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Nutritional Status, Feeding Practices and Factors Associated to Undernutrition among 6 to 59 Months of Age Orphans in the Arusha Region

Philip Mrindoko[1,2*], Matei Mselle[1,2], Lucy Frisch[1,2], Ali Iman[1,2], Magreth Swai[1,2], Zaituni Hatibu[1,2], Ikupa Minga[1,2], Arnold Likiliwike[1,2], Elise Kimambo[1,2], Nyemo Peter[1,2], Baraka Moshi[3], Aisa Shayo[1,2]

[1]Department of Pediatrics and Child Health, Kilimanjaro Christian Medical Centre, Moshi, Tanzania
[2]Department of Pediatrics and Child Health, Kilimanjaro Christian Medical University College, Moshi, Tanzania
[3]Institute of Public Health, Kilimanjaro Christian Medical University College, Moshi, Tanzania
Email: *philipmrindoko1@gmail.com

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Abstract

Background: Orphans are potentially at greater risk of malnutrition because they are more likely to be extremely poor and receive less medical and social care. Children living in orphanages tend to be neglected and may be malnourished and they're at risk of losing their full potential, with consequences to the child, nation and worldwide. Despite the nutritional concerns raised globally and in neighboring countries among these children, there exists an inadequate body of information about orphans' nutritional status and feeding practices in Tanzania. This study aimed to assess the nutritional status, feeding practices and factors contributing to malnutrition among children aged 6 - 59 months in Arusha region orphanages, Tanzania. **Study Objective:** To assess the nutritional status, feeding practices and factors contributing to undernutrition among children aged 6 - 59 months in Arusha region orphanages, Tanzania. **Methodology:** This was an institution-based cross-sectional study conducted in selected orphanage Centre in the Arusha region. A representative sample size of 216 children aged 6 - 59 months in Arusha orphanages was selected to participate in the study. Multistaging sampling was used to select the study participants. Interviewer-administered questionnaires and anthropometric measurements were used during data collection. The data collected were entered, processed, and analyzed; continuous variables were summarized by use of mean and Standard deviation, while categorical variables were summarized by use of frequency, percentages and figures. Multivariable logistic regression

was used to estimate the Odds Ratio with 95% CI and measure the strength of association between the outcomes with respect to selected independent variables. Variables with a p-value of less than 0.05 were considered statistically significant. **Results:** A total of 216 children from the orphanage Centre were involved in this study. Prevalence of Stunting, underweight and wasting among orphan children were 23.60%, 15.30% and 9.30%. The proportions of MDD and MMF were 89% and 99%. Children being on medication for any kind of illness during the survey (AOR: 7.9; 95% CI: 1.95, 31.78), unmarried caregivers (AOR: 1.9; 95% CI: 1.32, 10.86), fever 2 weeks before the survey (AOR: 2.9; 95% CI: 1.09, 9.24) and orphanage Centre with more than 30 children (AOR: 1.8; 95% CI: 1.08, 6.86) were found to be associated with undernutrition. **Conclusion:** In Arusha orphanages, the prevalence of stunting, underweight, and wasting among children exceeded WHO standards. Despite adequate feeding practices, the child's illness, the number of children in the orphanage, and the marital status of caregivers were factors influencing the nutritional status of the orphans.

Keywords

Undernutrition, Eating Habits, Under Five Children, Home Based Care

1. Introduction

Background

Malnutrition in children under five years old remains a significant global health issue, characterized by inadequate intake or absorption of essential nutrients. This can lead to undernutrition (stunting, wasting, and underweight) or overnutrition (overweight) [1]-[3]. In 2021, 149.2 million children under the age of five years globally were stunted, 38.9 million were overweight and 45.4 million were wasted. Notably, almost two out of five children with stunting reside in South Asia, while another two out of five live in Sub-Saharan Africa [1]. Malnutrition has long-term impacts on physical and cognitive development, leading to a heightened risk of infections, learning disabilities, and even mortality [4]-[7].

Children from low-income households face higher risks of malnutrition due to limited access to nutritious food, healthcare, and sanitation [5] [8]-[10]. These vulnerabilities are particularly pronounced in orphans, who often experience significant economic and psychosocial challenges after the loss of one or both parents. Orphans, especially those living in orphanages or alternative care, are at an even greater risk of malnutrition due to factors such as food insecurity, lack of parental care, and unstable living conditions [11] [12]. In fact, globally, orphans represent a substantial portion of vulnerable children, with 147 million estimated in 2022, many of whom reside in Sub-Saharan Africa [13]-[17].

Tanzania has a considerable orphan population, with an estimated 1,696,349 orphans, including 24,000 residing in orphanages. The Arusha Region, with a

population of 1,694,310 as of 2012, has about 7% of its population classified as orphans [18]. Despite notable progress in reducing malnutrition rates, undernutrition remains a public health challenge in Tanzania. Stunting affects 30% of children under five, while 12% of children are underweight [19]-[22]. Although national statistics provide a general overview of malnutrition, limited data exists regarding the nutritional status, feeding practices, and factors associated with undernutrition among orphans.

Therefore, the primary goal of this study was to offer critical insights for researchers, health policymakers, and nutrition experts by assessing the nutritional status, feeding practices, and factors contributing to undernutrition among orphans aged 6 to 59 months aiming to inform targeted interventions and improve child health outcomes.

2. Methods

2.1. Study Design, Period and Setting

An institutional based cross sectional was conducted within orphanages in the Arusha Region from May 2023 to June 2023. Arusha Region, located in northern Tanzania. It lies approximately 480 kilometers northwest of Dar es Salaam, the country's largest city, and about 100 kilometers from Mount Kilimanjaro. According to the 2022 national census, the Arusha Region has a population of approximately 2.4 million people.

2.2. Study Populations

The study population of this study was all institutionalized 6 - 59 months orphan children residing in Arusha Region orphanages.

2.3. Sample Methods and Procedures

The sample size of 360 was determined using the Kish Leslie formula (1965) for cross-sectional studies, considering a 31% prevalence of stunting among under five children in Arusha [19], a 95% confidence level, and a 5% margin of error. To accommodate a potential non-response rate of 10%, the sample size was adjusted upward. Multistage sampling was employed, using purposive selection to choose orphanages housing children under 5 years old. Convenience sampling was adopted due to its feasibility in accessing the study population, enabling the selection of 216 participants aged 6 - 59 months within the Arusha Region.

2.4. Data Collection Tools and Measurements

Data were collected by using a structured questionnaire and anthropometric measurements performed by standardized weighing scales (Seca 877 and Seca 384), UNICEF measuring board. The questionnaire was adapted from various sources including UNICEF. It has several contents including socio-demographic characteristics, housing and sanitation, feeding practices and dietary diversity, morbidity variables and household food insecurity. It was initially prepared in

English and translated into Swahili language for data collection. Back translation of the questionnaire into English was carried out by an independent translator to check for the consistency of the translation.

Height was measured in standing position for children ≥ 2 years and length was measured in recumbent position in children < 2 years. The child was barefooted and free of head wear. For measuring height, the child was helped onto the baseboard with feet slightly apart. The back of the head, shoulder blades, buttocks, calves and heels were touching the vertical board. The assistant held the child's knees and ankles. With the child's chin held between thumb and forefinger and eyes facing directly forward, the interviewer pulled the headboard down to rest firmly on top of the child's and read to the nearest completed 0.1 cm. For measuring length, the child was placed on its back. The assistant standing opposite the tape held the child's head against the headboard. The child's eyes were looking straight up. The interviewer standing on the side of the measuring tape held down the child's knees with the left hand and moved the footboard with the right hand flat against the soles. The measurement was read and recorded to the nearest completed 0.1 cm.

Weight was measured with the child lightly dressed on a standard scale and recorded to the nearest 0.1 kg. Children < 2 years of age, were weighed using SECA 384 and children ≥ 2 years were weighed using SECA 877. The scales were calibrated immediately before each session

The nutritional status of the respondents was assessed using the WHO growth reference values of 2007 [3] Respondents with z-scores less than -2 were classified as stunted (height/length-for-age), wasted (weight-for-height/length) and underweight (weight-for-age).

Information was collected about the frequency of food consumption for different food groups, and a 24-hour dietary recall was conducted. A point was awarded to each of the seven food groups (grains/roots/tubers, legumes/nuts, dairy products, flesh foods, eggs, vitamin A-rich fruits/vegetables, and other fruits/vegetables) consumed by the respondents over the reference period. The sums of all points were calculated to determine the dietary diversity score (DDS) for each respondent. The dietary diversity score ranged from 0 to 7, with a minimum of 0 if none of the food groups were consumed and a maximum of 7 if all the food groups were consumed. The World Health Organization (WHO) recommended a cutoff point of ≥ 4 points for high dietary diversity, while DDS < 4 indicated low dietary diversity. For MMF a point was awarded each time the child was fed in the 24 hours and adequate MMF was met if the child was fed ≥ 5 times a day (Appendix) [23].

2.5. Data Analysis

The data was collected through Kobotoolbox form, and was exported to a Microsoft Excel spreadsheet to check for consistency and imported into STATA statistical software version 15 for analysis. Data cleaning and processing was involved checking for missing values, outliers, and data inconsistencies.

Categorical variables were summarized by use of frequency, percentage and figures while continuous variables were summarized by use of mean and standard deviation.

Multivariable logistic regression was used to estimate the Odds ratio with 95% CI and measure the strength of association between outcomes with respect to selected independent variables. Variables with a p-value of less than 0.05 were considered statistically significant, and the findings were reported using appropriate statistical tables, graphs, and narrative descriptions.

2.6. Ethical Approval

The ethical clearance was obtained from KCMU-College research ethics committee with a Clearance Certificate **No. PG 41/2022**, and permission to conduct the research was obtained from the head of the Pediatrics department in KCMC, Chief Executive Officer of Arusha District council, Meru District, Arusha Municipal Council and the officers in charge of the selected orphanage centers.

Informed consent forms were signed by the caregivers and the management of the orphanage before the study commenced. The information obtained from the participants were kept confidential and held in confidence.

3. Results

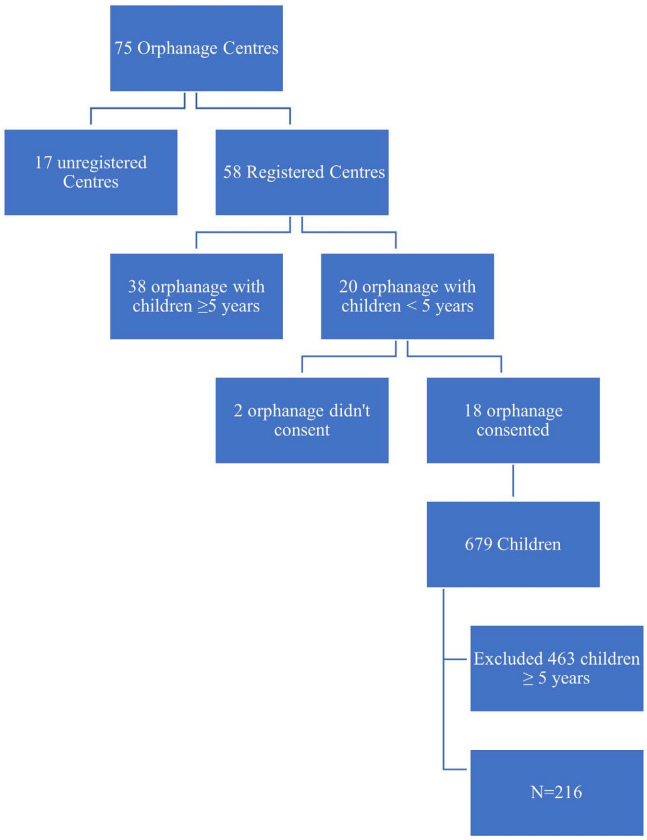


Figure 1. Flowchart of children enrolled in the study from October 2022 to June 2023 (N = 216).

During the study period from October 2022 to October 2023, a multistage identification process identified a total of 216 eligible participants from 75 Orphanages. Out of 75 orphanages in Arusha Region only 58 orphanages were registered for the study. Among the registered orphanages, 20 had children under the age of 5. Out of these 20, 18 orphanages consented to participate in the study. A total of 679 children within the Arusha districts were identified. However, 463 children were excluded due to not meeting the inclusion criteria. Ultimately, the study focused on the remaining 216 children who fulfilled the inclusion criteria (Figure 1).

3.1. Characteristics of Study Participants

A total of 216 orphaned children were involved in this study. Majority of them, 124 (57.4%) were older than 24 months with a mean age of 31.3 months and a standard deviation of 17.5 months. More than half, 111 (51.4%) of all participants were male. Among them, 142 resided in non-governmental organizations, 46 in religious institutions, and 28 in private or group homes.

Regarding the parental status of the children, the majority 132 (61.1%) still had at least one living parent, while 84 (38.9%) were double orphans. Among all reason for the children being in the orphanage poverty was the main reason, which accounted for 118 (54.6%) of cases.

In terms of their length of stay in the orphanage, majority 111 (51.4%) of the orphaned children had been there for more than 1 year but less than 3 years. A total of 58 (26.8%) had been there for less than 1 year, and 47 (21.8%) had been there for more than 3 years.

Regarding their health status, 54 (23.2%) of the orphaned children had experienced a cough in the two weeks prior to the survey, 39 (18.1%) had a history of fever, and only 4 (1.8%) had experienced episodes of diarrhea during that time (Table 1).

Table 1. Socio-demographic and clinical characteristics of study participants (N=216).

Variable	Frequency	Percentage
Age of the Child in Months		
≤ 24	92	42.6
>24	124	57.4
Mean ± SD	31.3 ± 17.5	
Gender of the Child		
Male	111	51.4
Female	105	48.6
Reason for Living in Orphanage		
Parent abandonment	58	26.9
Death of parent	35	16.2
Poverty	118	54.6
Others	5	2.3
Biological Parent Alive		
Yes	132	61.1
No	84	38.9

Continued

Time Spent in the Center (Months)		
<12	58	26.8
12 - 23	76	35.2
24 - 35	35	16.2
>36	47	21.8
Number of Children in the Orphanage		
≤30	52	24.1
>30	164	75.9
Number of Caregivers		
≤10	95	44
>10	121	56
Gender of Caregivers		
Male	23	10.6
Female	193	89.4
Age of Caregiver		
≤20	37	17.1
21 - 30	31	14.3
31 - 40	55	25.5
>40	93	43.1
Education Level of Caregiver		
Primary	64	29.6
Secondary	93	43.1
University	59	27.3
Caregiver Marital Status		
Single	118	54.6
Married	98	45.4
Washing Hand before Feeding Children		
Yes	208	96.3
No	8	3.7
Child Hospitalized		
Yes	29	13.4
No	187	86.6
History of Coughing 2 Weeks before the Survey		
Yes	50	23.2
No	166	76.8
History of Fever 2 weeks before the Survey		
Yes	39	18.1
No	177	81.9
History of Diarrhea 2 Weeks before the Survey		
Yes	4	1.8
No	212	98.2
Child on Medication		
Yes	187	86.6
No	29	13.4
Health Insurance of the Child		
No	114	52.8
Yes	102	47.2

3.2. Prevalence of Undernutrition (Underweight, Stunting and Wasting)

Among all children taking part in this study (N = 216), the prevalence of stunting was 23.6%, wasting 9.3% and underweight 15% among orphan children (Figure 2).

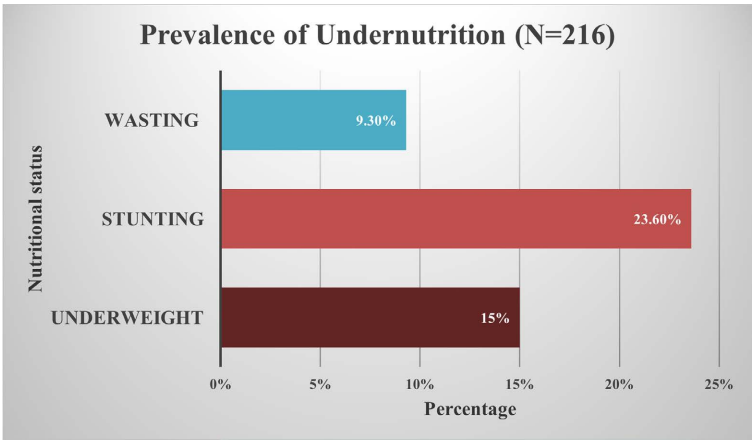
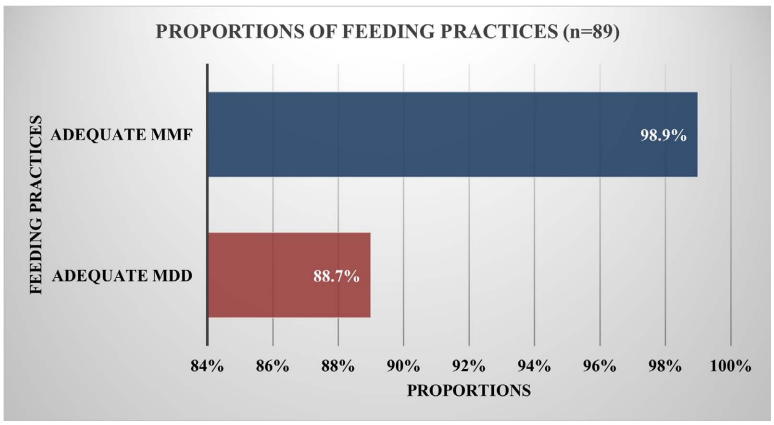


Figure 2. Prevalence of undernutrition among children living in an orphanage in Arusha Region, Tanzania (N = 216).

3.3. Feeding Practices

Of the 89 orphans aged 6 - 23 months in our study, we found that 98.9% had achieved minimal meal frequency (MMF) and 88.7% had achieved adequate dietary diversity on the day prior to the survey (Figure 3).



MDD = Minimal dietary diversity, MMF = Minimal meal frequency.

Figure 3. Proportions of feeding practices to the children at different orphanage centers (N = 216).

3.4. Factors Associated to Undernutrition

3.4.1. Factors Associated with Underweight among Orphaned Children Aged 6 - 59 Months

The findings revealed several important factors related to underweight among the

studied children. Prior adjustment for potential confounders, child being on medication during the survey, number of children in the Centre, number of caregivers present in the Centre, age of caregivers, Education of the caregiver, caregivers' marital status, ownership status of the orphanage and type of orphan were related to underweight of the children in the orphanages.

After adjusting for potential confounders, it was found that children older than 24 months had 10% lower odds of being underweight compared to younger children (AOR: 0.9; 95% CI: 1.50, 42.99). Furthermore, children on medications had significantly higher 7.9 times odds of being underweight compared to those who weren't under medication (AOR: 7.9; 95% CI: 1.95, 31.78).

The number of caregivers in the centers played a crucial role, as centers with more than 10 caregivers had 50% lower odds of having underweight children as compared with less than ten caregivers (AOR: 0.5; 95% CI: 0.09, 0.82). Additionally, single caregivers had higher odds of having underweight children compared to married caregivers (AOR: 1.9; 95% CI: 1.32, 10.86).

The education level of the caregiver was also associated with underweight. Specifically, secondary education was linked to higher odds of being underweight, whereas university education did not show a significant association (AOR: 0.5; 95% CI: 0.04, 0.98). Moreover, children who were orphaned in the Religious Centre had lesser odds of underweight compared to children from private and NGOs Centre (AOR: 0.2; 95% CI: 0.04, 0.94) (**Table 2**).

Table 2. Factors associated with underweight among orphaned children aged 6 - 59 months (N = 216).

Factors	N	Underweight (%)	OR (95% CI)	*p*-value	AOR (95%CI)	*p*-value
Age of Child in Months						
≤ 24	92	16 (17)	1		1	
>24	124	17 (13.9)	0.8 (0.38, 1.66)	0.532	0.9 (1.50, 42.99)	0.043
Gender of Child						
Male	111	18 (16.2)	1		1	
Female	105	15 (14.3)	0.9 (0.41, 1.81)	0.694	0.7 (0.30,1.77)	0.480
History of Fever 2 Weeks before the Survey						
No	177	24 (13.6)	1			
Yes	39	9 (23.1)	1.9 (0.81, 4.52)	0.140		
History of Cough Fever 2 Weeks before the Survey						
No	50	11 (22)	1			
Yes	166	22 (13.3)	1.8 (0.82, 4.13)	0.136		
Child on Medication						
No	187	22 (11.8)	1		1	
Yes	29	11 (37.9)	4.6 (1.92, 10.96)	0.001	7.9 (1.95, 31.78)	0.004
Number of Children in Centre						
≤30	52	2 (3.9)	1		1	
>30	164	31 (18.9)	5.8 (1.34, 25.25)	0.018	4.6 (0.32, 66.62)	0.265
Number of Caregivers						
≤10	95	20 (21.1)	1		1	
>10	121	13 (10.7)	0.5 (0.21, 0.96)	0.040	0.5 (0.09, 0.82)	0.038

Continued

Time Spent in the Centre (Months)						
<12	58	14 (24.1)	1			
12 - 23	76	9 (11.8)	0.4 (0.17, 1.06)	0.066		
24 - 36	35	4 (11.4)	0.4 (0.12, 1.35)	0.141		
>36	47	6 (12.8)	0.5 (0.16, 1.31)	0.146		
Insurance Status						
No	114	16 (14)	1			
Yes	102	17 (16.7)	0.8 (0.39, 1.71)	0.592		
Biological Parent						
Yes	132	26 (19.7)	1		1	
No	84	7 (8.3)	1.6 (1.06, 2.56)	0.028	1.3 (0.76, 2.32)	0.316
Gender of Caregivers						
Female	193	32 (16.6)	1		1	
Male	23	1 (4.4)	0.2 (0.03, 1.76)	0.156	0.5 (0.92, 26.21)	0.567
Age of Caregiver (Years)						
≤20	37	12 (32.4)	1		1	
21 - 30	31	2 (6.5)	0.1 (0.03, 0.70)	0.017	0.3 (0.01, 1.99)	0.141
31 - 40	55	13 (23.6)	0.6 (0.25, 1.63)	0.354	0.8 (0.12, 5.68)	0.832
>40	93	6 (6.5)	0.1 (0.05, 0.42)	<0.001	0.2 (0.03, 1.63)	0.135
Education Level of Caregiver						
Primary	64	6 (9.4)	1		1	
Secondary	93	22 (23.7)	3.0 (1.14, 7.88)	0.026	1.2 (0.14, 9.62)	0.899
University	59	5 (8.5)	0.9 (0.26, 3.10)	0.861	0.5 (0.04, 0.98)	0.045
Caregiver Marital Status						
Married	98	7 (7.1)	1		1	
Single	118	26 (22)	3.7 (1.5, 8.89)	0.004	1.9 (1.32, 10.86)	0.043
Ownership Status						
NGO	142	26 (18.3)	1		1	
Private	46	5 (10.9)	0.5 (0.20, 1.51)	0.243	0.6 (0.09, 4.61)	0.666
Religious	28	2 (7.1)	0.3 (0.08, 1.54)	0.162	0.2 (0.04, 0.94)	0.041

3.4.2. Factors Associated with Stunning among Orphaned Children Aged 6 - 59 Months

There were several notable findings regarding factors associated with stunting among the studied children. Prior adjustment of potential confounders, gender of the child, number of caregivers in the Centre, age, marital status of the caregivers and ownership status of the orphanage were associated with stunting of the children in the orphanage. After adjustment of potential confounders only two factors had a significant association. Female children had significantly 60% lower odds of being stunted compared to male children (AOR: 0.4; 95% CI: 0.21, 0.88). Additionally, orphanages with more than 10 caregivers had significantly lower odds of having stunted children as compared to orphanage Centre with less than 10 caregivers (AOR: 0.4; 95% CI: 0.13, 0.97) (Table 3).

Table 3. Factors associated with stunting among orphaned children aged 6 - 59 months (N = 216).

Factors	N	Wasting (%)	OR (95% CI)	*p*-value	AOR (95% CI)	*p*-value
Age of Child (Months)						
≤ 24	92	23 (24.5)	1		1	
>24	124	28 (23)	0.9 (0.49, 1.73)	0.795	1.1 (0.46, 2.61)	0.825
Gender						
Male	111	33 (29.7)	1		1	
Female	105	18 (17.1)	0.5 (0.26, 0.94)	0.031	0.4 (0.21, 0.88)	0.020
History of Fever 2 Weeks before the Survey						
No	177	43 (24.3)	1			
Yes	39	8 (20.5)	0.8 (0.34, 1.88)	0.615		
History Cough 2 Weeks before the Survey						
No	166	39 (23.5)	1			
Yes	50	12 (24)	1.1 (0.49, 2.16)	0.941		
Child on Medication						
No	187	42 (22.5)	1		1	
Yes	19	9 (31)	1.6 (0.66, 3.67)	0.314	1.6 (0.58, 4.34)	0.362
Number of Children in Centre						
≤30	52	8 (15.4)	1		1	
>30	164	43 (26.2)	2.0 (0.85, 4.48)	0.113	1.3 (0.33, 5.12)	0.705
Number of Caregivers in the Centre						
≤10	95	30 (31.6)	1		1	
>10	121	21 (17.4)	0.5 (0.24, 0.86)	0.016	0.4 (0.13, 0.97)	0.045
Time Spent in the Center (Months)						
<12	58	17 (29.3)	1			
12-23	76	20 (26.3)	0.9 (0.40, 1.85)	0.701		
24-36	35	6 (17.1)	0.5 (0.18, 1.42)	0.192		
>36	47	8 (17)	0.4 (0.19, 1.28)	0.146		
Insurance Status						
No	114	25 (21.9)	1			
Yes	102	26 (25.5)	0.8 (0.44, 1.54)	0.539		
Biological Parent						
Yes	132	34 (25.8)	1			
No	84	17 (20.2)	1.2 (0.84, 1.63)	0.353		
Gender of Caregivers						
Female	193	48 (24.9)	1		1	
Male	23	3 (13)	0.5 (0.13, 1.59)	0.217	0.9 (0.31, 14.81)	0.440
Age of Caregiver (Years)						
≤20	37	18 (48.7)	1		1	
21-30	31	4 (12.9)	0.2 (0.05, 0.54)	0.003	0.2 (0.04, 1.13)	0.069
31-40	55	10 (18.2)	0.4 (0.09, 0.60)	0.003	0.4 (0.09, 1.67)	0.208
>40	93	19 (20.4)	0.3 (0.12, 0.61)	0.002	0.4 (0.10, 1.71)	0.226
Education Level of Caregiver						
Primary	64	15 (23.4)	1		1	
Secondary	93	27 (29)	1.3 (0.64, 2.78)	0.437	1.2 (0.14, 1.75)	0271
University	59	9 (15.3)	0.6 (0.24, 1.47)	0.256	0.5 (0.11, 2.16)	0.348
Caregiver Marital Status						
Married	118	35 (29.7)	1		1	

Continued

Single	98	16 (16.3)	2.2 (1.11, 4.20)	0.023	1.4 (0.52, 3.85)	0.498
Ownership Status						
NGO	142	41 (28.9)	1		1	
Private	46	6 (13)	0.4 (0.15, 0.94)	0.036	0.4 (0.12, 1.23)	0.107
Religious	28	4 (14.3)	0.4 (0.13, 1.26)	0.119	0.7 (0.15, 3.04)	0.616

3.4.3. Factors Associated with Wasting among Orphaned Children Aged 6 - 59 Months

The results revealed several findings regarding factors associated with wasting among the studied children prior to adjustment of potential confounders. History of fever 2 weeks prior the survey, number of children present in the orphanage, time spent by the child since arrival to the orphanage, number of caregivers and marital status of the care giver had and influence on the wasting of the children. After adjustment of potential confounders, Children with a history of fever 2 weeks prior to the survey had significantly higher odds of experiencing wasting (AOR: 2.9; 95% CI: 1.09, 9.24). Additionally, orphanages with more than 30 children had significantly 80% higher odds of having wasting children as compared to children Centre with less than 30 children (AOR: 1.8; 95% CI: 1.08, 6.86), while orphanages with more than 10 caregivers had significantly 20% lower odds of having wasting children as compared to orphanage Centre with less than 10 caregivers (AOR: 0.8; 95% CI: 1.08, 3.23) (Table 4).

Table 4. Factors associated with wasting among orphaned children aged 6 - 59 months (N = 216).

Factors	N	Wasting (%)	OR (95%CI)	*p*-value	AOR (95%CI)	*p*-value
Age of Child (Months)						
≤ 24	92	9 (9.6)	1		1	
>24	124	11 (9)	0.9 (0.37, 2.36)	0.888	0.5 (0.16, 1.75)	0.297
Gender						
Male	111	12 (10.8)	1		1	
Female	105	8 (7.6)	0.7 (0.27, 1.74)	0.421	0.5 (0.18, 1.38)	0.178
History of Fever 2 Weeks before Survey						
No	177	13 (7.3)	1		1	
Yes	39	7 (18)	2.8 (1.02, 7.46)	0.045	2.9 (1.09, 9.24)	0.042
History of Cough 2 Weeks before Survey						
No	166	12 (7.2)	1			
Yes	50	8 (16)	2.4 (0.94, 6.37)	0.067		
Child on Medication						
No	187	18 (9.6)	1			
Yes	19	2 (6.9)	0.7 (0.15, 3.17)	0.639		
Number of Children in the Centre						
≤30	52	5 (9.6)	1		1	
>30	164	15 (9.2)	1.9 (0.33, 0.94)	0.041	1.8 (1.08, 6.86)	0.039
Number of Caregivers						
≤10	95	13 (13.7)				
>10	121	7 (5.8)	0.4 (0.15, 0.97)	0.045	0.8 (1.08, 3.23)	0.041

Continued

Time Spent in the Center (Months)						
<12	58	9 (15.5)	1			
12 - 23	76	2 (2.6)	0.1 (0.03, 0.71)	0.017		
24 - 36	35	3 (8.6)	0.5 (0.12, 2.03)	0.335		
>36	47	6 (12.8)	0.7 (0.24, 2.28)	0.595		
Insurance Status						
No	114	7 (6.1)	1			
Yes	102	13 (12.8)	0.4 (0.17, 1.17)	0.101		
Biological Parent						
Yes	132	12 (9.1)	1			
No	84	8 (9.5)	1.1 (0.37, 2.43)	0.915		
Gender of Caregivers						
Female	193	19 (9.8)	1			
Male	23	1 (4.4)	0.4 (0.05, 3.26)	0.404		
Age of Caregiver						
≤20	37	7 (18.9)	1		1	
21 - 30	31	2 (6.5)	0.3 (0.06, 1.54)	0.148	0.2 (0.02, 1.62)	
31 - 40	55	6 (10.9)	0.5 (0.16, 1.71)	0.285	0.4 (0.06, 2.56)	
>40	93	5 (5.4)	0.2 (0.07, 0.82)	0.023	0.1 (0.09, 1.18)	
Education Level of Caregiver						
Primary	64	4 (6.3)	1		1	
Secondary	93	12 (12.9)	2.2 (0.68, 7.23)	0.185	1.2 (0.02, 1.62)	0.124
University	59	4 (6.8)	0.9 (0.26, 4.57)	0.905	0.4 (0.06, 2.56)	0.332
Caregiver Marital Status						
Married	98	8 (8.2)	1		1	
Single	118	12 (10.2)	1.3 (1.50, 3.25)	0.032	1.6 (0.13, 2.51)	0.453
Ownership Status						
NGO	142	12 (8.5)	1		1	
Private	46	6 (13)	1.6 (0.57, 4.61)	0.361	2.5 (0.44, 13.93)	0.306
Religious	28	2 (7.1)	0.8 (0.18, 3.95)	0.818	0.9 (0.27, 23.24)	0.420

4. Discussion

This study aimed to assess the nutritional status, feeding practices, and factors contributing to undernutrition among children in orphanages. The findings of this study revealed a concerning prevalence of stunting, underweight, and wasting, with prevalence of 23.6%, 15.3%, and 9.3%, respectively. Furthermore, the study examined feeding practices and found that 99% of the children achieved the recommended (MMF), while 89% achieved adequate (MDD).

Several factors were identified as contributors to the nutritional status of orphaned children in the studied orphanages. The age of the child, gender, number of children in the orphanage, health factors such as a history of fever two weeks prior to the survey and being on medication, caregivers' marital status and education level, the number of caregivers in the orphanage, and the ownership status of the orphanage were all found to be significant factors.

In this study, the prevalence of stunting among orphaned children was consistent with findings from similar studies conducted in Eastern Africa, such as Sudan (20.3%) and Kenya (24.8%) [24] [25]. However, the prevalence observed in

this study appeared to be higher compared to a study conducted in Nigeria, which reported a prevalence of 13.3% [26], and a study in Ethiopia, which reported a prevalence of 12.2% [27]. Nevertheless, when comparing the prevalence from this study to other studies conducted in Africa, it was consistently lower. Several studies conducted in Ethiopia reported significantly higher prevalence ranging from 34.8% to 50.2% [28]-[30]. Additionally, the prevalence observed in this study was lower than the regional level prevalence of 30.7% reported in a general cohort of under-five children [19].

The prevalence of stunting among orphaned children in the selected orphanage centers in the Arusha region indicates the need for targeted interventions to address growth impairment in this vulnerable population. These interventions should focus on improving the nutritional quality of their diets, promoting appropriate feeding practices, and ensuring access to essential nutrients. The variations in stunting prevalence compared to other studies highlight the importance of understanding and addressing contextual factors that contribute to differences in nutritional status.

The prevalence of underweight among orphaned children in the current study was found to be consistent with the findings of a study conducted in Ethiopia, which reported a prevalence of 12.3% [28] However, when compared to other studies, the prevalence appeared to be inconsistently lower than the 21% reported in India [31]. Furthermore, it was slightly lower than the prevalence of 25.5% reported in Ethiopia [29]. Conversely, it was higher than the prevalence of 11.7% reported in Nigeria [26]. Other sub-Saharan countries, such as Sudan and Kenya, reported lower prevalence rates at 8.1% [25] and 10.1% [24]. In Tanzania, despite limited data on orphaned and vulnerable children (OVC), the prevalence of underweight among under-five children in the Arusha region was reported at 20.1% [19].

Similarly, the prevalence of underweight among orphaned children calls for interventions that address the specific challenges faced by this population, such as improving caregiver support and access to nutritious food. Contextual factors should be taken into account to tailor interventions effectively.

The prevalence of wasting among orphaned children in the current study was found to be consistent with the findings of a study conducted in India, which reported a prevalence of 9.8% [31], as well as with a study in Kenya with a prevalence of 10.1% [24]. However, in Egypt, the prevalence was inconsistently higher than the reported 2.8% prevalence [32] and it was higher compared to a study in West Africa that had a prevalence of 5.6% [26]. Conversely, most studies conducted in Ethiopia reported higher prevalence rates ranging from 11.1% to 37.8% [27] [29] Nevertheless, within the same country, other studies reported lower prevalence rates of 4.7% [33] and 4.4% [28] compared to the current study. A higher Prevalence of 18.7% was reported in Sudan [25]. In Tanzania, a national study on under-five children reported a higher prevalence of 20.1%, which was greater than the prevalence observed in the current study [19].

The consistent prevalence of wasting among orphaned children compared to

certain studies suggests the need for interventions that target wasting prevention and management. Additionally, understanding the factors contributing to higher prevalence rates in specific regions can inform targeted strategies.

The observed consistencies and inconsistencies in the prevalence of, stunting, underweight and wasting in this study may be attributed to several factors, including differences in sample characteristics, geographical variations, and variations in the availability and effectiveness of interventions targeting malnutrition, as they relate to this current study.

The proportions of feeding practices observed in this study showed high rates of adequacy, with 99% of orphaned children meeting the MMF recommendation and 89% achieving MDD. These findings are consistent with a study conducted in Ghana, where the proportion of children meeting MDD was reported at 97.4% and MMF at 90% [34]. However, in Nigeria, the proportions were slightly lower, with MMF reported at 62.5% and MDD at 80% [35]. Overall, the findings suggest that efforts to promote adequate feeding practices in orphanage centers can contribute to improving the nutritional status of orphaned children. It is important for policymakers, caregivers, and stakeholders to prioritize and invest in nutrition programs and support systems to ensure the well-being of these vulnerable children.

However, it is important to note that these findings are specific to some orphaned children in the selected orphanages of the Arusha region, Tanzania. The generalizability of these proportions to other populations or regions should be done cautiously due to differences in sample characteristics, geographical variations, and variations in the availability and effectiveness of interventions targeting malnutrition.

This study identified several factors contributing to undernutrition among orphaned children. The findings of this study revealed that orphaned children who had a history of fever 2 weeks prior to the survey had significantly higher odds of experiencing wasting. This result is in line with a study conducted in Ethiopia, which also reported a similar association between fever and wasting [27] [28]. Fever is often an indicator of an underlying infection or illness, which can lead to decreased appetite, nutrient malabsorption, and increased metabolic demands. These physiological responses can contribute to inadequate nutrient intake and utilization, ultimately resulting in wasting among children. The association between fever and wasting highlights the need for effective management of febrile illnesses in these settings. Early identification, prompt treatment, and appropriate nutrition support are essential to prevent or minimize the negative impact of fever on nutritional status. This emphasizes the importance of comprehensive healthcare services that integrate both medical and nutritional interventions.

Children who were under the care of unmarried caregivers were found to have a higher risk of experiencing underweight. While limited comparative data are available to make direct comparisons, this finding suggests that unmarried caregivers may encounter additional challenges in providing adequate care and support

for the child, which can contribute to a higher risk of undernutrition. Further research is needed to explore this association in more detail and investigate potential underlying mechanisms. Providing educational programs, counseling, and resources to unmarried caregivers can help them overcome the challenges they face and improve their ability to provide adequate care and support for the children under their care.

Interestingly, our study also found that having more than 10 caregivers in the center was consistently protective against undernutrition. This suggests that a higher caregiver-to-child ratio in the orphanage setting may have a positive impact on the nutritional status of the children. Having a larger number of caregivers could potentially lead to better supervision, individualized care, and increased attention to the nutritional needs of the children.

5. Conclusions

The prevalence of undernutrition among orphaned children is at a higher level of public health significance according to WHO cutoff points emphasizing the need for targeted interventions.

Despite adequate meal frequency and a diversified diet, recent illness, unmarried caregivers, and a low caregiver-to-child ratio are strongly associated with undernutrition among orphaned children in this population.

6. Limitations of the Study

The study did not meet the desired sample size of 360 and ended up with 216 in this study period.

The study was conducted in government-licensed and registered orphanages that adhere to established standards, which may limit its representativeness of the broader population of orphans, particularly those in unregistered or informal care settings.

Abbreviations

AIDS-Acquired Immune Deficiency Syndrome, CDC-Center for Disease Control and Prevention, HAZ-Height for Age Z score, HICs-High Income Countries, IBC-Institutionalized Based Care, JME-Joint Malnutrition Estimate, LMICs-Lower-Middle Income Countries, MDD-Minimal diatery diversity, MMF-Minimal meal frequency, NGOs-Non-Governmental Organizations, OVC-Orphans and Vulnerable Children, SAM-Severe Acute Malnutrition, SDG-Sustainable Development Goals, TNNS-Tanzania National Nutrition Survey, UNICEF-United Nations Children's Fund, WAZ-Weight for Age Z score, WHO-World Health Organization, WHZ-Weight for height Z score.

Author Contribution

PEM contributed to the conception, study design, data acquisition and interpretation, and drafting of the manuscript. AMS supervised and reviewed the entire

research process. Additionally, ADL, MM, EL, NP, AI, LF, MS, IM, ZH provided valuable feedback and data collection on the research work and BM was involved in the analysis. All authors thoroughly reviewed and approved the final manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Part 1. Questions on Socio demographic characteristics.

Number	Question	Response
Q. 101	What is the gender of the child	Male Female
Q. 102	What is the birth date of the child	
Q. 103	Are the biological parents of the child alive?	Yes No Unknown/Not applicable
Q. 104	Has the child been transferred from another orphanage?	Yes No Unknown/Not applicable
Q. 105	What is the duration of the child's stay in the orphanage? years/months/days? *To be asked in terms of date of arrival in the orphanage*	
Q. 106	What was the reason for placing the child in an orphanage?	Parental death Parental abandonment Poverty Neglect or abuse Disability or illness of the child Other
Q. 107	What is the birth date of the caregiver?	
Q. 108	What is the gender of the caregiver?	Male Female
Q. 109	What is the education level of the caregiver?	No formal education Primary education Secondary education University education Other, please specify
Q. 110	What is the marital status of the caregiver?	Married Single Widowed Divorced Separated
Q. 111	Has the caregiver received any training on providing care to orphans?	Yes No

Part 2. Question to assess the feeding practices and household food security.

	Question	
Q.201	Do you have a feeding timetable or schedule?	Yes No
Q.202	Please provide details about the feeding timetable or schedule for the child	

Continued

Q.202	Over the past 24 hours, what types of grains, roots, or tubers did the child eat?		Rice Maize Wheat Cassava Sweet Potatoes Irish Potatoes Others please specify
Q.203	Over the past 24 hours, what types of legumes or nuts did the child eat?		Beans Peas Groundnuts Cashew nuts Peanuts Others please specify
Q.204	Over the past 24 hours, what types of dairy products did the child eat?		Milk Yogurt Cheese Butter Other (please specify)
Q.205	Over the past 24 hours, what types of flesh foods did the child eat?		1. Beef 2. Chicken 3. Fish 4. Pork 5. Others specify
Q.206	Over the past 24 hours, did the child eat any eggs?		Yes No
Q.207	Over the past 24 hours, what types of Vitamin A-rich fruits and vegetables did the child eat?		Carrots Spinach Mangoes Papayas Oranges Red palm oil Other (please specify)
Q.208	Over the past 24 hours, what other fruits and vegetables did the child eat?		Bananas Pineapples Tomatoes Cucumbers Cabbage Other (please specify)
Q.209	In the past four weeks, did you worry that your household would not have enough food?	1. Yes 2. No	How often did this happen a. Rarely (1 - 2 times/4weeks) b. Sometimes c. Often (>10times/4weeks)
Q.210	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	1.Yes 2. No	How often did this happen a. Rarely (1 - 2 times/4weeks) (mara 1 - 2/wiki 4) b. Sometimes (3 - 10 times/4weeks) (mara 3 - 10/wiki 4)

Continued

			c.	Often (>10times/4weeks) (Zaidi ya mara kumi/wiki 4)
Q.211	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	1.Yes (Ndio) 2. No (Hapana)		How often did this happen
			a.	Rarely (1 - 2 times/4weeks) (mara 1 - 2/wiki 4)
			b.	Sometimes (3 - 10 times/4weeks) (mara 3 - 10/wiki 4)
			c.	Often (>10times/4weeks)
Q.212	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	1.Yes 2. No		How often did this happen
			a.	Rarely (1 - 2 times/4weeks)
			b.	Sometimes (3 - 10 times/4weeks) (mara 3 - 10/wiki 4)
			c.	Often (>10times/4weeks)
Q.213	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	1.Yes 2. No		How often did this happen
			a.	Rarely (1 - 2 times/4weeks)
			b.	Sometimes (3 - 10 times/4weeks)
			c.	Often (>10times/4weeks)
Q.214	In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?	1.Yes 2. No		How often did this happen
			a.	Rarely (1 - 2 times/4weeks)
			b.	Sometimes (3 - 10 times/4weeks) (mara 3 - 10/wiki 4)
			c.	Often (>10times/4weeks)
Q.215	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	1.Yes 2. No		How often did this happen
			a.	Rarely (1 - 2 times/4weeks)
			b.	Sometimes (3 - 10 times/4weeks)
			c.	Often
Q.216	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	1.Yes 2. No		How often did this happen
			a.	Rarely (1 - 2 times/4weeks) (mara 1 - 2/wiki 4)
			b.	Sometimes (3 - 10 times/4weeks)
			c.	Often (>10times/4weeks)
Q.217	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	1.Yes 2. No		How often did this happen
			a.	Rarely (1-2 times/4weeks)
			b.	Sometimes (3-10 times/4weeks)
			c.	Often (>10times/4weeks)

Part 3. Health characteristics of the child.

No.	Question	Responses
Q.301	What was the gestation age of the child at birth?	Less than 37 weeks 37 - 41 weeks More than 41 weeks Don't know
Q.302	What was the birth weight of the child?	
Q.303	What is the health insurance status of the child?	Insured through government program Insured through private health insurance Not insured Other (please specify)
Q.303	Has the child received all recommended vaccines for their age? If no, please specify which	Yes No (specify) Don't know
Q.303	Has the child ever been diagnosed with any chronic illnesses? If yes, please specify	1. Yes Specific disease 2. No
Q.304	Has the child ever been hospitalized? If yes, please specify reason and length of stay	1. Yes Specification Times 2. No Reason of stay Length of stay
Q.305	Does the child have any known allergies? If yes, please specify	1. Yes Specify 2. No
Q.306	Has the child ever undergone any surgeries? If yes, please specify	1. Yes Specify 2. No
Q.307	Does the child take any medications or supplements regularly? If yes, please specify	1. Yes Specify 2. No
Q.308	Did the child have a history of coughing in the 2 weeks before the survey while living in the orphanage?	1. Yes 2. No
Q.309	Did the child have a history of diarrhea in the 2 weeks before the survey while living in the orphanage	1. Yes 2. No
Q.310	Did the child have a history of fever in the 2 weeks before the survey while living in the orphanage?	1. Yes 2. No

Part 4. Water, sanitation and hygiene characteristics in the orphanage.

No.	Question	
Q.401	What is the primary source of water in the orphanage?	
Q.402	Where and how is the water stored?	
Q.403	What measures are taken to ensure that the water is safe for consumption?	
Q.404	Do you wash your hands before feeding the children?	Yes No

Continued

Q.405	Do you wash your hands after using the toilet?	Yes No
Q.406	What type of latrines are available in the orphanage?	Flash Toilets Composing Toilets) Pit latrines No Latrines available Others specify
Q.407	How are wastes disposed of in the orphanage?	Collected and disposed offside Burned onsite Buried on site Composted on site Others specify

Part 5. Anthropometric measurements.

NO.	Childs measurements	1st Measurement	2nd Measurement	Average measurement
Q. 501	Height/length of child in cm			
Q. 502	Weight of child in kg			

CRERC 07

KILIMANJARO CHRISTIAN MEDICAL UNIVERSITY COLLEGE

(A Constituent College of Tumaini University Makumira)

P. O. Box 2240, MOSHI, Tanzania.

RESEARCH ETHICAL CLEARANCE CERTIFICATE

No. PG 41 / 2022

Research Proposal No. 41

Study Title: Nutritional status, feeding practices and factors contributing to malnutrition among children aged 6 - 59 months in Arusha region orphanages, Tanzania

Study Area: Kilimanjaro

PIs Name : Philip Eliewaha Mrindoko

Institution (s) : Kilimanjaro Christian Medical University College

The Proposal was approved by CRERC on : 4th October, 2022

Duration of Study : One year

From : 4th October, 2022 to 3rd October, 2023

PROF. MRAMBA NYINDO
Chair – CRERC

Ephata E. Kaaya MD, PhD
PROFESSOR
PROF. EPHATA KAAYA
PROVOST - KCMU College