

## Original Research Article

## Assessment of Nutritional Status and Health Problem that affect under five Children Living with HIV/AIDS at the Tropical Diseases Teaching Hospital (2021)

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**Abstract:** Malnutrition is a major health problem especially for HIV-infected children. There is a vicious circle between HIV infection and malnutrition. Approximately 980 children became infected with HIV and approximately 320 children died from AIDS related causes, mostly because of inadequate access to HIV prevention (WHO, 2020). The study aimed to assess the nutritional status of under- five children living with HIV/AIDS at the Tropical Diseases Teaching Hospital-Sudan 2021. **Methodology:** A descriptive cross sectional hospital base study conducted at Tropical Diseases Teaching Hospital. 88 HIV- infected children attending Tropical Diseases Teaching Hospital were selected as participants. Data were collected using designed interview questionnaire. **Results:** According to (MUAC) 36.5% of the HIV- infected children were severely malnourished, 26.9% were moderately malnourished. According to weight – for –Height 76.1% of the HIV- infected children were underweight. According to height – for – age 39.6% of the HIV- infected children were moderately and mild impairment. 47.7% of the HIV- infected children have diarrheal disease during the last month. HIV- infected children's mothers attending the Tropical Diseases Teaching Hospital received health counselling from Health care providers. HIV- infected children were facing nutritional complications such as malnutrition, oral problems, lack of appetite, growth retardation. **Conclusion:** More than half of HIV- infected children were malnourished, facing nutritional complications such as, oral problems, lack of appetite, diarrhoea, growth retardation that are impaired their immunity. Adequate nutrition cannot cure HIV infection, but it is an essential part of maintaining the immune system and physical activity and of achieving optimal quality of life. **Recommendation:** Special attention of nutritional requirements for HIV- infected children, increases of mother's awerance about the health problem impaired child immunity. Nutritional assessment and support should be integrated into the routine care of HIV-infected children.

**Keyword:** HIV, Malnutrition, Nutrition status, Dietary Management.

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### 1. BACKGROUND

Human Immunodeficiency Virus (HIV) is a virus spread through certain body fluids that attacks the body's immune system, specifically CD4 cells, often called T cells [1].

#### AIDS

Acquired immunodeficiency syndrome is a chronic, potentially life-threatening condition caused by the human immunodeficiency virus (HIV). By damaging your immune system [1] HIV affects the body's ability to fight off infection and disease, which ultimately can lead to death.

Medications used to treat HIV have enhanced the quality of life and increased life expectancy of HIV-

infected individuals. These *antiretroviral therapy (ART)* medication slow the replication of the virus but do not eliminate HIV infection. With increased access to ART, people are living longer with HIV [2].

Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. The term malnutrition covers 2 broad groups of conditions. One is 'under nutrition'—which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other one is overweight, obesity and diet-related non communicable diseases such as heart disease, stroke, diabetes, and cancer [3].

The HIV/AIDS epidemic continues to have a devastating impact on health, nutrition, food security and overall socioeconomic development in the countries that have been greatly affected by the disease [4].

The adverse effects of HIV and AIDS on nutritional status occur while the body simultaneously needs the best possible nutrition. This often results in rapidly accelerated weight loss, malnutrition, and wasting. Adequate nutrition cannot cure HIV infection, but it is an essential part of maintaining the immune system and physical activity and of achieving optimal quality of life [5]. Replenishment of macronutrients and micronutrients is an essential intervention for people living with HIV and AIDS to mount an effective immune response to fight opportunistic infections. It is required to optimize the benefits of antiretroviral treatment (ART) and may significantly lengthen the period between HIV infection and the onset of active illness [6].

Children deserve special attention of nutritional requirements which is necessary for growth and development. Nutritional assessment and support should be integrated into the routine care of HIV-infected children. Dietary interventions should consider issues of food security, food quantity and food quality, as well as absorption and digestion of nutrients [7].

Nutrition and HIV are related to each other. Malnutrition further worsens the effect of HIV and contributes to more rapid progression to AIDS. Malnutrition can both contribute to and result from the progression of HIV. In fact, the linkages between HIV/AIDS and food security are bi-directional: HIV/AIDS is a determining factor of food insecurity as well as a consequence of food and nutrition insecurity [8].

Nutritional problems are among the first negative effects of HIV infection. These problems are due to inadequate diet intake and altered metabolic conditions, provoking impaired balance of energy and nutrients in patients even when they are treated with anti-retroviral therapy (ART) [9].

Most children who have HIV got it from their mother during pregnancy, during the birth process, or during breastfeeding. Women who are tested, and then stick with treatment if they're positive, greatly lower the chance of passing the virus to their babies. This is the best way to prevent HIV in children [4].

#### **Suggestions for Symptom Management** (Dietary Management)

**1. Nausea:** small frequent meals, avoidance of high fat greasy foods, cool or temperature foods, avoidance of lying down after eating. Take medications after meal.

- 2. Sore mouth or throat:** soft moist foods, avoidance of spicy or acidic foods, (avoidance of very hot or very cold or room temperature foods are best).use of nutrient and energy dense foods and maximize oral intake. Xerostomia (Dry mouth) use foods that are moist or served with a sauce ,emphasis on good oral hygiene: flossing brushing and rinsing, regular dental care, use of fluoride gels or mouth washes, consideration of prophylactic anti fungal therapy, chewing of sugarless gum or sucking mints.
- 3. Diarrhea:** Fluid and electrolyte replacement, low insoluble and soluble fibre diet, low fat diet, avoidance of gas causing foods and beverages, avoidance of caffeine, Take medications after meal.
- 4. Constipation:** increase fluid intake, increase dietary fibre intake. Inadequate oral intake: use of nutrient and energy dense foods including nutritional supplements, use of small frequent meals and snacks, consideration of alternative nutrition support or appetite stimulant.
- 5. Fatigue:** Adequate sleep, relaxation, exercise, adequate diet especially foods rich with vitamin B12, foliate, carotene or zinc in adequate amounts, avoided caffeine, identify and manage the possible cause of Anaemia.
- 6. Body cell mass loss Diet:** 500 calories above daily energy requirements .1.6-1.8g protein/kg current weight per day) [10].

#### **1.1 Statement of the Problem**

Underweight, stunting, and wasting were present among 21 million, 28 million, and 14 million children less than 5 years of age, respectively. HIV infection and malnutrition often coexist in children, and malnutrition is a major problem for HIV-infected children. The risk for malnutrition was significantly higher in HIV-infected children than in HIV-uninfected children. Malnutrition also increased the frequency and severity of infection and delayed recovery from disease [11]. Sudan is confronted with the fact that almost one-third of the current youth will not be able to contribute to the nations' development due to the chronic malnutrition that affected them during their childhood period [12].

#### **1.2 Justification**

Among children with severe malnutrition, the risk of death is three times higher in HIV-infected children compared to those who are not infected Human immunodeficiency virus (HIV) infection is also a major public health problem in children. In 2015 about 1.8 million children under 15 years of age were infected with HIV worldwide, with About 52 million children under five years of age suffer from wasting, while 155 million are affected by stunting and 41 million are overweight. Nutritional problems are among the first negative effects of HIV infection [9].

There are groups in the Sudanese population that are particularly vulnerable to malnutrition,

including those living with HIV, and those living in institutional settings [13]. This vulnerable group needed more attention and studies to highlight their problems. Nutritional assessment and support should be integrated into the routine care of HIV-infected children.

### 1.3 General Objective

To assess the Nutritional status of under five children living with HIV/AIDS at the Tropical Diseases Teaching Hospital-Sudan 2021.

### 1.4 Specific Objectives

1. To determine the anthropometric measurements of under five children with HIV/AIDS at the Tropical Diseases Teaching Hospital.
2. To determine the dietary intake of under- five children with HIV/ AIDs at the Tropical Diseases Teaching Hospital
3. To identify the health complications that affects under five children with HIV/AIDS at the Tropical Diseases Teaching Hospital.

## 2. METHODOLOGY

### 2.1 Study design

Cross sectional, descriptive Hospital based study.

### 2.2 Study Area

The Tropical Diseases Teaching Hospital is located at Shuhad'aa Omdurman locality. It has been established 2003 to provides services to malnutrition children. The hospitals consist of four departments, Paediatric (clinic, counsellor, and reception), Laboratory, Pharmacy and Administration with the purpose of effective and efficient health care. The hospital provides outpatients clinic, follow up, free medical treatment and nutrition counselling to HIV positive children under-five year.

Five health care providers work in the hospital (two medical doctors, one pharmacologist, two laboratory's technician,) beside security guard and cleaners.

### 2.3 Target group

Under five children with HIV/AIDS at the Tropical Diseases Teaching Hospital

### 2.4 Sample size

88 under-five children with HIV/ AIDs attending the Tropical Diseases Teaching Hospital during the collection of data

### 2.5 Data Collection

Questionnaire was carefully prepared, tested and directed to obtain data regarding assessment of the nutritional status of under five children living with HIV/AIDS at the Tropical Diseases Teaching Hospital-Sudan 2021.

### 2.6. Data Analysis

Data were analyzed using software computerized programmer Statistical Package for Social Sciences (SPSS) Version 24.0. Percentage, Mean+ SD used to presents the data.

### 2.7 Ethical Considerations

Ethical approval will be obtained from the University of Bahri, Ministry of Health, Tropical Diseases Teaching Hospital's authorities and patient's family to participate in the study obtained before commencement of the research. All collected data will be treated with most confidentiality and will only be used for scientific purpose.

## 3. RESULTS

**Table 1: Characteristics of the HIV infected children N=88**

Child Age (M)	Frequency	%
-12	22	25
13-24	24	27.2
25-36	19	21.6
37-48	18	20.5
49-60	5	5.7
<b>Total</b>	<b>88</b>	<b>100</b>
<b>Gender</b>		
Male	25	28.4
Female	63	71.6
<b>Total</b>	<b>88</b>	<b>100</b>

Table 1 Represents the age and gender characteristics of study group. Most of the participants their age between 13-36month 45.8%, the majority were female 71.6%.

**Table 2: Mid-Upper Arm Circumference (MUAC) of HIV children N=88**

Age	Sex	Mean + SD	Severe *(1)		Moderate *(2)		Normal *(3)		Total n
			N	%	N	%	n	%	
<6	Male	7.9+5.3	1	50	1	50	0.0	0.0	2
	Female	11.7+0.38	2	33.3	4	66.7	0.0	0.0	6
6-8	Male	12.7+0.0	0.0	0.0	1	100	0.0	0.0	1
	Female	11.4+1.26	1	16.6	5	83.3	0.0	0.0	6
9-11	Male	13.6+0.0	0.0	0.0	0.0	0.0	1	100	1
	Female	11.0+1.2	1	50	1	50	0.0	0.0	2
12-17	Male	9.5+1.8	2	66.7	1	33.3	0.0	0.0	3

	Female	12.2+1.09	0.0	0.0	2	66.7	1	33.3	3
18-23	Male	10.3+3.0	2	50	1	25	1	25	4
	Female	9.8+1.7	4	100	0.0	0.0	0.0	0.0	4
24-35	Male	10.1+2.8	2	40	2	40	1	20	5
	Female	9.7+1.7	9	69.2	3	23	1	7.6	13
36-47	Male	11.8+3.7	2	33.3	0.0	0.0	4	66.7	6
	Female	12.1+1.6	4	36.3	1	9	6	54.5	11
48-	Male	12.7+0.89	0.0	0.0	2	66.7	1	33.3	3
	Female	12.8+1.46	2	11.1	1	5.5	15	83.3	18
Total	Male	10.8+3.08	9 36		8 32		8 32		25
	Female	11.57+1.91	23 36.5		17 26.9		23 36.5		63

Source: Field.

\*(1)/ Severe: Less than 11.5 CM

\*(2)/ Moderate: 11.5 -12.4) CM

\*(4)/ Normal: More than 12.4 CM

Table 2 shows the nutritional status of the children using Mid-Upper Arm Circumference (MUAC), which is an indicator of chronic malnutrition.

36.5% of the study group were severely malnourished, 26.9% were moderately malnourished.

**Table 3: Nutritional Status according to Weight – for –Height N=88**

Age	Sex	Mean + SD	Underweight *(1)		Healthy *(2)		Overweight *(3)		Obese *(4)		Total n
			N	%	N	%	N	%	N	%	
<6	Male	12.91+1.28	2	100	0.0	0.0	0.0	0.0	0.0	0.0	2
	Female	11.28+4.05	6	100	0.0	0.0	0.0	0.0	0.0	0.0	6
6-8	Male	15.38+0.0	1	100	0.0	0.0	0.0	0.0	0.0	0.0	1
	Female	14.34+1.35	6	100	0.0	0.0	0.0	0.0	0.0	0.0	6
9-11	Male	9.59+0.0	1	100	0.0	0.0	0.0	0.0	0.0	0.0	1
	Female	15.43+1.73	2	100	0.0	0.0	0.0	0.0	0.0	0.0	2
12-17	Male	12.48+6.04	2	66.7	1	33.3	0.0	0.0	0.0	0.0	3
	Female	13.44+0.39	3	100	0.0	0.0	0.0	0.0	0.0	0.0	3
18-23	Male	14.38+3.28	4	100	0.0	0.0	0.0	0.0	0.0	0.0	4
	Female	14.35+0.62	4	100	0.0	0.0	0.0	0.0	0.0	0.0	4
24-35	Male	13.12+3.71	5	100	0.0	0.0	0.0	0.0	0.0	0.0	5
	Female	13.02+2.79	13	100	0.0	0.0	0.0	0.0	0.0	0.0	13
36-47	Male	15.34+4.29	2	33.3	4	66.7	0.0	0.0	0.0	0.0	6
	Female	16.48+3.67	8	72.7	3	27.3	0.0	0.0	0.0	0.0	11
47-	Male	16.16+0.84	0.0	0.0	3	100	0.0	0.0	0.0	0.0	3
	Female	18.37+4.92	8	44.4	8	44.4	2	11.2	0.0	0.0	18
Total	Male	13.16+5.56	17 68		8 32		0.0 0.0		0.0		25
	Female	15.29+4.22	50 79		11 17		2 3.2		0.0		63
			76.1%		21.6		2.27				100%

Source: Field

\*(1)/ Underweight: below 18.5 CM

\*(2)/ Healthy: (18.5 -24.9) CM

\*(3)/ Overweight: (25-29.9) CM

\*(4)/ Obese: 30 & above CM.

Table 3 Represents the weight-for-age for the study group. (76.1%) of the study group were underweight. Weight loss and malnutrition are common

among patients with HIV infection and are likely to accelerate disease progression and increase morbidity and mortality.

**Table 4: Nutritional Status according to Height – for – Age N=88**

Age	Sex	Mean + SD	Severely impaired *(1)		Moderately impaired *(2)		Mildly impaired *(3)		normal *(4)		Total n
			n	%	N	%	n	%	n	%	
<6	Male	6.2+1.1	2	100	0.0	0.0	0.0	0.0	0.0	0.0	2
	Female	6.08+0.73	0.0	0.0	0.0	0.0	3	50	3	50	6
6-8	Male	8+0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	100	1
	Female	7.83+0.4	0.0	0.0	1	14.3	3	42.8	3	42.8	7
9-11	Male	9+0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	100	1
	Female	9.2+0.35	0.0	0.0	1	50	1	50	0.0	0.0	2
12-17	Male	12.2+0.2	1	33.3	2	66.7	0.0	0.0	0.0	0.0	3
	Female	12+0.11	0.0	0.0	0.0	0.0	1	33.3	2	66.7	3
18-23	Male	13.1+0.19	1	33.3	1	33.3	1	33.3	0.0	0.0	3
	Female	13+0.0	0.0	0.0	3	75	1	25	0.0	0.0	4
24-35	Male	14+0.0	2	33.3	1	16.6	3	50	0.0	0.0	6
	Female	13.8+1.68	2	14.2	9	64.2	2	14.2	1	7.1	14
36-47	Male	16+0.0	0.0	0.0	2	50	3	50	0.0	0.0	6
	Female	16.2+0.9	1	14.2	4	57.1	2	28.5	0.0	0.0	7
48-	Male	18+0.0	0.0	0.0	1	33.3	2	66.7	0.0	0.0	3
	Female	18.2+0.47	1	5	7	35	12	60	0.0	0.0	20
Total	Male	13.55+3.3	6 24		8 32		9 36		2 8		25
	Female	13.92+4.2	4 6.3		25 39.6		25 39.6		9 14.2		63

Source: Field.

\*(1)/severely impaired: <80

\*(2)/moderately impaired: 80-87.5

\*(3)/mildly impaired: 87.5-95.

\*(4)/normal: >95

The nutritional status of HIV positive children at Tropical disease centre according to Height-for-age is shown in Table 4. (11.36%) were severely impaired,

(37.5%) of the study group were moderately impaired, and (38.6%) were mildly impaired.

**Table 5: Diseases during last month N=88**

Disease	Frequency	%
Diarrhoea	42	47.7
Nausea	1	1.1
Vomiting	11	12.5
Cough	6	6.8
Fever	17	19.3
Poor appetite	1	1.1
No sickness	10	11.4
Total	88	100.0

Table 5 shows the diseases affects the HIV infected children. 47.7% of the children have diarrhoea during the last month.

**Table 6: Type of Food taken /day N=88**

Food category/day	Frequency	(%)
Cereals/ Fruits/vegetables	56	63.6
Eggs	14	15.9
Meats	6	6.8
Milk and products	12	13.6
Total	88	100

Table 6 Shows type of food the infected child with HIV taken/day. 63.6% of the study group used cereal/ Fruits/vegetables daily.

**Table 7: Types of ARTs Drugs given to the HIV children**

Treatment apart from ARV	frequency	(%)
Temixys	20	22.7
Lamivudine	17	19.3
Aluvia	24	27.3
Abacavir sulfate	8	9.0
Efavirenz	19	21.5
Total	88	100

Table 7 Shows the types of ARTs Drugs given to the HIV children. All the children in this study got free ARTs treatment from the hospital as recommended for the HIV infected children.

#### 4. DISCUSSION

Most of the participants their age between 13-36month 45.8%, the majority of the study group are female 71.6% (Table 1). All under-five children have HIV from their mothers, this result agree with [13] the majority of these infections stem from mother-to-child transmission in uterus, during delivery, or through consumption of HIV-infected breast milk.

36.5% of the study group were severely malnourished, 26.9% were moderately malnourished. More than half of HIV-infected children have malnutrition (Table 2). Malnutrition is a major problem especially for HIV-infected children. Study done by [14] said that there is a vicious circle between HIV infection and malnutrition, this vicious circle contributes in depressing the child's immune system. Immuno depression combined with HIV infection and malnutrition is a determinant of poor prognosis for child survival even with antiretroviral therapy (ART). HIV-infected children with malnutrition have a poorer prognosis than their uninfected counterparts [15].

(76.1%) of the study group were underweight (Table 3). Weight loss and malnutrition are common among patients with HIV infection and are likely to accelerate disease progression and increase morbidity and mortality [2]. Wasting and weight loss are common features of HIV infected children [5]. Poor growth may be an early indicator for progression of HIV disease. Growth failure can result from HIV infection itself [16] Early identification of malnutrition is necessary to undertake preventive measures and appropriate therapeutic strategies [17].

(11.36%) were severely impaired, (37.5%) were moderately impaired, (38.6%) were mildly impaired (Table 4). where is the impaired is severely or moderately or mildly the sequences is result of stunting (low height for age), wasting (low weight for height), which refers to deficiencies, or imbalances in a person's intake of energy and/or nutrients [3].

Weight and height of HIV-infected children generally lags behind uninfected children of the same age. Loss of lean body mass with no changes in total

body weight also can occur. To appropriately measure body changes, serial anthropometric measurements should be recorded, along with tracking of height and weight on growth charts [18].

47.7% of the children have diarrhoea during the last month (Table 5). Failure to thrive, upset stomach, nausea, vomiting or diarrhoea are common feature of symptoms appear on HIV infected children which may lead to malnutrition [19].

63.6% of the study group used cereal/vegetables and fruits food as main dish taken daily (Table 6). HIV infected children were not takes enough adequate diet. Dietary interventions should consider issues of food security, food quantity and food quality, as well as absorption and digestion of nutrients [7]. WHO recommended that asymptomatic HIV infected children should increase his/her energy intake by 10%, compared to a non-infected child but if they were symptomatic HIV infection or episodes of opportunistic infection developed also added to up to 20–30% and when a severe malnutrition episode occurs added up to 50–100% [20].

Adequate and balanced nutrition intake is essential for children living with HIV, to maintain a healthy immune system and prolong life. It has been documented that children and adults who are living with HIV have lower fat-free and total fat mass [21]. Proper nutrition may help maintain lean body mass, reduce the severity of HIV-related symptoms, improve quality of life, and enhance adherence to and effectiveness of ART 100%, all the children in this study got free ARTs treatment from the hospital as recommended for the HIV infected children (Table 7). Even the study group take ARTs medication but they developed malnutrition and this disagree with what stated by [22] children treated with ARTs become less immune deficient, and their nutritional status improves.

Interactions between food and drugs can influence the efficacy of the drug or may cause additional or worsening adverse effects. ART medications can cause diarrhea, fatigue, gastro-esophageal reflux, nausea, vomiting, dyslipidemia, and insulin resistance [23].

#### 5. CONCLUSION

More than half of HIV- infected children were malnourished, facing nutritional complications such as,

oral problems, lack of appetite, diarrhoea, growth retardation that are impaired their immunity. Adequate nutrition cannot cure HIV infection, but it is an essential part of maintaining the immune system and physical activity and of achieving optimal quality of life.

## 6. RECOMMENDATION

Special attention of nutritional requirements for HIV- infected children, increases of mother's awareness about the health problem impaired child immunity. Nutritional assessment and support should be integrated into the routine care of HIV-infected children

## REFERENCES

1. Centre for Disease Control and Prevention (CDC). (2019). Stages of HIV/AIDS. <https://www.cdc.gov/hiv/basics/whatishiv.html>
2. Kimberly, R., & Cindy, M. (2017). Medical Nutrition Therapy for HIV and AIDS. Krause's Food and Nutrition Care Process ELSEVIER Inc. 14<sup>th</sup> ed.
3. WHO. (2020). News room/questions and answer details malnutrition. <https://www.who.int/news-room/q-a-detail/malnutrition>
4. WHO. (2005). Consultation on Nutrition and HIV/AIDS in Africa -Evidence, lessons, and recommendations for action, Durban, South Africa.
5. Caroline, B., Shannon, S., Kate, G., Natalie, K. L., Kristin, W., & Paul, P. (2006). Nutrition and food security for people living with HIV. Catholic Relief Services Baltimore.
6. Duggal, S., Chugh, T. D., & Duggal, A. K. (2012). HIV and malnutrition: effects on immune system. *Clin Dev Immunol*, 1–8.
7. Hussein, I. H., Youssef, L., Mladenovic, A., Leone, A., Jurjus, A., & Uhley, V. (2019). HIV-infected children and nutrition: the friend and the foe. In *Nutrition and HIV/AIDS-Implication for Treatment, Prevention and Cure*. IntechOpen.
8. Food and Agricultural Organization (FAO). (2003). Committee on World Food Security. 29th Session, Food Security & HIV/AIDS: an Update FAO, Rome.
9. Clark, W. A., & Cress, E. M. (2018). Nutritional issues and positive living in human immunodeficiency virus/AIDS. *Nursing Clinics*, 53(1), 13-24.
10. Kathleen, M., & Sylvia, E. (2007). Krause's Food and Nutrition Therapy. Saunders. Elsevier.
11. Poda, G. G., Hsu, C. Y., & Chao, J. C. (2017). Malnutrition is associated with HIV infection in children less than 5 years in Bobo-Dioulasso City, Burkina Faso: A case-control study. *Medicine*, 96(21).
12. FMOH (Federal Ministry of Health). (2021). National Nutrition Policy Summary-Sudan. <https://www.fmoh.gov.sd>
13. Centres for Disease Control and Prevention (CDC). (2011). *HIV surveillance –Epidemiology of HIV infection (through 2011)*.
14. Ethiopian Federal Ministry of Health. (2008). Vicious cycle of malnutrition and HIV, Ethiopian Federal Ministry of Health. *Ethiopian Guide to Clinical Nutrition Care for Children and Adults with HIV*. Available from: <https://www.fantaproject.org/sites/default/files/resources/Ethiopia-HIV-Nutrition-Trainers-2008.pdf>.
15. Hindawi. (2012). HIV and Malnutrition: Effect on Immune system. Available from: [Doi.org/10.1155/2012/784740](https://doi.org/10.1155/2012/784740)
16. Guillén, S., Ramos, J. T., Resino, R., Bellón, J. M., & Muñoz, M. A. (2007). Impact on weight and height with the use of HAART in HIV-infected children. *The Pediatric infectious disease journal*, 26(4), 334-338.
17. Musoke, P. M., & Fergusson, P. (2011). Severe malnutrition and metabolic complications of HIV-infected children in the antiretroviral era: clinical care and management in resource-limited settings. *The American journal of clinical nutrition*, 94(6), 1716S-1720S.
18. Sabery, N. (2009). Pediatric HIV. In Hendricks, K. editors: *Nutrition management of HIV and AIDS*, Chicago, 2009, American Dietetic Association.
19. Penda, C. I., Moukoko, E. C. E., Nolla, N. P., Evindi, N. O. A., & Ndombo, P. K. (2018). Malnutrition among HIV infected children under 5 years of age at the Laquintin hospital Douala, Cameroon. *The Pan African Medical Journal*, 30, 91.
20. American Dietetic Association. (2010). Position paper on nutrition intervention and human immunodeficiency virus infection, *J Am Diet Assoc*, 110, 1105.
21. Garcia-Prats, A. J., Mc Means, A. R., Ferry, G. D., & Klish, W. J. (2010). Nutrition and HIV/AIDS. *HIV Curriculum*, 286, pp.4. <https://www.avert.org/professionals/history-hiv-aids/overview>
22. Heikens, G. T., Bunn, J., & Amadi, B. (2008). Case management of HIV-infected severely malnourished children: challenges in the area of highest prevalence. *The Lancet*, 371(9620), 1305–1307.
23. Department of Health and Human Services (DHHS). (2013). Panel on Treatment of HIV-Infected Pregnant Women and Prevention of Perinatal Transmission. Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in U.S, 2012.

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