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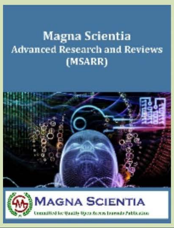

(RESEARCH ARTICLE)

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Prevalence of protein energy malnutrition in HIV-infected under five children and the effects of highly active antiretroviral therapy on their nutritional status in Nigeria

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Abstract

Aim: To determine the prevalence of malnutrition among HIV- infected under-five children and effect of highly active antiretroviral therapy (HAART) on the nutritional status.

Method: This cross-sectional and descriptive study was conducted among under-fives presenting at the Paediatric HIV clinic in a tertiary centre in Nigeria. HIV positive children aged less than five years, who were on HAART and whose parents/caregivers gave consent were included. Odds ratios (ORs) and their 95% confidence intervals (CIs) were determined in a multivariate logistic regression analysis and p-values of <0.05 were considered significant.

Result: A total of 92 HIV positive children comprising 52 (56.5%) males and 40 (43.5%) females were recruited, giving a ratio of 1.3:1. Children who were more than 48 months of age were (46.7%), while (9.8%) were aged 24 months or less. The mean age of the children was 44.5±12.9 months, while that of the male and female children were 43.9 ±13.1 months and 45.2±12.6 months, respectively, and their age difference was statistically insignificant.

The prevalence of undernutrition was 40.2% with a significantly higher proportion of them being male children (P= 0.02) while 1.1% of the children was overweight. The prevalence of severe wasting, severe underweight and severe stunting were 2.1, 3.3 and 17.4% respectively. A total of 12 (13.0%) were wasted, 14 (15.2%) were underweight, and 26 (28.3%) were stunted. Children who received HAART for more than 12 months were less likely to be wasted (P=0.02). Multivariate logistic regression also showed that being a male increased the risk of being underweight (OR=2.55, 95%CL=1.06-6.16) and stunted (OR=2.67, 95%CL=1.32-5.40).

Conclusion: Malnutrition remains a problem of children living with HIV even while they are on HAART. The longer duration of HAART is significantly associated with better nutritional status.

Keywords: Malnutrition; HIV-Infected; Children; Antiretroviral; Nutritional.

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1. Introduction

Protein Energy Malnutrition (PEM) is a nutritional problem that results from varying proportions of protein and calorie deficiency in infants and young children [1]. It is a global public health challenge that affects several parts of the world [2]. It has been identified by the World Health Organization (WHO) as the most lethal form of malnutrition, causing annual deaths of at least 10.8 million under-five children in developing countries [3]. Estimates from 2003-2013 Nigeria National Demographic and Health Survey (NDHS) gave a stunting rate of 41%, while underweight and wasting was estimated to be 23% and 14% respectively [4]. Malnutrition is rife even in the study area, as a survey of preschool children carried out several years earlier yielded a wasting rate of 21% [5].

Though some gains have been made in reducing childhood malnutrition by the improvement in child survival strategies through breastfeeding, immunization, use of oral rehydration therapy (ORT) in the management of diarrheal diseases, millions of children are still malnourished [4]. In Sub-Saharan Africa (SSA), providing sufficient food and nutrition to meet basic needs for health, growth and development of children has been a longstanding challenge [6]. This is further exacerbated by the emergence of the Human Immune Deficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS)[6,7]. The HIV pandemic has weakened the socioeconomic status in Africa, making it even more difficult to ensure food security, education and other essential services. It has also caused a dramatic increase in the mortality rates of infants and children due to AIDS-related deaths [8]. HIV-positive children are prone to malnutrition due to inadequate intake of food, nutritional loss, metabolic changes and increased requirements for both macro and micronutrients.

The effect of HIV on nutrition begins early in the course of the disease even before it becomes evident that the child is infected [9]. Energy requirement is likely to increase by 10% to maintain body weight, physical activity and growth in asymptomatic children and for this reason, energy intake needs to be increased by 50 – 100% over standard requirements in children experiencing weight loss in HIV [6].

Achieving the Sustainable Development Goal (SDG) that aims to reduce malnutrition and childhood mortality depends partly on the ability of the government and policy makers to address the nutritional needs of the children especially those living with HIV/AIDS in hyper endemic areas [10, 11]. The critical role of nutritional support in the survival of HIV-infected individuals is well known [12, 13]. Nutritional support is recommended as part of the care provided for HIV-positive children in developing countries such as Nigeria [14]. This is jeopardized by stigmatization and discrimination, ultimately contributing to reduced food availability and insufficient dietary intake for these patients.

Healthcare cost for laboratory investigations and antiretroviral (ARV) drugs further worsen the economic status of the affected families resulting in impoverishment [15].

This study seeks to determine prevalence of malnutrition in HIV infected children and the relationship between the nutritional status of these HIV/AIDS under-five children and duration on HAART. The findings of this study may help strengthen the support system targeted at these children.

2. Material and methods

2.1. The study site

This study was a cross-sectional descriptive study conducted in the Paediatric HIV Clinic of Nnamdi Azikiwe University Teaching Hospital Nnewi (NAUTH), Nnewi, Anambra State, Nigeria. NAUTH is a tertiary health institution in Anambra State, South East (S.E.) Nigeria. The hospital maintains a Paediatric HIV Clinic which runs daily from 8am to 4pm and is run by three Consultant Paediatricians, three senior Registrars, three Medical officers, five nurses, one adherence counsellor and a dietician.

2.2. The Study Participants and Recruitment.

Ninety-two confirmed HIV positive children aged less than five years, who were on HAART and whose parents/caregivers gave consent were recruited for the study. Convenient sampling was done.

2.3. Ethical approval

Ethical approval for the study was obtained from the Ethics committee of Nnamdi Azikiwe University Teaching Hospital, Nnewi South East Nigeria (NAUTH/CS/VOL.3/100). Written informed consent was obtained from caregivers before enrolling the selected subjects into the study. The caregivers were educated on the general nature of the research, the possible study benefits and the role the result of the research may play in improving the management of the patients. Participation was voluntary, and no penalty was borne by those who declined inclusion.

Subjects who met the inclusion criteria were recruited consecutively as they presented to the HIV clinic until the sample size was attained.

2.4. The Study procedures

For children aged more than two years, height was measured with the subject standing. The two legs were together and in full extension with the heels, buttocks, shoulder blade and occiput in firm contact with the measuring rule. Readings were recorded to the nearest 0.5cm using a stadiometer. (Health scale model, RGZ – 120).

The children were weighed with minimal clothing using Health scale model RGZ – 120. Each day, the weighing scale was validated using a standard weight of 20kg. The reading was recorded to the nearest 0.1kg.

For children less than two years, the recumbent length was measured using an infantometer placed on a firm surface with an assistant, usually the mother. The knees were held down, and the head held firmly against the headboard. The measurement was taken to the nearest 0.1cm.

Infant aged less than two years were weighed completely naked using a 20kg infant Health Scale model RGZ – 120 to the nearest 0.1kg. The measurements were read at eye level (in a squatting position) to avoid the error of parallax. The weighing scale was cross-checked for zero adjustments before another baby was weighed.

Social class was determined using the socioeconomic indices of the parents as described in the literature.[16]

The exact day HAART was commenced, and the Clinical Staging of the subjects was obtained from their medical records which are being updated from time to time by the Paediatric Infectious Diseases unit.

Furthermore, the percentile scores for height-for-age, weight-for-height, and weight-for-age were computed using the World Health Organization Anthro Software for calculating Paediatric anthropometry and compared with that of reference population from WHO-NCHS as a measure of the children's nutritional status.

2.5. Data Analysis

Data were analyzed using SPSS (Statistical Package for Social Science) version 21 (Chicago Illinois). Frequency distributions of categorical variables were represented in tables and charts. Mean and standard deviation of continuous variables – age, number of children, duration of breastfeeding including exclusive breastfeeding, age of introduction of complementary feeding and family diet, weight, height and duration on HAART were calculated. Test for statistical significance was carried out using appropriate statistical test – the student t-test for quantitative variables and Chi-square test for qualitative (categorical) variables, as well as multivariate logistic regression analysis and p-value of $p < 0.05$ was considered statistically significant.

3. Results

A total of 92 HIV positive children comprising 52(56.5%) males and 40 (43.5%) females were studied giving a male: female ratio of 1.3:1. Majority (66) of the children (71.7%) presented at WHO clinical stages 3 and 4, while earlier stages (1 and 2) accounted for 28.3% (26). Duration on HAART spanned from 1-27 months. Children who were aged more significant than 48 months were about (46.2%), while a few of them (9.2%) were aged 24 months or less. The females were slightly older than the male children, but there was no significant difference in the age distribution of the children. The mean age of the children was 44.5+12.9 months, while that of the male and female children were 43.9 ±13.1 months and 45.2±12.6 months, respectively (See Table 1). The distribution of the children by nutritional status and gender is shown in Table 2. Males were significantly more malnourished than the females (46.2% and 32.5%) respectively. Multivariate logistic regression also showed that being a male increased the risk of being underweight (OR=2.55, 95%CI=1.06-6.16) and stunted (OR=2.67, 95%CI=1.32-5.40). The relationship between the duration of HAART and nutritional status is shown in Table 3.

Table 1 Socio-demographic Characteristics of the Children by gender.

Characteristic	Male n=52(%)	Female n=40(%)	Total n=92(%)	P-value
Age (in months)				
<24	6 (11.5)	3 (7.5)	9 (9.8)	
25-36	12 (23.1)	9 (22.5)	21 (22.8)	0.18
37-48	9 (17.3)	10 (25.0)	19(20.7)	
>48	25 (48.1)	18(45.0)	43(46.7)	
Mean+SD	43.9+13.1	45.2+12.6	44.5+12.9	
Place of Residence				
Urban	35 (67.3)	27 (67.5)	62 (67.4)	
Rural	17 (32.7)	13 (32.5)	30 (32.6)	0.81
Social Class				
Low	39 (75.0)	32 (80.0)	71 (77.2)	
Middle	10 (19.2)	6 (15.0)	16 (17.4)	0.35
High	3 (5.8)	2 (5.0)	5 (5.4)	

SD-Standard deviations, X^2=Chi square test, p-value (value of precision), P-value<0.05 is statistically significant.

Table 2 Distribution of the children by Nutritional Status and gender

Malnutrition	Male n=52(%)	Female n=40(%)	Total n=92(%)	P-value
Wasting				
Normal	46 (88.5%)	34 (84.5)	80 (87.0)	
Wasting	5 (9.6)	5 (11.8)	10 (10.9)	0.53
Severe Wasting	1 (1.9)	1 (3.7)	2(2.1)	
Underweight				
Overweight	1 (1.9)	0 (0.0)	1 (1.1)	
Normal	41 (78.8)	36 (90.0)	77(83.7)	
Underweight	8 (15.4)	3 (7.5)	11 (11.9)	0.95
Severe underweight	2 (3.8)	1 (2.5)	3 (3.3)	
Stunting				
Normal	34 (65.4)	32 (80.0)	66 (71.7)	
Stunting	5 (9.6)	5 (12.5)	10 (10.9)	<0.001
Severe Stunting	13 (25.0)	3 (7.5)	16 (17.4)	
Overall malnutrition				
Normal	28 (53.8)	27 (67.5)	55(59.8)	0.02
Under nutrition	24 (46.2)	13 (32.5)	37(40.2)	

X^2 – Chi square test, p-value (value of precision), p-value <0.05 is statistically significant.

Table 3 Relationship between Duration of HAART and Nutritional Status

Nutritional Status	Duration of HAART ≤ 12 months n=29 (%)	>12 months n=63 (%)	P-value
Wasting			
Normal	23 (79.3)	57 (90.5)	
Wasting	5 (17.2)	5 (7.9)	0.02
Severe Wasting	1 (3.4)	1 (1.6)	
Underweight			
Normal	21 (72.4)	57 (90.5)	
Underweight	6 (20.7)	5 (7.9)	<0.001
Severe Underweight	2 (6.9)	1 (1.6)	
Stunting			
Normal	13 (20.2)	53 (84.1)	
Stunting	5 (55.3)	4 (6.3)	<0.001
Severe Stunting	11 (66.2)	6 (9.5)	

X^2=Chi-square test, p-value(value of precision).p<0.05 is statistically significant. df=degree of freedom (X^2) = Chi square test, p-value (value of precision). P<0.05 is statistically significant.

4. Discussion

Malnutrition is prevalent worldwide, but the impact is felt more in developing countries. Its effect is worsened by HIV/AIDS. Introduction of HAART in the management of HIV has resulted in improvement in the nutritional status of children living with HIV [17-21]. This present study observed a prevalence rate of undernutrition of 40.2%. The prevalence of wasting was 13.0%, underweight and stunting were 15.2% and 28.3% respectively, while 17.4% were severely stunted. This was lower than the prevalence of undernutrition reported by Anigilaje and Olutola [22] in Makurdi, Benue State, which gave prevalence rates of 12.1%, 33.5% and 54.4% for underweight, wasting and stunting respectively.

A study was done by Anyabolu et al [23] in Ile-Ife, South Western Nigeria also documented higher prevalence rates of 48.6%, 58.6% and 31.4% for stunting, underweight and wasting respectively. The reason for this disparity is because Anigilaje and Olutola and Anyabolu et al, [23] did their studies among HIV-infected children who were not on HAART. The prevalence rates in this study were also lower, as compared with the estimates from the 2013 NDHS [4], which gave a rate of 37% for stunting and 21% for severe stunting. About 18% of the studied population was wasted, while 29% were underweight in the NDHS survey. The reason for the lower prevalence rate seen in this study may probably be because the HIV children used in this study were under specialized care, with nutritional rehabilitation as a component of the package. Still, the NDHS survey considered a broader population of under-five children, some of whom may be HIV infected but not on HAART [4]. There is a lack of literature on the prevalence of stunting, wasting and underweight in HIV children on HAART in Nigeria. However, some studies done in other countries have documented higher prevalence rates. A study done in Cameroon among 39 HIV-infected children on HAART recorded a prevalence rate of 51.3%, 56.4% and 20.5% for stunting, underweight and wasting respectively [24]. Another study in Tanzania documented a rate of 36.6%, 22.1% and 13.6% for stunting, underweight and wasting respectively on ART-treated HIV children [25]. A study in India reported that malnutrition persists in HIV children even when they are on HAART [26]. The reasons for the disparity in the prevalence rates are not readily available but may be due to the level of care and secondly the prevalence and severity of malnutrition of these children before they were enrolled into HAART and HIV care programs. 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 minus two standard deviations (-2SD) from the median of the reference population were considered short for age (stunted) and are chronically malnourished, while those with height-for-age Z score less than minus three standard deviations (-3SD) were classified as severely stunted [27, 28].

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 minus two standard deviations (-2SD) from the median of reference population were considered thin (wasted) and were acutely malnourished. Children whose weight-for-height was less than minus three standards (-3SD) were considered to be severely wasted [27, 28].

Weight-for-age is a composite index of height-for-age and weight-for-height. It takes into account both acute and chronic malnutrition. Children whose weight-for-age Z-score was below minus two standard deviations (-2SD) from the median of the reference population were classified as underweight. Children whose weight-for-age was below minus three standard deviations (-3SD) from the median of the reference population were considered as severely underweight [27, 28].

Prevalence of stunting was also seen to be consistently higher than underweight and wasting. This is expected because stunting is a marker of longstanding nutritional deprivation. It was also noted in this present study that males were significantly more malnourished than the females (46.2% and 32.5%) respectively. Multivariate logistic regression also showed that being a male increased the risk of being underweight (OR=2.55, 95%CI=1.06-6.16) and stunted (OR=2.67, 95%CI=1.32-5.40). This could be explained in part by the fact that male children are usually more active and require more calories than females. Awogbenja and Ugwuona [29] in the Nasarawa State of Nigeria documented that females were less likely to be underweight in their study (AOR=0.292, 95%CI=0.103-0.820). A study in Kenya by Mishra et al [30] documented that males were more likely to be stunted. Another survey by Lwanga et al [31] in Uganda documented that males had a 4-fold risk of being stunted. Unlike in this study, Mohd et al[32] reported a higher prevalence of stunting among females in a study of 95 children on HAART in Malaysia, 39.0% and 33.3% females and males, respectively. Kumar et al [33] documented that stunting was commoner in girls than boys in India, 63.3% and 44.9% respectively. Woldie et al [34] in Southern Ethiopia documented that there was a slight increase in the prevalence of stunting (51.7%) in males than females (48.9%) though not statistically significant (p=0.965). Padmapriyadarsini et al[35] in India documented that rates of stunting were similar in both male and female. The reasons for these differences are not readily available, but one may infer that stunting could occur irrespective of gender.

The longer duration on HAART was shown to significantly improve the nutritional status of children in this study. Children who had received HAART for more than twelve months were less likely to be wasted (X2 = 7.64, p= 0.002), underweight (X2 = 21.60, p < 0.001) or stunted (X2=61.42, p < 0.001). This was further bolstered by the fact that logistic regression showed that the duration of HAART is a significant predictor of wasting (OR = 3.06, 95%CI = 1.45-8.06). This result is expected because with the introduction of HAART in the management of HIV, the viral load starts decreasing, CD4 starts increasing, and metabolic rate following infectious processes starts reducing, with subsequent improvement in the anthropometry of these children. A similar study by Ezeonwu et al [36], in Enugu South-East Nigeria, documented that children who were malnourished in their study had a shorter duration of HAART treatment than the well-nourished. Sunguya et al [37] in Tanzania compared HIV children on HAART for a duration of 6 months, 6 – 12 months and >12 months and documented that those that had ARV for >12months were less likely to be underweight and wasted. Lodha and Kabra [38] in a longitudinal study in India, involving HIV children commenced on HAART, documented that there was a statistically significant improvement in nutritional status over one year on HAART as against 6 months in underweight, wasting and stunting. Early commencement of HAART once the diagnosis of HIV is confirmed in children aids improvement in their nutritional status and hence reduce morbidity and mortality.

This study has a number of limitations. The cross-sectional design of this study limits the conclusion on the cause and effect relationship between associated factors of malnutrition.

5. Conclusion

It is concluded that malnutrition is still a problem for children living with HIV, even though on HAART. The duration on HAART is significantly associated with better nutritional status. There is a need for HIV positive mothers to begin nutrition counseling during pregnancy so that they can make well-informed choices on how to feed their babies. Also, the implementation of the already existing infant and young children feeding policies is advised. Implementation of growth monitoring should be sustained as part of the care of HIV patients. This will help to detect dwindling in anthropometric indices and institute appropriate intervention early enough.

Compliance with ethical standards

Acknowledgement

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Disclosure of conflict of interest

The authors declare no conflicts of interests.

Statement of Ethical approval

The study protocol was approved by the by Nnamdi Azikiwe University Teaching Hospital (NAUTH) Ethics committee with approval number of NAUTH/CS/VOL.3/100.

Authors' contributions

All the authors participated in the research.

Statement of informed consent

A written informed consent was obtained from all individual participants included in the study.

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