Human Immunodeficiency Virus in Children with Severe Acute Malnutrition (SAM) at Ola During Children's Hospital Freetown, Sierra Leone.

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Abstract
Background:
Human Immunodeficiency Virus (HIV) occurring in Children with Severe Acute Malnutrition (SAM) constitute two key health problems in sub-Saharan Africa. Where these coexist, disease severity is worse and outcome is poorer. The study looked at the prevalence of HIV in children with SAM and its associated risk factors.

Methodology:
This was a descriptive cross-sectional study carried out in 2018 at the therapeutic feeding centre (TFC) of the Ola During children's hospital in Freetown, Sierra Leone. A non-probability sampling method (opportunistic sampling) was used to recruit children for the study. Children were admitted into TFC, if they met the WHO criteria for SAM. A written consent was obtained from the parents or caregivers of these children. A structured questionnaire was used to collect data on the sociodemographic characteristics, clinical and laboratory data of the children and mother. Obtained data was analysed using Epi-info version 7 and are presented in prose and tables. A test of statistical significance at 95% confidence interval was $p<0.05$.

Result:
Males represented 103(62.8%) while females constituted 60 (36.6%) of the study participants giving a male female ratio of 1.7:1. Forty eight (29.3%) of the mothers had no formal education while 76 (46.3%) had only primary education. Traders and students constituted 89 (54.3%) and 26 (15.9%) of the mother's occupation respectively. Thirty six of the children were found to be HIV positive giving a prevalence of 22%. Among the mothers of children who were HIV positive, 23 (63.9%) had primary education while 9 (25.0%) had no formal education, nearly half (44.4%) of these mothers were petty traders while a quarter (25.0%) were students and this was statistically significant $p < 0.05$. Among the SAM children who were HIV positive, 34 (94.4%) presented with fever while 27 (75.0%) had diarrhoea. There was no statistically significant relationship between fever, diarrhoea and HIV status of the children ($p=0.924$).

Conclusion:
The HIV prevalence of 22% found in this study is high. Also, HIV was commoner among the mothers who were less educated, who were students and petty traders. We recommend: education on HIV risk factors and preventive methods targeted at the less educated and populations of the lower socioeconomic class; screening of all children with SAM for HIV to ensure proper treatment which will improve their outcome; free or augmented female education up to at least secondary level and welfare support for economically disadvantaged women by the government.

Keywords: Severe Acute Malnutrition, HIV, Children

INTRODUCTION

Human Immunodeficiency Virus (HIV) occurring in Children in association with Malnutrition constitute two key health problems in sub-Saharan Africa. [1], [2] Paediatric patients living with HIV who were less than 15years as at 2015 were estimated at 1.8million and 90% of these children existed in sub-Saharan Africa. [3]. Vertical transmission from HIV infected mother to their child throughout pregnancy, delivery or breastfeeding is the commonest mode of transmission in children. [3].

Underweight malnutrition, stunting and wasting occurred amongst twenty-one million, twenty-eight million and fourteen million respectively among children less than five years in addition to Human Immunodeficiency Virus infection in sub-Saharan Africa. [4] In Sierra Leone among children less than 5years, underweight malnutrition, stunting and wasting accounted for 16%, 38% and 9% respectively,

while HIV prevalence was 1.1% among children 15-19years [5]. Co-occurrence of HIV-infection and malnutrition in Paediatric patients is a common occurrence and malnutrition is a main problem in children with HIV infection. [6], [7] HIV infected children are more likely to be malnourished than uninfected children. [8] The rate of recurrence, brutality of infection and deferred recovery from disease is amplified with malnutrition [3], [4] Low weight for age has been described in about fifty percent of children with HIV infection not getting any treatment in low income countries. [9]

Children with severe acute malnutrition (SAM) who are HIV infected are three times more likely to die than children who are not HIV infected. [10] HIV infected child is expected to increase their energy demand by fifty percent to hundred percent when they have SAM as against ten percent by their counterparts who do not have any symptoms. [11] The Burden of HIV among malnourished children cannot be overemphasized. An improved understanding of this problem is vital especially in sub-Saharan Africa to enhance the care of malnourished children especially in the context of HIV, hence this study is on the prevalence of HIV among children with SAM at Ola During Children's hospital in Freetown Sierra Leone.

METHODOLOGY

This was a descriptive cross-sectional study carried out in 2018 at the therapeutic feeding centre (TFC) of the Ola During children's hospital in Freetown, Sierra Leone. A place where children with SAM are admitted and managed. Ola During Children's hospital is the only tertiary hospital in Freetown for the treatment of children. It receives referrals from all over the country. A non-probability sampling method (opportunistic sampling) in which every next child admitted into TFC, whose parents and caregivers gave consent for the study was used to recruit children until a calculated sample size of 164 was achieved. Under-five children admitted in to TFC during the period of the study formed the sample population. The children were admitted into TFC, if they met the WHO criteria for SAM. Severe acute malnutrition criteria was met as defined by WHO, if there was very low weight for height (Below -3zscores of the median NCHS/WHO growth standards), or visible severe wasting, or presence of nutritional oedema. [12] WHO Child Growth Standards and the identification of Severe Acute Malnutrition in infants and Children is a joint Statement by the World Health Organisation and the United Nations Children's Fund, 2009. All parents or caregivers whose children were on admission at TFC during the period of the study, who were approached by the researcher consented for the study. A structured questionnaire was used to collect data on parents/caregiver's and child's sociodemographic characteristics, presence or absence of fever and diarrhoea in the child and HIV status of the children. Obtained data was entered into Microsoft excel spread sheet and analysed using Epi-info version 7 and are presented in prose and tables. A test of statistical significance at 95% confidence interval was $p<0.05$

Results

I. Sociodemographic characteristics of the study population:

Males represented 103(62.8%) while females constituted 60 (36.6%) of the study participants giving a male female ratio of 1.7:1. More of the children (62.2%) were aged between 12 -59 Months. Forty eight (29.3%) of the mothers had no formal education while 76 (46.3%) had only primary education. Traders, students, housewife and unemployed represented 89 (54.3%), 26 (15.9%), 12 (7.3%) and 11 (6.7%) respectively of the mothers' occupation. Table 1

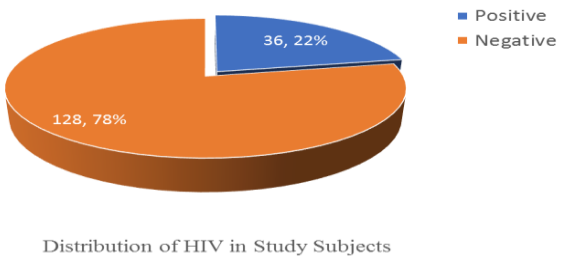
Table 1: Sociodemographic Information

Variable	***Frequency (n= 164)***	***Percent (%)***
Gender		
Male	*103*	*62.8*
Female	*60*	*36.6*
Not documented	*1*	*0.6*
Age Group (months)		
1 – 11	*62*	*37.8*
12 – 59	*102*	*62.2*
Mean age (months)	***15.8 ±9.2***	
Mother's Education		
No Formal education	*48*	*29.3*
Primary	*76*	*46.3*
Secondary	*32*	*19.5*
Tertiary	*5*	*3*
No Record	*3*	*1.8*
Mother's Occupation		
Caterer	*1*	*0.6*
Driver	*1*	*0.6*
Electrician	*1*	*0.6*

Teacher	*1*	*0.6*
Student	*1*	*0.6*
Business	*2*	*1.2*
Caregiver	*2*	*1.2*
Farmer	*3*	*1.8*
Tailor	*4*	*2.4*
Hair Dresser	*7*	*4.3*
Unemployed	*11*	*6.7*
Housewife	*12*	*7.3*
Student	*26*	*15.9*
Trader	*89*	*54.3*
No Response	*3*	*1.8*

II. Prevalence of HIV among children with Severe Malnutrition

Thirty six were found to be HIV positive among the study population giving a prevalence of 22% as shown in figure 1.



Distribution of HIV in Study Subjects

III. Association between HIV and Age group:

Among the children who were HIV positive, over a third (36.1%) were less than one year while 23 (63.9%) were aged between 12-59 Months. There was no statistically significant difference between HIV status and age p=0.812 (Table 2)

Table 2: Association between Age groups and HIV status

Age Groups (months)	***Positive***	***Negative***	***Chi-Square (p-value)***
1 – 11	*13 (36.1)*	*49 (38.3)*	*0.05 (0.812) ***
12 – 59	*23 (63.9)*	*79 (61.7)*	
Total	***36 (100.0)***	***128 (100.0)***	

***Distribution is not statistically significant (p > 0.05)*

IV. HIV Status and Mothers Education

Among the mothers of children who were HIV positive, 23 (63.9%) had primary education while 9 (25.0%) had no formal education. There was no statistically significant association between HIV status of the children and their mothers' education p = 0.122 (Table 3)

Table 3: HIV Status and Mothers Education

Educational Status	***HIV Positive***	***HIV Negative***	***Chi-square (p-value)***
No Formal education	*9 (25.0)*	*39 (30.0)*	
Primary	*23 (63.9)*	*53 (41.4)*	
Secondary	*4 (11.1)*	*28 (21.9)*	*7.27 (0.122) ***
Tertiary	*0 (0.0)*	*5 (3.9)*	
No Record	*0 (0.0)*	*3 (2.3)*	

Total	*36 (100.0)*	*128 (100.0)*

***Association is not statistically significant (p > 0.05)*

V. HIV and Mothers occupation:

A significant proportion of the mothers in this study were traders and they constituted nearly half (44.4%) of the mothers whose children were HIV positive while a quarter (25.0%) of the mothers were students. There was a statistically significant relationship between mothers who are Traders, students and HIV status p < 0.05 (Table 4)

Table 4: Association of Mother's Occupation and HIV status in subjects

Occupation of mothers	***HIV Positive (n, %)***	***HIV Negative (n, %)***	***Chi-square (p-value)***
No Response	*2 (5.6)*	*1 (0.8)*	*3.56 (0.0589)***
Trader	*16 (44.4)*	*73 (57.0)*	*49.66 (0.0001)**
Hair Dresser	*2 (5.6)*	*5 (3.9)*	*0.18 (0.6658)***
Student	*9 (25.0)*	*17 (13.3)*	*5.88 (0.0152)**
Unemployed	*1 (2.8)*	*10 (7.8)*	*1.13 (0.2860)***
Caterer	*1 (2.8)*	*0 (0.0)*	*3.57 (0.0585)***
Driver	*0 (0.0)*	*1 (0.8)*	*0.28 (0.5947)***
Farmer	*1 (2.8)*	*2 (1.6)*	*0.23 (0.6307)***
Tailor	*0 (0.0)*	*4 (3.1)*	*1.51 (0.2829)***
Housewife	*2 (5.6)*	*10 (7.8)*	*0.21 (0.6459)***
Electrician	*0 (0.0)*	*1 (0.8)*	*0.28 (0.5947)***
Business	*1 (2.8)*	*1 (0.8)*	*0.28 (0.5947)***
Teacher	*0 (0.0)*	*1 (0.8)*	*0.28 (0.5947)***
Student	*0 (0.0)*	*1 (0.8)*	*0.28 (0.5947)***
Caregiver	*1 (2.8)*	*1 (0.8)*	*0.92 (0.3449)***
Total	***36 (100.0)***	***128 (100.0)***	

VI. HIV status of children with SAM and Fever

Among the SAM children who were HIV positive, 34 (94.4%) presented with fever. A similar proportion (93.0%) among those who were HIV negative also presented with fever. There was no statistically significant relationship between HIV status and fever p=0.755 (Table5)

Table 5: HIV and Fever

Fever	***HIV Positive***	***HIV Negative***	***Chi-square (p-value)***
Yes	*34 (94.4)*	*119 (93.0)*	*0.98 (0.755) ***
No	*2 (5.6)*	*9 (7.0)*	
Total	***36 (100.0)***	***128 (100.0)***	

***Distribution is not statistically significant (p > 0.05)*

VII. HIV status of children with SAM and Diarrhoea

Twenty seven (75.0%) of the SAM children who were HIV positive had diarrhoea, while 95 (74.2%) of those who were HIV negative also had diarrhoea. There was no statistically significant relationship between HIV status and diarrhoea p=0.924 (Table 6)

Table 6: HIV and Diarrhoea

Diarrhoea	***HIV Positive***	***HIV Negative***	***Chi-square (p-value)***
Yes	*27 (75.0)*	*95 (74.2)*	*0.01 (0.924) ***
No	*9 (25.0)*	*33 (25.8)*	
Total	***36 (100.0)***	***128 (100.0)***	

***Distribution is not statistically significant (p > 0.05)*

DISCUSSION

The prevalence of HIV among malnourished children of 22% found in this study is high. This is similar to the finding of Chinkhumba J et al [13] who found a prevalence of 17.4% among severely malnourished children in Malawi. However, De Maayer T et al [14] and Amadi B et all [15] found a higher prevalence of 51.0% and 54% among children with severe acute malnutrition (SAM) in South Africa and those with persistent diarrhoea and malnutrition in Zambia respectively. The lower prevalence found in this study may reflect the general low prevalence of HIV in Sierra Leone among women as compared to that in South Africa and Malawi [16]- [18]. Due to a strong direct association between HIV prevalence in women and HIV in children, the prevalence of HIV among children with SAM in any area will generally reflect the prevalence of HIV among women in that area, hence areas with high HIV prevalence among women are more likely to have a higher HIV prevalence among children with SAM as was found in the South African study when compared to this study in Sierra Leone [16] where the HIV prevalence is lower.

Generally, many children with HIV are at increased risk for malnutrition and vice versa. The reason for this is multifactorial and include; reduced food intake and vomiting which could result from infections like oral thrush and oesophagitis by candida a very common opportunistic infection in these patients, malabsorption from acute and persistent diarrheal diseases [19], nausea and vomiting from medication side effects, increased nutritional requirement during fever and infections that accompany HIV infection and or SAM. This leads to loss of weight and lean muscle tissue. Also, worldwide, malnutrition is the most common cause of immunosuppression. Malnutrition as well as HIV have immunosuppressant effect and where both coexist, there is a double barrel effect on immunosuppression. Malnutrition, immune system, and infectious diseases are interlocked in a complex negative cascade and it elicits dysfunctions in the immune system and promotes increased vulnerability of the host to infections including HIV/AIDS [20], [21].

There was no significant association between the HIV status of the children with SAM and their age group in this study. Severe acute malnutrition and clinical manifestations of HIV disease are commoner in under-fives especially in infancy. This study findings were in tandem with existing literature as over a third of these children in HIV positive (36.1%) and HIV negative (63.9%) children were infants respectively [5]-[7].

Socioeconomic status of children is largely determined by the educational and occupational status of their parents. Since HIV in children (especially under-fives) is directly proportional to the HIV status of their mothers, we compared the HIV status of these children with the educational and occupational status of their mothers and the findings were interesting. Though there was no statistically significant association between HIV status of the children with SAM and their mother's education, it was found that none of these mothers whose children were HIV seropositive had secondary or tertiary education. Twenty three (63.9%) had primary while 9 (25.0%) had no formal education. This finding is in synchrony with other related studies where individuals from lower socio-economic class had higher risk of HIV [22], [23]. In a study [22] among gay men, it was found that Poorly educated gay men had poorer knowledge about HIV and preventive behaviour, perceived social norms to be less favourable towards condom usage with casual partners, and had lower perceived control over that behaviour than the better educated men. Poorly educated men were also more likely to have engaged in unprotected anal sex with casual partners in the six-month period that followed the assessment of the social cognitions. This sexual behaviour pattern among less educated gay men may not be different from that in poorly educated women as was found in this study. A more intense education of the general public especially sexually active populations on HIV and its preventive and transmission modes with a target at reaching the less educated population may cause a behavioural change that may change this trend among these population in Sierra Leone. Some study however found a disconnection between Knowledge of HIV and the practice of protective sexual behaviour against it [24], [25].

This study found a statistically significant relationship between the HIV status of the children with SAM and mothers who are Petty traders and Students. Nearly half (44.4%) and a quarter (25.0%) of the mothers whose children were HIV positive were petty traders and students respectively. The risk of acquiring HIV varies with different occupation and even in the same occupation, the risk varies between men and women. Petty traders may be at increased risk for HIV due to poorer knowledge and preventive practices against HIV. Sirika et al [26] found that a number of risk behaviors such as having multiple partners, non-use of condoms and excessive consumption of alcohol were practiced by petty traders. Also, they are at increased risk of frequent contraction of sexual transmitted infections (STIs) other than HIV/AIDS and this increased their chances for HIV/AIDS infection. Students have an increased risk to HIV due to several factors. Factors such as peer pressure, lack of maturity, and alcohol and drug use put students at risk for HIV infection. Students may have unprotected sex with multiple partners or while under the influence of alcohol or drugs. This may be something they wouldn't do if not under the influence. Abandoning safer sex techniques and failing to use condoms correctly and consistently can lead to possible HIV infection or other sexually transmitted infection (STI).

Having an STI can increase their chances of getting HIV/AIDS.

Malnutrition or HIV alone or in combination can cause significant immunosuppression in children and increase their susceptibility to infection. This may manifest with features such as fever or diarrhoea. Fever may be a manifestation of infection and or an ongoing inflammation in any of the body systems while diarrhoea caused by the usual or opportunistic pathogen in under-fives is mediated via alteration in all defence mechanisms including anatomic barriers, cell-mediated immune (CMI) responses, phagocytic cell/microbicidal functions, and humoral (antibody and complement responses) causes significant immunosuppression among these children [27]. This study found no significant difference among the HIV negative and positive children with SAM who presented with fever and diarrhoea. This is probably because severe acute malnutrition (SAM) alone causes significant immunosuppression that also increases their susceptibility to infection even in the absence of HIV. A study found a similar result but however noted that persistent diarrhoea was commoner in children with SAM and HIV [20]. The immune dysfunctions associated with malnutrition are referred to as Nutritional-Acquired Immune Deficiency Syndrome (NAIDS) [27]. Some of the immunological changes observed in malnourished individuals bear a striking resemblance to those encountered in HIV infection [27]

CONCLUSION

The HIV prevalence of 22% among children with SAM found in this study is high. Also, it was found that HIV is commoner among the mothers who were less educated, who were students and petty traders. However, the risk of presenting with features suggestive of infection such as fever and diarrhoea were similar among the HIV positive and negative children. The following are hereby recommended;

1. Education on HIV risk factors and preventive methods targeted at the less educated and populations of the lower socioeconomic class. This will mediate behavioural change and reduce the prevalence of HIV in these mothers and hence prevalence of HIV in children and malnourished children at large.
2. All children with SAM must be screened for HIV since the additional use of highly active anti-retroviral therapy (HAART) will improve the outcome of children with SAM who are HIV positive.
3. Free female education up to at least secondary level by the government and economic empowerment of women as well is advocated.

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