The Nutritional Status of HIV- Infected Children at Two Teaching Hospitals in Accra, Ghana

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ABSTRACT

Introduction: Human Immune Virus (HIV) infection and malnutrition are a major public health concern that affect children's health and well-being. They can lead to stunted growth, wasting, and micronutrient deficiencies that weaken immunity and increase infection risks. Malnutrition is a key driver of poor prognosis and mortality in affected children. Managing nutritional complications is especially challenging in resource-limited settings like Ghana. With around 21,000 children living with HIV/AIDS in Ghana as of 2020, urgent interventions are needed to address these conditions and improve the quality of life.

Aim: This study sought to determine the nutritional status of children, between 5-17 years, living with HIV/AIDS infection at the 37 Military hospital and Korle Bu Teaching hospital.

Methods: A quantitative, cross-sectional study was conducted in two teaching hospitals in Accra, with a sample of 153 children who access HIV/AIDS services in these health facilities. A questionnaire was used to collect data from caregivers using a convenience sampling method. Data analysis was performed using Stata-18. Descriptive summaries were used to characterize study participants to determine the overall nutritional status of children. Chi square test of association was performed to ascertained the association between dependent and independent variables. Kruskal Wallis analyses were performed determine the median difference between independent variables and nutrition. Ordinal logistic regression was used to analyze the relationship between nutritional status and predictors. Statistical significance was set at 0.05.

Results: The study found that majority, 85(56%) of the children had a good nutritional status (normal nutritional status), followed by those with poor nutritional status (severe malnutrition), 42(27%). The rest had fair nutritional status (moderate malnutrition) with 26(17%). About 53(34.6%) of the children were stunted, 43(28.1%) suffered from wasting and 13(8.5%) were underweight. The viral load showed a significant difference among the different nutritional status (p=0.04). There was a significant difference in BMI for age and overall nutritional status(p=0.01). The level of education of caregivers was a predictor of nutritional status (p<0.05).

Conclusion: This study found that most children had good nutritional status, with moderate levels of stunting and wasting but lower rates of overweight and obesity. BMI, age, and viral load were significantly associated with nutritional status. Education level of caregivers was a predictor of better nutritional status. Addressing

malnutrition requires integrating nutritional screening into routine services and implementing targeted interventions.

Keywords: Children, nutritional status, nutritional screening, micronutrients deficiencies, infection

INTRODUCTION

Malnutrition is a critical public health issue, particularly in Africa, where it disproportionately affects children.[1] According to UNICEF, Sub-Saharan Africa bears the heaviest burden, with 1 in 3 children under five experiencing stunted growth and nearly 8% suffering from acute malnutrition. Malnutrition can manifest in three primary forms: undernutrition, overnutrition, and micronutrient deficiencies.[2] Undernutrition includes stunting, wasting, and underweight conditions, while overnutrition results from excessive intake of energy-dense foods, leading to obesity and related non-communicable diseases.[3] Micronutrient deficiencies, also known as hidden hunger, arise from insufficient intake of essential vitamins and minerals.[4] These conditions often coexist in populations affected by socio-economic, environmental, and medical challenges.

The causes of malnutrition are multifaceted, including poverty, food insecurity, inadequate dietary diversity, and chronic infections like HIV/AIDS and tuberculosis.[5,6] Gastrointestinal disorders, metabolic diseases, and inflammatory conditions can further impair nutrient absorption and utilization.[7,8] Addressing malnutrition necessitates a comprehensive approach, integrating clinical evaluation and targeted interventions.[9] Nutritional status of individuals can be assessed using the ABCD method: Anthropometric measurements, Biochemical markers, Clinical assessment, and Dietary intake analysis.[1,10] Malnutrition can also be assessed using international growth standards, including height-for-age (stunting), weight-for-height (wasting), and weight-for-age.[16] Mid-upper arm circumference (MUAC) and body mass index (BMI) further aid in evaluating nutritional status.[12] Severe acute malnutrition (SAM) is defined by a weight-for-height z-score below -3 SD or MUAC <11.5 cm.[16] HIV/AIDS exacerbates malnutrition, creating a vicious cycle where malnutrition accelerates immune decline and HIV progression.[11] In 2020, an estimated 1.8 million children globally were living with HIV, with Sub-Saharan Africa having the highest burden.[12] In Ghana, approximately 21,000 children were living with HIV, with 3,317 new infections and 2,769 AIDS-related child deaths reported in 2019.[13] Diagnosing HIV in children involves antibody tests, antigen/antibody tests, and nucleic acid tests (Kimani-Murage et al., 2011).[14] Viral load monitoring is the gold standard for assessing antiretroviral treatment (ART) effectiveness.[15] HIV-positive children face unique nutritional challenges, including heightened inflammation and metabolic disturbances, contributing to both undernutrition and obesity.[17] Obesity in HIV-infected children is linked to increased inflammatory markers and comorbidities like diabetes and cardiovascular diseases.[18,19] The interaction between HIV and malnutrition affects immune function, as lower CD4 counts correlate with increased mortality risk and poor nutritional status.[20] Therefore, the current study sought to examine the nutritional status of HIV-Infected children at the 37 Military hospital and Korle-bu Teaching hospital.

METHODS

This study employed a cross-sectional quantitative design to assess the nutritional status of children living with HIV/AIDS who attended clinics at the 37 Military Hospital and Korle Bu Teaching Hospital in Accra, Ghana. The 37 Military Hospital is a 500-bed teaching hospital that primarily serves military personnel and their families, as well as civilians. It has a well-equipped pediatric department offering specialized services, including an HIV clinic tailored to the needs of children living with the disease. Korle Bu Teaching Hospital is the largest tertiary referral center in Ghana. It has 2,000 beds capacity with multiple subspecialty clinics, including the country's largest pediatric department. These facilities provide an appropriate setting for the study due to their extensive experience in managing pediatric HIV cases.

The study targeted children aged between 6 months to 17 years who were diagnosed with HIV/AIDS and attended pediatric HIV clinics at the two hospitals. Eligible participants included HIV-positive children without feeding disabilities, both newly diagnosed and those already on antiretroviral therapy (ART), whose caregivers provided informed consent. Children outside the specified age range, those with chronic comorbidities unrelated to HIV, those with feeding difficulties not linked to the disease, and those without confirmed HIV status were excluded.

A convenience sampling approach was employed to recruit participants. Data collection involved a structured questionnaire designed to capture demographic characteristics, dietary practices, viral load levels, and ART compliance. Anthropometric measurements, including height, weight, and body mass index (BMI), were recorded using standardized tools such as the WHO growth charts (2007). The prevalence of malnutrition was assessed through stunting, wasting, and underweight classifications based on WHO Z-score standards. Data were coded and analyzed using Stata version 18. Descriptive statistics were used to summarize participant characteristics. The Kruskal-Wallis's test was applied to examine the relationships between nutritional status and key factors such as age, sex, BMI, treatment history, viral load, and access to HIV/AIDS healthcare. The ordinal logistic regression was used to analyzed the nutritional status (normal or good nutritional status, moderately malnourished (fair nutritional status) and severely malnourished (poor nutritional status) with the above-stated independent variables. Statistical significance is set at 5%.

Pretesting of the data collection tool was conducted at Princess Marie Louise Hospital in Accra after obtaining ethical approval from the Community Health Dissertation Review Board of Family Health University, as well as the Institutional Review Boards of the participating hospitals.

RESULTS

Sociodemographic characteristics of caregivers of HIV-infected children compared with Children's overall nutritional status

The study included a total of 153 caregivers who sought health services at the HIV units of 37 Military Hospital and Korle Bu Teaching Hospital, with a fairly balanced sex distribution: males, 87 (56.9%). Regarding findings on relationship to a child, majority of caregivers were parents, 102 (66.7%), followed by guardians 4 (26.8%), and others (such as relatives or family friends) constituted 10 (6.5%). Guardians and others had similar distributions across the nutritional status categories, with no significant association (p=0.99). There was a significant association between the caregiver's education level and the child's nutritional status (p=0.01). The occupation of caregivers did not show a significant association with the nutritional status of the children (p= 0.37). However, public servants had a higher proportion of children with poor nutritional status (59.50%) Table 1.

Characteristics of HIV-Infected children compared with overall nutritional status

Table 1 shows a significant association between the child's ethnicity and their nutritional status (p= 0.00). Ewe children had a higher proportion of fair (50.00%), and poor (35.70%) nutritional status compared to other ethnic groups. The religion of the participants did not show a significant association with the nutritional status of the children (p= 0.74). The majority of children across all nutritional status categories were Christians.

Table 1. Socio-demographic characteristics of caregivers and their children compared with children's overall nutritional status

Variable	Good (N)	Fair (N)	Poor (N)	Total (N)	*p*-value.
Relationship to child					0.99
Parent	57 (67.10)	17 (65.40)	28 (66.70)	102 (66.70)	
Guardian	23 (27.10)	7 (26.90)	11 (26.20)	41 (26.80)	
Other	5 (5.90)	2 (7.70)	3 (7.10)	10 (6.50)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Education level of the caregivers					0.01*
No formal Education	7 (8.20)	1 (3.80)	8 (19.00)	16 (10.50)	
Basic education	35 (41.20)	12 (46.20)	11 (26.20)	58 (37.90)	
Secondary	25 (29.40)	2 (7.70)	15 (35.70)	42 (27.50)	
Tertiary	18 (21.20)	11 (42.30)	8 (19.00)	37 (24.20)	
Trader	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	

Occupation of caregiver					0.37
Public servant	37 (43.50)	8 (30.80)	25 (59.50)	70 (45.80)	
Artesian	22 (25.90)	9 (34.60)	6 (14.30)	37 (24.20)	
Student	13 (15.30)	6 (23.10)	6 (14.30)	25 (16.30)	
Retired	10 (11.80)	2 (7.70)	2 (4.80)	14 (9.20)	
Unemployed	2 (2.40)	0 (0.00)	1 (2.40)	3 (2.00)	
Other	1 (1.20)	1 (3.80)	2 (4.80)	4 (2.60)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Gender					0.788
Male	48 (56.50)	14 (53.80)	21 (50.00)	83 (54.20)	
Female	37 (43.50)	12 (46.20)	21 (50.00)	70 (45.80)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Ethnicity of child					0.003*
Ga	28 (32.90)	3 (11.50)	13 (31.00)	44 (28.80)	
Akan	35 (41.20)	8 (30.80)	7 (16.70)	50 (32.70)	
Ewe	11 (12.90)	13 (50.00)	15 (35.70)	39 (25.50)	
Guan	3 (3.50)	0 (0.00)	2 (4.80)	5 (3.30)	
Northern Tribe	8 (9.40)	2 (7.70)	5 (11.90)	15 (9.80)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Religion					0.74
Christianity	79 (92.90)	23 (88.50)	38 (90.50)	140 (91.50)	
Islam	6 (7.10)	3 (11.50)	4 (9.50)	13 (8.50)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Number of siblings					0.85
0	6 (7.10)	2 (7.70)	2 (4.80)	10 (6.50)	
1	27 (31.80)	6 (23.10)	14 (33.30)	47 (30.70)	
2-3	27 (43.50)	12(46.10)	14(33.30)	63(41.20)	
>4	13 (15.30)	6(23.10)	12 (28.60)	33 (21.60)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Birth position of child					0.35
1	38 (44.70)	10 (38.50)	20 (47.60)	68 (44.40)	
2-3	41 (48.20)	12 (46.10)	17 (40.50)	70 (45.80)	
≥4	6 (7.10)	4 (15.40)	5 (11.90)	15 (9.80)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Household size					0.76+
2-3	38 (44.70)	11 (42.30)	15 (35.70)	64 (41.80)	
4-5	42 (49.40)	15 (57.70)	26 (61.90)	83 (54.20)	
≥6	5 (5.90)	0 (0.00)	1 (2.40)	6 (3.90)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Income Level					0.82
1	31 (36.50)	9 (34.60)	23 (54.80)	63 (41.20)	
2-3	41 (48.20)	11 (42.30)	13 (31.00)	65 (42.50)	
≥4	13 (15.30)	6 (23.10)	6 (14.30)	25 (16.30)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	

Overall nutritional status of HIV-Infected Children

Overall, 85(56%) of the children recorded a good nutritional status (normal nutritional status), followed by those with poor nutritional status (severe malnutrition), 42(27%). The rest had fair nutritional status (moderate malnutrition) with 26(17%) Figure 1.

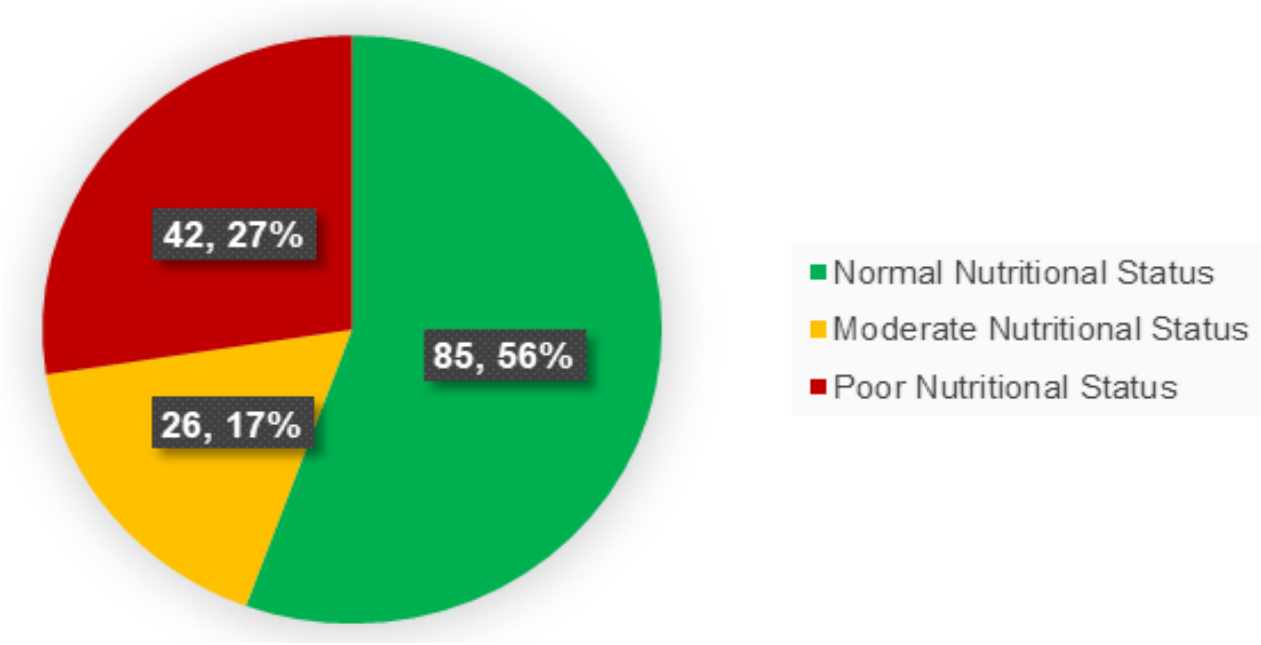

Figure 1. Overall nutritional Status of HIV-Infected children

Nutritional assessments of HIV-Infected Children across different ages groups using specific parameters.

The nutritional assessment across different age groups using various parameters revealed that majority of children had a normal BMI for age (65.2%), with smaller numbers classified as obese or overweight (9.6%). For weight-for-age Z-score, most children were within the normal range (77%). For height/length-for-age Z-score the majority of children had normal height/length (65.4%), with others being mildly stunted (9.2%), moderately stunted (15.0%), and severely stunted (10.5%). For the MUAC-for-age Z-score, most children had a normal MUAC (73.9%). With weight-for-height Z-score, the majority of children had a normal weight-for-height (74.4%), with others being mildly overweight (18.65) and overweight (7.0%) (Table 2).

Table 2. Nutritional assessment of HIV-Infected Children across different ages groups using different parameters.

Body Mass Index (BMI) for age	N (%)	Weight-for-age Z-score	N(%)	Height/length-for-age Z-score	N(%)
Normal	84(65.2)	mild overweight	3(3)	mildly stunted	14(9.2)
obesity	12(9.6)	mild underweight	5(5)	moderately stunted	23(15.0)
overweight	12(9.6)	moderate underweight	6(6)	Normal	100(65.4)
severe thinness	11(8.8)	Normal	77(77)	severely stunted	16(10.5)
mild thinness	6(4.8)	Overweight	4(4)		
		severe overweight	3(3)		
		severe underweight	2(2)		
MUAC-for-age Z-score	**N(%)**	**Height/length-for-age Z-score**	**N(%)**	**Weight-for-height Z-score**	**N(%)**
mild malnutrition	3(13.0)	mildly stunted	14(9.2)	mild overweight	8 (18.6)
mild overweight	1(4.3)	moderately stunted	23(15.0)	normal	32(74.4)
moderate malnutrition	2(8.7)	Normal	100(65.4)	overweight	3(7.0)
normal	17(73.9)	severely stunted	16(10.5)		

Children's nutritional indicators and its association with overall nutritional status

The nutritional assessment of children revealed several key findings across different parameters: There was no significant association between the child's appetite and their nutritional status (p= 0.15). Also, children with a

very good appetite mostly had good nutritional status (28.20%), while those with a fair appetite had the highest proportion of poor nutritional status (40.50%). There was a significant association between food consumption challenges, fruit/vegetable Frequency, dietary restrictions due to HIV, and nutritional status (p= 0.04). The majority of children with good nutritional status reported no food consumption challenges (97.60%), while those with low appetite had a higher proportion of fair (15.40%) and poor (4.80%) nutritional status. The use of nutritional supplements showed a significant association with nutritional status. There was a significant association between drug regime and nutritional status (Table 3).

Table 3. The relationship between nutritional indicators and nutritional status of IV-Infected children

Parameter	Good, N (%)	Fair, N (%)	Poor, N (%)	Total, N (%)	*p*-value
Child's appetite					0.15
Very poor	1 (1.20)	2 (7.70)	1 (2.40)	4 (2.60)	
Poor	6 (7.10)	5 (19.20)	1 (2.40)	12 (7.80)	
Fair	28 (32.90)	8 (30.80)	17 (40.50)	53 (34.60)	
Good	26 (30.60)	5 (19.20)	9 (21.40)	40 (26.10)	
Very good	24 (28.20)	6 (23.10)	14 (33.30)	44 (28.80)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Food consumption challenges					0.04
Not sure	0 (0.00)	1 (3.80)	1 (2.40)	2 (1.30)	
No	83 (97.60)	21 (80.80)	39 (92.90)	143 (93.50)	
Low appetite	2 (2.40)	4 (15.40)	2 (4.80)	8 (5.20)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Fruit/vegetable frequency					0.24
Daily	9 (10.60)	4 (15.40)	0 (0.00)	13 (8.50)	
Occasionally	47 (55.30)	12 (46.20)	22 (52.40)	81 (52.90)	
Often	20 (23.50)	6 (23.10)	15 (35.70)	41 (26.80)	
Rarely	9 (10.60)	4 (15.40)	5 (11.90)	18 (11.80)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Nutritional supplements					0.00*
None	6 (7.10)	4 (15.40)	12 (28.60)	22 (14.40)	
Zincovit	79 (92.90)	22 (84.60)	30 (71.40)	131 (85.60)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Dietary restrictions due to HIV					
None	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Current ART regimen					0.04*
ALD	62 (72.90)	16 (61.50)	20 (47.60)	98 (64.10)	
TLD	20 (23.50)	7 (26.90)	16 (38.10)	43 (28.10)	
ZLD	3 (3.50)	3 (11.50)	6 (14.30)	12 (7.80)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Frequency of medication intake					0.39
Daily	84 (98.80)	25 (96.20)	42 (100.00)	151 (98.70)	
Not Com	1 (1.20)	1 (3.80)	0 (0.00)	2 (1.30)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	
Knowledge about nutrition for HIV					0.12
Ver Knowledgeable	16 (18.80)	6 (23.10)	9 (21.40)	31 (20.30)	
Somewhat Knowledgeable	36 (42.40)	6 (23.10)	14 (33.30)	56 (36.60)	
Not very Knowledgeable	29 (34.10)	9 (34.60)	11 (26.20)	49 (32.00)	
Not at all Knowledgeable	4 (4.70)	5 (19.20)	8 (19.00)	17 (11.10)	
Total	85 (100.00)	26 (100.00)	42 (100.00)	153 (100.00)	

The relationship between nutritional status and selected parameters among HIV-infected children.

From the Kruskal Wallis test, there was a significant difference in age across the nutritional status groups. The mean age increased from 7.03 years in the good nutritional status group to 9.53 years in the poor nutritional status group (p<0.01). The viral load showed a significant difference among these groups. The good nutritional status group had a mean viral load of 136.08, while the poor nutritional status group had a much higher mean viral load of 7895.91 (p<0.04). The normal nutritional status group recorded a mean BMI of 17.11, while the poor nutritional status group registered a higher mean BMI of 20.97 (p<0.00). Although, not statistically significant, the poor nutritional status group had a higher mean height (124.63) compared to the normal nutritional status group (118.28) (p<0.31). There was no significant difference in household size among the groups, with the mean household size being similar across all groups (3.68 - 3.95) (p=0.17) (Figure 2: a-i).

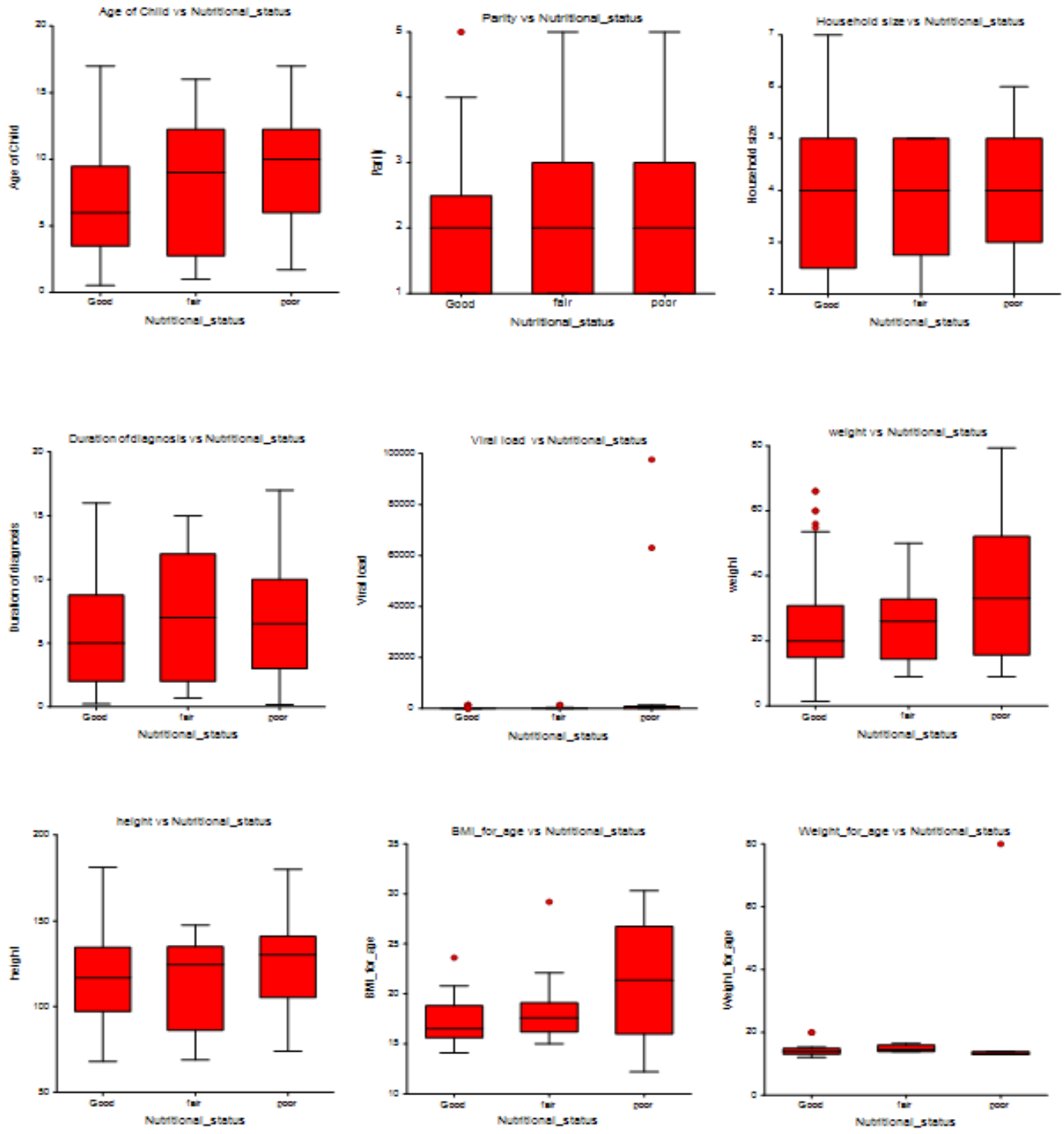

Figure 2 (a-i). Association between children's parameters and nutritional status using Kruskal Wallis

Predictors of overall nutritional status of HIV-Infected Children

Regarding predictors of overall nutritional status, the male sex recorded an aOR of 0.53 (95% CI: 0.18, 1.56; *p*=0.25). For children with guardians, the cOR observed was 0.98 (95% CI: 0.48, 1.98; *p*=0.96), and aOR was 1.92 (95% CI: 0.52, 7.09) with a *p*=0.33. For TLD and ZLD, the cOR was 2.11 (95% CI: 1.05, 4.30; *p*<0.04) and cOR of 4.25 (95% CI: 1.37, 13.02; *p*<0.01), respectively, but both aOR lost significance (*p*> 0.05). Zincovit supplementation recorded an aOR of 0.08 (95% CI: 0.02, 0.37; *p*<0.01) **(Table 4).**

Table 4. Predictors of overall nutritional status of HIV-Infected children

Variable	cOR	95% (C.I)	*P*-value	aOR	95% (C.I)	*p*-value
Sex						
Male	0.92	(0.49, 1.70)	0.78	0.53	(0.18, 1.56)	0.25
Female	1			1		
Caregiver						
Guardian	0.98	(0.48, 1.98)	0.96	1.92	(0.52, 7.09)	0.33
Other	1.22	(0.35, 4.14)	0.76	1.09	(0.16, 7.43)	0.93
Education						
Basic	**0.36**	**(0.12, 1.08)**	**0.07**	**0.07**	**(0.01, 0.56)**	**0.01**
Secondary	**0.49**	**(0.15, 1.55)**	**0.23**	**0.09**	**(0.01, 0.73)**	**0.02**
Tertiary	**0.52**	**(0.16, 1.60)**	**0.25**	**0.09**	**(0.01, 0.76)**	**0.03**
Parity						
1	1.26	(0.32, 4.26)	0.74	1.44	(0.14, 15.01)	0.76
2	1.12	(0.28, 4.31)	0.87	0.69	(0.06, 7.80)	0.76
3	1.00	(0.23, 4.31)	1.00	0.87	(0.07, 11.68)	0.92
4	2.69	(0.58, 12.84)	0.21	2.29	(0.13, 41.62)	0.58
5	1.48	(0.33, 6.62)	0.61	2.83	(0.20, 39.32)	0.44
Length of HIV	1.05	(0.97, 1.12)	0.20	1.16	(0.98, 1.36)	0.08
Knowledge about Nutrition for HIV						
Good	0.74	(0.39, 1.37)	0.34	1.00	(1.00, 1.00)	0.43
Recent Viral Load	1.00	(0.99, 1.00)	0.14	0.46	(0.16, 1.34)	0.16
Age group						
0-5 years		0.51	(0.26, 0.99)	0.05*	0.51	(0.14, 1.88)
ART used						
TLD	2.11	(1.05, 4.30)	0.04*	0.50	(0.09, 2.61)	
ZLD	4.25	(1.37, 13.02)	0.01	1.00	(0.10, 9.63)	0.31
Supplements						
Zincovit	0.25	(0.10, 0.59)	0.00	0.08	(0.02, 1.37)	0.11

Sig=Significance; CI- Confidence interval; HIV-Human immunodeficiency virus; **TLD-***Tenofovir Disoproxil Fumarate+ Lamivudine+ Dolutegravir; ZLD- Zidovudine + Lamivudine + Dolutegravir; cOR-Crude Odds Ratio; aOR-Adjusted Odds Ratio*

DISCUSSION

This study sought to examine the relationship between nutritional status of HIV-Infected children at the 37 Military hospital and Korle-bu Teaching hospital. According to findings, 85 (56%) of the children included had a good nutritional status (normal nutrition), followed by those with poor nutritional status (severely malnourished), 42 (27%), and the rest with fair nutritional status (moderately malnourished) with 26 (17%). This result is similar to the 21% prevalence in malnutrition among children found in the Atwima Kwawoma district in the Ashanti region of Ghana [1]. The current findings are however, lower than the 36.5% recorded among HIV- infected children who were severely malnourished and 26.9% with moderate malnourishment in Kenya [2]. Again, inconsistent with the present results, global data shows that there is a high prevalence of

malnutrition (68.7%) among HIV- infected children at the initiation of ART.[21] In addition, the current results is lesser than those obtained by Chiabi et al. with 66.7% in Cameroun, [22] and other studies in Burkina Faso and the Democratic Republic of Congo.[23] These inconsistencies can be explained by the varying malnutritional status among HIV-infected children in different countries with different sample sizes in different studies, and differences in the characteristics of study participants.[23-25] In addition, it has also been shown that as HIV infection deteriorates, malnutrition becomes a major problem especially for HIV-infected children(3). Another study said that there is a vicious circle between HIV infection and malnutrition. This vicious circle contributes to depressing the child's immune system. Immuno-depression combined with HIV infection and malnutrition is a determinant of poor prognosis for child's survival even on antiretroviral therapy (ART). HIV- infected children with malnutrition have a poorer prognosis compared with their uninfected counterparts even when ART is initiated.[26]

According to the present results, the mean age increased from 7.03 years among children with normal nutritional status (Good group) to 9.53 years, with a significant difference. The viral load of children showed a significant difference among all categories, as those with the normal nutritional status having a mean viral load of 136.08, while, those who were severely malnourished (Poor group) having a much higher mean viral load of 7895.91. Similarly, a significant association were observed between viral load and stunting in a previous study in Nigeria. This Nigerian study defined viral suppression as any viral load greater than 1000 cp/ml, similar to the criteria used for the current study. This definition is also in accordance with WHO recommendations in countries with limited resources, and similar to previous reports by Fokam et al.[27] These findings suggest that achieving the third pillar of the 90-90-90 is possible and could be reinforced with adequate nutrition in the frame of an effective ART(Global Causes of Maternal Death: A WHO Systematic Analysis | Enhanced Reader, 2009).[28] Further, our results could also be attributed to the fact that malnutrition is a significant contributor to childhood morbidity and can weaken the immune system, leading to an increase in viral load levels, both independently and in combination with other illnesses. According to a study in Ethiopia 2023, children and adolescents who had good nutritional status increased the viral load to an undetected state by 2.3 times as compared with children and adolescents with a poor nutritional status.[29] Our findings disagree with these results. The reason could be that the study was conducted in a different setting.[30]

Regarding BMI of children, a significant difference in BMI and nutritional categories was observed in this study. Children with normal nutritional status had a mean BMI of 17.11, while, the malnourished ones had a significantly higher mean BMI of 20.97. A different study noted a similar result where overweight was more prevalent among children especially those living in rural areas.[31] The BMI values were found to be significantly correlated with the biochemical markers of AIDS progression.[32] However, other studies reported a different result compared to the present one.[33-37] Malnutrition can further reduce the capacity of the body to fight infection by compromising various immune parameters according to previous studies. Therefore, knowledge of the essential components of nutrition and incorporating them in the management goes a long way in improving quality of life and better survival in HIV-infected patients.[26]

Caregivers with basic, secondary and tertiary education showed significant associations with nutritional status ($p<0.05$) in this study. Similarly, a previous study in Ghana noted that clients with caregivers with primary, JSS/JHS, SSS/SHS and tertiary were less likely to be malnourished compared with caregivers with no formal education.[13] This finding is also in congruent with a previous study which posited that educational status significantly influence the nutritional status of Persons living with HIV/AIDS (PLWHA).[32] This may be due to knowledge providing a better understanding to caregivers on the special nutritional needs of PLWHA, thereby, making it possible to engage in nutritional practices that will in turn positively strengthen their children nutritional status. Moreover, this result confirms what world organizations such as the World Food Program has advocated, regarding the supreme importance of education, as effective means of combating HIV/AIDS transmission and infection. From our findings, being a male was not associated with nutritional status. This finding is unlike the report of another investigation where males were significantly associated with nutritional status.[32] Taking ARTs was not independently associated with good nutritional status in a previous study, consistent with the present results where patients on ZLD did not show independent relationship with good nutritional status. [32]

CONCLUSION

Malnutrition is common among HIV-infected children. Early detection of HIV and malnutrition as well as concomitant adequate nutrition is essential, children infected with HIV deserve special attention because of increased nutrient needs for normal growth and development. In addition, proper nutritional assessment, management, and support should be an integral part of the care plan to avoid irreversible consequences of malnutrition. This study has showed that majority of the children had good nutritional status. The study results indicate a moderate prevalence of stunting and wasting in HIV-infected children but low proportions of overall overweight and obesity. The prevalence of stunting among the children was 34.6%, wasting 28.1% and underweight 8.5%. The prevalence of overweight was 58.3%, and obesity was 58.3% among female children. There were significant relationships between BMI, age and viral load of participants and their nutritional status. Considering predictors of good nutritional status, the level of education showed significant association.

Strengths and Limitations

The present study has notable strengths, including it is the first study of this type to use two leading hospitals in Accra to determine the nutritional status of children living with HIV/AIDS. Also, an extensive questionnaire was implemented and data gathering and analyses were subjected to rigorous processes expected in survey research. However, this study has some limitations. First, a more representative sample is required in order to generalize the findings in the Greater-Accra region. Second, longitudinal research is required to establish causal associations between the independent variables and knowledge about HIV/AIDS. Third, limitation related to beliefs, attitudes and behaviors that are relevant to nutrition were not included in the study.

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