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Prevalence and associated factors of underweight among children aged 06-59 months living in the slum areas of Mbarara city, Uganda: A cross-sectional study.

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Abstract

Background
Undernutrition among children aged 6-59 months remains a public health concern posing a major challenge in achieving Sustainable Development Goal 2.2. Despite considerable efforts to quantify the burden of stunting and wasting, little attention has been paid to underweight. Moreover, children living in slum areas and poor households are significantly affected by underweight. This study aimed to determine the prevalence of underweight and associated factors among children aged 6-59 months living within the slum areas of Mbarara city.

Methods
This was a cross-sectional study done within the slum areas of Mbarara city among children aged 6-59 months and their caregivers. Proportionate probability sampling and simple random sampling were used to select 532 households with potential participants within the slum areas. Interviews were done using a researcher-administered questionnaire, and anthropometric measurements of children were taken using a digital weighing scale. Data was analyzed using Stata version 17. Associated factors were determined using a modified Poisson regression model.

Results
The prevalence of underweight was 8.3%.
Child's age 12-23 months (APR=2.6; 95% CI: 1.2-5.6) and multiple pregnancy (APR=2.7; 95% CI: 1.4-5) were independently associated with underweight. Children aged 12-23 months were 2.6 times more likely to be underweight than those aged 6-11 months. Additionally, children born to multiple pregnancies were 2.7 times more likely to be underweight than those from singleton pregnancies.

Conclusions
Underweight among children living within the slum areas of Mbarara city is still a public health problem, with about 1 in 10 children underweight. Child's age 12-23 months and multiple pregnancy were the associated factors.

Recommendation
The study recommends health education for child caregivers on optimal child feeding practices, particularly for children aged 12-23 months and those born to multiple pregnancies.

Keywords: *Undernutrition, Underweight, Children, Slums*
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Background

Undernutrition is the deficiency in a person's intake of nutrients (Uribe-Quintero et al., 2022; World Health Organisation [WHO], 2024). Undernutrition includes wasting (low weight-for-height), underweight (low weight-for-age), and stunting (low height-for-age) (WHO, 2024). Undernutrition among children aged 6-59 months remains a public health concern, posing a major challenge in achieving Sustainable Development Goal

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2.2, which calls for ending malnutrition by 2030 (de Onis & Branca, 2016; WHO et al., 2014; WHO, 2014). Despite considerable efforts to quantify the burden of stunting and wasting, little attention has been paid to underweight. Moreover, children living in slum areas and poor households are significantly affected by underweight (Food and Agriculture Organisation [FAO] et al., 2022; Murarkar et al., 2020; WHO et al., 2014). Underweight children often develop a dangerously weak immunity and die from common infections (WHO et al., 2014). Evidence has also shown that underweight in these children delays their mental development, impairs cognitive ability, and results in non-communicable diseases later in their lives (United Nations Children's Fund [UNICEF], 2023; WHO et al., 2014; WHO, 2014; WHO & World Bank, 2023). About half of all mortalities among children below 5 years are related to undernutrition, including underweight (UNICEF, 2023). These mortalities can be greatly minimized with simple and affordable interventions such as adequate nutrition, safe water, safe food, and quality health care (WHO, 2020). Globally, 99 million children below 5 years were underweight in 2020, and more than one-third of these children were from Sub-Saharan Africa (Ahamada & Sunguya, 2022; WHO & World Bank, 2023). In Uganda, underweight remains high, with 1 in 10 children experiencing it (10.2%) (Uganda Bureau of Statistics [UBOS], 2023).

Evidence has shown that underweight in children below 5 years is associated with maternal age, maternal education, child's sex, child's age, and birth order (Khatri et al., 2015; Li et al., 2020; Pramod Singh et al., 2009). The growing concern over the increasing burden of underweight among children aged 6-59 months living in the slum areas of Mbarara city formed a basis for undertaking this study.

Methods

Study design, setting, and study population

This was a cross-sectional study done from April/2025 to May/2025 among children aged 06-59 months and their caregivers living within the slum areas of Mbarara city. Mbarara city is located in the south-western part of Uganda, approximately 269 km south-west of Kampala, Uganda's capital city. The slums in Mbarara city include: Tank Hill, Kirehe, Kizungu, Kisenyi, Kashanyarazi, Biafra, Kiyanja, and Kihangire. The dwellers in these slums are mainly tenants and low-income earners (Uganda Slum Dwellers Federation, 2010). The slums are characterized by poor waste disposal and drainage systems, which could be predisposing children to diarrheal diseases resulting in undernutrition (Uganda Slum Dwellers Federation, 2010).

Eligibility criteria

The study included children aged 6-59 months and their caregivers who were available during the data collection period and had lived within the study area for at least 6 months.

Children aged 6-59 months and their caregivers who had not lived within the study area for at least 6 months were excluded from the study.

Sample size determination

The sample size was determined using the Kish and Leslie formula, denoted as $n = \frac{Z^2_{\alpha/2} p(1-p)}{d^2}$

Where n represented the estimated minimum sample size required, $Z_{\alpha/2}$ =1.96 represented the standard normal value corresponding to a 95% confidence interval. p represented the estimated proportion of children aged 6-59 months with undernutrition. A similar cross-sectional study done in Wakiso District, Uganda, revealed a prevalence of undernutrition of 29.8% for stunting and 16.1% for underweight (Nsubuga et al., 2022). The proportion for stunting was considered since it yielded the maximum sample size; therefore p=0.298, d represented the margin of error of 5%. The sample size (322) was increased by a design effect of 1.5 (322x1.5=483) to account for Intercluster variations. A non-response rate of 10% was assumed, resulting in an estimated sample size of 532 caregiver-child pairs. Therefore, 532 households with potential participants were sampled from the slums.

Bias

A child's health card was used to confirm the child's date of birth, birth weight, immunization status, and birth order. Research assistants were trained, and data collection tools were pretested to ensure their validity and reliability.

Sampling technique and procedures

Mbarara city slums were sampled purposively because of the rising cases of underweight among children living within these areas. Proportionate probability sampling was used to distribute the 532 households proportionately to the slums within the city. The number of households from each slum settlement was determined

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by dividing the number of households for a given slum by the total number of households for all the slums in Mbarara city and then multiplying by the study sample size.

Selection of households from each slum was done using simple random sampling by a random number generator. Mapping and listing of all households with children aged 6-59 months for each slum was done to establish a sampling frame. Sampled households were approached, potential participants assessed for eligibility, and eligible ones enrolled in the study. A household that contained twins or triplets or more than one child aged 6-59 months, a participant child would be picked randomly, where papers with the identifiers for these children would be rolled and shuffled. A caregiver would then be asked to randomly pick one. The selected child would be considered for the study. A household where no one would be present at the time of data collection would be revisited for at most 2 different days. Failure to find one after the two days, the household would be replaced.

Table 1: Proportionate sample households per slum area

Slums area	Households with children aged 6-59 months per slum (H)	Proportionate Sample Households per slum (h) h=(H/TH)*Sample Size
Kizungu	767	135
Kisenyi	893	157
Kiswahiri	120	21
Kiyanja	131	23
Kihangire	398	70
Biafura	346	61
Butabika	114	20
Kashanyarazi	68	12
Tank Hill	68	12
Kirehe	119	21
Total	3024	532

Data collection technique and tools

A pretested semi-structured researcher-administered questionnaire, a digital weighing, and a MUAC tape were used by trained, experienced, and qualified research assistants to collect data. Data was collected on socio-demographic characteristics of the caregivers such as age, religion, marital status, employment status, level of education, household income, household food insecurity, household size and household main food source as well as child related characteristics such as age, sex, birth weight, type of pregnancy, dietary diversity, history of diarrhea and immunization status. Lastly, anthropometric measurements of the child, including Weight and his or her age, were collected as well.

Data collection procedure

Permission was obtained from the Mbarara City Clerk. The study team then approached the head of the Mbarara city slum dwellers association and the heads of the cells within the slum settlements, introduced themselves, and gave information regarding the study. Thereafter, the research team reached out to the heads of selected households, explained the study, and sought permission. Informed Consent was obtained, and data were collected using pretested questionnaires from the participants.

Study variables

Dependent variable

The dependent variable in this study was underweight. Underweight was defined as a weight for age z -z-score below −2 Standard Deviations (SD) of the median of a reference standard (UNICEF, 2023; WHO et al., 2014; WHO, 2014; WHO & World Bank, 2023).

Independent variable

Independent variables in this study included

1) Socio-demographic factors such as caregiver's age, religion, marital status, employment status, level of education, household income, household food insecurity, household size, and household main food source.

2) Child-related factors such as the child's age, sex, birth weight, type of pregnancy, dietary diversity, history of diarrhea, and immunization status.

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Data processing and analysis

Data was entered into Excel, cleaned and checked for completeness, and exported to Stata Version 17 for analysis.

WHO Anthro software version 3.2.2 was used to calculate the z scores for each child using anthropometric measurements (Age and Weight). The calculated z-scores were used to classify the children as either underweight or not.

Data was analyzed using Stata Version 17 at 3 levels: Univariate, Bivariate, and Multivariate analysis.

At the univariate level, descriptive statistics were used to analyze categorical and numerical variables.

For categorical variables, Proportions and frequencies were determined.

For normally distributed numerical variables, means and standard deviations were analyzed and presented. For non-normally distributed numerical variables, median and interquartile range were determined and presented.

In bivariate analysis, a simple modified Poisson regression analysis was used to determine factors associated with underweight.

At multivariate analysis, all variables that were found with p values less than 0.2 were considered at multivariate analysis. Confidence Intervals, P values, and Prevalence Ratios were considered to determine factors independently associated with underweight.

Ethical considerations

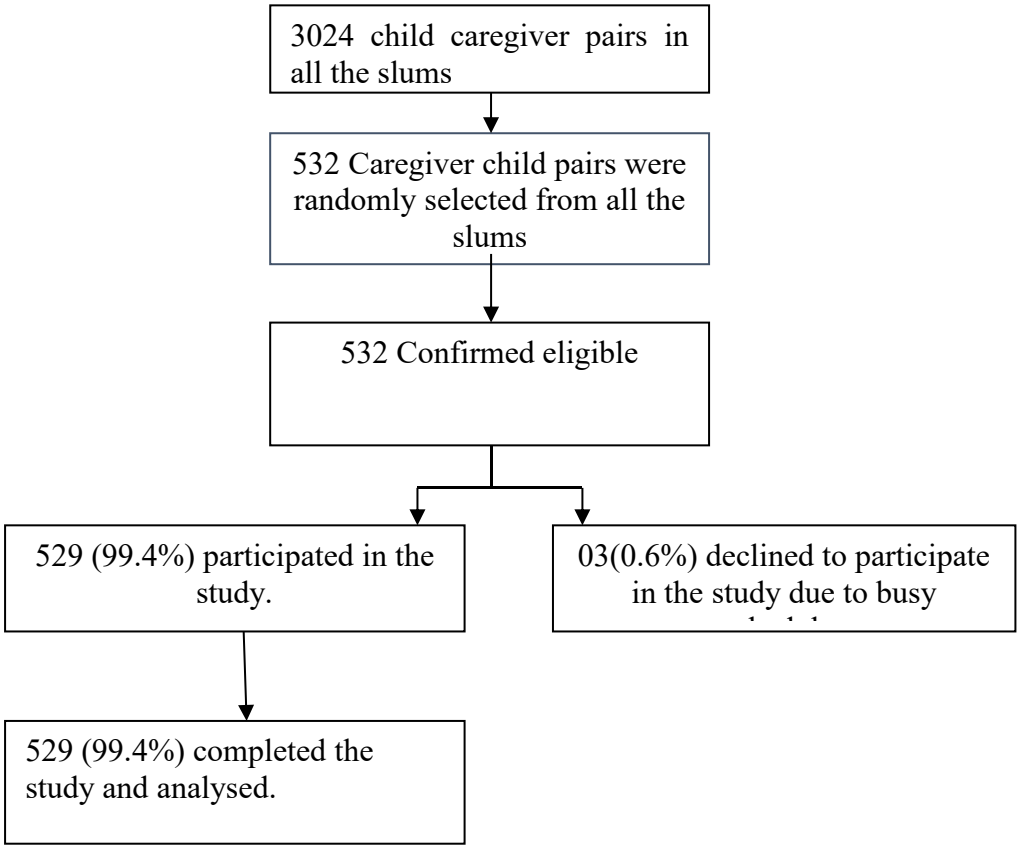
Ethical clearance was obtained on 12th/March/2025 from the Research and Ethics Committee (REC) of Bishop Stuart University (BSU-REC-2024-469). Administrative clearance was obtained from the City Clerk of Mbarara City. Participants were asked to voluntarily sign the consent form after having been educated by the investigator/research assistant. Confidentiality of all data collected was observed.

Results

Participants flow

Of the 532 eligible participants, 529 caregiver-child pairs participated in the study, giving a response rate of 99.4%. 03 participants declined to participate in the study due to their busy schedules, which prevented them from dedicating the necessary time to the study. 529 child caregiver pairs were finally analyzed

Fig 1: Participants flow



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Study profile

A total of 529 out of 532 caregiver-child pairs participated in this study between April and May 2025, giving a response rate of 99%. The distribution of by slum shows that Kisenyi had the highest representation with 154 participants (29%), followed by Kizungu with 135 (25.5%). Kihangire accounted for 70 participants (13.2%) while Biafra had 61 (11.5%). Other slums with notable proportions included: Kirehe with 21participants (4%), Butabika with 20 participants (3.8%), Kiyanja with 23 participants (4.4%), and Kiswahiri with 21 participants (4%). Kashanyaraze and Tank Hill slums had the smallest counts of 12 participants each (2.3%).

Table 2: Response rates from the different slum settlements (n=529)

Slum Name	Proportionate Sample	Proportion (%)
Kizungu	135	25.5
Kisenyi	154	29
Kiswahili	21	4
Kiyanja	23	4.4
Kihangire	70	13.2
Biafura (Kajogo)	61	11.5
Butabika	20	3.8
Kashanyarazi	12	2.3
Tank Hill	12	2.3
Kirehe	21	4
TOTAL	529	100

Socio-demographic characteristics of the participants

Of the 529 caregivers, 520 (98.3%) were biological mothers of the children, whereas 09(1.7%) were guardians of the children. The mean age of the caregivers was 29.5 years with a standard deviation of 6.1 years. Most 162 (30.62%) of the caregivers were aged 25–29 years, and the least 11 (2.08%) were aged below 20 years. Regarding education, the majority of the caregivers, 240 (45.37%), had attained secondary education, and only 19 (3.59%) had never attended school. More than three-quarters, 461 (87.15%) of the caregivers were married, 46 (8.7%) were widowed, 06 (1.13%) were separated, and 16 (3.02%) were single. Religiously, more than three-quarters 445, 84.12%) were Christians, and only 84 (15.88%) were Muslims. More than half, 357(67.49%), were employed. Nearly all (482, 91.1%) caregivers get their household food from buying, and less than 5% (18, 3.40%) get their household food from the garden. Food insecurity was reported by 431 (81.5%), while 98 (18.5%) were food secure. The median household size was 4 (IQR: 3-5), and the majority (82.04%, 434) of the caregivers had household sizes from 2-5 household members.

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Table 3: Baseline characteristics of the caregivers (n=529

Characteristics	n=529 Freq (prop%)	Underweight	No Underweight
Caregiver type			
Mother	520(98.3)	43(8.13)	477(90.17)
Guardian	09(1.7)	1(0.19)	8(1.51)
Age (years)			
≥35	121(22.87)	7(1.32)	114(21.55)
30-34	128(24.20)	14(2.65)	114(21.55)
25-29	162(30.62)	15(2.84)	147(27.29)
20-24	107(20.23)	7(1.32)	100(18.90)
15-19	11(2.08)	1(1.89)	10(0.19)
Education level			
None	19(3.59)	3(0.57)	16(3.02)
Primary	187(35.35)	17(3.21)	170(32.14)
Secondary	240(45.37)	18(3.40)	222(41.97)
Tertiary	83(15.69)	6(1.13)	77(14.56)
Marital status			
Married	461(87.15)	38(7.18)	423(79.96)
Single	16(3.02)	0(0.00)	16(3.02)
Separated	06(1.13)	1(0.19)	5(0.95)
Widowed	46(8.70)	5(0.95)	41(7.75)
Religion			
Moslem	84(15.88)	5(0.95)	79(14.93)
Christian	445(84.12)	39(7.37)	406(76.75)
Employment status			
Employed	357(67.49)	28(5.29)	329(62.19)
Unemployed	172(32.51)	16(3.02)	156(29.49)
Food security			
Yes	98(18.53)	4(0.76)	94(17.77)
No	431(81.47)	40(7.56)	391(73.91)
Main source of food			
From garden	18(3.40)	0(0.00)	18(3.40)
From buying	482(91.12)	44(8.32)	438(82.80)
From both	29(5.48)	0(0.00)	29(5.48)
Household size			
2-5	434(82.04)	38(7.18)	396(74.86)
6-9	87(16.45)	5(0.95)	82(15.50)
≥10	8(1.51)	1(0.19)	7(1.32)

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Regarding children, most children 522 (98.7%) were born from singleton pregnancies with a median age of 24 months (IQR: 14–37 months). Slightly less than a third, 149 (28.17%) of the children were aged 12-23 months, and only 50 (9.45%) were aged 48-59 months. Slightly more than half were males, 273 (51.6%).

The majority, 476 (90.0%), were vaccinated and exclusively breastfed (471; 89.0%), though 58 (11.0%) were not. Diarrheal history was reported in 204 children (38.6%). More than three-quarters (479, 90.55%) did not have low birth weight at birth, and about 5% (33, 6.24%) had a low birth weight at birth (0-2.4 kg). More than half (283; 53.50%) met the minimum dietary diversity.

Table 4: Baseline characteristics of the children (n=529)

Characteristics	n=529 Freq (prop %)	Underweight	No Underweight
Pregnancy type			
Multiple	7(1.32)	2(0.38)	5(0.95)
Singleton	522(98.68)	42(7.94)	480(90.74)
Age group (Months)			
6-11	109(20.60)	7(1.32)	102(19.28)
12-23	149(28.17)	24(4.54)	125(23.63)
24-35	128(24.20)	7(1.32)	121(22.87)
36-47	93(17.58)	3(0.57)	90(17.01)
48-59	50(9.45)	3(0.57)	47(8.88)
Birth weight(kg)			
<2.5	33(6.24)	5(0.95)	28(5.29)
≥2.5	479(90.55)	37(6.99)	442(83.55)
No record of weight	17(3.21)	2(0.38)	15(2.84)
Sex			
Female	256(48.39)	20(3.78)	236(44.61)
Male	273(51.61)	24(4.54)	249(47.07)
Vaccination status			
No	53(10.02)	5(0.95)	48(9.07)
Yes	476(89.98)	39(7.37)	437(82.61)
Exclusive breastfed			
Yes	471(89.04)	36(6.81)	435(82.23)
No	58(10.96)	8(1.51)	50(9.45)
History of diarrhea			
No	325(61.44)	19(3.59)	306(57.84)
Yes	204(38.56)	25(4.73)	179(33.84)
Dietary diversity			
Yes	283(53.50)	21(3.97)	262(49.53)
No	246(46.50)	23(4.35)	223(42.16)

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Prevalence of underweight.

Underweight stands at 8.32% (95% CI: 6.11–11.01).

Table 5: Prevalence of underweight

Outcome Variable	n	Underweight children	Prevalence (%)	95% CI
Underweight	529	44	8.32	6.11 – 11.01

Factors associated with Underweight among children aged 06 to 59 months living within the slum areas of Mbarara city

Child's age 12-23 months (APR=2.6; 95% CI: 1.2-5.6) and Multiple pregnancy (APR=2.7; 95% CI: 1.4-5) were independently associated with underweight. Children aged 12-23 months were 2.6 times more likely to be underweight than those aged 6 months to 11months. Additionally, children born to multiple pregnancies were 2.7 times more likely to be underweight than those from singleton pregnancies.

Table 6: Caregiver-related factors associated with underweight among children aged 06-59 months living within the slum areas of Mbarara city

Category	Crude PR (95% CI) at BA	P-value	Adjusted PR at (95% CI) at MV	P-value
Caregiver characteristics				
Age(Years)				
≥35	1			
15-19	1.6(0.2-12.6)	0.671		
20-24	1.13(0.6-2.2)	0.714		
25-29	1.6(0.6-4.2)	0.342		
30-34	1.9(0.6-5.8)	0.269		
Education level				
Tertiary	1		1	
None	2.2(-0.76-6.3)	0.147	2.2(0.8-6.2)	0.144
Primary	1.3(0.5-3.1)	0.620	1.2(0.5-2.6)	0.05
Secondary	1.04(0.4-2.5)	0.935	1.1(0.5-2.3)	0.892
Employment status				
Employed	1			
Unemployed	1.2(0.6-2.3)	0.618		
Religion				
Christian	1			
Moslems	0.7(0.3-1.7)	0.394		
Household Income				
300,000-500,000	1			
<300,000	1.04(0.4-2.3)	0.920		
>500,000	0.99(0.3-2.6)	0.990		
Food Insecurity				
Food secure	1		1	
Food insecure	2.3(0.74- 7)	0.153	2.1(0.7-6.7)	0.207

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Table 7: Child-related factors associated with underweight among children aged 06-59 months living within the slum areas of Mbarara city.

Category	Crude PR (95% CI) at BA	P-value	Adjusted PR at (95% CI) at MV	P-value
Age (Months)				
6-11	1		1	
12-23	2.5(1.2-5.3)	0.015	2.6(1.17-5.6)	0.018
24-35	0.9(0.4-2)	0.719	0.9(0.3-2.2)	0.749
36-47	0.5(0.1-1.8)	0.298	0.6(0.16-1.9)	0.339
48-59	0.9(1.2-3.97)	0.927	1.09(0.3-4.3)	0.906
Sex				
Female	1			
Male	1.1(0.63- 1.996)	0.687		
Exclusive breastfed				
Yes	1		1	
No	1.8(0.9-3.5)	0.084	1.5(0.8-2.8)	0.206
Pregnancy type				
Singleton	1		1	
Multiple	3.6(1.3-9.5)	0.012	2.7(1.4-5)	0.002
History of diarrhea				
No	1		1	
Yes	2.1(1.016-4.33)	0.045	1.8(0.9-3.5)	0.110
Birth weight				
≥2.5	1		1	
<2.5	1.96(0.9-4.3)	0.091	1.9(0.9-3.7)	0.074
No record of weight	1.5(0.3-7)	0.595	1.5(0.4-5.9)	0.527
Minimum Dietary Diversity				
Yes	1			
No	1.26 (0.64-2.48)	0.503		
Up-to-date vaccination status				
Yes	1			
No	1.15(0.5- 2.5)	0.728		

Discussion

Prevalence of underweight among children aged 6-59 months living in the slum areas

The current study has found that 8.3% of the children living within the slum areas are underweight. A similar study done in Nakasongola and Nakaseke districts in Uganda revealed similar findings (13.5%) (Habaasa, 2015). Additionally, a study done in an informal urban settlement in Nairobi, Kenya, revealed a similar underweight prevalence of 11.8% (Olack et al., 2011). The study populations in these areas stay in similar geographical regions with similar demographics, which could explain the similarity in the findings. Contrary to this, a study done in the slums of West Bengal, India, revealed a much higher prevalence of underweight of 22.3% (Jaleel et al., 2025). This difference could be attributed to the differences in the geographical contexts in which these two studies were done. This implies that context-specific interventions should be implemented to address the burden of underweight within the study area.

Factors associated with underweight among children aged 6-59 months living in the slum areas of Mbarara city

The current study has shown that a child's age 12-23 months and the child's type of pregnancy (Multiple) are associated with underweight. A similar study done in urban informal settlements in Mumbai, India, revealed that Toddlers aged 18-23 months were more likely to be

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underweight than their younger counterparts (Huey et al., 2019). Children older than one year are children transitioning from complementary feeding to independent feeding and therefore, are more likely to be missing the nutrients from breast milk, hence developing underweight. This implies that improving optimal feeding among the toddlers could reduce the burden of underweight. Additionally, the current study has revealed that children born to multiple pregnancies are more likely to be underweight compared to those from singleton pregnancies. Children born from multiple pregnancies stand a risk of being born with low birth weight and prematurity, which may predispose them to being underweight later in their lives.

Generalizability of the study findings

The findings of this study are consistent with previous studies done in slum areas (Huey et al., 2019; Olack et al., 2011). These findings may therefore be generalized to slum areas with similar demographics. However, the study's focus on children aged 6-59 months might limit the generalizability of these findings to children below 6 months or older than 59 months living in the slum areas.

Conclusions

Underweight among children living within the slum areas of Mbarara city is still a public health problem, with about 1 in 10 children underweight. Children aged 12-23 months are more likely to be underweight compared to children aged 6-11 months. Additionally, Children born from multiple pregnancies are more likely to be underweight than those born from a singleton pregnancy.

Limitations of the study

The study was based on the caregivers' recall for some independent variables, such as the child's history of diarrhea and dietary diversity. There are chances that the study may have under- or overestimated these variables.

Recommendations

Health education of child caregivers about optimal child feeding practices, particularly for children aged 12-23 months and those born to multiple pregnancies.

Areas for further research

Further studies need to qualitatively explore and explain why children aged 12 to 23 months are associated with underweight.

Abbreviations

WHO: World Health Organization
UNICEF: United Nations International Children's Emergency Fund.
MoH: Ministry of Health.
MUAC: Mid Upper Arm Circumference.
WFP: World Food Programme.
FAO: Food and Agriculture Organisation.
UBOS: Uganda Bureau of Statistics.
UDHS: Uganda Demographic and Health Survey.
VHT: Village Health Team.
BV: Bivariate analysis.
MV: Multivariate Analysis.

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Authors' contributions

EA conceived and designed the study. EA performed the analysis and interpretation of data. AJ and TM supervised the design conception, analysis, and interpretation of data, and made critical comments at each step of research. EA drafted the manuscript. All authors read, reviewed, and approved the final Manuscript.

Competing interests

The authors declare that they have no competing interests.

Conflict of interest

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Data availability

All data reported in this manuscript will be made available on reasonable request from the corresponding author.

Author biography

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