Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.30, 2014

Snacking and its effect on nutritional status of adolescents in two national high schools in Nairobi Kenya

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Abstract

Snacking is defined as any intake of food or energy-containing beverage outside of breakfast, lunch and dinner (Bellisle, 2007). Previous studies have shown that snacking among adolescents is most common in the afternoon (Cross et al., 1994; Howarth et al., 2007). This study focused on snacking and its effect on dietary intake of macronutrients from normal school balanced meals and nutritional status of adolescents in two public national high schools namely Nairobi School for boys and Kenya High School (KHS) for girls, in Kenya. These schools were purposefully and randomly selected. A cross-sectional study on nutritional status and level of snacking was carried out involving 172 and 180 adolescent girls and boys respectively aged 13 to 18 years. A total of 352 adolescent high school girls and boys were assessed. A semi- structured questionnaire was used to collect quantitative data on socio-economic status (SES) of the respondents' families while qualitative data were collected through focus group discussions, key informant interviews and observations. Anthropometric measurements on height and weight for nutritional status were used. Food consumption frequency was used to assess food intake from school meals and snacks. Energy and protein intake data were collected using a 24-hour recall based on a sub-sample of 31 students (14 boys and 17 girls).
Eleven percent (11.0%) boys and 10.2% girls was stunted. Almost an equivalent number of both boys and girls (45.2% and 44.1% respectively) were found to be normal and nourished. Although, the girls are more likely to be stunted than boys stunting was not significantly different between the two groups and underweight was significantly higher in boys than in girls. Significantly more girls were overweight and obese than boys. Among the students who reported to be snacking, 10.4% were underweight and 76.9% had normal BMI-for-age as compared to those who did not snack where 20.0 % were underweight and 63.3% with normal BMI-for-age. It was observed that amongst those who snacked, an equal number of boys and girls at 5.2% were underweight while 6.9% more girls than boys (5.9%) were overweight. Most of the students who snacked had a normal (89.3%) height-for-age. Amongst those who snacked and based on gender, more boys (5.9%) than girls (4.8%) were found to be stunted. Among the gender the difference between those who snacked and those who didn't was insignificant There were almost an equivalent percentage of those who snacked at 10.7% and those who didn't at12.0% and were stunted.
There was no significant difference between the BMI-for-age among those who were snacking and those who were not (χ^2=5.84, p value=0.120). Whether one snacks or not there is no significant relationship between snacking, BMI- for-Age, and hence nutritional status of both adolescent boys and girls in national boarding high schools. This study shows that snacking has no effect on adolescents' nutritional status.

Key words: adolescent, snacking, high school, malnutrition, nutritional status, underweight, overweight, obese, stunting, githeri, ugali

1. Introduction

Snacking has become quite rampant in high schools where girls snacked more than boys. Snacking is any intake of food or energy-containing beverage outside of the usual meal times (breakfast, lunch and dinner). These snacks can be savory like nuts, cheese, crisps, pretzels and breads; sweet like cakes, yoghurts, fruit, biscuits, chocolate and confectionery, and beverages like fruit juices, squashes, carbonated soft drinks or milk (Bellisle, 2007). Malnutrition remains widespread in many developing countries (Mwongera, 2004. Marie-Pierre et al., 2003). The nutritional status of a population is an indicator of the level of development and future potential of the community. In school going adolescents, malnutrition and ill health act as impediments to overall performance in school, as well as severely impairing psychomotor and intellectual development (GOK, 2004).

According to the World Health Organization adolescence is a stage of development which corresponds roughly to the ages between 10 and 19 years (WHO, 2003). Adolescents have very special nutritional needs due to the rapid growth (lean body mass, fat mass, bone mineralization) and maturational changes associated with the onset of puberty. According to nutritional surveys carried out mostly in developed world, many adolescents do not meet dietary requirements for their age group due to inadequate dietary intake of energy and proteins. Some adolescents have, however, problems with dietary excesses resulting in overweight and obesity as well as dietary inadequacies resulting in underweight (Barbara et al, 2001).

Growth proceeds as a series of small growth spurts that vary in amplitude and frequency. This factor including peer pressure, and increased hunger often influence adolescent's nutritional needs, food and snack choices which will vary between and within individuals overtime (Wardlaw, 2003). As the growth spurt begins, adolescents begin to eat more. They face many challenges as they pursue their independence, experience identity crises, seek peer acceptance, and worry about physical appearance, constantly being bombarded with mixed messages (Sebastian et al., (2010). Many schools that adolescents attend offer fat-rich, high-sugar snacks and soft drinks in their tuck shops. This in turn competes with school meals. Eating healthy is not always consistent with eating what is always popular. Adolescents rarely think about the long-term benefits of good health and have a hard time relating today's actions to tomorrow's health outcomes (Wardlaw, 2003). Poor food choices are the adolescents' problem but not snacking.

Adolescent males and females differ in their nutritional needs because of earlier maturation of females and the considerable variability of puberty and nutrient requirements (Dwyer, 1996; Dwyer et al., 2001). Nutrient needs are increased for protein, and energy. **A**dolescents' growth spurt occurs approximately 2 years later in boys than in girls (Barbara et al., 2001). Adolescent girls are very concerned with weight gain, appearance, and social acceptance. In an attempt to reach personal goals of gaining or losing weight, girls may eat dangerously little, select a few items and frequently skip meals. Adolescents also have a common problem of having fat phobia (Keast et al., 2010). If their limited food choices consist of French fries, sugar-sweetened soft drinks and pastries, only little room is left for school meals that are rich nutrient sources. Skipping of meals could translate into consumption of energy-dense or nutrient-poor diets that may potentially contribute to overweight or underweight respectively. Snacking may involve foods that are not healthy to contribute sufficiently to nutrition (Guthrie, 1989). Snacking may reduce consumption of the nutritionally balanced meals served in schools or even act as replacements altogether. This may affect the dietary intake from the school meals and therefore the nutritional status. It has been observed that there is usually a lot of snacking by adolescents especially in boarding schools (Sebastian et al., 2010).

Little information exists about snacking by adolescents in schools, or how snacking may influence meal consumption (Cross et al., 1994; Howarth et al., 2007). This study focused on snacking by adolescents in two National High schools, to assess its association with dietary intake of macronutrients from school meals and nutritional status. Continued negligence of adolescents in nutritional studies may impede the benefits already accrued from nutrition improvement for ages 6-59 months. Good nutrition is the foundation of a healthy and strong nation. This study was to determine the level of snacking and its effect on the nutritional status among high school adolescent students aged 13-18 years in two public boarding national schools in Nairobi Kenya.

2.0 Methods

2.1 Study site

The study was carried out in two Public National Boarding Schools in Westland District in Nairobi, namely Kenya High School for girls and Nairobi School for boys. The two schools were purposefully and randomly selected based on their diverse socio-economic background, and gender from among the Six Public National High Schools in Nairobi namely: Kenya High School, Starehe Girls in Kasarani District (Girls Boarding), Nairobi School, Lenana High School in Dagoretti District, Starehe Boys Centre (Starehe District), Moi Forces Academy (Kamukunji District) (Boys boarding). Nairobi School had a population of slightly above 1200 students with six streams of Forms 2-4 and seven streams in form one. Kenya High School had an enrollment of about 910 students with five streams in form 2-4 and six streams in Form 1.

2.2 Study design, population and sampling frame

This study was a cross-sectional descriptive and analytical study designed to assess the food consumption patterns, nutritional adequacy and nutritional status of high school adolescents aged 13-18 years in Nairobi. The population consisted of all adolescents attending national schools in Nairobi with a sampling frame of adolescents attending the two schools selected.

2.3 Sample size determination

This was calculated using the Fishers' formula **(Fisher et al., 1991)** based on the prevalence of underweight among the school going children aged 11-17 years (adolescents) in Nairobi province, which stood at 35.1% (Ngatia, 2006). A minimum sample size of 264 was used with an attrition allowance of 10% giving a total of 290. But, a larger sample size of 357 was used.

2.4 Sampling procedure

2.4.1 Sampling of Schools

A multistage cluster sampling, gender- and boarding-stratified sampling was used. Out of the six public national boarding schools in Nairobi two were purposefully, randomly selected based on gender and elimination methods i.e. Kenya High School and Nairobi School. From these two schools, the respondents were apportioned on 50-50% basis for both girls and boys respectively.

2.4.2 Sampling of students: Proportionate to size method (PPS) was used according to the number of streams and gender. The total population of the high school adolescents in Nairobi School and Kenya High school was obtained from the Ministry of Education (M.O.E) and confirmed from the school's class registers. Adolescents aged 13-18 years from the two selected schools were purposefully chosen. Consent from the school administration was sought before the actual research commenced. A list of all adolescent students aged 13-18 years of each stream and in each school were purposefully and randomly selected and compiled from the class registers. The sampling procedure for schools and students is shown in Figure 1.

2.4.3 Focus group discussions (FGDs)

These were conducted to collect qualitative data. Two FGDs (each from junior and senior classes respectively) from Kenya High School and four FGDs from Nairobi school were conducted according to levels and streams. These FGDs comprised of 12-14 members with 2 students per stream. All participants were picked by their respective class based on the most knowledgeable in the area. Information collected consisted of factors contributing to their divergent selection of foods, eating habits, and snacking while in school.

2.4.4 Key informant interview (KII)

This was conducted using eight Key Informants (one cateress, one caterer and two cooks from Nairobi school; two cateresses and two cooks from Kenya High School) were selected based on their knowledge on catering/ food production and service. This was done to collect information on general cleanliness/hygiene of the kitchens, dining room and the environment, kitchen personnel, food storage, quality and quantity of food cooked, meals eaten by students while at school.

2.4.5 Sampling for 24-Hour Recall

Probability Proportionate to Size (PPS) method was used to select the sub-sample for the 24-hour recall dietary assessment. This gave a total of 36 students; however five students were flagged off during data cleaning. The 24-hour recall instrument was used to determine the type and quantity of ingredients used and amount of food taken in the previous 24 hours. Liquid measuring cylinders of 5ml, 100ml and 1000ml were used.

2.5 Research instruments/tools and data collection methods

2.5.1 Questionnaire

A semi-structured questionnaire was used to collect both qualitative and quantitative data. This was preferred over other instruments because it was easier to administer, analyze and economical to use in terms of time and money (Mugenda and Mugenda, 1999). This was used to collect information on socio-demographic characteristics (age, sex), snacking, dietary intake of protein and energy. The questionnaire was pre-tested on a sample size of approximately 8% (26) of the total sample size at Lenana high school with similar characteristics as the actual sample in the study. Pre-testing results were used to modify the questionnaires before actual data collection thereby improving and enhancing their quality and reliability respectively.

2.5.2 Food frequency questionnaire form (recall guide)

This was used to collect qualitative data on the frequency of foods eaten, the levels and frequency of snacking as well as when the snacks were most eaten. It was also to determine dietary/ food intake from the normal school meals.

2.5.3 Anthropometric Measurements

Adolescent Height (with light clothing and without shoes) was determined using Standard Height boards (stadiometre) which were placed against a flat wall and on a flat surface. Two readings were taken each time and where the second height reading was found to have a wider variation (+0.1cm), a third reading was taken. Height was recorded to the nearest 0.1 centimeters (cm). Height-for-age (HAZs) z-score was used for stunting.Weights were taken with minimum clothing on using the electronic scale, whose battery was replaced every morning. An average of two or three readings was recorded to the nearest 0.1kg. The nutritional status of students was assessed as Body Mass Index (BMI)-for-age Percentiles (BAPs) for underweight, overweight and obesity. Food Frequency established the frequency of certain types of food (those of particular interest in the survey) that were consumed over a specified time-frame normally a week. The foods were grouped into seven main food groups: fruits and vegetables; legumes; animal products; cereals; roots and tubers; oils and fats; sugars and snacks. Their frequency of consumption was coded as: "Frequently consumed"- food item consumed once a week to many times a day, "Not frequently consumed"- food item consumed no more than twice a month, and "Never – consumed"=food item not consumed at all.

2.6 Recruitment and training of research assistants (RAs)

Research assistants were informed verbally or through friends. Seventeen students of Nutrition and Dietetics from The Technical University of Kenya with good written and oral communication skills were selected. They were trained thoroughly on the background, statement of the problem, purpose and the objectives of the study, ethical issues, and methods of interaction with the respondents, understanding and use of the questionnaire, data collection techniques, use of equipment and material checklists, use of anthropometric equipment, taking and recording measurements correctly.

2.7 Data management and analysis

Intake of macronutrients (energy, carbohydrates, fats and proteins) in the last 24 hours by the students was established using a 24-hour recall on a sub-sample of 31 students and further segregated by gender and age group. Using the Nutri-survey software (WHO, 2009), RDA percentage fulfillment of nutrient intake was established. By grouping the students by age and sex, the analyzed values were grouped into inadequate (less than 100%) and greater than or equal to 100% RDA macro-nutrient fulfillment of energy, carbohydrates, fats and protein. The means were required to determine the average adequacy of protein intake when considering the requirements per kilogram body weight per day. In addition, food frequency from both school meals and snacks was assessed to find out the consumption of different food groups by all the students. Data analysis was done using SPSS software to provide descriptive information (Mean ± SE) for all study variables, Epi-info and Nutri-Survey software, Excel software. Statistical analyses performed included descriptive statistics (measures of central tendency i.e. mean, median, mode; and measures of dispersion i.e. range, SD, variance for describing the different indicators; Chi square tests were used to determine whether associations between variables were significant or not. Data from FGDs were analyzed to make baseline information about snacking levels and frequencies by the adolescent students, eating habits and factors influencing their food and snack choices. For Analytical statistics, cross tabulations between all categorical variables, dietary intakes of energy and protein as well as nutritional status were performed. The variables from the student's Socio-demographic profile, levels and frequencies of snacking, dietary intake of proteins and energy were analyzed to establish how they influenced the adolescents' dietary intake and nutritional status relating it to the UNICEF'S (1998) conceptual framework for malnutrition. Dependent variable was Nutritional Status as measured by Height-for age (HAZ), and BMI-for Age. Pearson chi-square test was used to test for associations between snacking, nutritional status and individual categorical variables. Data collected, and analyzed were presented using tables, bar-graphs and pie-charts.

2.8 Inclusion and exclusion criteria

Only those high school adolescent aged 13 to 18 years were included. Those with chronic illnesses and those unwilling to participate in the interview were excluded and replaced with those from the same sex and age.

2.9 Ethical and human rights considerations

During data collection, verbal consent was obtained from the respondent before administering the questionnaire or taking any measurements. Throughout the research process, confidentiality, privacy, respect and dignity of all respondents was upheld**.**

3.0 Results and discussions

3.1 Types of snacks available in the schools

There were different kinds of snacks available in the canteens of the two schools. The girls' school offered a wider variety of snacks than the boys' school i.e. nuts, masala sticks (from refined wheat flour into thin sticks and deepfried). Fruits such as pineapple, slices of water melon, avocado**, a**pple and grapes were stocked in the girls canteen in addition to those types found in the boys canteen. The boys' canteen contained more of the prepared snacks such as smokies/sausages, chapatti(refined white wheat flour mixed with water into a dough then rolled and pan fried), mandazi (refined wheat flour mixed with sugar, baking powder and water into a dough, then rolled and deep fried) biscuits, soft carbonated drinks, and drinking chocolate cookies (cinnamon, chocolate, ginger and melting), chocolate bar and roxy chocolate, Cashew nuts, and Mixed Nuts, Glucose, Bread, boiled eggs, Sugar, Beverages: Ribena (black currant drink), Lucozade (glucose drink),Soft carbonated drinks, Squashes, potato crisps.

3.2 Snack consumption according to type of nutrient

Table 1 shows the snack items consumed which were placed into five major categories according to the type of nutrients they provide. 1) Carbohydrates/fat snacks included mandazi, biscuits, cookies, potato sticks, bread, chapatti, potato crisps, cakes, glucose, bites, buns, French fries, sweets, nuts, pop corn, doughnuts and chocolate bars; 2) Protein snacks included sausages/smokies, milk and ice cream; 3) Fruits included apple, mango, avocado, bananas and water melon; 4) Beverages such as drinking chocolate, tea and coffee were available; 5) carbonated soft drinks included commercial juices and cordials, sodas, lucozade (carbonated glucose solution) and ribena (black currant drink). No vegetable snacks were stocked in the school canteens. They were not popular (1.1%), may be because they were expensive. There was a very high snacking level during midterm, opening day because students brought snacks from home and during "githeri" (boiled mixture of maize and beans) and "ugali" (cooked mixture of maize four and water) meal times. This can be explained by the fact that school meals are not compulsory. Snacks providing starches and fats were consumed by most (58.3%) of the students, whereby more girls (37.2%) than boys (21.1%) were found to snack on starches probably because they were provided at the school
canteen. However, more boys snacked on proteins (5.4%) than girls (1.6%). This could be because milk and sausages were sold in the boys' school canteen which was open throughout the day both during weekdays and weekends. The Girls' school canteen was open between 5.30 pm to 6.00 pm on weekdays and a few hours during weekends. The girls indicated that there was no need to snack fruits because they were provided with the school meals. The boys indicated that fruits were not available in the school canteen, moreover, in the FGD, they requested fruits be provided with school meals.

Table 1 Categories of snacks consumed by type of nutrient

Group of snacks eaten [a]	Boys Mean (%)		Girls Mean (%)		Total (N=1591) Mean (%)	
Carbohydrates/fats (g)	335	(21.1)	593	(37.2)	928	(58.3)
Protein snacks (g)	86	(5.4)	26	(1.6)	112	(7.0)
Fruits (g)	6	(0.37)	12	(0.75)	18	(1.1)
Beverages (ml)	180	(11.3)	172	(10.8)	181	(22.2)
Carbonated soft drinks (ml)	92	(5.8)	89	(5.6)	352	(11.4)

[a] **Multiple responses allowed. Percentages and totals are based on respondents**

3.3 Means of snack quantities consumed

The students provided information on the amounts of snacks taken (in grams for solids or milliliters for fluids), either by stating the actual weight/volume or by indicating the cost of the snack. A market survey in the school canteens was done to establish the quantities of the said snacks.
Table 2 shows that there was great variation in the quantities consumed by the students. Solids consumed were between 5g and 1835g with a mean of 202.37g, while quantities of fluid snacks ranged between 300 ml - 1890mls with a mean of 517.63ml. The mean consumption of solid snacks by girls (206.8g ±188.29) was higher than that of the boys (170.3g). On the other hand, boys consumed more liquids (mean=501.1ml±287.8) than girls (mean= 249.9ml±270.07). This is probably because the school canteen was operational throughout the day. It

was noted that both Form 1 and 2 students consumed slightly lower quantities of solids (mean= 410g) than their senior counterparts (Form 3 and 4 classes) who had a mean of 419g. There was however, a different trend with beverages, where the juniors (Forms 1 and 2) had taken relatively larger amounts, with a mean of 1043 ml than the seniors (Forms 3 and 4) with a mean of 1015 ml.

Table 2 means of snack quantities consumed

Mean quantities Consumed	**Boys (n=297) Mean (SD)**	**Girls (n=344) Mean (SD)**
Mean quantities Solid snack (g)	170.3± 152.28	206.8±188.29
Mean quantities Fluid snack (ml)	501.1±287.8	249.85±270.07

3.4 Effect of snacking on school meals consumption

Table 3 shows that majority of the students took snacks and also ate the normal school meals. It was found that 68.8% of the students who consumed three normal school meals also ate snacks, while 22.1% took snacks and consumed less than 3 school meals. There was no significant (P-value = 0.890) difference between the snacking among those who took the three normal school meals and those who took less (χ^2= 1.692). All students were served with more or less the same rations. Though snacking may not affect the attendance to the meals, it might, however affect the quantities of meals consumed as well as consumption of normal school meals. These results agree with reports of similar study in Portugal on trends of food intake in 1987-1999 (Marques-Vidal, et al., 2006).

Table 3 Snacking and consumption of normal school meals

Consumption of the 3 Normal school meals	**Snacking**				**Total**	
	Yes	**(%)**	**No**	**(%)**	**n**	**(%)**
Yes	234	(68.8)	26	(7.6)	260	(76.5)
No	75	(22.1)	5	(1.5)	80	(23.5)
Total	**309**	**(90.9)**	**31**	**(9.1)**	**340**	**(100)**

NB: Percentages is in parenthesis

3.5 Nutritional status

3.5.1 Anthropometric measurements

The mean weight and height of the students showed that boys were relatively taller than girls, having a mean of 162.8cm compared to 159cm for girls. Girls had a higher mean weight of 56kg compared to boys with 51.7kg. The minimum weight recorded for girls was 32kg and highest recorded was 89kg, while for boys, the minimum was 31kg and highest 78kg.

3.5.2 BMI-For-Age

BMI-for-age index was used as it is a good indicator for assessing nutritional status of adolescents (Gibson, 1990 and WHO reference 2007). According to Table 4, majority (75.7%) of the respondents had a normal BMI-for-Age. Boys normal BMI-for-age was not significantly different from girls' normal BMI-for- age. Then 11.1% of the total students were underweight. Boys stood at 19.9% underweight and females at 2.4%. More girls were overweight at 16.4% than boys at 2.9%). Only 3.5% of the total students were obese. Girls were significantly more obese at 5.9% than boys at 1.2%. Girls were more likely to be overweight and obese than boys.

Table 4 BMI-for-Age percentiles by gender

BMI-for-Age Percentiles	Boys		Girls		Total	
	n	%	n	%	n	%
Underweight (<5th)	34	19.9	4	2.4	38	11.1
Normal (5th to < 85th)	130	76.0	128	75.3	258	75.7
Overweight (85th to 95th)	5	2.9	28	16.4	33	9.7
Obese (>95th)	2	1.2	10	5.9	12	3.5
Total	**171**	**100**	**170**	**100**	**341**	**100**

All the three main balanced school meals were served on time and provided adequate energy for majority of the students. Specifically, girls were provided with a snack (bun) and plain drinking chocolate at 10'oclock whereas boys were only served drinking cocoa at 4.00pm but were allowed to buy snacks at the school canteen.
The above findings of 75.7% normal BMI-for-age is higher than that reported by Malla (2004) of 47.5% from a study done in Nairobi. However, these findings on obesity 3.5% compares well with those of Malla, (2004) at 4.1%. According to Mascarenthas et al (2001), nutritional needs of adolescents are higher than those of children because of growth spurt, sexual maturation, changes in body composition, skeletal mineralization and changes in physical activity. This increases total energy needs due to the larger body size. Again adolescent boys and girls differ in their nutritional needs. Reasons include the earlier maturation of females and the considerable variability of puberty and nutrient requirements (Dwyer, 1996).

3.5.3 Stunting

Out of the total boys and girls (n=352), a total of 89.3% students were found to have normal Height-for-age (Normal (>-2 Z-scores). Slightly higher proportion of girls (89.8%) had normal height-for-age compared to boys (89%). This means that 11.0% (<-2 Z-scores) boys and 10.2% girls were thus stunted. There was no significant difference between normal height-for-age for both boys and the girls.

3.6 Effect of snacking on nutritional status

A cross tabulation was done between BMI-for-age and snacking by students to find out if snacking affected this index. The same was done with height-for-age and snacking. In addition, Chi-square tests were done to determine any significance between each of the two.

3.6.1 Snacking and BMI-for-age

According to Table 5, most of the students (91.1%) who reported to be snacking, 10.4% were underweight and 76.9% had normal BMI-for-age as compared to those who did not snack with 20.0 % being underweight and 63.3% with normal BMI-for-age. There was however, no significant difference between the BMI-for-age among those who were snacking and those who were not (χ^2=5.84, p value=0.120). This is in tandem with the research conducted in USA among school going teenagers. Snacking therefore contributes to the energy intake of adolescents (Guthrie, 1989).

Table 5 Relation between snacking and BMI-for-Age

BMI-for-age index	Snacking n (%)							Chi-Square tests
	Yes			No				n=337 χ^2=5.84; df=3; P value=0.120
	Boys	Girls	Sub Total	Boys	Girls	Sub Total	Total	

BMI-for-age (underweight)	16
	(5.2)
		16
		(5.2)
			32
			(10.4)
				2
				(6.7)
					4
					(13.3)
						6
						(20.0)
							38
							(11.3)
								YES
								n=307;
								χ2=0.279;
								df=1;
								p value=0.597

BMI-for-age (Normal)	121 (39.4)	115 (37.5)	**236** **(76.9)**	9 (30.0)	10 (33.3)	**19** **(63.3)**	255 (75.6)	
BMI-for-age (Overweight)	18 (5.9)	21 (6.9)	**39** **(12.8)**	3 (10.0)	2 (6.7)	**5** **(16.7)**	42 (9.5)	**NO** n= 30 χ2=0.871; df=1; p value=0.351
Total	155 (50.5)	152 (49.5)	**307** **(100)**	14 (46.7)	16 (53.3)	**30** **(100)**	337 **(100)**	

NB: Percentages is in parenthesis

Among the gender the difference between those who snacked and those who didn't was insignificant (Yes χ2=0.279; p value=0.597 and for NO**;** χ2=0.871; p value=0.351). This can be concluded that whether one snacks or not there is no significant relationship between snacking and BMI- for-Age and hence Nutritional status of the high school adolescents. It was observed that amongst those who snacked, an equal number of boys and girls (5.2%) were underweight while 6.9% more girls than boys (5.9%) were overweight. 14.95% of the adolescents were overweight. Studies indicate that 30% to 35% of teenagers are overweight and that 80% of them are likely to remain overweight as adults (Guthrie, 1989).

3.6.2 Snacking and stunting

According to Table 6 and when considering students' height-for-age and their snacking, most of the students who snacked had a normal (89.3%) height-for-age. There was no significant difference between the nutritional status and whether the student snacked or not (χ^2=0.043, p value =0.836). This can be concluded that snacking did not determine the height-for-age and therefore nutritional status of the adolescent students. Even amongst the gender, more boys (5.9%) than girls (4.8%) were found to be stunted. Almost an equivalent number of both boys and girls (45.2% and 44.1% respectively) were found to be normal and nourished.

It is interesting to note that the percentage of those who snacked (10.7%) and were stunted and those who didn't (12.0 %) was almost the same. Therefore snacking does not significantly affect the nutritional status of the adolescent students even amongst the gender (Wardlaw, 2003).

Table 6 Snacking and stunting

Height-for-Age (HAZ)	Whether student snacks n (%)							Chi-Square tests
	Yes			No			Total n(100%)	n=297 χ^2=0.043; df=1; P value=0.836
	Boys	Girls	Total	Boys	Girls	Total		
stunted/malnourished (<-2 Z-scores)	16 (5.9)	13 (4.8)	**29 (10.7)**	1 (4.0)	2 (8.0)	**3 (12.0)**	**32**	**YES** n=272; χ2=0.215; df=1; p value=0.643
Normal(> -2 Z scores)	123 (45.2)	120 (44.1)	**243 (89.3%)**	10 (40.0)	12 (48.0)	**22 (88.0)**	265	**NO** n=25; χ2=0.157; df=1; p value=0.692
Total	139 (51.1)	133 (48.9)	**272 (100)**	11 (44)	14 (56)	**25 (100)**	297 **(100)**	

NB: Percentages is in parenthesis

4.0 Conclusions and recommendations

4.1 Conclusions

Most of the students were found to snack on crisps, sweets, chapatti, mandazi, masala sticks and carbonated soft drinks, other than healthy snacks.

There were no varieties of snacks, in terms of quality and quantities stocked in the boys' school canteen. There was no significant difference between snacking among those who consumed three normal balanced school meals and those who took less.

Though snacking may not affect the attendance to the meals as well as consumption of normal school meals, it does however, reduce consumption of regular school meals. Snacking was rampant in both schools where girls snacked more than boys.

Stunting was not significantly different between the two genders. Underweight was significantly higher in boys than in girls. Significantly more girls were overweight and obese than boys.

Snacking does not affect the nutritional status of both adolescent boys and girls consuming balanced normal school meals as there was no significant difference in BMI-for- age and Height-for-age between boys and girls.

4.2 Recommendations

Snacking should complement but not replace the three normal balanced school meals.

There is need to develop strategies for promotion of healthy snacking habits among adolescents and sale of a variety of quality and adequate quantities of affordable snacks healthy food stuffs and snacks in the school canteen. This will ensure that those who opt out of some school meals can have adequate intake of energy and protein nutrients as well as contribute to their overall healthful daily dietary intake and nutritional status.

4.3 Recommendations for further studies

More research need to be done on the effect of snacking on micro-nutrients notably iron and calcium, vitamins A and C intake by adolescents as their deficiencies can lead to increased fatigue and decreased ability to concentrate and learn which may affect their school and physical performance.

Acknowledgement

Special thanks go to my supervisors Prof. Jasper K. Imungi and Dr. Edith M. Ngatia for their consistent guidance, patience, time, understanding and encouragement.; my dear husband, Dr. Jackan M. Gutu, for his inspiration, great counsel and moral support; our daughters Grace Njoki and Wanjiru Gutu who kept on reminding me about finishing corrections; for always loving and being there for me through this important course of a lifetime. My heartfelt gratitude go to J. Malla and P. Gichuhi, Benta Achieng, Jedidah Kihara, Ben Muchoki, Stephen Obiro

and class of 2011/2012 Diploma of Technology in Nutrition and Dietetics students of Technical University of Kenya for assisting in data collection. Many thanks to the teachers particularly W. Mutindwa and J. Maina (Deputy Principal) of Nairobi School; L. Mugendi, and principal R. Saina, the Principal, Kenya High School for their support; cateresses/caterers, cooks and all students who enthusiastically provided information for this study, Ministry of Education and National Council of Science and Technology for clearing me to conduct this research.

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