Gender, Underweight and Dietary Practices Among Male and Female Adolescents in Pastoral Community, Kenya

Judith Munga (munga.judith@ku.ac.ke)
Kenyatta University School of Applied Human Sciences: Kenyatta University School of Public Health and Applied Human Sciences

Laura Kiige
United Nations Childrens Fund: UNICEF

Lucy Maina-Gathigi
United Nations Childrens Fund: UNICEF

Peter L'Parnoi
Centre for behavior change and communication_Africa

Catherine Mesianto Lengewa
Centre for behavior change and communication_Africa

Festus Kiplamai
Kenyatta University

Esther Kariuki
Centre for behavior change and communication_Africa

Research

Keywords: Adolescent nutrition, Dietary diversity, Pastoral community

Posted Date: September 28th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-919296/v1

Abstract

Background: Many boys and girls in developing countries transition to adolescence undernourished, making them more vulnerable to disease and mortality. Growth during adolescence is faster than any other period of life leading to increased requirements for both macro- and micronutrient. High vulnerability to undernutrition has been expressed more on adolescent girls despite similar stage of growth for both males and females. This necessitates more information on gender influence on undernutrition and dietary practices especially in resource poor environments with rich cultural practices such as pastoral Samburu community in Kenya.

Methods: The study design is cross sectional with both quantitative and qualitative components for in-depth understanding of the parameters in context of the target population that targeted 490 male and female adolescents based on probability proportionate to population size. Simple random sampling method was used to reach adolescent respondents in each cluster in Samburu Central sub-county. Questionnaires, in-depth interview, and Focus Group Discussion guides were used to collect data. Quantitative data was analyzed and presented descriptively as frequencies and percentages and inferentially as odds ratio, Chi-square and t-test. Content analysis was done on qualitative data and information triangulated with quantitative data for in-depth understanding of the context of study findings,

Results: Low education level was observed among the adolescents where 21.9% dropped out of primary school while 21.9% completed primary education. There was no difference in gender distribution in both primary and secondary schools' enrolment (χ^2, $p > 0.05$). The married adolescents were more likely to be females than males (χ^2, $p<0.001$). The adolescents aged 10-14 years were two times more likely to be underweight compared to 15–19-year-old (OR,2.101; CI,1.331-3.317; P=0.001). Males aged 15-19 years associated with underweight (χ^2, p=0.049). Females had significantly higher Mean Dietary Diversity Score (MDDS) at 3.93±1.39 compared to 3.59±1.40 of their male counterparts (t-test, p=0.007). Male adolescents (59.9%) were more likely to consume less than 4 food groups compared to the 35.3% female counterparts (χ^2, $p<0.001$).

Conclusion: Adolescents are vulnerable to malnutrition that is associated to poor dietary practices and nutrient inadequacies that are further compromised by cultural gender roles that place the male adolescent at a higher risk. Culture sensitive strategies are recommended to reduce malnutrition and all its forms in this population group

Introduction

The adolescents make up a significant proportion of populations that is higher in developing countries especially Sub-Saharan Africa[1]. In Kenya, the proportion of the total population of adolescents is higher than the world average at 24.5% with higher representation from 10–14 years[2]. Samburu County, one of the Arid and Semi-Arid Lands (ASAL) in Kenya that are mainly pastoralists has 27.9% of population aged

10–19 years[2]. Among the female adolescents, 6% are pregnant with their first child and 19.7% have ever given birth[3].

Growth during adolescence is faster than any other period of life except for period of infancy and this leads to increased requirements for both macro- and micronutrient. The key micronutrients are as iron, calcium, zinc, vitamin A and vitamin D[4, 5]. Adolescence provides a window of opportunity to address any nutritional deficits and linear-growth faltering generated during the first decade of life by practicing healthy eating practices, and additionally limits non-communicable diseases in adulthood[6].

Adolescents in Samburu are exposed to multiple risks and challenges that heighten their vulnerability to malnutrition. Some of the issues include food and nutrition insecurity owing to frequent droughts and limited livelihood options that not only limit their dietary diversity, but also increase their malnutrition risk. Additionally, the culture defines gender roles for boys and girls from as early as 10 years that may predispose them to further nutrition vulnerabilities. Kenya is in support of global strategy 2016–2030 for adolescent health and wellbeing[7] and has adolescent program implementation to support this course[8]. The nutrition interventions have mainly focused on adolescent girls, and it would be of importance to provide knowledge on gender influence on nutrition status (Body mass Index- BMI for Age) and dietary practices especially in pastoral resource limited communities such as Samburu community in Kenya.

Materials And Methods

The study adopted cross sectional analytical design with both quantitative and qualitative aspects. This design provided the relationship between variables at a single point in time providing a snap shot of the variables of interest. The study was conducted in Loosuk and Suguta wards in Samburu Central Sub-County in Samburu County targeting male and female adolescents aged 10–19 years. Adolescents aged ≥ 18 years gave consent to the study while caregivers gave consent for those < 18 years. Additionally, assent was requested from the younger (> 18 years) adolescents to participate in the study.

The sample size was determined using Fisher formula[9] with minimum dietary diversity as the indicator on characteristic of interest with degree of confidence at 95%. Cluster design was used in the study and to cater for heterogeneity; design effect of 1.3 was used in sample size calculation and corrected by 7% for non-response, yielding a final sample of 490 adolescents that was proportionately distributed between Suguta and Loosuk wards in Samburu Central sub-county. The study was composed of 35 clusters at the village level.

Reference household was randomly selected using segmentation method for villages with more than 30 households where; a map of households in the interview location was drawn up with the help of a village leader followed by dividing the village into segments containing approximately 15–30 households per segment that were numerated and one segment randomly chosen to determine the reference household. All households in the selected segment were given a number and one household randomly selected as a reference household that served as the starting point but did not participate in the survey. The survey

team administered their first questionnaire in the next nearest household based on availability of the study universe and willingness to participate in the study. The enumerators then proceeded to the next nearest household until they realized the targeted number of adolescents per cluster. In case of multiple adolescents at the household level, simple random sampling was used to select one adolescent to participate in the study..

Dietary Diversity Score (DDS) was calculated by summing the number of 9 food groups consumed during 24 hours preceding the study namely; starchy staples; dark green leafy vegetables; other vitamin A rich fruits and vegetables; other fruits and vegetables; organ meats; meat and fish; eggs; legumes, nuts and seeds; milk and milk products .Dietary diversity score was based on that for women of reproductive age, due to lack of specific dietary diversity guidelines for adolescents[10]. The food groups were. Any quantity of any food group consumed by an individual at least once per day was taken into count without considering a minimum intake for the food group. Consumption of at least 4 out of the 9 food groups was considered adequate[10].

Data was collected using researcher administered questionnaire; focus group discussion and key informant guides that solicited information on demographic characteristics, nutrition status (BMI for Age) and dietary practices of adolescents (Food groups, dietary diversity and micronutrient sources). Data was then cleaned, coded and analyzed using SPSS version 22 and segregate based on gender and age (10–14 years and 15–19 years).

Results

Demographic characteristics of adolescents

Overall, there was non-significant higher proportion of female adolescents than males with 56.1% and 43.9% representation respectively (χ^2, $p>0.05$). Adolescents aged 10-14 years had higher representation at 56.3% compared to 43.7% aged 15-19 years. There was no significant difference between gender distributions across the age cohorts (χ^2, $p=0.369$). Majority (92.4%) of the adolescent females were neither pregnant nor lactating while 94.7% were not married. The married adolescents were more likely to be females than males (χ^2, $p<0.001$) who were married to older youth with an average age of spouses at 29 years. Majority of the adolescents 99.2% were Christians (Table 1).

Table 1: Demographic Characteristics of adolescents

		Female N=275		Male N=215		Total N=490		Chi square
		N	%	n	%	n	%	
Age distribution	10-19 (N=490)	275	56.1%	215	43.9%	490	100%	χ=0.808
	10-14	150	54.5%	126	58.6%	276	56.3%	p=0.369
	15-19	125	45.5%	89	41.4%	214	43.7%	
Physiological status (n=275)	Pregnant	8	2.9%	0	0%	8	2.9%	NA
	Lactating	12	4.4%	0	0%	12	4.4%	
	Pregnant and lactating	1	0.4%	0	0%	1	0.4%	
Marital status	Currently married/Cohabiting	22	7.3%	1	0.5%	23	4.3%	χ=15.522
	Separated/Divorced	2	0.7%	1	0.5%	3	0.6%	p<0.001
	Never married	251	91.3%	213	99.1%	464	94.7%	
Religion	Christian	274	99.6%	212	98.6%	486	99.2%	χ=1.925
	Muslim	0	0%	1	0.5%	1	0.2%	p=0.382
	Traditional	1	0.4%	2	0.9%	3	0.6%	

Education level of adolescents

Majority (91.2%) of the adolescents had ever been to school of which 21.9% attained less than primary school education while 21.9% completed primary education. Higher proportion of 41.8% was in primary school at the time of the study with the ages 10-14 years two times more likely to be in the primary school (OR, 2.014; CI, 1.244-3.262; P=0.004). There was no difference in gender distribution in both primary and secondary schools enrolment (χ^2, p> 0.05). At the time of the survey most (61.1%) were not attending school with majority (87.5%) citing COVID 19 as a barrier, this was significantly associated with male adolescents (χ^2, p=0.011). Due to COVID 19, schools were partially open with only grades 4 and 8 in school at the time of the survey. The females cited other reasons for not being in school such as Marriage (8.6%) pregnancy, 3.9% child care and 3.3% family labor (Table 2).

Table 2: Education level of adolescents

		Female N=275		Male N=215		Total N=490		Chi square
		N	%	n	%	n	%	
Ever been to school	Yes	250	90.9%	197	91.6%	447	91.2%	χ=0.078
	NO	25	9.1%	18	8.4%	43	8.8%	p=0.780
Education level	Less than primary school	58	23.2%	40	20.3%	98	21.9%	χ=5.359 p=0.616
	Primary school	58	23.2%	40	20.3%	98	21.9%	
	Secondary school	11	4.4%	11	5.6%	22	4.9%	
	Vocational training	1	0.4%	1	0.5%	1	0.2%	
	College/pre-university/university	0	0%	1	0.5%	1	0.2%	
	Currently in primary school	98	39.2%	89	45.2%	187	41.8%	
	Currently in secondary school	23	9.2%	14	7.1%	37	8.3%	
	Currently in a vocational training	1	0.4%	2	1.0%	3	0.7%	
Currently attending school	Yes	98	39.2%	76	38.6%	174	38.9%	χ=0.018
	No	152	60.8%	121	61.4%	273	61.1%	p=0.894
Reason for NOT attending school (N=273)	Chronic Sickness	0	0%	1	0.8%	1	0.4%	χ= 19.813 p=0.011*
	Family labor responsibilities	5	3.3%	2	1.7%	7	2.6%	
	Working outside home	0	0%	2	1.7%	2	0.7%	
	Fees or costs	1	0.7%	1	0.5%	2	0.7%	
	Migrated/ displaced from school area	1	0.4%	0	0%	1	0.4%	
	Insecurity/ violence	1	0.7%	0	0%	1	0.4%	
	Married	13	8.6%	1	0.5%	14	5.1%	
	Pregnant/ taking care of her own child	6	3.9%	0	0%	6	2.2%	
	COVID 19 Pandemic	125	82.2%	114	94.2%	239	87.5%	

*Significance at p<0.05

Distribution of adolescents in school by age indicated reduction in enrolment with advanced grades where, about a third (32.7%) were either in grade 4 or below, 28.7% in grade 5-6 and 24.1% in grade 7-8 with less than 15% in secondary school (Figure 4.1). There was higher representation of males than females at 26.3% and 22.4% respectively in 7th -8th grade despite non-significant differences (Figure 1). There was low enrolment of adolescents in 11th to 12th grade with a higher proportion of females (4%) than boys (1.3%).There was no difference in the distribution of adolescent by grades between males and females (χ^2, p=0.591).

Underweight (BMI for age)

According to WHO growth reference standard[11], underweight in adolescence is defined as BMI-for-age Z-score below –2, BMI-for-age Z-score below –3 as severe underweight, t as a BMI-for-age Z-score above 1 as overweigh, and obesity as Z-score > 2. of the.

In this study, overall, 22.7% of adolescents aged 10-19 years were underweight (GAM, <-2SD) while 7.9% had severe acute malnutrition (SAM, ≤-3SD). The younger adolescents (10-14) presented higher prevalence for underweight presenting GAM of 28.1% and SAM of 10% compared to the 15-19 years old with 15.7% and 4.8% (Global acute malnutrition (GAM) and severe acute malnutrition (SAM) respectively. The adolescents aged 10-14 years were two times more likely to be underweight compared to 15-19 year old (OR,2.101; CI,1.331-3.317; P=0.001). Generally, male adolescents presented higher prevalence for underweight compared to the female counterparts where males 10-19 years were 1.5 times more likely to be underweight compared to the female counterparts though not significant (OR, 1.472; CI, 0.959-2.260; p=0.077). Underweight was significantly associated with males aged 15-19 years (χ^2, p=0.049).

Table 3: Underweight in adolescents (BMI for Age)

Dietary practices of adolescents

This study measured dietary practices of adolescents using 24-hour dietary diversity while observing the key nutrients to adolescents aged 10-19 years. Food groups consumed by adolescents were mainly starchy staples (97.6%), milk (80.8%) and dark green leafy vegetables (53.9%). The rest of the food groups were consumed by less than 50% of the adolescents with eggs being the least consumed (9.8%) despite its availability (Figure 2). Legumes, nuts and seeds intake was more associated to females (43.9%) than 27.6% males (χ^2, p>0.001) and significant low likelihood among the males (OR, 0.489; CI, 0.333-0.718; p=<0.001). Similar observation was made in consumption of other fruits and vegetables with 41.9% females against 28.5% males (χ^2, p=0.002). Despite low consumption of organ meat generally (12.7%), males were 1.6 times more likely to consume the same compared to females (OR, 1.646; CI, 0.963-2.813; p=0.068).

BMI (WHO BMI-for-age in years and months)		Females		Males		Total		Chi square P value
		N	%	n	%	n	%	
10-19 yrs	Normal	216	80.3%	155	73.5%	374	77.3%	χ=3.150
N=480	MAM (<-2and >-3SD)	35	13.0%	37	17.5%	72	14.9%	p=0.076
M=211	SAM(≤-3SD)	18	6.7%	19	9.0%	38	7.9%	
F=269	GAM(<-2SD)	53	19.7%	56	26.5%	110	22.7%	
10-14 yrs	Normal	107	73.3%	87	70.2%	194	71.9%	χ=1.120
N=270	MAM (<-2and >-3SD)	27	18.5%	22	17.7%	49	18.1%	p=0.571
M=124	SAM(≤-3SD)	12	8.2%	15	12.1%	27	10.0%	
F=146	GAM(<-2SD)	39	26.7%	37	29.8%	76	28.1%	
15-19 yrs	Normal	109	87.2%	68	78.2%	177	84.3%	χ=6.033
N=210	MAM(<-2and >-3SD)	8	6.5%	15	17.2%	23	11.0%	p=0.049*
M=87	SAM(≤-3SD)	6	4.9%	4	4.6%	10	4.8%	
F=123	GAM(<-2SD)	14	11.4%	19	21.8%	33	15.7%	

Dietary diversity: Figure 3 shows dietary diversity among adolescents. Among adolescents 10-19 years, the mean dietary diversity score (MDDS) was 3.77±1.40. Females had more diversified diets expressed with significantly higher MDDS (3.93±1.39) compared to their male counterparts that recorded 3.59±1.40 (t-test, p=0.007). Similar observation was made between males and female adolescents aged 15-19 years with MDDS at 3.36(±1.32) and 3.89(±1.46) respectively (t- test, p=0.007).

Individual Dietary Diversity Score (IDDS):

This was determined as proxy indicator for nutrient adequacy of adolescent diet. Among adolescents aged 10-19 years, 42.9% consumed less than 4 food groups in the preceding 24 hours that was more associated with male adolescents (59.9%) compared to 35.3% of the females (χ^2, p<0.001) and this observation was similar within 10-14 and 15-19 years age cohorts with χ^2, p=0.033 and χ^2, p=0.022 respectively (Figure 4). Overall, the males were 2 times more likely to achieve IDDS below 4 food groups compared to the females (OR, 1.976; CI, 1.371-2.848; p<0.001).

Micronutrient intake by adolescents:

Figure 5 shows that on overall, dietary sources of vitamin A and calcium were consumed by 81.5% and 80.8% of adolescents respectively, mainly from high intake of milk by both males and females. Iron rich foods intake was at 73.5% mainly from plant sources that was more associated with adolescent females (79.0%) compared to 66.4% males (χ^2, p=0.002). Vitamin C rich foods consumed by 68.2% mainly from cooked green leafy vegetable with higher association of consumption to females than males at 73.5% and 61.7% respectively (χ^2, p=0.005). Low consumption of dietary sources of Zinc was registered at 36.7% and 39.4% from plant and animal sources respectively with higher association of plant sources to females (χ^2, p< 0.001).

Discussions

Demographic characteristics:

Despite expected decline in adolescent population globally[12], there is high representation of the adolescents in this study presenting above 40% of the population with higher representation among adolescents aged 10-14 years that is in agreement with both national and county level data[2]. Adolescents therefore represent a significant proportion of the population and their health status would determine that of the future generation significantly and would make an opportune time for corrective intervention to reduce undernutrition. Low education level was observed among the adolescents with majority (>80%) either primary school drop outs or in primary school at the time of the study. The successful learner understands ideas, and has the ability to transfer their knowledge into new situations and apply it to new contexts which is realized with some basic education. This would therefore be a limitation for adolescents in understanding and manipulating their environment for best nutrition practices promoting the vicious circle of poverty that is already experienced in the low economic environments with limited resources. Exposing more adolescents to basic education and life skills increases their access to resources that would enhance sound nutrition, health and wellbeing[25].

Underweight (BMI for Age):

Being underweight has been linked to nutritional deficiencies that result to systemic sub-optimal body functions and stunting while increasing vulnerability to disease[13]. Furthers associations have been reported between optimal health and development throughout adolescence and future output in reference to local and global leadership in problem solving abilities and response to future challenges and promotion of economic growth[13].

In this study, high level of malnutrition above 20% was observed among adolescents aged 10-19 years that was even higher among 10–14-year-olds. Male adolescents had weak higher likelihood and strong association to underweight compared to female counterparts. In Samburu Community, in-depth analysis revealed that culture contributed to undernutrition of adolescents. The adolescent boys graduated to adulthood after rites of passage that could be done as early as 10 years. Thereafter, the male adolescents join the other males referred to as *Morans* who are guardians to the community. The males become

independent of parental care and fend for themselves and not expected to eat food cooked by females including their mothers. They live out of home environment with their peers despite their young inexperienced age and life skills. This compromises their ability to access resources including nutritious food that is aggravated with the already limited resources. Beaded females (betrothed for marriage) are married off early without transition phase and have to learn to be wives, mothers and caregivers to households and their lack of necessary skills increases their vulnerability to nutrition inadequacies. The female adolescents remain within the home environment and have their spouses as the main bread winners unlike the males that have to fend for themselves increasing their vulnerability to undernutrition and underweight. A study conducted in rural Pakistan reported that, gender as significantly associated with food insecurity of adolescents and it is more prevalent among boys in food insecure households[14]. Early independence expected from the male adolescents compromise their ability to fend for themselves if proper transition structures have not been put in place.

Dietary diversity:

Dietary Diversity represents the number of different foods or food groups consumed over a given reference period that was 24 hours prior to this study. Food Group Indicators (FGIs) represent consumption of a set of foods that share similar nutritional properties or biological characteristics[15]. The food groups are positively associated to dietary diversity score and food access. Overall, 3 food groups were consumed by at least 50% of adolescents in this study namely, starchy staples, milk and milk products and dark green leafy vegetables. Poor consumption of eggs was observed that is similar to findings among adolescents in Ethiopia and Uganda respectively[16, 17]. Despite being a pastoral community, meat was not commonly consumed with adolescents in Samburu cultural value for animals that were not purposively made available for consumption but sold to earn some income and more animals would be held in the herds as a sign of wealth. Further culture contributed to food intake where certain foods such as poultry were considered as birds and animals with non-split hooves like rabbits and pigs considered as unclean while fish was associated with snakes. Such cultural practices could further reduce variety food available in the already resource limited environment like Samburu. Adolescent females tended to consume more diversified diet compared to the males with significantly higher consumption of legumes, seeds and nuts alongside fruits and vegetables, a finding shared by other studies from reviews[18]. In Samburu context, high intake of plant-based proteins and vegetables could be attributed to cooking skills as the males were fending for themselves after initiation and would prefer to eat *Ugali* (maize meal) and milk that required less work to prepare. There is need to consider cultural affiliations and gender inclinations to food to inform on feasible contextual interventions to address dietary intake among the adolescent population.

Dietary diversity can be measured at either the household or the individual level and higher scores represent a more diverse diet. Positive correlation between Individual dietary diversity score and nutrient adequacy that translated to reduced malnutrition has been reported.[19, 20, 21, 22] Therefore, diversity in the diet is important measure of macro and micro-nutrient adequacy for nutrition vulnerable groups like

adolescents. Gender norms that vary with communities influence dietary diversity. A study in India reported higher likelihood of poor dietary diversity among adolescent girls than boys in a school setting[23]. In this study, adolescent respondents were from the community and overall, 50% of adolescents consumed less than 4 food groups with females presenting significantly higher IDDS compared to the males who were 2 times more likely to achieve low IDDS. There is need to consider influence of gender roles on adolescents that may be unique in different populations as a means of addressing feeding practices of for optimal nutrition.

Micronutrients Intake:

Micronutrient requirement among adolescents is high due to increased needs to support fast growth that comes with the age. In particular, need increases for iron, calcium, zinc, vitamin A and vitamin D[13, 24]. Studies have observed high micronutrient deficiencies among adolescents associated to overall reduced health[24]. Calcium is the nutrient with highest requirements in adolescence compared to other life stages. Similarly, there is increased needs of iron at ages 14–18, especially for females largely due to the onset of menarche and monthly menstrual blood loss[13]. In this study, high intake of vitamin A foods was observed mainly from milk consumption and from green leafy vegetables by both males and females. High consumption of non-haem iron sources by female adolescents was observed. Non-haem iron is not readily available and this is further compromised if no careful preparation or meal planning is put in place to increase availability especially in limited resource settings. High consumption of vitamin C sources was observed but from cooked green leafy vegetables that would have reduced amounts due to heat treatment during cooking hence, may not translate to adequate intake of vitamin C that would further be compromised by low intake of fruits due to unavailability in the dry environment. Despite low intake of Zinc sources, females were more likely to consume the plant sources compared to the male counterparts. With low intake of animal food, vulnerability to zinc inadequacies could be increased among the male adolescents. Intake of dietary sources of vitamin D was the lowest but this may not be of concern since there is adequate sunshine in the area all the year round. Micronutrient intakes among adolescents remain an area of concern in addressing malnutrition in this population.

Conclusions

While cognizant of limited resources in pastoral community due to persistent droughts, poor dietary practices among adolescents are further influenced by socio-cultural gender norms that increase the risk to malnutrition that in turn hinders the chances of optimizing their future potential. Lack of Social survival skills compromise the ability of adolescents to realize optimal nutrition while reducing chances of breaking the vicious cycle of poverty and malnutrition in the life course. Poor dietary practices remain a challenge in realizing improved nutrient intake among adolescents in different populations that is shared by those in pastoral communities. Cultural beliefs and gender expectations further compromise the ability of adolescents to realize quality diets that is a part of world health organization's (WHO) global strategy to improve adolescent health and wellbeing. There is need to consider multi-sector context specific collaboration approaches in designing interventions targeting adolescents in pastoral

communities that not only address the limited resources but also environmental and social-cultural gender aspects as a strategy to realize World Health Organization (WHO) goal for addressing malnutrition among adolescent populations.

Abbreviations

MDDS Mean dietary diversity score

ASAL Arid and Semi-Arid Lands

BMI Body mass Index

DDS Dietary Diversity Score

IDDS Individual Dietary Diversity Score

MAM Moderate acute malnutrition

SAM Severe acute malnutrition

GAM Global acute malnutrition

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Maseno University Ethics Review Committee, reference number - MSU/DRPI/MUERC/00919/20. Informed written consent was obtained from the all adolescents 18 years and above while younger adolescents (<18 years) gave written ascent in addition to parental consent to participate in the study.

Consent for publication.

Not Applicable.

Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

The study was funded by UNICEF, Kenya that catered for logistical support as part of their community outreach programs in Kenya (program number: KEN/PCA2020278/PD2020268). The funding body did not participate in the design, data collection, analysis and interpretation of the study findings.

Author's contribution

JM, EK, LK, LM and CML participated in designing the study and data collection in the study population and finally in drafting of the manuscript. FK and PL provided technical support in statistical analyses and participated in the drafting of the manuscript. All authors have read and approved the final manuscript.

Acknowledgements

Appreciation goes to the ministry of health Samburu County for logistic and technical support, Lamech Otieno for co-ordination of data collection process, enumerators, field supervisors and to study participants.

References

1. UNICEF. 2019: UNICEF Data: Monitoring the situation of children and women. Adolescent demographics, October 2019. Accessed at https://data.unicef.org/topic/adolescents/demographics/ on 23rd May, 2021.
2. KNBS. 2019: Kenya population and housing census; volume 1. Accessed at https://www.knbs.or.ke/?wpdmpro=2019-kenya-population-and-housing-census-volume-i-population-by-county-and-sub-county on 23rd May, 2021.
3. ASRH-Samburu-County fact sheet. 2017; https://www.afidep.org/publication/adolescent-sexual-and-reproductive-health-in-samburu-county/ Accessed on 24th May 2021.
4. Lassi Z, Moin A, Bhutta Z. Nutrition in Middle Childhood and Adolescence. In: Bundy DAP, Silva Nd, Horton S, et al., editors. Child and Adolescent Health and Development. 3rd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2017 Nov 20. Chapter 11. Available from: https://www.ncbi.nlm.nih.gov/books/NBK525242/ doi: 10.1596/978-1-4648-0423-6_ch11.
5. Spear BA. Adolescent growth and development. J Acad Nutr Diet. 2002;102:23–9.
6. WHO Adolescent and young adult health. January, 2021. Accessed at https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions on 2nd July, 2021.
7. The Global Strategy for Women's. Children's and Adolescents' Health, 2016–2030. Accessed at https://www.who.int/life-course/partners/global-strategy/global-strategy-2016-2030/en/ in May, 2021.
8. GOK, Adolescent Reproductive Health and Development (ARHD). in 2003. Accessed at https://www.prb.org/wp-content/uploads/2013/05/kenya-policy-assessment-report.pdf.

9. Fisher AA. (1991): Formular for sample size calculation (For populations more than 10,000. Accessed at https://www.google.com/search?q=sampling+procedures+by+Fisher+et+al.%2C+1991+&tbm=isch&ved=2ahUKEwj-3KSdzfbwAhVNBt8KHTkaDBEQ2- on 31st May, 2021.
10. FAO. 2013: Guidelines for Measuring Household and Individual Dietary Diversity. Accessed at http://www.fao.org/3/i1983e/i1983e.pdf on 31 May, 2021.
11. WHO. Growth reference data for 5–19 years. Accessed at https://www.who.int/tools/growth-reference-data-for-5to19-years.
12. UNICEF. 2019: UNICEF Data: Monitoring the situation of children and women. A dolescent demographics, October 2019. Accessed at https://data.unicef.org/topic/adolescents/demographics/ on 23rd May, 2021.
13. Christian P, Smith E. R: Adolescent Undernutrition: Global Burden, Physiology, and Nutritional Risks. Ann Nutr Metab. 2018;72:316–28. doi:10.1159/000488865.
14. Sheikh S, Iqbal R, Qureshi R, et al. Adolescent food insecurity in rural Sindh, Pakistan: a cross-sectional survey. BMC Nutr. 2020;6:17. https://doi.org/10.1186/s40795-020-00343-w.
15. Arimond M, Wiesmann D, Becquey E, Carriquiry A, Daniels MC, Deitchler M, Fanou-Fogny N, Joseph ML, Kennedy G, Martin-Prevel Y, Torheim LE. Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor settings. J Nutr. 2010;140(11):2059S–69S. https://doi.org/10.3945/jn.110.123414.
16. Endalifer ML, Andargie G, Mohammed B, et al. Factors associated with dietary diversity among adolescents in Woldia, Northeast Ethiopia. BMC Nutr. 2021;7:27. https://doi.org/10.1186/s40795-021-00430-6.
17. Isabirye N, Bukenya JN, Nakafeero M, et al. Dietary diversity and associated factors among adolescents in eastern Uganda: a cross-sectional study. BMC Public Health. 2020;20:534. https://doi.org/10.1186/s12889-020-08669-7.
18. Keats EC, Rappaport A, Jain R, Oh C, Shah S, Bhutta ZA. Diet and Eating Practices among Adolescent Girls in Low- and Middle-Income Countries: A Systematic Review. USAID; 2017.
19. Hatloy A, Torheim LE, Oshaug A. Food variety-a good indicator of nutritional adequacy of the diet? A case study from an urban in Mali, West Africa. Eur J Clin Nutr. 1998;52:891–8. doi:10.1038/sj.ejcn.1600662.
20. Ogle MM, Hung PH, Tuyet HT. The significance of wild vegetables in micronutrient intakes of women in Vietnam: an analysis of food variety. APJCN. 2001;10:21–30.
21. Torheim LE, Barikmo I, Parr CL, et al. Validation of food variety as an indicator of diet quality assessed with a food frequency questionnaire for western Mali. Eur J Clin Nutr. 2003;57:1283–91. doi:10.1038/sj.ejcn.1601686.
22. Wassie MM, Gete AA, Yesuf ME, et al. Predictors of nutritional status of Ethiopian adolescent girls: a community based cross sectional study. BMC Nutr. 2015;1:20. https://doi.org/10.1186/s40795-015-0015-9.

23. Aurino E. Do boys eat better than girls in India? Longitudinal evidence on dietary diversity and food consumption disparities among children and adolescents. Econ Hum Biol. 2017;25:99–111.
24. Akseer N, Al-Gashm S, Mehta S, Mokdad A, Bhutta ZA. Global and regional trends in the nutritional status of young people: a critical and neglected age group. Ann N Y Acad Sci. 2017 Apr;1393(1):3–20. doi: 10.1111/nyas.13336. Erratum in: Ann N Y Acad Sci. 2017 May;1396(1):236. PMID: 28436100.
25. Raghupathi V, Raghupathi W. The influence of education on health: an empirical assessment of OECD countries for the period 1995–2015. Arch Public Health. 2020;78:20. https://doi.org/10.1186/s13690-020-00402-5.

Figures

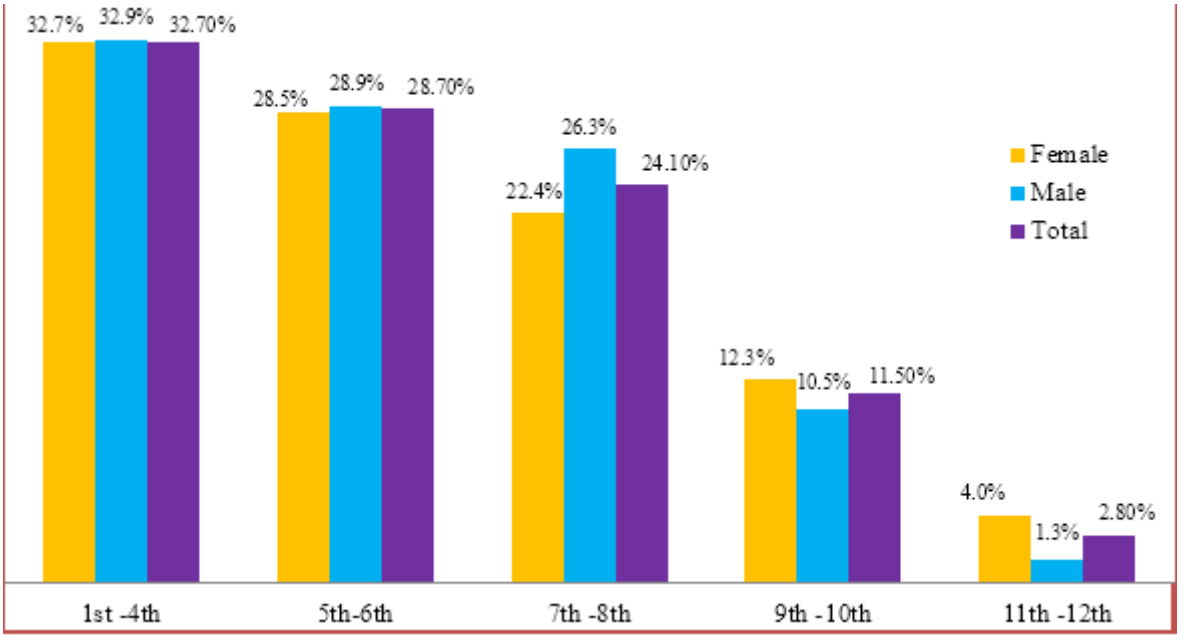

Figure 1

Grade distribution of adolescents by sex

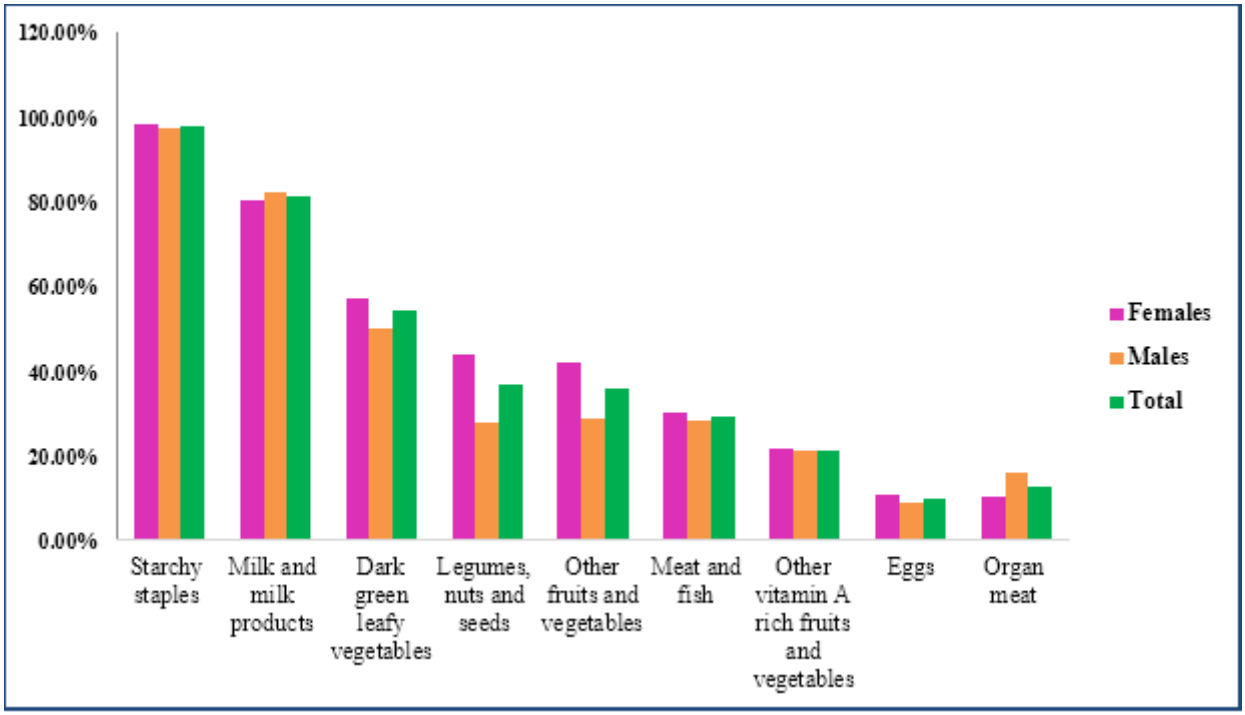

Figure 2

Food groups consumed by sex

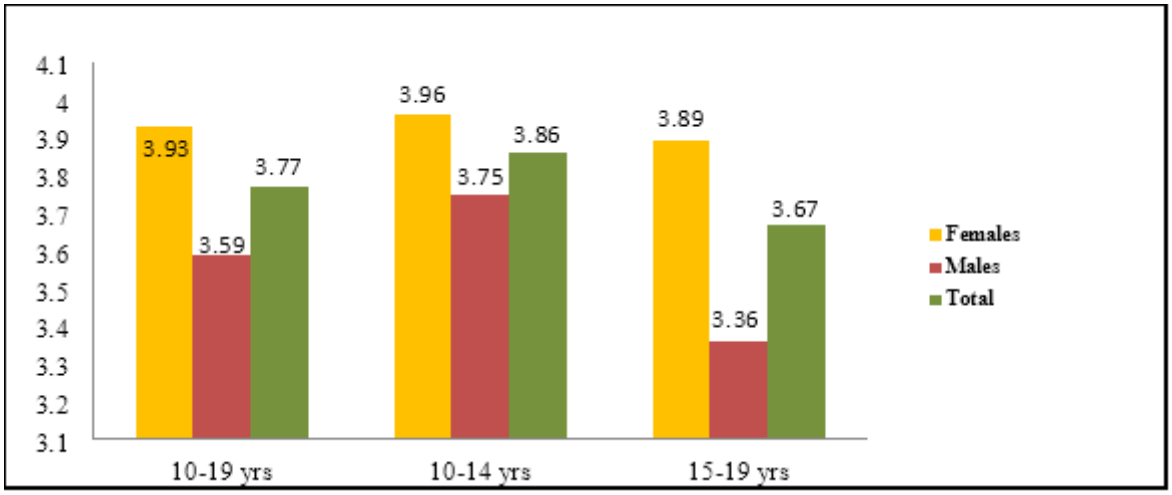

Figure 3

Mean dietary diversity score (MDDS) by age and sex

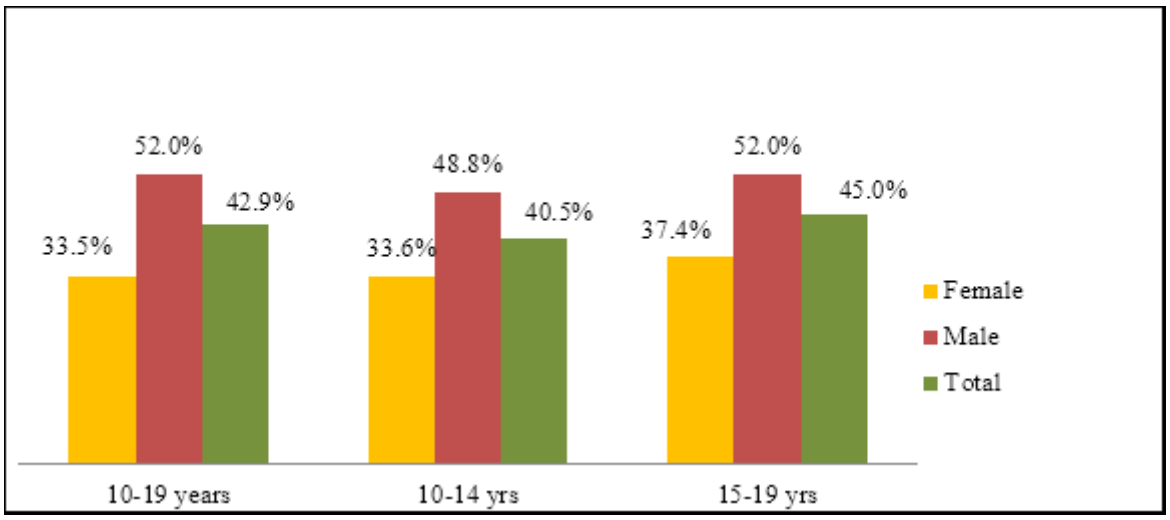

Figure 4

Individual dietary diversity (IDDS) with < 4 food groups by age and sex

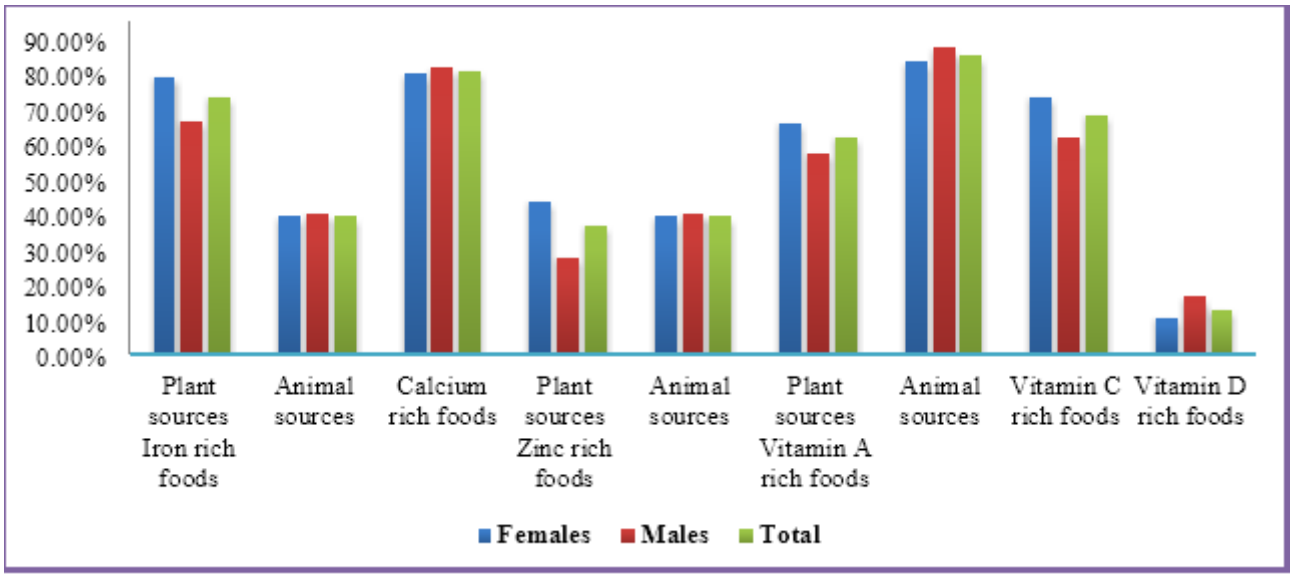

Figure 5

Intake of dietary sources of selected micronutrients