

## Prevalence and Dietary Practices Associated with Childhood Overweight and Obesity among Pupils Aged 6-15 Years Attending Public Primary Schools in Kisumu Central Sub-County, Kisumu County, Kenya

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### Abstract

Overweight for children aged 6 - 15 years is body mass index for age equivalent to or above 85<sup>th</sup> percentile while obesity for the same age group is body mass index (BMI) for age equivalent to or above 95<sup>th</sup> percentile. In Kenya the prevalence is estimated at 21%, being higher among females (10.9% obese and 3.6% overweight) than males (6.5% obese and 2.6% overweight). The etiology of this condition is closely linked to the individual's dietary practices. However, there is still scarce information on the trends and distributions of these risk factors among children. The main objective was to determine dietary practices associated with childhood overweight and obesity among public primary school-going pupils aged 6 - 15 years in Kisumu central sub-County, Kisumu County, Kenya. A sample of 15 primary schools was identified through simple random sampling from a list of all schools in Kisumu Central Sub-County. 1268 eligible male and female participants aged 6 to 15 years were selected through simple random sampling for screening. Out of 1268 children, 282 overweight and obese children were selected to continue with the study. Dietary recall tool was used to assess dietary practices for a period of one week. Saskatchewan Food Costing Task Group tool was used to assess school food environment. Chi-square, Binary logistic regression and Pearson product moment correlation were used to determine association between dietary practices and childhood overweight and obesity. Dietary practices associated with childhood overweight and obesity were: number of times eaten in a day ( $r = 0.176$ ,  $p < 0.002$ ), carrying snacks to school ( $X^2 = 77.510$ ,  $p < 0.000$ ), high consumption of beverages (70.6%), sweets (47.2%), cereals (99%), deep-fried chips (50%) and failure of schools to collaborate with community partners to create and sustain a healthy nutrition environment ( $r = 0.922$ ,  $p < 0.001$ ). These results may inform planning and implementation of school health policies to mitigate factors influencing childhood obesity and overweight in primary schools in Kisumu and Kenya at large.

**Keywords:** Overweight; Obesity; Body Mass Index; Dietary Practices; Food Environment; World Health Organization

## **Abbreviations**

BMI: Body Mass Index; CVD: Cardiovascular Disease; WHO: World Health Organization; CIDP: County Integrated Development Plan; FRAC: Food Research Action Centre

## **Introduction**

Childhood overweight and obesity is an emerging public health problem worldwide [1]. It's estimated that around 1 billion people in the world are obese. These include: 340 million adolescents, 39 million children and 650 million adults [1]. WHO estimates that approximately 167 million people including children and adults will be overweight or obese by 2025 [1]. During World Obesity Day 2022, WHO urged countries to do more to reverse this health crisis [1]. According to WHO, obesity leads to a range of non-communicable diseases (NCDs), such as hypertension, type 2 diabetes, cardiovascular disease, stroke, various forms of cancer and mental health issues [1]. People with obesity are more likely to be hospitalized for COVID-19 than non-obese people [1].

In Kenya, 4% of rural and 21% of urban children are overweight/obese based on WHO cut off points [2]. According to Kisumu County Integrated Development plan for 2018, the county recognized that unhealthy lifestyles, physical inactivity and poor dietary practices as the leading causes of overweight, obesity and lifestyle diseases and hence prioritized promoting public awareness and healthy living through education in schools and communities [3]. The goal to preventing obesity is to act early at childhood stage through implementing effective dietary practices such as providing access to healthy food and limiting marketing of drinks and food high in fats, sugar and salt [1].

Dietary practices like regular snacking have a great influence in childhood overweight and obesity [4]. Regular snacking of children is associated with increased overall dietary intake [5]. Most of the snacks are high in carbohydrates and fats [6]. Food consumption patterns, food industry, presence of fast foods, media and cultural behaviours related to food are some of the factors which influence occurrence of childhood overweight and obesity [6]. Meal patterns vary across cultures and populations as well as by individual habits [7]. These may include having three meals in a day, less well-defined eating occasions in both young people and adults, slimming and dietary restraint, which leads to skipping of meals, e.g. supper, lunch and breakfast [8]. Skipping of meals is associated with snacking later in the day and increased fat intake hence leading to childhood overweight or obesity [8].

Globalization and industrialization have increased consumption of highly processed foods [9]. The fast-food industry provides access to take away services, preferred meals and home delivery services [9]. These foods are normally low in complex carbohydrates, high in fat and energy dense [9]. Fast food places are intensively advertised, widely available and this has contributed to many children not preferring home prepared meals and consuming more fast foods [10].

The media has a persuasive influence on food choice and provides information on new and existing recipes and foods to consumers [11]. It has been very influential in altering dietary patterns [11]. Television and radio play major roles in influencing and informing children. [11]. Cultural factors which include religious practices, social conventions, peer groups, influence of other members of household, the status value accorded to the different foods and individual lifestyle have potential impact on food choices [7]. Increase in weight has been viewed as a sign of health prosperity by most people [12].

Increasing childhood obesity has been largely accounted for by obesogenic environments. Obesogenic environment is termed as the sum of the influences that the surroundings, conditions and opportunities of life have in promoting obesity [13]. Children interact with the environment in multiple micro or local environments or settings, including schools, homes and neighborhoods [13]. These are, in turn, influenced by the broader macro environments including health systems, education systems, government, food industry, society

attitudes and beliefs [13]. Food Environment has a major impact on childhood obesity and overweight. Research conducted outside Kenya has shown that supermarkets offer a large variety of non-food and food products including fruits, vegetables, frozen, canned and cooked foods, and offer foods at lower prices [14]. Additionally, a globalized market has increased the pace at which processed foods become available in Africa [15]. Food processing methods such as pasteurization, nutrient enrichment and food fortification have contributed to food safety, food security and improved nutrition amongst human populations [16]. However, highly processed or ultra-processed foods are unhealthy as they contain high amounts of added sugars, saturated fats and sodium and are poor sources of health-promoting nutrients like protein, fibre, vitamins and minerals [17]. Consumption of highly processed or ultra-processed foods has been associated with higher risks of obesity, cancer, metabolic syndrome, gastro-intestinal disorders, cardiovascular disease (CVD) and all-cause mortality [18].

Studies conducted in the United States have shown that healthy school food environment are significantly associated with lower intake of calories, sugar-sweetened beverages, low-nutrient, energy-dense foods and lower likelihood of obesity among school children [19]. A meta-analysis on the effectiveness of school food environment on children's dietary behaviours showed that interventions which provided healthy foods and beverages were associated with significant increase in fruit and vegetable consumption [20]. Health-oriented competitive food and beverage policies were associated with significant reductions in consumption of sugar-sweetened beverages and unhealthy snacks while more healthy policies about school meal standards were associated with significant increase in fruit consumption and reduced intake of sodium, total fats and saturated fats [20]. Hence, exposing children to a healthy food environment has the potential to contribute to preventing obesity in different populations [21].

## **Materials and Methods**

This was a cross sectional study conducted in Kisumu Central Sub-County, Kisumu County. The population was 1268 pupils, aged 6 to 15 years who were attending public primary schools. After screening, overweight and obese pupils who proceeded with the study were 282. Hence, the sample size was 282. The primary school population was chosen because studies conducted around the world have shown that managing obesity at childhood age may have greater effect than managing at adulthood. Public schools were chosen because from these schools there is representation of all social-economic classes which may influence childhood overweight and obesity. In each respective school, pupils aged 6-15 years were selected randomly and coded with the school code (A-0) and numbers 1, 2, 3. The total number of study participants added up to 1,268. Females were 644 (50.8%) while males were 624 (49.2%) giving us a ratio of 1:1.

Data was collected using a questionnaire for parent whose child was either overweight or obese. Dietary recall was used to assess obese and overweight children's dietary intake. Meal time teachers, class teachers and parents to study participants enrolled in the study were asked to record the name/type of food consumed, time, location where food is consumed on each day over a period of one week. It was anticipated that recording of list of foods lasted about 30 minutes on each day. The dietary recall booklets were distributed by the research assistants. Meal time teachers, class teachers and parents to study participants were asked to write down the name of foods consumed during each meal/snack in the respective daily food list form for one week. They were asked to wear a plastic bracelet to act as a reminder to record foods consumed on the days of interest and submitted the completed daily food list every weekday morning in the assigned research room/space in each school. Teachers in charge of meals and class teachers were asked to fill the school food environment questionnaire to collect data on school food environment. The research assistant was present to receive the completed forms.

Chi-square and Pearson product moment correlation were used to determine dietary practices associated with childhood overweight and obesity. The 95% confidence intervals and  $\chi^2$  test for proportions across groups and respective  $p$ -values were reported with  $p < 0.05$  considered significant.

## Results

### Prevalence of overweight and obesity among aged 6 - 15 years

A total of 1268 study participants from public primary schools in Kisumu Central Sub-County were recruited into the study. Of the 1268 pupils, 624 (49.2%) were male and 644 (50.8%) were female with a male to female ration of 1:1. Out of 1268 (100%) study participants recruited in the study, total of those who were overweight and obese was 282 (22.3%). Prevalence of childhood obesity and overweight in this study was 182 (14.4%) and 100 (7.9%) respectively. Female children were more obese (9.5%) than male children (4.9%) and female children were also more overweight (4.3%) than male children (3.6%) as shown in table 1.

Characteristic	Classification				Total	
	Overweight		Obese		n	%
	n	%	n	%		
<b>Age</b>						
6	16	(1.3)	4	(0.3)	20	(1.6)
7	17	(1.3)	13	(1.0)	30	(2.6)
8	11	(0.9)	14	(1.1)	25	(2.0)
9	12	(0.9)	31	(2.4)	43	(3.3)
10	3	(0.2)	21	(1.7)	24	(1.8)
11	10	(0.8)	22	(1.8)	32	(2.6)
12	14	(1.1)	28	(2.2)	42	(3.3)
13	13	(1.0)	34	(2.7)	47	(3.7)
14	2	(0.2)	10	(0.8)	12	(1.0)
15	2	(0.2)	5	(0.4)	7	(0.6)
<b>Gender</b>						
Female	55	(4.3)	120	(9.5)	175	(13.8)
Male	45	(3.6)	62	(4.9)	107	(8.5)
<b>School</b>						
Kondele Primary School	0	(0)	3	(0.2)	3	(0.2)
Arina Primary School	1	(0.1)	0	(0)	1	(0.1)
Ezra Gumbe Primary School	1	(0.1)	0	(0)	1	(0.1)
Highway Primary School	1	(0.1)	0	(0)	1	(0.1)
Arya Primary School	0	(0)	1	(0.1)	1	(0.1)
Joel Omino Primary School	0	(0)	1	(0.1)	1	(0.1)
Kibuye Mixed Primary School	10	(0.7)	2	(0.2)	12	(0.9)
Lake Primary School	6	(0.5)	2	(0.2)	8	(0.7)
Manyatta Primary School	1	(0.1)	0	(0)	1	(0.1)
Manyatta Arab Primary School	2	(0.2)	2	(0.2)	4	(0.4)
Migosi Primary School	12	(0.9)	37	(2.9)	49	(3.8)
MM Shah Primary School	16	(1.3)	24	(1.9)	40	(3.2)
Shauri Moyo Primary School	1	(0.1)	5	(0.4)	6	(0.5)
Victoria Primary School	32	(2.5)	54	(4.2)	86	(6.7)
Xaverian Primary School	17	(1.3)	51	(4.0)	68	(5.3)
<b>Class</b>						
1	19	(1.5)	7	(0.6)	26	(2.1)
2	15	(1.2)	8	(0.6)	23	(1.8)
3	14	(1.1)	26	(2.1)	40	(3.2)
4	11	(0.9)	25	(2.0)	36	(2.9)
5	11	(0.9)	32	(2.5)	43	(3.4)
6	12	(0.9)	23	(1.8)	35	(2.7)
7	10	(0.8)	23	(1.8)	33	(2.6)
8	8	(0.6)	38	(3.0)	46	(3.6)

**Table 1:** Prevalence of childhood overweight and obesity.

**Dietary practices associated with childhood overweight and obesity**

**Dietary practices**

Most overweight and obese children were given pocket money to school 258 (91.5%), 98 (34.7%) bought junk food with the pocket money, 172 (61%) ate more than thrice in a day, 176 (62.4%) skipped meals, 225 (79.8%) carried snacks to school and 173 (61.3%) preferred hotel/take away foods as shown on table 2.

Characteristic	Classification				Total	
	Overweight/Obese					
	Females		Males		n	%
	N	%	n	%		
<b>Pocket Money Given</b>						
Yes	150	(53.2)	108	(38.3)	258	(91.5)
No	15	(5.3)	9	(3.2)	24	(8.5)
<b>Amount of Pocket money given (Kshs)</b>						
1-50	81	(31.4)	65	(25.2)	146	(56.6)
51-100	56	(21.7)	35	(13.6)	91	(35.3)
101-150	8	(3.1)	5	(1.9)	13	(5.0)
Above 150	5	(1.9)	3	(1.2)	8	(3.1)
<b>Foods bought with Pocket money</b>						
Junk foods	55	(19.5)	43	(15.2)	98	(34.7)
Fruits	38	(13.5)	21	(7.4)	59	(20.9)
Dairy products	45	(16.0)	31	(11.0)	76	(27.0)
Vegetables	26	(9.2)	23	(8.2)	49	(17.4)
<b>Number of times eaten in a day</b>						
Once	2	(0.7)	1	(0.4)	3	(1.1)
Twice	8	(2.8)	1	(0.4)	9	(3.2)
Thrice	57	(20.2)	41	(14.5)	98	(34.7)
More than thrice	98	(34.8)	74	(26.2)	172	(61)
<b>Skipping of meals</b>						
Yes	106	(37.6)	70	(24.8)	176	(62.4)
No	59	(20.9)	47	(16.7)	106	(37.6)
<b>Number of times meals were skipped</b>						
Once	90	(51.1)	61	(34.7)	151	(85.8)
Twice	14	(8.0)	8	(4.5)	22	(12.5)
Thrice	1	(0.6)	1	(0.6)	2	(1.2)
More than Thrice	1	(0.6)	0	(0)	1	(0.6)
<b>Carrying snacks to school</b>						
Yes	126	(44.7)	99	(35.1)	225	(79.8)
No	39	(13.8)	18	(6.4)	57	(20.2)
<b>Who makes choice of snacks</b>						
Child	38	(16.9)	24	(10.7)	62	(27.6)
Parent/Guardian	88	(39.1)	75	(33.3)	163	(72.4)
<b>Preference of foods</b>						
Home foods	64	(22.7)	45	(16)	109	(38.7)
Hotel/Take away foods	101	(35.8)	72	(25.5)	173	(61.3)
<b>Satiety</b>						
Yes	56	(19.9)	17	(6.0)	73	(25.9)
No	109	(38.6)	100	(35.5)	209	(74.1)
<b>Hunger</b>						
Yes	153	(54.3)	77	(27.3)	230	(81.6)
No	12	(4.2)	40	(14.2)	52	(18.4)

Table 2: Dietary practices.

**Dietary practices associated with childhood overweight and obesity**

To determine dietary practices associated with childhood overweight and obesity, chi-square was used. All variables were statistically significant i.e., giving pocket money ( $\chi^2 = 48.956, p = 0.000$ ), buying junk foods ( $\chi^2 = 64.076, p = 0.000$ ), skipping of meals ( $\chi^2 = 13.031, p = 0.000$ ), carrying snacks to school ( $\chi^2 = 77.510, p = 0.000$ ), preference of hotel/takeaway foods ( $\chi^2 = 8.414, p = 0.004$ ) as shown on table 3.

Characteristic	Association	
	Overweight/Obese	
	$\chi^2$	P value
<b>Pocket Money Given</b>	48.956	<0.000
Yes		
No		
<b>Foods bought with Pocket money</b>	64.076	<0.000
Junk foods		
Fruits		
Dairy products		
Vegetables		
<b>Skipping of meals</b>	13.031	<0.000
Yes		
No		
<b>Carrying snacks to school</b>	77.510	<0.000
Yes		
No		
<b>Who makes choice of snacks</b>	17.663	<0.000
Child		
Parent/Guardian		
<b>Preference of foods</b>	8.414	<0.004
Home foods		
Hotel/Take away foods		
<b>Satiety</b>	11.056	<0.001
Yes		
No		
<b>Hunger</b>	11.617	<0.001
Yes		
No		

**Table 3:** Dietary practices associated with childhood overweight and obesity.

To determine dietary practices associated with childhood overweight and obesity, Pearson product moment correlation was used. All variables were statistically significant i.e., Amount of pocket money ( $r = 0.226, p = 0.001$ ), number of times eaten in a day ( $r = 0.176, p = 0.002$ ) and number of times meals were skipped ( $r = 0.966, p = 0.041$ ) as shown on table 4.

Characteristic	Association	
	Overweight/Obese	
	r	P value
<b>Amount of Pocket money given (Kshs)</b>	0.226	<0.001
1-50		
51-100		
101-150		
Above 150		
<b>Number of times eaten in a day</b>	0.176	<0.002
Once		
Twice		
Thrice		
More than thrice		
<b>Number of times meals were skipped</b>	0.966	<0.041
Once		
Twice		
Thrice		
More than thrice		

**Table 4:** Dietary practices associated with childhood overweight and obesity.

#### Food frequencies of the overweight and obese study participants

Foods which were frequently consumed by overweight and obese study participants were beverages (70.6%), sweets (47.2%), cereals (99%) and deep-fried chips (50%). There was low consumption of Vitamin A rich vegetables and tubers (9.6%), Vitamin A rich fruits (3.5%) and white roots and tubers (1.1%). Data on frequencies of consumption of foods from morning to dinner are shown on table 5.

Food groups		Locally available foods	Morning n (%)	Break time n (%)	Lunch n (%)	Dinner n (%)
Group 1	Cereals	Barley, Wheat, maize, rice, pasta, wheat bread, other bread, wheat flour, other flour, pasta products, popcorn, noodles, chapati, mandazi, ugali, corn, githeri, porridge, samosa	120 (42.6%)	57 (20.2%)	216 (76.6%)	279 (99%)
Group 2	White roots and tubers	Potato, arrow roots, cassava, sweet potatoes, yams	3 (1.1%)	3 (1.1%)	0 (0%)	0 (0%)
Group 3	Vitamin A rich vegetables and tubers	Pumpkin, carrot, red sweet pepper, matoke	0 (0%)	0 (0%)	3 (1.1%)	6 (2.1%)
Group 4	Dark green leafy vegetables (DGLV)	Spinach, Sukuma wiki, sagaa, Kale, coriander, mrenda, managu, kunde, mint, green onion, green garlic, [Consider as DGLV when consumed at least one tablespoon of these vegetable(s) per day. Otherwise, go to Group 16]	0 (0%)	0 (0%)	12 (4.3%)	47 (16.7%)

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Group 5	Other vegetables	Cabbage, cauliflower, garlic, cucumber, onion, tomato, eggplant, beetroot, mushrooms fresh and dried, green beans, green pepper	0 (0%)	0 (0%)	52 (18.4%)	1 (0.4%)
Group 6	Vitamin A rich-fruits	Apricot and dried apricot, peach and dried peach,	0 (0%)	1 (0.4%)	0 (0%)	0 (0%)
Group 7	Other fruits	Apple, banana, lemon, watermelon, mandarin, grapes, pears, berries, dried fruits and berries, oranges, cherries, plum, raspberries, strawberries, blackberries, pineapple, grapefruit	1 (0.4%)	4 (1.4%)	5 (1.8%)	10 (3.5%)
Group 8	Flesh foods and organ meat	Beef, mutton, goat, rabbit, chicken, goose, turkey, quail, sausages, lamb, meat of wild animals and games, sausage products and smoked meat, horse, duck, ox tail, liver, kidney, heart, lung, stomach, intestine, tongue, brain	14 (5.0%)	12 (4.3%)	13 (4.6%)	52 (18.4%)
Group 9	Eggs	Quail eggs, chicken eggs, goose eggs, turkey eggs, duck eggs	17 (6.0%)	7 (2.5%)	17 (6.0%)	26 (9.2%)
Group 10	Fish and sea food	Fresh and frozen fish, canned fish, smoked fish, dried fish, crab sticks, omena	0 (0%)	0 (0%)	0 (0%)	39 (13.8%)
Group 11	Beans and peas	peas, red beans, white beans, lentils, chickpeas, split peas, cow peas, pigeon peas, dengu, kamande	0 (0%)	0 (0%)	132 (46.8%)	45 (16.0%)
Group 12	Nuts and seeds	Sesame seed, almonds, pumpkin seeds, sunflower seeds, walnuts, peanuts, apricot seeds, hazelnut, ground nuts, macadamia	0 (0%)	1 (0.4%)	5 (1.8%)	0 (0%)
Group 13	Milk and milk products	Milk, skim milk, sour milk, yogurt, cheese, sour cream, powdered milk, condensed milk, goat milk	41 (14.5%)	67 (23.8%)	21 (7.4%)	49 (17.4%)
Group 14	Oils, Deep fried chips, crisps, fries and fats	Vegetable oil (sunflower, flax, sesame, cotton, olive), butter, sheep fat, margarine, mayonnaise, mixed oil (animal fat and vegetable oil), potato chips, cow fat, sheep fat, Bhajia, crisps, fries	43 (15.2%)	19 (6.7%)	141 (50%)	26 (9.2%)
Group 15	Sweets	Sugar, honey, candies, chocolate, cakes, biscuits, jam, ice cream	90 (32.0%)	133 (47.2%)	52 (18.4%)	19 (6.7%)



Group 16	Spices, condiments, beverages	Black pepper, cumin, ketchup, salt, chicken/ beef cubes; balsamic vinegar, vinegar Dill, coriander, mint, parsley, blue basilica, green garlic, green onion, sorrel, rosemary (small green leaves), black sesame seeds, bay leaf. [Consider as condiments when these vegetable(s) are consumed less than one tablespoon a day. Otherwise, go to Group 4]; Coffee, black and green tea, fruit drinks, boiled water, sweet soda, water, juices	189 (67.0%)	73 (25.9%)	199 (70.6%)	133 (47.2%)
Group 17	None (No food)	Skipped meals	26 (9.2%)	27 (9.6%)	2 (0.7%)	(0.4%)

**Table 5:** Food frequencies.

**School food environment, overweight and obesity**

To determine the relationship between school food environment and overweight and obesity, Pearson product moment correlation was used. There was a statistically significant positive relationship between enough time not set for students to eat and overweight and obesity ( $r = 0.680, p < 0.005$ ), a statistically significant positive relationship between failure to limit distractions like television while eating and overweight and obesity ( $r = 0.747, p < 0.001$ ), a statistically significant strong negative correlation between food not used as reward and overweight and obesity ( $r = -0.861, p < 0.000$ ) and statistically significant positive relationship between schools not collaborating with community partners to create and sustain a healthy nutrition environment ( $r = 0.922, p < 0.001$ ) as shown on table 6.

Characteristics	Overweight/obese	
	Pearson's product moment correlation (r)	Sig (2-tailed)
<b>School Physical Environment</b>		
All foods and beverages sold or served at school (e.g., meal/snack programs, cafeterias, canteens or vending machines) do not meet Balanced Nutrition and Food Standards	0.757	0.06
All foods and beverages brought into the school by vendors, caterers or restaurants to be served or sold do not meet Balanced Nutrition and Food Standards.	0.592	<0.05
Staff, students and volunteers involved in food provision do not receive regular nutrition and food safety education.	0.667	0.07
Schools do not seek opportunities to include healthy locally grown foods.	0.592	<0.02
<b>School Social Environment</b>		
Enough time is not set aside for students to eat. Scheduled lunch breaks allow for at least 20 minutes of eating time (once seated).	0.680	<0.005

Distractions such as television, computers or smart phones are not limited while eating.	0.747	<0.001
Food is not used as a reward. If rewards are offered, they are non-food items. The school does not accept student rewards or incentives from local restaurants or businesses that include food items.	-0.861	<0.000
<b>Family and Community Engagement</b>		
The school does not collaborate with community partners (e.g., families, community groups, local governments, health authority, non-profit organizations or local businesses) to create and sustain a healthy nutrition environment.	0.922	<0.001
Boards of education, school divisions and schools do not engage with local health professionals (e.g., registered dietitians or public health inspectors) for their expertise and support to develop and implement the nutrition policy and administrative procedures.	0.680	0.05
School and community partners do not collaborate to improve access to healthy foods (e.g., school meal and snack programs, collective kitchens or community gardens) and collectively advocate and implement strategies to support food security.	0.680	0.05
<b>Effective Policy</b>		
Boards of education, school divisions and schools do not work collaboratively with stakeholders including students, parents, School Community Councils and community organizations to develop, review, implement and evaluate the school nutrition policy and administrative procedures.	0.757	<0.001
Understandings, skills and confidences related to healthy eating in the school nutrition policy and administrative procedures are not reinforced.	0.672	<0.006
Teachers do not have access to and support for professional development opportunities related to healthy eating	0.757	0.08

**Table 6**

**Discussion**

Prevalence of childhood obesity and overweight in this current study was 14.4% and 7.9%. respectively. The finding of this study was similar to study reports from Kenya in which 14.4% school children were overweight [22]. This prevalence was also in range with a study done in Addis Ababa, Ethiopia where (12.7%) of school children were overweight [23]. In this study, more female study participants were obese than males. A recent study in Kenya among school children 9 - 13 years [3] reported a more prevalence rate of obesity among girls than boys, (16.7% among girls and 6.8% among boys).

In the current study, most overweight and obese study participants were given pocket money and bought junk foods with the pocket money. Studies in Saudi Arabia [24] and in Gujarat, India [25] similarly showed overweight, and obesity was significantly associated with frequent consumption of junk food. Receiving of pocket money had significant impact on junk food consumption pattern in our study. Similarly, [26] revealed significant association of junk food consumption with pocket money.

Most overweight and obese study participants ate more than thrice in a day. Obesity and overweight levels increased with increase in number of times eaten in a day. A previous study also showed that overeating and eating more than appropriate number of times in a day is associated with overweight and obesity [27].

In this study, most overweight and obese study participants skipped meals. Eating behaviours such as breakfast skipping and rare participation in family meals have been reported to be associated with the risk for being overweight among pre-adolescents and adolescents, probably due to compensating with larger meals at next feeding or this may be physiological [28]. Several studies have shown that obese children tend to skip meals, especially breakfast [20], more often than non-obese children [29].

Additionally, most overweight and obese students carried snacks to school. The results of this study were in accordance with [30] study, which showed that the average energy intake and macronutrients from snacks in the school environment is higher in obese children. [30] further states that the consumption of snacks with energy of  $\geq 30\%$  of energy intake a day has a 3.24 times higher risk to become obese hence regular snacking and carrying snacks to school to consume in between meals is highly associated with overweight and obesity.

Majority of overweight and obese study participants preferred hotel or take away foods. Eating out or ordering food has become a popular habit [31]. The favorite foods which children eat outside of their homes are so-called fast-food hamburgers, hot-dogs and pizzas [32]. Such meals are most often high in calories, saturated fats, monosaccharides and at the same time they are scanty in nutrients needed for a proper development of a child such as vitamins, unsaturated fats and fiber [33]. For instance, the medium food package in one of the most famous fast-food restaurants consisting of hamburger, medium portion of fries, medium Coca-Cola and portion of ice-cream with topping contains about 1200 kcal [34]. It is half of the daily calories demand of a school-age boy but does not consist much of the essential nutrients [35]. Eating out very often leads to caloric overbalance and can contribute to development of obesity [36]. In a research run by Gillis and Bar-Or [23] the group of obese children ate 8 meals per month outside of home and children with proper weight ate on average 5 meals per month outside of home. Eating out is often connected with greater meat consumption and, as the consequence, higher amount of fat in the diet [37]. Apart from the fact that meals eaten outside of homes very often do not comply with the rules of rational nutrition, they are served in amounts, which exceed the recommended single portion, especially for children [27]. In the last years, the portions of served meals have significantly increased [38]. The results of several studies have shown that increased portion size leads to a greater energy intake [39].

Majority of overweight and obese study participants were not getting full satiety after eating. In response to food intake, entero-endocrine cells release hormones into the bloodstream that send signals to the brain, telling us when we are full [40]. A reduction in entero-endocrine cells leads to a decrease in the release of satiety hormones, which may fuel an increase in food intake and further causes obesity [40]. Several studies have shown increase in obesity as a result of decrease in satiety [16,41]. More overweight and obese study participants got hungry while at school and home. Most studies have shown a strong positive relationship between hunger and increase in overweight and obesity [42,43].

Foods which were highly consumed by overweight and obese study participants were beverages, sweets, cereals, milk, milk products, flesh foods, organ meat oils, deep fried chips, crisps and fries. Least consumed foods were fruits, white roots, tubers, dark green leafy vegetables, other vegetables, vitamin A rich-fruits, fish, sea foods, beans, peas, nuts, seeds and vitamin A rich-vegetables. This current study is in accordance with EsKiMo study which showed that children consume an average of just under half a litre (484 mL) of sugar-sweetened soft-drinks per day (not including beverages sweetened with fruit juice) on average [44]. Also, this is similar to [45] study whereby same age group of children were recruited, 2 RCTs were performed to prove the role of added sugar in development of obesity. In an 18-month trial, 641 primarily normal-weight children aged 4 years 10 months to 11 years 11 months were randomized to receive 250 mL (8 oz.) per day of a sugar-free, artificially sweetened beverage (sugar-free group) or a similar sugar-containing beverage that provided 104 kcal (sugar group) [45]. The sugar-free group had significantly lower BMI and weight at the study end [45].

High consumption of sugar-sweetened soft drinks and carbohydrates, which provide excess calories and large amounts of rapidly absorbable sugars, is associated with an increased risk of obesity in children [46], [47]. According to cross-national Health Behaviour in School-aged Children (HBSC) study conducted in 2002, 2006 and 2010, in Lithuania school-aged children had low intakes of fruits and vegetables with only 21.1% of boys and 27.1% of girls reporting daily fruit consumption [48]. Therefore, possible compensation for insufficient nutrition with unhealthy food is an important public health issue in these age groups, highlighting the need for elaborating comprehensive educational strategies on healthy nutrition in school programs [15,32]. As published earlier, children with normal weight eat vegetables, fruits, tubers, nuts and berries more frequently than overweight children [49], and the consumption of vegetables is negatively associated with overweight in children [50].

In this study, school food environment played a huge role in predisposing study participants to overweight and obesity. All foods and beverages sold or served or brought at school (e.g. meal/snack programs, cafeterias, canteens or vending machines) did not meet Balanced Nutrition and Food Standards. Also, Staff, students and volunteers involved in food provision had not received regular nutrition and food safety education and schools never sought opportunities to include healthy locally grown foods. This is consistent with other studies in Malawi, Botswana and Tanzania which showed presence of unhealthy food options at school environment which predisposed pupils to overweight and obesity [12,51,52]. Enough time was not set aside for students to eat, distractions during eating were rampant and food was used as reward. A similar study in Nairobi reported that the majority of participants ate while watching television either daily or at least 2–3 times in a week, and those that had access to a television had higher consumption of fast foods and sweetened beverages [11]. Various other studies support a link between television viewing while eating and increased consumption of nutrient-poor foods high in added sugars and fats [53-55] reported that parents' use of food as reward, distractions during eating and less time during meals was associated with a higher BMI. There was also no collaboration between board of education and community partners to improve expertise or access to healthy foods. There were also no effective school nutrition policies improving access and implementation of healthy food behaviors. [56] highlighted that lack of school nutrition policies addressing the need to healthy eating behaviour at school is a key concern increasing overweight and obesity among pupils. A review of 42 European studies [32] showed that multicomponent school-based interventions promoting healthy diets through engaging local health professionals in developing nutrition policies were associated with improving (self-reported) dietary behaviour and decreased obesity. WHO global nutrition targets 2025 on childhood overweight reported that policies and actions to improve children's health and nutrition and prevent childhood overweight need to be reinforced and require considerable political will, along with investment of resources and the participation of a wide variety of sectors and stakeholders [57]. Lack of access of teachers to and support for professional development opportunities related to healthy eating was associated with obesity and overweight. This is consistent with a previous study which showed that a nutrition program, delivered and taught by in-service teachers trained in nutrition, is effective in lowering the increase in the incidence of overweight among school-children [39]. Intervened children have a significantly lower increase in BMI and a lower proportion of children become overweight [58]. This is particularly important as it provides further evidence to the WHO recommendations for schools to include both dietary and physical activity components in the curriculum taught by trained teachers [59].

## **Conclusion**

Childhood overweight and obesity is a growing public health problem in Kisumu Central Sub-County, Kisumu County, Kenya with a prevalence of 7.9% and 14.4% respectively. Female children were more obese (9.5%) than male children (4.9%). Also, female children were also more overweight (4.3%) than male children (3.6%).

Majority of overweight and obese children were given pocket money to school (56.6%), (34.7%) buy junk food with the pocket money, (61%) eat more than thrice in a day, (62.4%) skip meals, (79.8%) carry snacks to school and (61.3%) prefer hotel/take away foods. Foods which were frequently consumed by overweight and obese study participants were beverages (70.6%), sweets (47.2%), cereals (99%)

and deep-fried chips (50%). There was low consumption of Vitamin A rich vegetables and tubers (9.6%), Vitamin A rich fruits (3.5%) and white roots and tubers (1.1%). School food environment was also a factor influencing childhood overweight and obesity. There was a statistically significant positive relationship between enough time not set for students to eat and overweight and obesity ( $r = 0.747$ ,  $p < 0.00$ ), a statistically significant positive relationship between failure to limit distractions like television while eating and overweight and obesity ( $r = 0.747$ ,  $p < 0.00$ ), a statistically significant strong negative correlation between food not used as reward and overweight and obesity ( $r = -0.861$ ,  $p < 0.001$ ) and statistically significant positive relationship between schools not collaborating with community partners to create and sustain a healthy nutrition environment ( $r = 0.922$ ,  $p < 0.001$ )

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## **Conflict of Interest**

The authors declare no conflict of interest with respect to authorship, research and publication of this article.

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