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Socio-demographic Determinants of Undernutrition In HIV- Infected Under- Five Children

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ABSTRACT

***Background*: The disease burden associated with HIV/AIDS is a key factor in the etiopathogenesis of undernutrition in growing children. This is aggravated by resultant social factors in HIV such as orphaning, low socioeconomic status, food insecurity, and marital status of caregivers.**

***Objectives*: The relationship between sociodemographic factors and malnutrition in the background of HIV was evaluated.**

***Methods*: A cross-sectional descriptive survey was conducted among under-five HIV positive children in Anambra State, Nigeria.**

***Results*: A total of 370 HIV positive under-five children comprising 208(56.2%) males and 162(43.8%) females were recruited. The mean age of the children was 44.5±12.9 months. One hundred and forty-seven (39.7%) were globally undernourished: 15.7.0% (58) underweight (WFA <-2SD), 13.3% (49) wasted (WFH < -2SD), and 27.9% (103) stunted (HFA <-2SD). Males were significantly more stunted than females (p<0.001). 77% (285) were of low socioeconomic class (SEC), 47.3% (175) had advanced HIV disease, and 68.1% (252) had been on HAART for >12 months. 26% (96) were orphans, while 28.6% (106) were cared for by single parents. Being on HAART for >12 months was associated with less undernutrition, while advanced HIV disease seemed to enhance it. Children of low SEC were more likely to be undernourished. Not having been breastfed, introduction of complementary feeds at age 3mo or less, poor food variety and suboptimal feeding frequency increased susceptibility to undernutrition. Orphans were more wasted and stunted than underweight. Single parenthood predisposed to undernutrition.**

***Conclusions*: HIV-infected children are vulnerable to malnutrition by virtue of the disease process, further compounded by interwoven social dilemma associated with HIV. It, therefore, behooves the health care provider to ensure a proactive growth monitoring and nutritional support, with prompt treatment of co-morbid debilitating infections. There is also a dire need for public health interventions targeted at single parents of low socioeconomic means.**

Keywords: Anthropometric indices, determinants of undernutrition, HIV positive children, malnutrition.

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I. INTRODUCTION

According to the World Health Organization, 47 million children under 5 years of age are wasted, 14.3 million are severely wasted and 144 million are stunted [1]. Undernutrition is a direct or underlying cause of at least 45% of all-cause mortality in children aged less than five years. These mostly occur in low- and middle-income countries. The developmental, economic, social, and medical impacts of the global burden of malnutrition are grave and permanent, for individuals and their families, for communities and for countries. Undernutrition is normally categorized into four main components: wasting, stunting, underweight and deficiencies in vitamins and minerals. Wasting is low weight-for-height. It usually connotes recent and severe weight loss because the child has not had enough food to eat and/or they have had an infectious disease, such as diarrhoea, which has caused weight loss. Stunting is low height-for-age. It results from chronic or recurrent undernutrition, usually associated

with poor socioeconomic conditions, poor maternal health and nutrition, frequent illness, and/or inappropriate infant and young child feeding and care in early life. Stunting holds children back from reaching their physical and cognitive potential. Children are said to be underweight when they have a low weight-for-age. A child who is underweight may be stunted, wasted, or both.

Nigeria has the second highest burden of stunted children in the world, with a national prevalence rate of 32% of children under five [2]. Consequent upon these high rates of malnutrition are significant public health and development challenges. Stunting, in addition to an increased risk of death, leaves in its wake poor cognitive development, a decreased performance in education and an overall low adult productivity – all contributing to economic losses estimated to account for as much as 11% of Gross Domestic Product [2].

The HIV/AIDS pandemic is having tremendous negative impact on health, nutrition, food security and overall socioeconomic development in countries that have been most seriously affected by the disease. The pandemic is mostly affecting populations where malnutrition is endemic [3]. Nigeria has the second largest HIV epidemic in the world, and one of the highest rates of new infections in sub-Saharan Africa. Although the HIV prevalence among adults is 1.3%, this translated to 1.8 million people living with HIV in 2019, due to the large national population size [4]. In 2016 Nigeria accounted for 37,000 of the world's 160,000 new cases of babies born with HIV. Being the most populous country in Africa, Nigeria showcases an exceptionally large HIV-infected population. The high infection rate, in addition to about 30% antiretroviral coverage resulted in the death of 24,000 children in 2016 [5].

Malnutrition in the milieu of HIV represents a distinct clinical entity with unique medical and social etiological factors [6]. Children with HIV have a higher daily calorie requirement than their HIV-negative peers, and indeed may be as much as three times more wasted, stunted, and underweight than those without HIV [7]. Moreover coinfections (opportunistic infections) and chronic diarrhea due to HIV enteropathy play a major role in HIV-associated malnutrition. Households affected by HIV/AIDS are at an increased risk for food insecurity, disease burden and malnutrition [8]. In general, the age and sex of the child, complementary food taken, poor dietary diversity, diarrheal diseases, maternal education, maternal height, residential area, and socioeconomic status all play some part as risk factors for undernutrition [9]. Orphan status, marital and family disharmony instigated by the presence of HIV in families also take their toll on the nutritional status of children and family members at large. This study was therefore caried out to determine the relationship between the myriad of these sociodemographic factors and undernutrition among under-five children in Anambra State, Nigeria. The findings of this study may help strengthen the supportive interventions targeted at these vulnerable children.

II. Methods

A. Study Sites

This study was conducted in the Paediatric Out-patients' Clinics of the Nnamdi Azikiwe University Teaching Hospital Nnewi (NAUTH) and its subsidiary health centres - Comprehensive Health Centre Umunya, Comprehensive Health Centre Ukpo, Comprehensive Health Centre (NAUTH Trauma Centre) Oba and Comprehensive Health Centre Neni; all domiciled in Anambra State, Nigeria. Anambra State lies in the south-eastern part of Nigeria. It is bounded by Enugu and Abia states in the East, by Delta state in the West, and in the South and Northwest by Imo and Kogi states respectively. The state is made up of 21 LGAs, 236 wards and 177 communities [10]. The major occupations are trading, farming, transport, and manufacturing. Anambra state is the eighth most populous state in Nigeria and the second most densely populated state after Lagos. Children aged 0-14 years constitute 36.5% of the population. Over the last three decades the rural/urban exodus has caused a shift, making Anambra a highly urbanized state with about 62% of its population living in urban areas [10]. The high volume of trade in the commercial cities of Anambra create a thriving environment for transactional sexual relations involving sex workers and students. Also, the same obtains with certain cultural practices of women marrying women, begetting children for dead husbands to maintain the family lineage, inheritance of widows, etc. Anambra State has a predominant Igbo population, even though it is home to all other major tribes in Nigeria. Even though the current HIV prevalence rate in Nigeria is 1.4%, Anambra State has a prevalence of 2.4% and ranks fifth out of all other states in Nigeria.

B. Study Design

This was a cross-sectional descriptive study. The study was carried out over a ten-month period (September 2018-June 2019). Interviewer-administered questionnaires were used to collect relevant demographic data, and thereafter anthropometric measurements were taken for each subject.

C. Target Population and Sampling Method

This study involved under-five children presenting at Paediatric Clinics of the health facilities, who have been confirmed and enrolled into care at varying periods, irrespective of their duration on antiretroviral therapy. Subjects were recruited consecutively as they presented to the clinic for the duration of the study. Children outside the above age bracket, patients with other known chronic ailments such as sickle cell disease, malignancy and chronic kidney disease were excluded.

D. Ethical Considerations

Ethical approval for this work was obtained from the Research and Ethics committee of NAUTH. Written informed consent was obtained from parents/caregivers before enrolling the selected subjects into the study. Participation was voluntary. Permission was also obtained from the Clinical Heads of the participating centres.

E. Data Collection and Analysis

Each subject had a questionnaire filled by the researchers, documenting demographic, social and nutritional details.

Clinical data on diagnosis, date of commencement and duration on antiretroviral drugs (HAART), and clinical stage were abstracted from each subject's medical records in their hospital folders. Height /length and weight were obtained. For children who were more than two years, height was measured with the subject standing. The two legs were placed together and in full extension with the heels, buttocks, shoulder blade and occiput in firm contact with the measuring rule and readings recorded to the nearest 0.5cm using a vertical stadiometer. (Health scale model RGZ – 120). For those <2 years, recumbent length was measured with the aid of a horizontal stadiometer. The knees were held down and the head held firmly against the headboard. The measurement was recorded to the nearest 0.1cm. Children were weighed with minimal clothing, without footwear and caps using the Health scale model RGZ – 120. Infants were weighed without diapers. Social class was ascertained using the socioeconomic indices of the parents as described by Oyedeji [11].

Data was analyzed using SPSS (Statistical Package for Social Science) version 21 (Chicago Illinois). Frequency distributions of categorical variables were represented in tables. Mean and standard deviation of continuous variables – age of child, age at introduction of complementary feeding and family diet, weight, height, and duration on HAART were calculated. The relationship between nutritional status and socio-economic status, family setting, orphan status, feeding practices was assessed using Chi-squared test. Multivariate logistic regression was used to investigate the predictors of wasting, underweight and stunting. Odds Ratios with the corresponding 95% Confidence Interval were used to show the strength of associations, and variables with P-values of <0.05 were regarded as statistically significant.

The percentile scores for height-for-age, weight-for-height, and weight-for-age were computed using the World Health Organization Anthro Software version 3.2 for calculating Paediatric anthropometry and compared with that of reference population from WHO-NCHS. The height-for-age index is an indicator of linear growth retardation. Children whose height-for-age Z-score was found to be less than -2SD from the median of the reference population were considered short for age (stunted) and chronically malnourished, while those with height-for-age Z score was less than -3SD were classified as severely stunted [12]. The weight-for-height index measures body mass in relation to body height or length and describes current nutritional status. Children whose weight-for-age Z-scores were found to be less than -2SD from the median of reference population were considered thin (wasted) and acutely malnourished. Children whose weight-for-height was less than -3SD were considered to be severely wasted. Weight-for-age is a composite index of height-for-age and weight-for-height [12] and takes into account both acute and chronic malnutrition. Children whose weight-for-age Z-score was below -2SD from the median of the reference population were classified as underweight. Children whose weight-for-age was below -3SD from the median of the reference population were considered as severely underweight.

III. Results

A total of 370 HIV- positive children comprising 208 (56.2%) males and 162 (43.8%) females were studied giving a male: female ratio of 1.3:1. About two-thirds (67.8%) were urban dwellers, and (77.0%) of low socio-economic class. The bulk (90.8%) of the subjects were aged > 24 months. The mean age of the children was 44.5±12.9 months (males 43.9±13.1 months and females 45.2±12.6 months). The characteristics of the subjects are outlined in Table I.

TABLE I: Characteristics of Subjects

Characteristics	Number	Percentage
Age of child [months]		
≤24	34	9.2
25-48	165	44.6
49-<60	171	46.2
Gender		
Females	162	43.8
Males	208	56.2
Marital status of caregiver		
Unmarried or separated	25	6.7
Married	264	71.4
Widowed	81	21.9
Social Class		
Lower	285	77.0
Middle	62	16.8
Upper	23	6.2
Orphan Status		
Both parents alive	274	74.0
Single orphan	71	19.2
Double orphan	20	5.4
Mother unmarried	5	1.4
Mother's living status		
Alive	314	84.9
Dead	56	15.1
Father's living status		
Alive	311	84.1
Dead	59	15.9
Number of children in the family		
≤ 4	312	84.3
>4	58	15.7
Duration on HAART (Months)		
≤6	43	11.6
7-12	75	20.3
13-24	140	37.8
25-36	84	22.7
>36	28	7.6

One hundred and forty-seven children (39.7%) were globally undernourished. Fifty-eight (15.7%) children were underweight, 49 (13.3%) wasted and 103 (27.9%) stunted. Details of their nutritional status are shown in Table II.

TABLE II. Nutritional Status of the Children

Nutritional status	Frequency	Percent
Weight-for-age [WFA]		
Normal	312	84.3
Underweight [≤-2SD]	47	12.7
Severe underweight [≤-3SD]	11	3.0
Weight-for-height		
Normal	321	86.7
Wasted [≤-2SD]	38	10.3
Severely wasted [≤-3SD]	11	3.0
Height-for-age [HFA]		
Normal	267	72.1
Stunted [≤-2SD]	38	10.3
Severely stunted [≤-3SD]	65	17.6
Overall		
Normal	223	60.3
Undernourished	147	39.7

Majority were commenced on cereals at between 4-6 months (66.8%) with the mean age of commencement of cereals to be 4.3±1.8 months. Many of them (47.5%) were introduced to family diet at 6 months and beyond with an average age of introduction to family diet being 7.3±2 months. Mean duration on HAART was 19.9±11.4 months.

Children who had received HAART for more than 12 months were less likely to be wasted (X^2=7.64, p=0.02), underweight (X^2=21.60, p<0.001) or stunted (X^2=61.42, p<0.001). Wasting (X^2=7.91, p=0.02), underweight (X^2=35.07, p<0.001) and stunting (X^2=30.36, p<0.001) were commoner among those in clinical stages 3 and 4 than those in clinical stages 1 and 2.

Poor nutritional status was positively associated with low socioeconomic status. A significantly higher proportion of children of low socio-economic status were more likely to be wasted (X^2=6.07, p=0.013), underweight (X^2=5.38, p=0.020) and stunted (X^2=7.85, p=0.01) than those of upper and middle socio-economic classes. Family size did not affect the proportion of underweight children. On the other hand, children from larger families were more wasted but less stunted. Orphans were more wasted and stunted than underweight. Children who were wasted, underweight or stunted were more likely to be found among those whose parents were widowed, separated or single (Tables III-V).

There was no significant difference in the pattern of wasting and underweight between the male and female children. However, male children were significantly more stunted compared to the females (X^2=15.88, p<0.001). A slightly higher proportion of those who were not breastfed was either more wasted or underweight compared to those who were breastfed. However, this difference was not statistically significant.

Initiation of cereal at 3 months and below was associated with wasting (X^2=22.32, p<0.001) and underweight (X^2=21.68, p<0.001). Stunting was commoner among those who initiated cereal later than 3 months, however this association was not found to be statistically significant.

Those who were wasted or underweight were more likely to have initiated feeding on family diet earlier than 6 months. Particularly, wasting was found to be significantly associated with early commencement on family diet (X^2=8.94, p=0.03). On the other hand, late commencement on family diet was found to be significantly associated with stunting (X^2=8.41, p=0.04). There was no significant relationship between frequency of feeding per day with family diet and wasting. However, there was significant association between frequency of feeding with family diet and underweight and stunting. Children who were fed less than or equal to thrice daily were more likely to be underweight (X^2=5.18, p=0.02) or stunted (X^2=8.23, p=0.02).

TABLE III. FACTORS ASSOCIATED WITH UNDERWEIGHT

Characteristic	Normal	Underweight	Severe underweight	Total (%)	p-value
Sex					
Male	168(80.8)	33(15.9)	7 (3.3)	208(56.2)	0.95
Female	144 (88.9)	14 (8.6)	4 (2.5)	162 (43.8)	
Duration on HAART					
≤12 months	86 (72.9)	23 (19.5)	9 (7.6)	118 (31.9)	<
> 12 months	226 (89.7)	24 (9.5)	2 (0.8)	252 (68.1)	0.001*
WHO clinical stage					
Stage 1 and 2	183 (93.8)	12 (6.2)	0 (0.0)	195 (52.7)	<0.001*
Stage 3 and 4	129 (73.7)	35 (20.0)	11(6.3)	175 (47.3)	
Social class					
Upper and middle	79 (92.9)	5 (5.9)	1 (1.2)	85(23.0)	0.020*
Lower	233((81.7)	42 (14.7)	10 (3.5)	285 (77.0)	
Orphan status					
Non-orphan	239 (85.7)	34 (12.2)	6 (2.1)	279 (75.4)	0.18
Single orphan	55 (77.5)	11 (15.5)	5 (7.0)	71(19.2)	
Double orphan	18 (90.0)	2 (10.0)	0 (0.0)	20(5.4)	
Caregiver's marital status					
Married	229 (86.7)	30 (11.4)	5 (1.9)	264 (71.4)	0.04*
Unmarried/widowed/separated	83 (78.3)	17 (16.0)	6 (5.7)	106 (28.6)	
Number of children in the family					
≤ 4	263 (84.3)	39 (12.5)	10 (3.2)	312 (84.3)	0.81
>4	49 (84.4)	8 (13.8)	1 (1.7)	58 (15.7)	
Breastfeeding status					
Breastfed	269 (84.9)	38 (12.0)	10 (3.1)	317 (85.7)	0.75
Not breastfed	43 (81.1)	9 (17.0)	1 (1.9)	53 (14.3)	
Age at Introduction of Cereals					
≤3 months	60(69.0)	19 (21.8)	8 (9.2)	87(23.5)	<0.001*
>3 months	224(88.2)	27(3.6)	3 (1.2)	254(68.7)	
Cannot recall	28(96.6)	1(3.4)	0(0.0)	29 ((7.8)	
Age at Introduction of Family Diet					
≤5 months	41 (73.2)	11 (19.6)	4(7.1)	56(15.1)	
6-8 months	180(83.3)	31(14.4)	5(2.3)	216(58.4)	0.65
>8 months	69(92.0)	4(5.3)	2(2.7)	75(20.3)	
Cannot recall	22(95.7)	1(4.3)	0(0.0)	23(6.2)	
Frequency of Feeds per day					
≤3	167(80.3)	31(14.9)	10(4.8)	208(56.2)	0.02*
>3	141(89.3)	16(10.1)	1(0.6)	158(42.7)	
Cannot recall	4(100.0)	0(0.0)	0 (0.0)	4(1.1)	

*p -value statistically significant.

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TABLE IV: FACTORS ASSOCIATED WITH WASTING

Characteristic	Normal	Wasted	Severely wasted	Total (%)	p-value
Sex					
Male	184(88.5)	19 (9.1)	5 (2.4)	208(56.2)	0.53
Female	137 (84.6)	19 (11.2)	6 (3.7)	162 (43.8)	
Duration on HAART					
≤12 months	94 (79.7)	19 (16.1)	5 (4.2)	118 (31.9)	< 0.001*
> 12 months	227(90.1)	19(7.5)	6 (2.4)	252 (68.1)	
WHO clinical stage					
Stage 1 and 2	176(90.3)	12 (6.1)	7(3.6)	195 (52.7)	0.02*
Stage 3 and 4	145(82.8)	26(14.9)	4(2.3)	175 (47.3)	
Social class					
Upper and middle	81(95.3)	4(4.7)	0(0)	85(23.0)	0.013*
Lower	240(84.2)	34(11.9)	11(3.9)	285 (77.0)	
Orphan status					
Non-orphan	249(89.3)	23(8.2)	7(2.5)	279 (75.4)	0.04*
Single orphan	57(80.3)	11(15.5)	3(4.2)	71(19.2)	
Double orphan	15(0.7)	4(0.2)	1(0.1)	20(5.4)	
Caregiver's marital status					
Married	231(87.5)	27 (10.2)	6 (2.3)	264 (71.4)	0.08
Unmarried/widowed/separated	90 (84.9)	11 (10.4)	5 (4.7)	106 (28.6)	
Number of children in the family					
≤ 4	274(87.8)	29(9.3)	9(2.9)	312 (84.3)	0.34
>4	47(81.0)	9(15.5)	2(3.5)	58 (15.7)	
Breastfeeding status					
Breastfed	275(86.7)	32(10.1)	10(3.2)	317 (85.7)	0.85
Not breastfed	46(86.8)	6(11.3)	1(1.9)	53 (14.3)	
Age at Introduction of Cereals					
≤3 months	69(79.3)	17(19.5)	1(1.1)	87(23.5)	<0.001*
>3 months	228(89.8)	17(6.7)	9(3.5)	254(68.7)	
Cannot recall	24(82.8)	4(13.8)	1(3.4)	29 ((7.8)	
Age at Introduction of Family Diet					
≤5 months	43(76.8)	10(17.9)	3(5.3)	56(15.1)	0.03*
6-8 months	187(86.6)	23(10.6)	6(2.8)	216(58.4)	
>8 months	71(94.7)	3(4.0)	1(1.3)	75(20.3)	
Cannot recall	20(87.0)	2(8.7)	1(4.3)	23(6.2)	
Frequency of Feeds per day					
≤3	179 (86.1)	23(11.1)	6(2.8)	208(56.2)	0.85
>3	138(87.3)	15(9.5)	5(3.2)	158(42.7)	
Cannot recall	4(100.0)	0(0.0)	0(0.0)	4(1.1)	

*p -value statistically significant.

TABLE V: FACTORS ASSOCIATED WITH STUNTING

Characteristic	Normal	Stunted	Severely stunted	Total (%)	p-value
Sex					
Male	137 (65.9)	20 (9.6)	51(24.5)	208(56.2)	<0.001*
Female	130 (80.2)	18(11.1)	14 (8.6)	162 (43.8)	
Duration on HAART					
≤12 months	54(45.8)	21(17.8)	43(36.4)	118 (31.9)	< 0.001*
> 12 months	213(84.5)	17(6.8)	22(8.7)	252 (68.1)	
WHO clinical stage					
Stage 1 and 2	164(84.1)	14(7.2)	17(8.7)	195 (52.7)	<0.001*
Stage 3 and 4	103(58.9)	24(13.7)	48(27.4)	175 (47.3)	
Social class					
Upper and middle	72(84.7)	3(3.5)	10(11.8)	85(23.0)	0.01*
Lower	195(68.4)	35(12.3)	55(19.3)	285 (77.0)	
Orphan status					
Non-orphan	203(72.8)	25(8.9)	51(18.3)	279 (75.4)	0.04*
Single orphan	45(63.4)	13(18.3)	13(18.3)	71(19.2)	
Double orphan	19(95.0)	0(0)	1(5.0)	20(5.4)	
Caregiver's marital status					
Married	197 (74.6)	20 (7.6)	47 (17.8)	264 (71.4)	0.001*
Unmarried/widowed/ separated	70 (66.0)	18 (17.0)	18 (17.0)	106 (28.6)	
Number of children in the family					
≤ 4	216(69.2)	34(10.9)	62(19.9)	312 (84.3)	0.01*
>4	51(87.9)	4(6.9)	3(5.2)	58 (15.7)	
Breastfeeding status					
Breastfed	226(71.3)	33(10.4)	58(18.3)	317 (85.7)	0.60
Not breastfed	41(77.4)	5(9.4)	7(13.2)	53 (14.3)	
Age at Introduction of Cereals					
≤3 months	66 (75.9)	5(5.7)	16(18.4)	87(23.5)	0.11
>3 months	176(69.3)	31(12.2)	47(18.5)	254(68.7)	
Cannot recall	25(86.2)	2(6.9)	2(6.9)	29 ((7.8)	

TABLE V: CONTD.

Characteristic	Normal	Stunted	Severely stunted	Total (%)	p-value
Age at Introduction of Family Diet					
≤5 months	44(78.6)	4(7.14)	8(14.3)	56(15.1)	
6-8 months	144(66.7)	29(13.4)	43(19.1)	216(58.4)	0.04*
>8 months	59(78.7)	4(5.3)	12(16)	75(20.3)	
Cannot recall	20(87.0)	1(4.3)	2(8.7)	23(6.2)	
Frequency of Feeds per day					
≤3	138(66.3)	43(20.7)	27(13.0)	208(56.2)	0.02*
>3	125(79.1)	22(13.9)	11(7.0)	158(42.7)	
Cannot recall	4(1.0)	0(0.0)	0(0.0)	4(1.1)	

*p -value statistically significant.

Social class, duration on HAART and age of introduction of complementary feeding were found to be significant predictors of wasting among the children. Children of low social class were 11 times more likely to be wasted compared to those of higher social classes [OR=11.66 (1.45-90.50)], while children who were less than 12 months on HAART were found to be thrice at risk of being wasted than those who have been on HAART for a longer period of time [OR=3.06 (1.45-8.06)]. Those that started complementary feeding at ≤3 months were two and half times at risk of being wasted compared to those who commenced complementary feeding after 3 months.

Significant predictors of underweight in the children were sex, age, marital status of parents/guardian, number of children in the family, clinical stage, breastfeeding, and age of introduction of complementary feeding. Male gender OR=2.55 (1.06-6.16), younger child (<24 months) OR=2.28 (1.35-3.86), children of whose parents were either widowed or dead OR=3.92 (1.52-10.08), number of children in the family >4 OR=3.93 (1.80-13.07), clinical stage 3&4 OR=4.60 (1.70-12.45), not breastfed OR=1.51 (1.03-2.23), and initiation of complementary feeding ≤3 months OR=5.90 (2.25-15.45) increased the odds of being underweight.

Sex, age, clinical stage, duration on HAART were found to be significant predictors of stunting. Being a male OR=2.67 (1.32-5.40), younger child (<24 months) OR=2.52 (1.73-3.66), clinical stage 3&4 OR=2.81 (1.39-5.68), HAART duration of <12 months OR=2.75 (1.29-5.86) increase the odds of being stunted. Each of these predictors increases the risk of stunting by at least twice.

IV. Discussion

The present study examined the association of various determinants of undernutrition in HIV-Infected under-fives using WFA, HFA and WFH. Socioeconomic status was observed to be one of the major factors influencing the nutritional status of HIV children. In this study significantly higher proportions of children from the low socioeconomic class were more likely to be wasted, underweight and stunted. This finding is in conformity with expectation since children from low-income families have a restricted access to nutrient-rich foods and quality medical care. This is attested to by other workers [9], [13], [14]. Contrary to these findings, in South Africa, Kimani-Murage and his co-workers [15] documented that socioeconomic status was not a significant determinant of nutritional outcome. The reason for this disparity may probably be because in their study, they determined the nutritional status using household asset index by proxy rather than actual income and expenditure which may not be a true representation of the economic states of those families. Effective HIV intervention must go beyond HAART treatment and consider how patients' lives are shaped around the disease. Interventions that target poverty alleviation and provision of food for these children could make a world of difference.

This present study also showed that orphans were more likely to suffer undernutrition, especially wasting. This stands to reason, because children who have lost either or both parents have an increased risk of food insecurity, hunger, poor access to health facility and all forms of abuse and exploitations. Review of literature has shown varied reports from different authors on the relationship between orphan status and nutritional status [16]-[18]. Some authors documented a higher incidence of stunting, while some documented higher incidence of wasting or underweight. Panpanich *et al* [19] in Malawi documented that among children living in villages, orphaned children were not more malnourished than non- orphans. A study in Kenya by Mishra *et al* [20] showed orphaned children were less likely to be stunted. A similar study in Kenya by Kikafunda [21] documented that prevalence of stunting among the orphans was significantly higher than non-orphans. Gulthie and colleagues [22] in Ethiopia noted that prevalence of stunting and underweight were significantly higher in orphans then non-orphans. The reasons for the varied reports are not known but could still be attributed to the level of care given to these children, especially where some interventions have been in place. Support of HIV orphans form an integral part of care for children living with HIV and must be sustained.

Single parenthood/widowhood is another important factor that influenced the nutritional status of HIV-positive children in the study. Children who were wasted, underweight or stunted were more likely to be found among those whose parents were single and widowed. Children whose parents are widowed were more underweight compared to those whose both parents were alive. This finding is expected because the financial burden of the home is borne by one person. Also, a single mother who has never married may not get support from her family and even the society. Mahgoub *et al* [23] in Botswana documented that children in single parent households suffered from underweight to a significantly higher level than children brought up by both parents. Odimegwu and Ntoimo [24] in a large cohort study involving children from Nigeria, Cameroun and Democratic Republic of Congo corroborrated that children of single mothers who were not widows were more likely to stunted. Sichona *et al* [25] in Tanzania documented that in households in which mothers are currently married, children suffered less from stunting than those in which mothers were divorced, widowed

or have never married. This was also evident among HIV-uninfected children, as reported by Mishra *et al* [20] in Kenya, who documented that children of single mothers with no spouse were more likely to be underweight and wasted than their married counterparts. In addition, Tette *et al* [26] found that mothers of malnourished children were more likely to be unmarried or cohabiting and have lower family incomes. These studies tend to emphasize the effect of stable family union to the nutritional status of children. Therefore, nutritional support programs should involve training of single parents and also empowerment of widows and unmarried single mothers.

With increasing number of children in the family, the time for individual care of each child reduces, and so does food availability. These are expected to cause faltering in growth parameters. Families with more than four children were at a higher risk of wasting. Ndukwu *et al* [16] in a study in Nnewi had earlier demonstrated that the number of children in the family was significantly associated with stunting. Owoaje *et al* [18] in Ibadan also noted that children from homes with more than four children had a 4-fold risk of developing malnutrition compared to those from homes with four children or less. Male children were observed to be more stunted than females. Studies [27], [28] across sub-Saharan Africa have attested to this finding. The reason may be multifactorial – involving socioeconomic, environmental and biodemographic factors.

Beyond the breastfeeding period, the nutritional status of children is a complex interaction between interrelated factors which include environmental, economic, educational, cultural and food security and inappropriate quantity and quality of complementary feeding. The WHO recommends that children living with HIV should be fed five or more times so as to meet their high energy and nutrient demand. Feeding frequency was therefore not optimal in more than half of the study population. This may probably be as a result of ignorance or because the parents/caregivers could not afford to feed the child up to five times due to poverty. It was observed in Tanzania [29] that low feeding frequency was associated with stunting; a lower feeding frequency was associated with low wealth index, food insecurity, and caregiver's education. Such poor feeding practices were opined to result from poor nutrition knowledge, food insecurity, low income and poverty. It is therefore imperative for nutrition education to be an integral part of care for HIV-infected children and their caregivers.

V. Conclusion

HIV-infected children are vulnerable to malnutrition by virtue of the disease process and interwoven social dilemma associated with HIV. It, therefore, behooves the health care provider to ensure a proactive growth monitoring and nutritional support, with prompt treatment of co-morbid debilitating infections. There is also a dire need for public health interventions targeted at single parents of low socioeconomic means.

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