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## **Prevalence of HIV-infection among under-5 children with protein energy malnutrition presenting at Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria**

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**Abstract Background:** HIV infection is a major health problem worldwide. It is associated with Protein-Energy Malnutrition (PEM) among under-5 children with attendant high morbidity and mortality.

**Objective:** To determine the prevalence of HIV-infection among children presenting with various subtypes of PEM.

**Methodology:** Children suffering from PEM aged below 5 years admitted into the Paediatric units of UDUTH, Sokoto between October 1<sup>st</sup>, 2010 and April 30<sup>th</sup>, 2011 were tested for HIV infection using ELISA tests and HIV-DNA PCR. Nutritional status was determined using the modified Wellcome Classification and socioeconomic classification was by the scheme developed by Oyedeji's. Data were analyzed using SPSS 17.0 statistical package. P-value  $\leq 0.05$  was considered significant.

**Results:** One-hundred under-5 children (64 males, 36 females) with PEM were studied. The mean ( $\pm$ SD) age was  $19.8 \pm 9.2$  months and the majority were

aged 12.0-23.9 months. Twenty-seven of the 100 children with PEM had HIV-infection giving a prevalence rate of 27%: 59.3% in males and 40.7% in females. Among the HIV-infected children, the 24.0 – 35.9 months age group was the most affected (53.8%). Infected and non-infected children were comparable in terms of age ( $\chi^2=7.35$ ,  $p=0.12$ ), gender ( $\chi^2=0.36$ ,  $p=0.55$ ) and socio-economic ( $\chi^2=3.01$ ,  $p=0.25$ ). The mode of transmission was maternal to child transmission in all cases. The highest prevalence of HIV infection was found among marasmus subgroup (65%). Twenty-two (81.5%) of the 27 cases were discharged home, while five patients died giving a case fatality rate of 18.5%.

**Conclusion:** HIV infection is common among under-5 children with PEM with no age, gender or socioeconomic predilection. The clinical type of PEM most often affected is marasmus.

**Key words:** Protein-energy malnutrition, HIV-infection, Under-5

### **Introduction**

Protein-energy malnutrition (PEM) is a prevalent health condition among under-5 children in developing countries, contributes directly or indirectly to almost half of under-five mortalities globally<sup>1</sup>. PEM is estimated to affect every fourth child in the developing world with the regional prevalence range for the mild-moderate and severe forms of 20-40% and 1-10% respectively<sup>2</sup>. According to the 2008 Nigerian Demographic and Health Survey<sup>3</sup>, it was estimated that 41% of the under five children are undernourished in Nigeria with majority seen in the Northwestern part of the country.

Human Immunodeficiency Virus infection is also a major health problem facing the world today. As at the end of 2010, about 34m people were living with HIV worldwide. This includes 3.0 – 3.8 million children aged  $\leq 15$  years, about 68% of whom live in sub-Saharan Africa<sup>4</sup>. HIV infection has a complex and intimate relationship with PEM<sup>5</sup>. The triad of weight loss, chronic diarrhoea and prolonged fever are the major criteria for the diagnosis of symptomatic HIV infection especially in resource-poor settings where laboratory diagnosis of HIV is not always possible. Clinically, unexplained severe wasting or severe malnutrition not responding to standard therapy is classified as Stage IV in paediatrics

HIV/AIDS clinical staging.<sup>6</sup> Both severe malnutrition and HIV have a deleterious effect on the immune system and their clinical presentations overlap with many similarities.<sup>7</sup> Studies have suggested that certain clinical features and co-morbidities may be more predictive of HIV infection in severe PEM<sup>8-11</sup>. These clinical features include lymphadenopathy, oral candidiasis, skin disorders, hepatomegaly, persistent diarrhoea, chronic discharging ears and prolonged fever.

HIV infection and its complications have been associated with nutritional disorders. Several studies both in Nigeria and other parts of Africa have shown that undernutrition (wasting) is a common presentation of HIV/AIDS in children<sup>11-15</sup>. Jiya and coworkers<sup>12</sup> in 2010 reported that 87.8% of the children admitted with HIV infection in Usmanu Danfodiyo University Teaching Hospital, Sokoto had protein-energy malnutrition and majority (58%) of them had marasmus. The cause of undernutrition may be multifactorial including poor intake, GI malabsorption of nutrients, increased nutritional requirement from high basal metabolic rate and psychosocial problems such as poverty, and illness in biological family members<sup>14</sup>.

HIV infection among inpatients and children admitted into nutrition rehabilitation units (NRUs) in sub-Saharan Africa had been reported to be between 8.6-54%<sup>8-11</sup>. However, Adeleke and his colleagues<sup>16</sup> reported HIV infection in 22.6% of children admitted with PEM in Kano, Nigeria. The co-existence of PEM and HIV infection especially among under-5 children increases the morbidity and mortality among this age group, therefore early detection of HIV infection will enhance reduction of morbidity and mortality in both the children and their families. The current study was conducted to determine the prevalence of HIV-infection among children presenting with PEM, its relationship with the clinical types of PEM at presentation and its outcome.

## Subjects and Methods

The cross-sectional study was conducted among under-5 children with protein-energy malnutrition who were seen at the Emergency Paediatric Unit (EPU), Paediatric Outpatient Clinic and Paediatric Medical Ward of Usmanu Danfodiyo University Teaching Hospital, Sokoto between October 1<sup>st</sup>, 2010 and April 30<sup>th</sup>, 2011. The subjects were recruited consecutively till sample size was achieved and all clinical types of PEM were equally represented. Thus, by design, the first 20 patients presenting with each form of malnutrition (underweight, marasmus, underweight-kwashiorkor, kwashiorkor and marasmic-kwashiorkor) were recruited into the study.

The hospital is a tertiary health facility that serves as a referral centre for people of Sokoto, Zamfara, and Kebbi states; and the neighbouring Niger and Benin Republics in the West African sub-region. Sokoto state is located at the extreme part of North-western Nigeria between longitude 3° and 7° East and between latitude 10° and 14°

North of the Equator. It shares borders with Niger Republic to the north, Kebbi State to southwest and Zamfara State to the east<sup>18</sup>. Approval was sought and obtained from the Ethics Committee of the hospital and written consent was also obtained from the parents/guardians of the patients. The information obtained was treated with confidentiality.

The age, sex, weight of the subjects, the presence of oedema, the occupation and the educational level attained by the parents/guardians were documented. The nutritional status and the socioeconomic class were classified using modified Wellcome Classification<sup>18</sup> and the Oyedeji's<sup>20</sup> socio-economic classification respectively.

The HIV status was confirmed using ELISA tests and HIV-DNA PCR (for those aged <18 months) after obtaining parental/caregiver's consent. The parents of the infected children were referred to the HIV Counseling and Testing Unit of the hospital for confirmation of their HIV status. The results of the HIV test for the parents were also documented and those who were positive were referred to Antiretroviral Treatment (ART) Clinic.

The data were entered and analyzed using SPSS 17.0 statistical package. Comparisons were made using chi-square tests and a p-value of less than 0.05 was regarded as statistically significant.

## Results

A total of one-hundred under-5 children with PEM were studied during the seven month study period. There were 64 (64%) males and 36 (36%) females giving a male: female ratio of 1.8:1. The mean ( $\pm$ SD) age was 19.8 $\pm$ 9.2 months with majority aged 12.0 – 23.9 months as shown in Table 1.

Fifty-two of the 100 children had their HIV status confirmed with HIV-DNA Polymerase Chain Reaction (HIV-DNA PCR) while that of the remaining 48 was with ELISA test. Twenty-seven (27%) of the 100 children with PEM were positive for HIV-infection. Among the 27 HIV-infected children, there were 16 males and 11 females with an M: F ratio of 1.45:1 ( $\chi^2=0.36$ ,  $p=0.55$ ) as in Table 1. The age group with the highest prevalence of HIV infection was 24.0 – 35.9 months (53.8%). All the HIV-infected under-5 children with PEM were aged below three years as shown in Table 2. HIV infection was confirmed positive in all the mother of the HIV infected children.

**Table 1:** Age distribution of children with Protein-Energy Malnutrition in relation to HIV study

Age Group months	HIV Status		Total
	HIV-Positive	HIV-Negative	
6.0 – 11.9	6 (33.3)	12 (66.7)	18
12.0 – 23.9	14 (21.2)	52(78.8)	66
24.0 – 35.9	7 (58.3)	5 (41.7)	12
36.0 – 47.9	-	2 (100)	2
48.0 – 59.9	-	2 (100)	2
All	27(27)	73(73)	100

Figures in brackets are percentages of total.  
 $\chi^2=7.35$ ,  $p=0.12$ .

**Table 2:** Gender distribution and HIV Status of Under-5 Children with PEM in UDUTH, Sokoto

HIV Status	Gender		Total
	Female	Male	
HIV-Positive	11(40.7)	16(59.3)	27
HIV-Negative	25(34.2)	48(65.8)	73
All	36(36)	64(64)	100

Figures in brackets are percentages of total.  
 $\chi^2 = 0.36$ ,  $p = 0.55$

Table 3 shows the socioeconomic status (SEC) of the study subjects. About three-quarter of the malnourished were low SEC, one quarter who infected with HIV. The prevalence rates among the malnourished children of the upper and middle SEC were 18.2% and 46.2% respectively. This differences in prevalence rates of HIV infection according to SEC were not statistically significant ( $\chi^2 = 3.01$ ,  $p = 0.25$ ) as depicted on Table 3

All the HIV-infected children with PEM presented with prolonged fever, cough and chronic diarrhoea.

**Table 3:** The Socio-Economic Class of Children with Protein-Energy Malnutrition in relation to HIV Infection

Socio-Economic Class	HIV- Status		Total
	HIV-Positive	HIV-Negative	
Upper	2(18.2)	9(81.8)	11
Middle	6(46.2)	7(53.8)	13
Lower	19(25)	57(75)	76
All	27(27)	73(73)	100

Figures in brackets are percentages of total.  
 $\chi^2 = 3.01$ ,  $p = 0.25$

Table 4 shows that the prevalence of HIV infection was highest among patients with marasmus while no patient with kwashiorkor was infected.

Twenty-three (85.2%) were commenced on antiretroviral drugs. Twenty-two (81.5%) of the 27 of the HIV positive patients were discharged to Paediatric HIV clinic of the hospital while 5(18.5%) died on admission. Among the deaths, there were 4(80%) males and 1 (20%) female ( $\chi^2 = 1.1$ ,  $p = 0.59$ ); while all were aged less than two years ( $\chi^2 = 12.0$ ,  $p = 0.002$ ), 3(60%) presented with marasmus and 2(40%) with marasmic-kwashiorkor ( $\chi^2 = 7.3$ ,  $p = 0.83$ ).

**Table 4:** Types of Protein-Energy Malnutrition and HIV Status among Under-5 with Protein-Energy Malnutrition

Types of PEM	HIV-Status		Total
	HIV-Positive	HIV-Negative	
Marasmus	13(65)	7(35)	20
Underweight	9(45)	11(55)	20
Marasmic-Kwashiorkor	3(15)	17(85)	20
Underweight-kwashiorkor	2(10)	18(90)	20
Kwashiorkor	-	20(100)	20
All	27(27)	73(73)	100

Figures in brackets are percentages of total.  
 $\chi^2 = 29.73$ ,  $p = 0.0001$

## Discussion

HIV infection is a predisposing factor to PEM<sup>3,19</sup>. The co-existence of the two conditions increases the morbidity and mortality in under-5 children<sup>5</sup>. In the present study, the prevalence of HIV infection among the malnourished under-5 children was found to be 27%. This prevalence is comparable to 26.2% reported earlier by Adeleke and colleagues<sup>16</sup> among children with PEM in Kano, Nigeria and 29.2% overall prevalence reported by Fergusson et al<sup>21</sup> in a meta-analysis of seventeen African studies. However, the figure is lower compared to that reported by Bachou and his colleagues<sup>10</sup> who reported 40% among Ugandan children with severe PEM. The difference in the prevalence may be related to the difference in the HIV prevalence in the general population in these areas. As at the end of 2012, 7.2% and 3.7% of the population were living with HIV in Uganda and Nigeria respectively<sup>4</sup>. There was no significant difference in the prevalence in relation to the age, gender and socio-economic status as shown in this study. These factors seem not to confer any protection against HIV infection among the undernourished under-5 children. The most affected clinical type of PEM is marasmus as shown in this study. This is consonance with the findings of earlier workers<sup>7-16</sup>. HIV infection increases susceptibility to recurrent opportunistic infections which in turn reduces food intake, increases the basal metabolic rate, breakdown of muscle proteins, chronic diarrhoea and malabsorption<sup>14</sup>. This results in wasting culminating in PEM and increased morbidity and mortality among under-5s. In view of this observation, there is need for increased index of suspicion of HIV infection in under-5 children presenting with marasmus and such should be offered HIV screening.

The most common mode transmission of paediatric HIV-infection is vertical transmission i.e. mother-to-child transmission. In the current study, mothers of the HIV infected patients were HIV positive. This suggests that all the cases of HIV-infection in this series were likely through mother-to-child transmission. This is comparable to what has been reported in the literature<sup>8-10</sup>. This may imply low coverage of prevention of mother to child transmission (PMTCT) interventions in our community. Therefore, there is need for more concerted efforts to strengthen coverage of PMTCT interventions in our community. This, when implemented simultaneously with other child survival strategies, will go a long way in reducing the prevalence of PEM and indeed under-5 morbidity and mortality in our community in particular and the country at large.

The mortality rate observed in the present study was high but however lower than the earlier reported figures<sup>10,11,21,23</sup>. The high mortality rate may reflect the fact that significant number of perinatally HIV-infected infants tend to have fast progression of the disease with poor prognosis<sup>22</sup>. Perhaps, the lower figure reported in this study may be related to prompt detection and commencement of antiretroviral drugs and control of co-morbid conditions as majority of the diagnosed cases were commenced on antiretroviral drugs while on

admission. The high mortality rate associated with HIV infection co-existing with PEM could be related to the combined deleterious effects of these conditions on the immune system namely acquired immunodeficiency syndromes (AIDS) and nutritionally acquired immunodeficiency syndromes (NAIDS).<sup>7,9</sup> These make them susceptible to potentially life-threatening co-morbidities like PTB, bacteraemia and diarrhoeal diseases which may worsen their chances of survival. It could also be related to the fact that HIV-infected children are more likely to have complicated case management issues like multiple pathology, drug-drug interactions and drug toxicities.

## Conclusion

In conclusion, there is high prevalence of HIV-infection among under-5 children with PEM, mainly transmitted vertically, and the most affected clinical type of PEM in this study was marasmus. There is need, therefore, to provide counseling and testing for children with PEM, especially those presenting with marasmus. This may improve early detection and prompt treatment of children with HIV infection and ultimately improves the outcome and survival of these children in our community. Furthermore, the prevention of MTCT of HIV infection should be given urgent and very serious attention in Nigeria.

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