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The prevalence and factors associated with wasting and stunting among adolescent girls aged 10-19 years in Kaabong District, Karamoja Sub-Region. A cross-sectional study.

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Abstract

Background.

In the Karamoja sub-region, Uganda, adolescent girls face multiple challenges, including food insecurity, limited access to nutritious diets, and socio-cultural barriers that may predispose them to undernutrition. This study assessed the Prevalence and factors associated with wasting and Stunting among Adolescent Girls Aged 10-19 Years in Kaabong District, Karamoja Sub-Region.

Methodology.

A cross-sectional study was conducted among adolescent girls aged 10-19 years across four town councils in Kaabong. Data were collected using structured questionnaires and anthropometric measurements (MUAC and BMI-for-age Z scores). Bivariate and multivariate logistic regression analyses were performed to identify factors associated with wasting and stunting.

Results.

The prevalence of wasting was 42.2% and stunting 52.9%, indicating substantial nutritional deficits. Multivariate analysis revealed that adolescents aged 15–19 years were 46% less likely to be wasted (AOR: 0.54, 95% CI: 3.907–12.735, p=0.039) but 2.54 times more likely to be stunted (AOR: 2.54, 95% CI: 1.066–7.824, p=0.002). Adolescents consuming three or more meals per day were 67% less likely to be wasted (AOR: 0.33, 95% CI: 8.899–19.354, p<0.001) and 1.72 times less likely to be stunted (AOR: 1.72, 95% CI: 5.834–15.735, p=0.002). Household size (>5 members) increased the odds of stunting 2.2-fold (AOR: 2.20, 95% CI: 6.451–17.965, p=0.022), while high wealth index reduced the likelihood of wasting by 45% (AOR: 0.55, 95% CI: 2.857–16.347, p=0.046). Illness history and limited access to nutritious diets were additional significant predictors.

Conclusion.

Wasting and stunting are highly prevalent among adolescent girls in Kaabong District, with age, meal frequency, household size, economic status, and recent illness significantly influencing nutritional outcomes.

Recommendations.

Nutrition-specific interventions targeting early adolescents, promotion of dietary diversity, improved access to nutrition services, household food security initiatives, and health education are urgently needed to mitigate undernutrition in this population.

Keywords: *Adolescent girls, Wasting, Malnutrition, Nutritional status, Stunting, Kaabong District, Karamoja Sub-Region.*
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Background.

Adolescence, defined as the period between ages 10 and 19, is a critical stage of life characterised by rapid biological growth, development, and shifts in social roles (World Health Organisation, 2019). Nutrition during this period is essential, as it significantly influences health, cognitive

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development, and long-term well-being, ultimately affecting national development and the economy of future generations (Gebreyohannes, 2014). Globally, adolescents comprise approximately 20% of the population, with 4% living in developing countries (Teji et al., 2016). In low- and middle-income countries, many adolescents lack access to the nutritious diets needed to meet the demands of growth and, for some, early pregnancy. These countries often face widespread micronutrient deficiencies (FAO, 2020). Although global data on adolescent wasting and stunting are limited, trends show that underweight among adolescent girls decreased from 29.6% in 2000 to 25.9% in 2016, while overweight and obesity increased from 10.3% and 2.5% in 2000 to 17.5% and 5.6% in 2016, respectively (Bentham et al., 2017). In Sub-Saharan Africa, the prevalence of wasting among adolescent girls ranges from 1% to 10% (Akseer et al., 2017). In Uganda, a 2017 national study reported underweight and overweight prevalence among adolescents as 6.5% and 6.8%, respectively, while stunting affected 15.5% of adolescents aged 10–14 years, particularly those from low socio-demographic backgrounds (Ministry of Health, 2017).

In the Karamoja sub-region, including Kaabong District, data on adolescent nutritional status are scarce. Factors likely influencing nutritional outcomes among adolescent girls include early marriage, low literacy rates, poor water, sanitation, and hygiene, limited access to adolescent-friendly health services, inadequate knowledge of available services, exploitative labour, poor dietary practices, socio-economic vulnerabilities, and gender-related barriers (Ministry of Health, 2017). Despite these challenges, there is little published evidence on how these determinants impact wasting and stunting among adolescent girls in Kaabong. This study, therefore, sought to assess the prevalence of wasting and stunting and identify associated factors among adolescent girls aged 10–19 years in Kaabong District, Karamoja sub-region.

Methodology.

Design of The Study.

This study employed a community-based cross-sectional design with a quantitative data collection approach.

Study Area.

This study took place in Kaabong District, in the Karamoja sub-region, Uganda. Kaabong was chosen for the study because it is easily accessible to the researcher. Also, the FSNA results of 2021 showed that Kaabong district had the worst nutrition indicators (with a GAM rate of 18.6 per cent) (FSNA, 2021). To the northwest of Kaabong is South Sudan, while to the northeast and east is Kenya. In Uganda, Moroto, Kotido, and Karenga districts border Kaabong to the southeast, south, and west, respectively. According to UBOS projections, 128,600 people inhabit the Kaabong district (UBOS, 2021), with adolescent girls accounting for 17.5 per cent of the household population (FSNA, 2020). Kaabong district comprises one health sub-district (HSD), 3 counties, 17 sub counties and 02 town councils, 27 health facilities, 84 parishes, and 454 villages; with 32,697 children below the age of five and 27,006 women in the reproductive age group. Most of the Kaabong district is semi-arid, has thorny shrubs, and some savannah vegetation. Annually, Kaabong has only one cultivation season, whereby farmers usually commence harvest of crops such as beans, maize, and Irish potatoes by August.

Study Population.

The study population was adolescent girls aged 10–19 years in the Kaabong district. These participants included both school-going and out-of-school girls. Given that a portion of the study population comprises minors. (Adolescents aged 18-19 years). Appropriate ethical safeguards were implemented. Proxy consent from parents or legal guardians for all participants under 18 years, while assent was obtained from the adolescent girls themselves after clearly explaining the purpose, procedures, and voluntary nature of the study in age-appropriate language. For participants aged 18 years and above, informed consent was obtained directly from them.

Sampling and Sampling Techniques.

This study employed a multistage sampling technique where four (4) parishes from two sub-counties and four (4) wards from two (2) Town Councils were selected through a simple random sampling technique. This was done by writing each name of the parishes and town wards on different small pieces of paper, putting them in a closed tin, and shaking. 8 pieces of paper were selected one by one at every pick and thoroughly shaken before another pick. Parishes and town councils were considered to ascertain geographical variability.

From every 2 parishes/wards, 3 villages/cells were selected randomly using the lottery/fish bowl technique. At the cell/village level, a systematic random sampling technique using a calculated sampling interval (total number of households in a cell over the number of households

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required) was used to identify 6 households to engage. A minimum of 15 adolescent girls from 6 different households were obtained from each village/cell. This summed up to about 187 adolescent girls who met the inclusion criteria. Sample size determination was done using a 5 per cent precision, a 95 per cent confidence level, a design effect of 1.5, and a minimum 90 per cent response rate to reach a target sample size of 187.

Sample Size Determination.

The sample size was calculated using the Kish Leslie (1965) formula as follows;
Where,
n =sample size
P=12.7% prevalence of wasting in Uganda. (Walls et al., 2020)
Z=standard value corresponding to the 95% C.I (1.96)
q = 1 - p =1 - 0.127 = 0.873
e = margin of error=0.05
n = 170
Non-response rate of 10% of 170=17
Therefore, 187 adolescent girls were considered in this study.

Selection Criteria.

Inclusion criteria:

Adolescent girls of Kaabong district aged 10-19 years who clearly understood the relevance and rationale of the study and were willing to comply were involved.
Pregnant and lactating adolescents were included.
Physically disabled 10-19-year-old adolescent girls were included.

Exclusion criteria:

Those with threatening illnesses and those who failed to understand the objectives of the study were excluded from the study.
Adolescents who were critically ill were excluded from the study.

Quantitative Data Collection Instruments.

Quantitative data were gathered through a structured questionnaire administered by research assistants. Research assistants who were fluent in English and their local languages were selected based on their data collection knowledge.

Training of the research assistants preceded data collection, including pretesting in Kaabong District to enhance tool quality.

Data Collection Procedure.

Recruitment of research assistants.

A total of 10 research assistants from Kaabong district with fluency in the Karamajong language were recruited to conduct the study.

Training of data collectors.

A day before the collection of data, the recruited research assistants participated in a training to ensure the accuracy and correctness of data capture. The ODK Collect tool was uploaded to the smartphones of the research assistants. Areas of focus in the training were: ethics of research, how to use the ODK-Collect software, and how to take anthropometric measurements. The data collectors were at least senior six graduates from the region who understood English and could also speak the Ngakarimojong language (Dodoth dialect), the main native language in Kaabong.

Pretesting of the tools.

Before the data collection, the tools were tested (pre-tested). In Kaabong town council, ten adolescent girls who met the study inclusion criteria were engaged in the pre-testing of the developed tools.

Administration of the questionnaire.

The research assistants made self-introductions, informed the participants about the study, and requested their consent before administering the questionnaires. The responses from the respondents and anthropometric measurements were recorded in the ODK Collect tool. Every day, the principal researcher synchronised all questionnaires from the research assistants and reviewed data collected for completeness and logical consistency.

Quantitative Processing and Analysis.

Nutritional status of adolescent girls in this study included those who were wasted, stunted, and those with normal nutritional status. Wasting was assessed using MUAC and BMI for Age Z Scores, while stunting was measured using Height-for-Age Z scores and compared to the WHO reference population. The Z scores were calculated using the WHO Anthro-Plus software.

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Wasting

Adolescent girls 10-14 years with MUAC of 18.5 cm and above were regarded as normal, ≥16.0 18.5 cm was considered moderately wasted, while less than 16 cm was considered severely wasted. For adolescent girls 15-19 years, ≥21.0cm was treated as normal, ≥18.5cm and <21.0 cm was categorised under moderate wasting, while <18.5 cm was considered as severely wasted. Among pregnant adolescents, nutritional status was assessed using only MUAC (Ministry of Health, 2016).

Stunting

Participants with Height for age Z scores of less than -2SD were regarded as stunted, while those greater than or equal to -2SD were normal (Ministry of Health, 2016).

The data analysis plan was structured according to each of the study objectives. The data was collected using mobile data collection tools programmed with the Kobol toolbox (Open Data Kit). This platform was installed on Android-enabled tablets and smartphones to ensure real-time, accurate, and paperless data capture in the field. Upon completion of data collection, the data were exported from the Kobol Toolbox ODK to Microsoft Excel for cleaning and validation. The cleaned data were then imported into the Statistical Package for the Social Sciences (SPSS) for analysis.

Validity and reliability of research instruments.

In enhancing the reliability and validity of research tools for studying determinants of wasting and stunting among adolescent girls aged 10-19 in Kaabong, two critical steps were taken. Firstly, a careful translation process was conducted, involving bilingual experts to ensure the questions retain their meaning and cultural relevance. Secondly, the content validity of the tools was scrutinised by subject matter experts and local researchers. Their thorough evaluation assessed whether the questions effectively measure the targeted constructs, with adjustments made based on their feedback.

Results.

Socio-Demographic Characteristics

Table 1: A summary of socio-demographic factors for adolescent girls 10-19 years in Kaabong district, Karamoja sub-region.

Variables	Frequency(N=187)	Percentage (%)
Number of respondents		
Kaabong town council	46	24.6
Kathile town council	46	24.6
Kakamar	47	25.1
Lodiko	48	25.7
Age of participant		
10-14 years	96	51.3
15-19 years	91	48.7
Marital status		
single	48	25.7
Monogamous	38	20.3
Never married	9	4.8
Polygamous	92	49.2
Disability status		
Yes	16	8.6
No	171	91.4
Age of mother/caregiver		
Below 30	32	17.1
30-40	90	48.1
40-50	56	29.9
Above 50	9	4.8

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The education status of the mother		
Less/not educated	176	94.1
Highly educated	11	5.9
Household size		
More than five	83	44.4
Less than or equal to five	104	55.6

Table 1 shows that more participants;48(25.7%) were from Lodiko, 96(51.3%) were early adolescents 10-14 years, 92(49.2%) were polygamous, 171(91.4%) weren't disabled, 90(48.1%) had mothers/care givers between 30-40 years, 176(94.1%) mothers were less/not educated, 104(44.4%) with a household size less or equal to five.

Association Between Socio-Demographic Factors and Nutrition Status of The Adolescent Girls.

Table 2: Cross Tabulations Between Sociodemographic Factors and Nutrition Status of Adolescent Girls.

VARIABLE	**NUTRITION STATUS**							
	Wasting				**Stunting**			
	Wasted (%)	**Normal**	**X^2**	**p-value**	**Stunted (%)**	**Normal**	**X^2**	**p-value**
Age			40.343	<0.001*			83.512	<0.001*
10-14 years	62(64.6)	34(35.4)			82(85.4)	14(14.6)		
15-19 years	17(18.7)	74(81.3)			17(18.7	74(81.3)		
Marital status			30.818	<0.001*			7.262	0.064
Single	15(31.3)	33(68.8)			19(39.6)	29(60.4)		
Monogamous	30(78.9)	8(21.1)			24(63.2)	14(36.8)		
Never married	6(66.7)	3(33.3)			7(77.8)	2(22.2)		
Polygamous	28(30.4)	64(69.6)			49(53.3)	43(46.7)		
Disability status			12.799	0.998			8.210	0.004*
No	79(46.2)	92(53.8)			96(56.1)	75(43.9)		
Yes	0(0.0)	16(100)			3(18.8)	13(81.3)		
Age of mother			34.943	<0.001*			9.930	0679
Below 30	14(43.8)	18(56.3)			16(50.0)	16(50.0)		
30-40	21(23.3)	69(76.7)			42(46.7)	53.3)		
40-50	35(62.5)	21(37.5)			32(57.1)	24(42.9)		

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Above 50	9(100)	0(100)			9(100.0)	0(0.0)		
Education status			2.774	0.096			9.021	0.003*
Less/not educated	77(43.8)	99(56.3)			98(55.7)	78(44.3)		
Highly educated	2(18.2)	9(81.8)			1(9.1)	10(90.9)		
Household size			17.244	0.116			54.603	<0.001*
more than five	49(59.0)	34(41.0)			69(83.1)	14(16.9)		
Less/equal to five	30(28.8)	74(71.2)			30(28.8)	74(71.2)		

Table 2 shows the results of bivariate analysis for the associations between demographic factors and wasting (by MUAC) and stunting.
Wasting: Age (X^2=40.343, p<0.001), marital status (X^2=30.818, p<0.001), age of mother/caregiver (X^2=34.943, p<0.01). All other socio-demographic factors analyzed were not associated with wasting among adolescent girls 10-19 years in Kaabong district.
Stunting; age (X^2=83.512, p<0.001), disability status (X^2=8.210, p<0.001), education level of the mother (X^2=9.021, p=0.003), and household size (X^2=54.603, p<0.001). All other socio-demographic factors analyzed were not associated with stunting among adolescent girls aged 10-15 years in Kaabong district.

Prevalence of Wasting and Stunting Among Adolescent Girls 10-19 Years in Kaabong District, Karamoja Sub-Region.

Table 3: Nutrition status of adolescent girls 10-19 years in Kaabong district, Karamoja sub-region.

Nutrition status	**WASTING**		**STUNTING**	
Subcounty/ TC	**WASTED (%)**	**NOT WASTED (%)**	**STUNTED (%)**	**NOTSTUNTED (%)**
Kaabong T/C	23(50.0)	23(50.0)	28(60.9)	18(39.1)
Kathile T/C	19(41.3)	27(58.7)	24(52.2)	22(47.8)
Kakamar	11(23.4)	36(76.6)	16(34.0)	31(66.0)
Lodiko	26(54.2)	22(45.8)	31(64.6)	17(35.4)
Total	79(42.2)	108(57.8)	99(52.9)	88 (47.1)

The study found that 79(42.2%) adolescent girls were wasted and 99(52.9%) adolescent girls were stunted.

Factors Associated with Wasting and Stunting Among the Adolescents at Multivariate Analysis.

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Table 4: Binary logistic regression for Factors associated with wasting by MUAC among the adolescent girls at multivariate analysis.

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age of participant				
10-14 years	1			
15-19 years	0.56(4.050-14.558)	<0.001*	0.54(3.907-12.735)	0.039*
Marital status				
Single	1			
Monogamous	0.11(0.001-0.089)	<0.001*		
Never married	0.21(0.045-0.941)	<0.001*		
Polygamous	0.99(0.460-2.135)	0.041*		
Knowledge level				
High knowledge	1			
Low knowledge	0.76(0.028-0.201)	<0.001*		
Meal frequency				
Two or fewer	1		1	
Three or more	0.29(10.998-17.667)	<0.001*	0.33(8.899-19.354)	<0.001*
Dietary diversity score				
High DDS	1			
Low DDS	0.99(0.047-0.209)	<0.001*		
Access to nutrition services				
High access	1			
Low access	0.50(0.019-0.134)	<0.001*		
Illnesses				
Yes	1			
No	7.61(3.888-14.881)	<0.001*		
Poverty level				
Low wealth index	1		1	
High wealth index	0.57(1.732-34.242)	0.037*	0.55(2.857-16.347)	0.046*
Culture and traditional beliefs				
Restrictive	1			
Supportive	2.93(8.727-9.895)	<0.001*		
Food insecurity				
Low food supply	1			
High food supply	3.09(1.145-8.318)	<0.001*		

Table 4 shows that adolescents aged 15-19 years were 46% less likely to be wasted compared to those 10-14 years old (AOR: 0.56, 95%CI: 3.907-12.735, p=0.039). Participants who had three or more meals per day were 67% less likely to be wasted compared to those who had two or fewer meals a day (AOR: 0.33, 95%CI: 8.899-19.354, p<0.001). Participants with a high wealth index were 45% less likely to be wasted compared to those with a low wealth index (AOR: 0.55, 95%CI: 2.857-16.347, p=0.002). Other factors analysed at the multivariate level weren't associated.

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Table 5: A table showing binary logistic regression for factors associated with stunting among adolescent girls.

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age of participant				
10-14 years	1			
15-19 years	2.54(1.175-5.528)	<0.001*	2.55(1.066-7.824)	0.002*
Marital status				
Single	1			
Monogamous	0.382(0.159-0.919)	0.032*		
Never married	0.187(0.035-0.999)	0.050*		
Polygamous	0.58(0.283-1.168)	0.076		
Disability status				
No	1			
Yes	5.55(1.525-20.174)	0.009*		
Household size				
Less than or equal to five	1		1	
more than five	2.16(5.952-24.831)	<0.001*	2.20(6.451-17.965)	0.022*
Knowledge level				
High knowledge	1			
Low knowledge	1.30(0.047-0.223)	<0.001*		
Meal frequency				
Three or more	1		1	
Two or fewer	1.76(8.343-37.290)	<0.001*	1.72(5.834-15.735)	0.002*
Dietary diversity score				
Low	1			
High	0.92(0.046-0.183)	<0.001*		
Access				
Low access	1			
High access	0.61(0.028-0.134)	<0.001*		
Illnesses				
Yes	1		1	
No	0.57(0.88-0.312)	<0.031*	0.52(0.047-0.0542)	0.045*
Economic status				
Low wealth index	1			
High wealth index	0.43(0.037-0.462)	0.002*		
Culture and traditional beliefs				
Restrictive	1			
Supportive	0.69(0.031-0.155)	<0.001*		
Food insecurity				
Low food supply	1			
High food supply	0.53(0.025-0.114)	<0.001*		

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Table 5 shows that participants aged 15-19 years were 2.54 times more likely to be stunted compared to those 10-14 years old (AOR: 2.54, 95%CI: 1.066-7.824, p=0.002). Adolescents from households with more than 5 were 2.2 times more likely to be stunted compared to those from households with fewer than five (AOR: 2.20, 95%CI: 6.451-17.965, p=0.022). Participants who had two or fewer meals per day were 1.72 times more likely to be stunted compared to those who had three or more meals a day (AOR: 1.72, 95%CI: 5.834-15.735, p=0.002). Adolescents who had no illnesses in the last three months were 48% less likely to be stunted compared to those who reported illnesses (AOR: 0.52, 95%CI: 0.047-0.0542, p=0.045). Other factors analysed at the multivariate level weren't associated with stunting.

Discussion of results.

Prevalence of Wasting and Stunting Among Adolescent Girls 10-19 Years in Kaabong District, Karamoja Sub-Region.

WASTING.

The study found that 79(42.2%) using MUAC and 84(44.9%) using BMI for Age Z scores, adolescent girls were wasted. This is a high prevalence, implying 4 in 10 adolescent girls 10-19 years in Kaabong district are suffering from nutritional wasting, unreasonably higher than 5.4% pooled wasting prevalence of East Africa. (*2021_Global_Nutrition_Report*). The relatively high prevalence of wasting is due to low food supply due to unfavorable climate and infertile soils that barely support agricultural activities, subsequently inducing a low daily food or nutrient intake and diversity for the adolescent girls and the population at large.

These results align with previous studies conducted globally, for instance, a 2014 community-based cross-sectional study on the prevalence of wasting and associated factors among children 6-59 months conducted in Habro district, Eastern Ethiopia cites a 69% wasting prevalence contribution by Asia. (Sileshi, 2024). Similarly, another community-based cross-sectional study on disparity in prevalence and predictors of undernutrition in children under 5 years in Karamoja sub-region estimates a 36-58% prevalence of wasting. (Okidi et al., 2022). On the contrary, most studies report relatively lower wasting prevalence percentages; South Africa (36.4%) (Melusi, 2020), Northern Ethiopia (37%) (Wasihun et al., 2018), Somalia (21%) (Damaris, 2015), among many others. The difference between the wasting prevalence percentages is due to differences in climate distribution. Climate is a precursor of most anthropogenic factors and activities, such as agriculture, migration, and nutrition, among others. Longer spells of drought and limited precipitation in the Karamoja sub-region don't support mass food production, aggravating food insecurity and resulting in high wasting incidences.

The high prevalence of wasting proves a public health threat to Karamoja and Uganda at large, reflecting a need for age-specific, gender-based, multi-disciplinary interventions through mainstreaming progressive climate change strategies, food supply, nutritional education and care services, WASH strategies, wealth creation, among others, to address underlying risk factors.

STUNTING.

The study found that 99(52.9%) adolescent girls were stunted. This implies a high prevalence of stunting in 5 in 10 adolescent girls aged 10-19 years in the Kaabong district. The high prevalence of stunting is due to high incidents of childhood diseases that cause malabsorption, and poor infant and young child feeding practices with less access to minimum acceptable diets for children during growth.

These results align with some previous studies, for instance, a community-based cross-sectional study in Karamoja sub-region on disparity in prevalence and predictors of undernutrition in children under 5 years estimates a 36-58% stunting pooled prevalence (Okidi et al., 2022). Another community-based study in the Blue Hora district, southern Ethiopia, on the prevalence of undernutrition and associated factors among young adolescents reports 47.6% stunting. (Asfaw et al., 2015).

On the contrary, most studies report relatively lower stunting prevalence percentages; Nkwata, Ghana (12.5%) (F.D. Danso, 2023), East Dembia (25.5%) (Mihretu, 2022), Mahanjaga, Madagascar (28.4%) (MTM, 2024), among many others. The huge difference between the stunting prevalence percentages is primarily based on the feeding practices. Karamajongs feed off blood and unpasteurized milk from livestock as staple food, which narrows their dietary diversity score, thus leading to undernourishment. Unpasteurized milk and raw milk also expose them to bacteria and other disease-causing micro-organisms, increasing incidents of childhood diseases such as diarrhea, dysentery, brucella, GIT disorders, among many others, which result in malabsorption.

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These findings emphasize the need for localized and nutrition-specific/sensitive interventions to address harmful cultural feeding behaviors and practices and other underlying factors, such as childhood diseases and low food intake, among others.

Factors Associated with Wasting and Stunting Among Adolescent Girls 10-19 Years in Kaabong District, Karamoja Sub-Region.

WASTING

Age of participant.

Adolescents aged 15-19 years were 46% (MUAC))/48% (BAZ) less likely to be wasted compared to those 10-14 years old. Late adolescents (15-19 years) have more established eating habits and a better understanding of nutrition, therefore are more likely to prioritize healthy eating and healthy choices about their diet. Additionally, early adolescence (10-14 years) is a period of rapid growth and development that demands increased intake of essential nutrients and energy; inadequate nutrition at this stage increases the risk of nutritional wasting.

These results align with most previous studies, including an institution-based cross-sectional study in East Dembia district on the prevalence of undernutrition and associated factors among students, which found that early adolescents ages 11-14 years were 3.70 times more likely to be wasted compared to late adolescents (Mihretu, 2022). Another cross-sectional study in the Karamoja sub-region on disparity in prevalence and predictors of undernutrition in adolescents reports early adolescents as the most vulnerable to wasting compared to any other age group (Okidi et al., 2022).

This calls for age-specific interventions on early adolescents, 10-14 years, for more nutritional care and attention, to address risk factors to malnutrition. This, however, shouldn't be a blueprint for misguidance and negligence of nutritional care and attention to all other age groups.

Meal frequency.

Participants who had three or more meals per day were 67 %(MUAC)/69(BAZ) less likely to be wasted compared to those who had two or fewer meals a day. This is because adolescents who eat more frequently have adequate nutrition intake, a diverse diet with balanced micro and macronutrients, and better energy levels to facilitate growth and development compared to those with fewer meals.

These results align with many other previous studies, including a community-based cross-sectional study in South Africa on the prevalence of wasting and associated factors among children 2-5 years, which concluded a 77% wasting prevalence among children who had less than 3 standard meals per day. (Reta, 2022). Another cross-sectional nutritional assessment survey in Somalia on predictors of risk of malnutrition among children found that children with a low food frequency and diet diversity score were 1.68 times more likely to be wasted compared to those with high daily food frequency. (Damaris, 2015).

This gears the demand for nutrition-sensitive interventions such as nutrition education, mass food production and supply, and financial empowerment, among others, to increase community food supply and household daily meal frequencies.

Economic status.

Participants with a high wealth index were 45 % (MUAC/BAZ) less likely to be wasted compared to those with a low wealth index. This is because adolescents from high-income households have high access to nutritious foods, better nutrition and healthcare services, reduced stress, and education and awareness compared to those with low wealth index, thus are at a reduced risk of being nutritionally wasted.

These results correspond to some other studies, among them, a retrospective statistical review for 5 South Asian countries' demographic health survey repositories spanning 2014 to 2018 on factors associated with wasting among children and young adolescents highlights financial muscle as a top-notch predictor of wasting, where the less privileged play victims. (Wali et al., 2020). Another secondary analysis of Uganda demographic health surveys of factors associated with undernutrition among 20-49-year-old women reported that participants with a poor wealth quintile were 3.60 times more likely to be wasted compared to those with a high wealth index. (Serwanja, 2020).

Therefore, there is a need for expanded wealth creation programs to alleviate poverty and improve the wealth quintile of adolescent girls and household incomes to improve access to nutritious foods, nutrition care and related services, safe water, and health care.

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STUNTING.

Age of participant.

Participants aged 15-19 years were 2.54 times more likely to be stunted compared to those aged 10-14 years old. Late adolescents (15-19 years) have more established eating habits and a better understanding of nutrition, therefore are more likely to prioritize healthy eating and healthy choices about their diet. Additionally, early adolescence (10-14 years) is a period of rapid growth and development that demands increased intake of essential nutrients and energy; inadequate nutrition at this stage increases the risk of nutritional stunting.

These results align with most previous studies, including an institution-based cross-sectional study in East Dembia district on the prevalence of undernutrition and associated factors among students, which found that early adolescents ages 11-14 years were more likely to be stunted compared to late adolescents (Mihretu, 2022). Another cross-sectional study in the Karamoja sub-region on disparity in prevalence and predictors of undernutrition in adolescents reports early adolescents as the most vulnerable to stunting compared to any other age group. (Okidi et al., 2022).

Therefore, this highlights the need for more 10-14-year age-focused nutritional care and attention through nutrition-specific and nutrition-sensitive interventions to holistically address all underlying risk factors of malnutrition in the Karamoja sub-region.

Meal frequency.

Participants who had two or fewer meals per day were 1.72 times more likely to be stunted compared to those who had three or more meals a day. This is because adolescents who eat more frequently have adequate nutrition intake, a diverse diet with balanced micro and macronutrients, and better energy levels to facilitate growth and development compared to those with fewer meals.

These results align with many other previous studies, including a community-based cross-sectional study in South Africa on the prevalence of stunting and associated factors among children 2-5 years, which reports high incidents of stunting among children who had less than 3 standard meals per day. (Reta, 2022). Another cross-sectional nutritional assessment survey in Somalia on predictors of risk of malnutrition among children found that children with a low food frequency and diet diversity score were 1.46 times more likely to be stunted compared to those with high daily food frequency. (Damaris, 2015).

This gears the demand for nutrition-sensitive interventions such as nutrition education, mass food production and supply, and financial empowerment, among others, to increase community food supply and household daily meal frequencies.

Household size.

Adolescents from households with more than 5 were 2.2 times more likely to be stunted compared to those from households with fewer than five household members. This is because adolescents from high households suffer scarce resources, including food, high competition and stress for survival, dispersed nutrition care and attention, which affect dietary intake per individual, causing undernourishment. This increases the risk of stunting compared to those from small household sizes.

The results correspond with those from many other studies, and these are: a secondary analysis of Uganda demographic health survey repositories in 2016 finds that adolescents from extended families and polygamous marriages were more likely to be stunted compared to those from monogamous and nuclear families. (Serwanja, 2020) Another cross-sectional survey in East Dembia on prevalence and factors associated with stunting and wasting among school-age children in rural primary schools recorded a high incidence of stunting among children from large households. (Mihretu, 2022).

Therefore, there is a need to educate all women of reproductive age about the importance of family planning and clear all related misconceptions to control household sizes. Additionally, more effort should be made to widen family planning and nutrition care service delivery networks to ensure wider coverage in the Kaabong district, Karamoja sub-region.

Illnesses.

Adolescents who had no illnesses in the last three months were 48% less likely to be stunted compared to those who reported illnesses. This is because illness-free adolescents still have a high nutrient wealth, as illnesses tend to deplete nutrients, better nutrient absorption, improved appetite and food intake, which reduces risks to stunting compared to those who have reported illness in the last three months.

This is similar to many other studies, among them, a cross-sectional nutrition assessment survey in Somalia on predictors of risks of malnutrition reports that participants with diarrhea were 1.34 times more likely to be stunted compared to those with no illnesses. (Damaris, 2015).

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Another cross-sectional secondary data survey on factors associated with malnutrition in Nakaseke and Nakasongola districts reports a high incidence of stunting among participants with diarrhea, anemia, dysentery, and GIT disorders. (BMC, 2015).

Therefore, more emphasis should be placed on addressing illnesses such as diarrhea, anemia, ulcers, dysentery, and most GIT disorders in the management of stunting in Kaabong district, as they are key precursors in causing undernutrition.

Conclusion.

Based on results from the study, Kaabong district has relatively high wasting and stunting prevalence, which calls for a multi-level collaborative approach by different stakeholders, including the ministry, district, government, policy makers, researchers, and community members, to address undernutrition and the associated factors through nutrition-sensitive and nutrition-specific strategies.

Significant factors associated with wasting were: age of participants, meal frequency, and economic level. Those associated with stunting were the age of participants, household size, meal frequency, and illnesses.

The limitation of the study

The study's cross-sectional design could limit the ability to establish a causal relationship between determinants and wasting/stunting among adolescent girls aged 10-19 years in Kaabong district, Karamoja sub-region.

The study's reliance on participant recall for dietary intake and other factors could lead to recall bias and social desirability.

Financial constraints. Limited funds could restrict the ability to conduct a comprehensive anthropometric process, purchase essential data collection tools, and transport research assistants to remote areas in the Kaabong district.

Cultural sensitivities and language barriers could affect the accuracy of data collection and the willingness of adolescent girls to participate in the study.

Recommendation.

1. The Ministry of Health (MoH) should foster collaboration between government agencies, healthcare providers, community organizations, and other stakeholders to enhance a multi-disciplinary approach in addressing undernutrition and also leverage partnerships to mobilize resources, expertise, and support for nutrition-related initiatives.
2. District management should integrate and strengthen sustainable software and hardware WASH programs in institutions of learning, health facilities, and in the community to address malnutrition-related illnesses such as diarrhea, dysentery, among other illnesses that cause malabsorption and undernutrition eventually.
3. To develop a national nutrition policy that outlines strategies to address undernutrition, wasting, and stunting, including prevention, treatment, and management.
4. Nutrition-sensitive policies that encourage mandatory food fortification programs, school feeding programs, and support sustainable agriculture, among many others, to improve food supply, diet diversity scores, and healthy meal frequencies.

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List of Acronyms.

ANC:	Antenatal Care
BAZ:	Body Mass Index for Age Z scores
BMI:	Body Mass Index
SD:	Standard deviation
CLTS:	Community-Led Total Sanitation
CNNS:	Comprehensive National Nutrition Survey
DDS:	Dietary Diversity Score
DHO:	District Health Officer
DNFP:	District Nutrition Focal Point

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FANTA: Food and Nutrition Technical Assistance
FAO: Food and Agriculture Organization of the United Nations
FEWSNET: Famine Early Warning System Network
FGM: Female Genital Mutilation
FIES: Food Insecurity Experience Scale
FSNA: Food Security and Nutrition Assessment
SGBV: Sexual and Gender-based violence
HAZ: Height for Age Z scores
HIV: Human Immune-Deficiency Virus
INGO: International Non-Governmental Organization
MAM: Moderate Acute Malnutrition
MIYCAN: Maternal, Infant, Young Child and Adolescent Nutrition
MUAC: Mid-Upper-Arm-Circumference
NCD: Non- Communicable Diseases
NGO: Non-Government Organization
NHPC: National Housing and Population Census
ODK: Open Data Kit
SBCC: Social Behavior Change Communication
STDs: Sexually Transmitted Diseases
UBOS: Uganda Bureau of Statistics
UDHS: Uganda Demographic Health Survey.

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Conflict of interest.
There is no conflict of interest.

Availability of data.
Data used in this study are available upon request from the corresponding author.

The author's contribution.
SA designed the study, conducted data collection, cleaned and analyzed data, drafted the manuscript, and GK supervised all stages of the study from conceptualization of the topic to manuscript writing and submission.

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