweight/obesity, as shown in table 1.

Table 1: Participants & Caregivers Demographic &Socio-economic Characteristics

	Characteristics	Frequency (n=126)	%	P-value
Gender	Male	61	51.6	
	Female	65	48.4	
Age	6 years	12	9.5	
	7 years	17	13.5	
	8 years	13	10.3	
	9 Years	22	17.5	
	10Years	20	15.9	
	11 Years	42	33.3	
Relationship to the child	Mother	102	81.0	0.14
	Father	13	10.3	
	Caregiver	11	8.7	
Marital Status	Separate/divorced	15	11.9	0.25
	Married	85	67.5	
	Single	23	18.3	
	Widow/Widower	3	2.3	
Occupation of mother	Farmer	1	0.8	0.38
	Business	57	45.6	

	Employed	29	23.4	
	Unemployed	12	9.6	
	Housewife	26	19.8	
	Student	1	0.8	
Occupation of father	Business	30	32.3	**0.02**
	Employed	49	52.7	
	Unemployed	7	7.5	
	Student	7	7.5	
Education level of father	Primary	20	15.9	0.54
	Secondary	62	49.2	
	Tertiary	44	34.9	
Education level of mother	Primary	51	40.4	**0.04**
	Secondary	36	28.6	
	Tertiary	39	30.95	
No. of household members	1-2	7	5.6	**0.04**
	3-4	49	38.8	
	5 and above	70	55.6	
Previous day expenditure on food	Below 100	10	7.9	
	KES 101- 250	13	10.3	
	KES 251- 500	71	56.3	
	KES 501- 1000	30	23.8	
	Above KES1000	2	1.6	
Monthly expenditure on food	Below KES 1000	4	3.2	
	KES 1000-5000	15	11.9	
	KES 5001-10000	47	37.3	
	Above 10000	59	46.8	
	Don't Know	1	0.8	

The majority of households 83.3% purchased their food, (13%) obtained food from supplies made by relatives and friends, while 3.2% sourced food from both relative/friends and purchases (Figure 1). Among the participants, over half 71 (56.3%) of households spent KES 251-500 daily on food. On monthly expenditure, about 59 (46.8%) of the households used above KES 10,000 on food, 47 (37.3%) used KES 5001-10,000 a month, (Table 1). The findings also indicate that mothers were the majority in terms of household food purchase 113 (90%) and preparation 115 (91%).

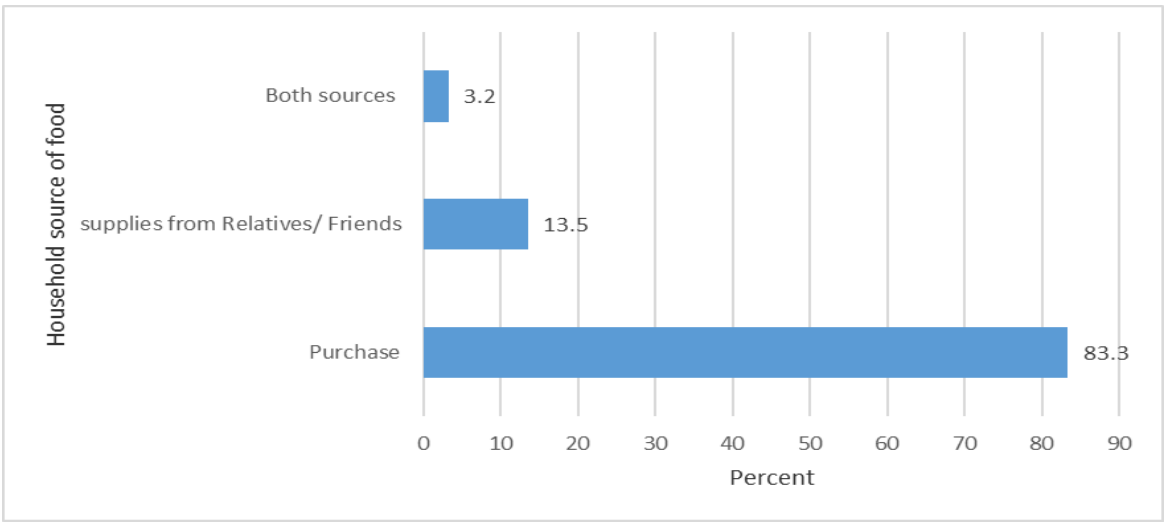

Figure 1: Main food Sources for the household

Dietary Practice of the Children

The mean kilocalorie (Kcals) consumed were 2,260.58 (n=126) Kcals per day. The male children's daily mean was 2,250.23 Kcals (n=61), while for girls, was 2,271.01Kcal (n=65). Roughly half of the selected indulged in two meals a day 53 (42.3%), 42 (33.3%) had three meals, 21 (16.3%) took four meals, while 10 (8.1%) took one meal a day. Just over a one-fourth of the children, 40 (31.74%), possessed an energy intake exceeding 120% of the estimated energy requirements (ERs); 80-120 % was considered adequate. Higher than half of the children ingested adequate energy intake 68 (53.9%), while less than a quarter 18 (14.3%) had inadequate energy intake. Individual dietary diversity score per child was calculated using 24-hour recall method, with nine food groups considered for calculating the score. A score of 1-3 food groups was classified as low dietary diversity, 4-6 food groups as medium, and 7-9 food groups as high dietary diversity. The outcome exhibited that the bulk of the children, 93 (73%), possessed medium dietary diversity score, while 29 (23%) showed low dietary diversity score, and only 4 (3.2%) had a high dietary diversity score.

Cereals were among the most consumed food group the study participants 126 (100 %,) took, on average 6.94 times per week. This was followed by oils and fats 98.4 %, consumed on average 6.24 times per week, and milk and milk products 66.7 %, 5.74 times per week, as shown in Table 2.

Table 2: Food consumption by children in a week

Food groups	Males N=61	%	Females N=65	%	Mean times
Cereals	61	100	65	100	6.94
Roots and tubers	4	6.55	2	3.07	1.54
Vegetables	43	70.49	41	63.07	5.05
Fruits	19	31.14	16	24.62	3.75
Meats and eggs	18	29.50	21	32.3	1.61
Fish	6	9.83	4	6.56	1.04
Legumes, nuts and seeds	23	37.70	35	53.84	3.23
Milk and milk products	50	81.97	56	86.15	5.74
Oils and fats	60	98.36	64	98.46	6.24

Physical activity level of the children

Physical activity (PA) level was assessed using PAQ-C (Physical Activity Questionnaire for Children). Nearly half of the children experienced moderate PA level 63 (49.7%), followed by low PA level at 46 (36.2%), and 17 (14.1%) had high PA level. More than half of the children attend physical education lessons 62 (49.2%),

while only 4 (3.2%) hardly attended any. During break and lunch times, most of the children 76 (60.3%) and 74 (58.8%), respectively, participated in moderate activity. Close to half, 58 (46%), had 2-3 times of activities during weekends, and 52 (41.3%), reported doing physical activity an average of 3-4 in a week. This is shown in table. An analysis of FGD from Embakasi primary, respondent (R5) noted, “My kids play using rope, playing football, and I also tell them to fetch water from the tap”. This shows that the caregivers involve children in some physical activities.

Table 3: Physical activity engagement in Embakasi Sub-County children.

Physical activity	N=126		
	Type	N	%
Physical Education (PE) last 7 days	Hardly Ever	4	3.2
	Sometimes	24	19.1
	Quite Often	36	28.6
	Always	62	49.2
	Sedentary	14	11.1
Break Time last 7 days	Moderate activity	76	60.3

	High activity	36	28.6
	Sedentary	14	11.1
Lunch Time last 7 days	Moderate activity	74	58.8
	High activity	27	21.4
	Did not participate	25	19.8
Physical activity last weekend (Times)	1	13	10.3
	2-3	58	46.1
	4-5	37	29.4
	≥6	18	14.2
Summary of PA in the previous 7 days	All free time	4	3.2
	Did physical activity 1-2 days	20	15.9
	Did physical activity 3-4 days	52	41.3
	Did physical activity 5-6 days	30	23.8
	Did physical activity 7 days	20	15.8

Nutrition status of the children

The mean weight and height of participants were 30.1kg and 135cm (N = 126), respectively. The majority of the children had normal BMI-for-Age Z score 91 (72.22%), 26 (20.64%) were underweight, while 6 (4.76%) and 3 (2.38%) were overweight and obese, respectively. According to gender, more female children were overweight 4 (3.17%) and obese 2 (1.59%) than male children 2 (1.59%) overweight and 1 (0.79%) obese. The data is presented in figure 2

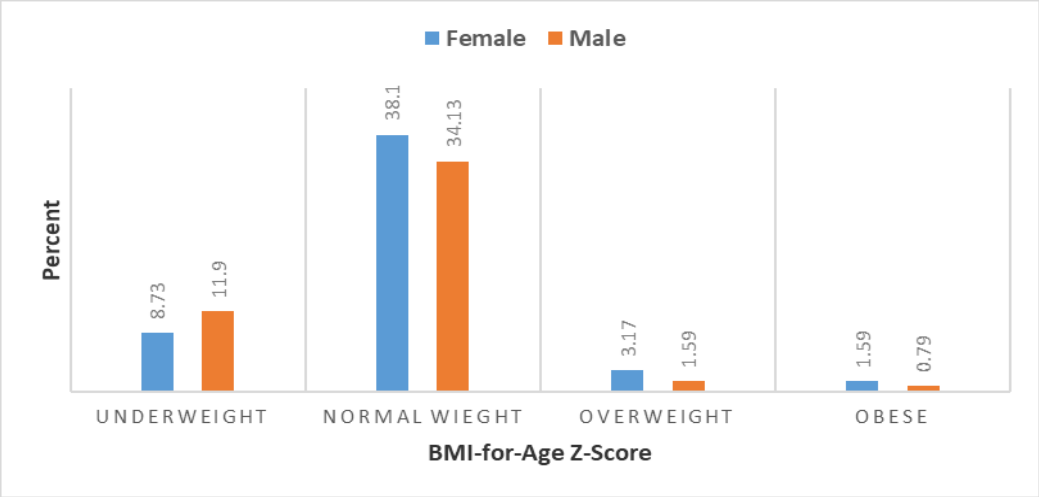

Figure 2: BMI-for-Age Z-scores (Female verse Male)

The relationship between dietary practices, physical activity, and overweight & obesity.

Pearson chi-square test outcome pointed to a statistically significant association between dietary practices and overweight & obesity (X^2 (9, N = 126) = 3.91, p value = 0.009). There was a statistically significant association between physical activity levels with overweight & obesity (X^2 (12, N = 126) = 15.92, p value = 0.041) as illustrated in Table 5. Therefore, there is a meaningful linkage in dietary intake, physical activities, and overweight & obesity among children 6-11 years in public schools in Embakasi.

Table 5: The affiliation in dietary practices, physical activity, and overweight & obesity

Variable	X^2	Df	P-value	Variable
Dietary practices (DI)	3.91	9	0.009	Dietary practices (DI)
Physical activity (PA)	15.92	12	0.041	Physical activity (PA)
Variable	X^2	Df	P-value	Variable

The logistic regression equation was y =β0+β1 DI+ β2PA. The implication from the regression findings was that 7.76 % (R-square was 0.0776) and 23% (0.23) of the variations in overweight/obesity status were associated with adjustment in the dietary practices and PA levels of the children aged 6-11 years, respectively. Dietary practices displayed a positive contributory factor to overweight/obesity levels with a positive coefficient of 0.036. This means that, as the dietary practices increased by one unit, the overweight/obesity levels increased by 0.036 units. However, this association was very weak and not significant (β = 0.036, S.E= 0.077, P = 0.672). For physical activity, it showed a weak but significant relationship (β = -0.176, S.E.= 0.011, P = 0.051) with overweight/obesity among children 6 -11 years. Similarly, the details are revealed in Table 6.

Table 6: Logistics Regression analysis concerning dietary practices and overweight & obesity

Variable	**Standardized coefficient Beta**	**SE**	**R_2**	**p-value**
Dietary practices (DI)	0.036	0.077	0.0776	0.672
Physical activity (PA)	-0.176	0.011	0.23	**0.051**
Variable	**Standardized coefficient Beta**	**SE**	**R_2**	**p-value**
Dietary practices (DI)	0.036	0.077	0.0776	0.672

Dependent variable: overweight/obesity; Association significant at p<0.05; SE-Standard error; R2= proportion of variance in the dependent variable

DISCUSSION

The study looked at children aged 6-12years nutrition status, with an interest in overweight and obesity since unmanaged childhood obesity leads to obesity in adulthood. Adult obesity has been associated with complications like cardiovascular diseases and brings an economic burden to manage these complications. There is currently an increase in childhood obesity. [3] The research showed that overweight and obesity among girls were higher at (3.17%, 1.59%), respectively, than among boys at (1.59%, 0.79%), respectively. These findings were similar to those of Kisumu City, Kenya, although the overweight and obesity rates was higher at 7.9% and 14.4%, respectively. [11] In contrast, a study in Ethiopia showed that boys (13.3%) are more likely to be overweight and obese than girls (11.5%). They defined overweight and obesity as excess fat in the body. The mother's employment status, which increased with education level, significantly increased the chances of overweight and obesity. [8] In this study, a positive correlation was observed between caloric intake and factors such as fathers' occupation (p = 0.02) and mothers' education (p = 0.047). Most participants in this study spend more than KES 10,000 on food per month, with more than half spending between KES 251-500 per day. This shows that most people could afford to buy food. Notably, most participants also had at least primary education (fathers 65.1% and mothers 69%). Another study stated that there is an increasing prevalence of obesity, especially in urban areas, regardless of socioeconomic status. [16]

Dietary practices are the main root of overweight and obesity. [11] A global surge in calorie-rich food consumption is linked to obesity and overweight. This has also been catalyzed by the obesogenic environment that leads to excess calorie consumption and reduced energy use through physical activity. [1] A significant proportion (31.74%) of the children in this study had an energy intake above 120% of the estimated energy requirements. The bulk of the children in the study ate two (42.3%) or three meals (33.3%) daily and had medium dietary variety scores (73%). In both studies, cereals were the most consumed food group, and school food environment, eating fast food, and eating in front of a TV had a positive relationship to overweight and obesity. [11] A previous study among urban schools reported different results; children mainly consumed a low-

calorie diet. [12] This study found a correlation between unhealthy eating habits and the prevalence of overweight & obesity among school-aged children (P = 0.009).

Children's physical activity level is low. Inadequate physical activity has negative effects like increased obesity, insulin resistance, heart diseases and suboptimal mental health. [13] The WHO advises at least 60 minutes of moderate-intensity physical activity (MVPA) every day, but most children don't attain this level. [17] Nearly half (49.7%) of the children in this study engaged in moderate exercise. This is mostly as a result of engaging in physical activity during PE (49.7%), and a majority also played moderately during break (60.3%) and lunch time (58.8%). The study also demonstrates a notable bond in; physical activity, body mass, and the prevalence of overweight & obesity in children (P=0.041).

CONCLUSION

The study concluded that the socioeconomic status of the parents influenced the children's dietary practices. The majority of the children consumed adequate energy intake, and more than a quarter took more than the required energy intake. The prevalence of overweight is slightly lower than recorded in the previous study. A significant relationship was found between dietary practice, physical activity & overweight and obesity. The study recommends a joint effort among the government, schools, and caregivers to ensure children eat proper meals and undertake physical activity. These efforts include: child-friendly food policies, creating grounds to carry out physical activities, nutrition education for children, and providing a healthy diet both at school canteens and at home. In addition, recommending longitudinal research to track children's dietary practices, physical activity to further understand the relationship to overweight and obesity.

Declaration by Authors

Ethical Approval: Approved

Kenyatta University Ethical Clearance Committee number PKU/2442/11572, NACOSTI number NACOSTI/P/22/18721 and Ministry of Education approval, Ref: RDE/NRB/RESEARCH/1/65 Vol.1.

Participation was voluntary, and consent forms were signed.

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Conflict of Interest: The authors declare no conflict of interest.

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