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Nutritional Status of HIV-infected Adolescents Enrolled into an HIV-care Program in Urban and Rural Uganda: A Cross-sectional Study

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Abstract Malnutrition is a major threat to the health of HIV infected individuals and is associated with increased risks of morbidity and mortality. We assessed the nutritional status of HIV-infected adolescents enrolled into HIV care program in Uganda. We carried out across-sectional study. Data were collected on 205 adolescents aged 10-19 years attending The AIDS Support Organization (TASO) HIV care services in Uganda. All adolescents attending an adolescent clinic day in the respective TASO centers were enrolled into the study. Nutritional status was assessed using BMI-for-Age (BAZ) and Height-for-age (HAZ) as measures of thinness and stunting respectively. Standard deviation (SD) scores (Z scores) were applied to determine the nutritional status. Adolescents whose BAZ and HAZ was ≤-3SD were considered severely undernourished; those ≤-2SD were considered malnourished while those > -2SD were well-nourished. Statistical analysis was done using STATA statistical software package. The prevalence of stunting was 36.2% (72/199) with 11.1% (22/199) of adolescents being severely stunted. The risk factors for stunting included being male (AOR: 4.0; 95% CI: 1.81- 7.02) and residence in rural settings (AOR: 6.0; 95% CI 2.70-12.16). Eighteen percent of the adolescents (36/200) were thin, 8% (16/200) being severely thin. The prevalence of stunting and thinness was high among the HIV infected adolescents. Male adolescents and residing in rural settings are important risk factors of malnutrition among the HIV infected adolescents. There is need for development of comprehensive care and support systems including adequate nutritional care and support for HIV infected adolescents.

Keywords: *adolescence, stunting, thinness, HIV, rural, urban, Uganda*

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1. Introduction

Malnutrition is a major threat to the health of HIV infected individuals. Severe forms of malnutrition are associated with increased risks of mortality and morbidity occurring among HIV infected children [1,2]. Worldwide, an increase in HIV related deaths among adolescents (aged 10-19 years) was reported between 2001 and 2012 [3]. However, as the overall number of HIV-related deaths fell by 30%, that of adolescents increased by 50% between 2005 and 2012 [4].

According to the World Health Organization, the increase in HIV-related deaths among adolescents has been attributed primarily to several factors including poor prioritization of adolescents in national HIV plans, inadequate provision of accessible and acceptable HIV testing and counseling (HTC) and treatment services as well as lack of support for adolescents to remain in care and adhere to antiretroviral therapy (ART) [4]. Prioritization of adolescents' nutrition services is a current area of concern. Adolescent nutrition services receive inadequate attention as most nutrition-related resources are traditionally directed towards young children and pregnant women. For example, whereas there are nationally recognized policy guidelines for infant and young child feeding in the context of HIV, none exists for the feeding of adolescents in Uganda [5]. Furthermore, the Uganda Nutrition Action Plan (UNAP) for 2011-2016 does not have specific actions directed towards adolescents [6].

The physical and psycho-social changes occurring during childhood and adolescence makes this age group more vulnerable to health and nutrition concerns compared to others. The total nutrient needs of adolescents are higher than at any other time in the human lifecycle [7]. A combination of these factors, at a time of high growth spurt, makes adolescents more vulnerable to

nutritional deficiencies. The role played by nutrition in determining the physical, mental and social aspects of HIV-exposed children has been documented [8,9]. Additionally, the HIV infection and drugs such as antiretroviral drugs may compromise nutrients intake as well as increasing the nutrients demanded through a number of metabolic pathways [10]. Despite the increased vulnerability to malnutrition, limited research has been conducted to inform adolescent policy and programs especially in the context of HIV care.

Malnutrition is a common problem occurring among HIV infected individuals. An estimated 20 to 25% of adult HIV infected patients starting ART were estimated to be mildly to severely malnourished in Uganda [11]. Approximately 30-40% of the severely malnourished children admitted in Mulago Hospital's nutrition unit were reported to be HIV-positive [2]. There is however, limited documentation of adolescent nutrition in the context of HIV especially in sub-Saharan Africa where the prevalence of both HIV infection and malnutrition is highest. We assessed the nutritional status of HIV infected adolescents receiving HIV care services at The AIDS Support Organization (TASO) in Uganda.

2. Methods

2.1. Study Setting

The study was conducted in the TASO centers across Uganda. TASO is an indigenous HIV and AIDS service initiative, registered in Uganda as a Non-Governmental Organization (NGO). The organization has cared for over 300,000 individuals living with HIV and reached out to over 900,000 members of their families. Over 50,000 people living with HIV under TASO are receiving antiretroviral drugs (ARVs). TASO operates in the central, eastern, northern and western regions of Uganda having a total of eleven HIV-care centers.

TASO provides adolescent HIV services in all the eleven centers and currently serves 3,143 adolescents (10-19 years). Data were collected from six TASO centers including Mulago in the Capital City of Kampala, Entebbe, Jinja, Masaka, Mbale and Soroti.

2.2. Data Collection Procedures

This was a cross-sectional study involving 205 HIV infected adolescents selected from six out of the eleven TASO centers. Data were collected for a period of two months between August and September 2014. Data collection took place on clinic days which did not coincide across the study centers. All adolescents attending an adolescent clinic day in the respective TASO centers were enrolled into the study.

Anthropometric measurements of height and weight were undertaken following Gibson's guidelines [12]. Socio-demographic data were collected using a structured interviewer-administered questionnaire which captured sex, age, education level, orphanage-hood, residence and number of household occupants.

Weight measurement: Adolescents were weighed using Seca scales. The scales were validated with standard weights before actual weighing of the adolescents. The scales were placed on a hard flat surface and adolescents weighed while wearing only lightweight clothing (excluding shoes, belts, socks, watches and jackets). Each child was measured twice and the average of the two measures recorded. For cases where the difference between the two measures exceeded the tolerance limit (the degree to which the two measurements are close), the child was repositioned and weighed a third time.

Height measurement: The adolescent stood with his or her back against the measuring board, heels, buttocks, shoulders and head touching a flat upright sliding head piece. The adolescents' legs were placed together making the knees and ankles touch each other. The study participants were asked to take in a deep breath. Height measurement was taken at maximum inspiration. The headpiece was then brought down onto the upper most point on the head and the height recorded to the nearest 0.1 cm.

2.3. Data Management and Analysis

Data were entered in an Epi-Info 2007 validated entry screen. It was later exported to STATA (ver. 12.0) for data cleaning and analysis using zanthro extensions which generate the standardized anthropometric measures for children and adolescents with reference to the WHO child growth standards [13].

The nutrition status of adolescents was assessed using BMI-for-Age (BAZ) and Height-for-age (HAZ) indices. Standard deviation (SD) scores (Z scores) were applied to determine the nutritional status. Adolescents whose BAZ and HAZ was equal or below -2SD scores were considered malnourished and those above -2SD scores as being well-nourished. All those scoring -3SD and below were considered severely undernourished. Statistical analysis was performed using STATA (Ver. 12.0). We performed both descriptive and multivariate linear regression analysis to determine the predictors of malnutrition including sex, age, education level, orphanage-hood, residence and number of household occupants.

2.4. Ethical Clearance

The study was approved by TASO Institutional Review Committee and the National Council for Science and Technology. Permission to carry out the study was sought from TASO program management at TASO Headquarters. TASO center managers were informed in advance about the study and made arrangements for adolescents to come with their parents or caretakers for purposes of consent and ascent. Adolescents had the right to accept or refuse to join the study without any consequences. Adolescents 18 years and above provided written informed consent while the younger adolescents provided assent and consent was obtained from their parents/guardians. Adolescents who were identified as malnourished were referred to providers for support.

3. Results

3.1. Prevalence and Factors Associated with Stunting

Table 2 reveals that 36.2% of the study subjects were stunted with 11.1% being severely stunted. Over three

quarters (76.4%) of the stunted adolescents were aged between 15-19 years as shown in Table 3. Males were more likely to be stunted than females (p=0.002). Adolescents living in rural areas were more likely to be stunted than those from the urban setting (p<0.001). The majority (62%) of adolescents lived in households with more than five occupants. Table 4 reveals that males and being a resident of the rural areas had 4 and 6 fold risks (AOR: 4; 95% CI 1.8-7.0; AOR: 6; 95% CI 2.7-12.2) of being stunted respectively.

Table 1. Socio-demographic Characteristics of the respondents

Variables	Sex		Total
	Female n(%)	Male n(%)	n(%)
Age group (Years)			
10-14	39(19.0)	24(11.7)	63(30.7)
15-19	81(39.5)	61(29.8)	142(69.3)
Education level			
Primary	64(31.2)	52(25.4)	116(56.6)
Secondary	56(27.3)	33(16.1)	89(43.4)
Residence			
Urban	47(22.9)	37(18.1)	84(41.0)
Rural	73(35.7)	48(23.3)	121(59.0)
Number of People in household			
1-4	45(22.0)	39(19.0)	84(41.0)
5& above	75(36.6)	46(22.4)	121(49.0)
Both parents dead			
Yes	48(23.5)	38(18.5)	86(42.0)
No	72(35.1)	47(22.9)	119(58.0)

Table 2. Nutritional status of adolescents as measured by height-for-age (Stunting)

Characteristic	Nutritional Status			Total
	≤ -3 Z-scores n(%)	>-3≤-2 Z-scores n(%)	>-2 Z-scores n(%)	n(%)
Age-group (Years)				
10-14	5(2.6)	12(6.0)	45(22.6)	62)31.2)
15-19	17(8.5)	38(19.1)	82(41.2)	137(68.8)
Sex				
Female	6(3.0)	26(13.1)	85(42.7)	117(58.8)
Male	16(8.0)	24(12.1)	42(21.1)	82(41.2)
Residence				
Urban	1(0.5)	14(7.0)	68(34.2)	83(41.7)
Rural	21(10.6)	36(18.1)	59(29.6)	116(58.3)
Education level				
Primary	15(7.5)	26(13.1)	71(35.7)	112(56.3)
Secondary	7(3.5)	24(12.1)	56(28.1)	87(43.7)
All parents dead				
Yes	5(2.5)	20(10.0)	58(29.1)	83(41.6)
No	17(8.6)	30(15.1)	69(34.7)	116(58.4)
Number of people in household				
1-4	8(4.0)	19(9.6)	52(26.1)	79(39.7)
5 & above	14(7.0)	31(15.6)	75(37.7)	120(60.3)

Table 3. Bivariate analysis for predictors of stunting

Characteristic	Nutritional Status		Total	P Value
	≤ -2Z-scores n(%)	>-2 Z-scores n(%)	n(%)	
Age-group (Years)				
10-14	17(23.6)	453(5.4)	62(31.2)	0.084
15-19	55(76.4)	82(64.6)	137(68.8)	
Sex				
Female	32(44.0)	85(67.0)	117(58.8)	
Male	40(56.0)	42(33.0)	82(41.2)	0.002*
Residence				
Urban	15(20.8)	68(53.5)	83(41.7)	
Rural	57(79.2)	59(46.5)	116(58.3)	<0.001*
Education level				
Primary	41(56.9)	71(55.9)	112(56.3)	0.887
Secondary	31(43.1)	56(44.1)	87(43.7)	
All parents dead				
Yes	25(25.0)	58(45.7)	83(41.7)	0.132
No	47(65.3)	69(54.3)	116(58.3)	
Number of people in household				
1-4	27(37.5)	52(51.5)	79(45.7)	0.068
5& above	45(62.5)	49(48.5)	94(54.3)	

*Statistically significant difference

Table 4. Multivariate analysis for stunting

Characteristic	n(%)	Unadjusted Odds Ratio		Adjusted Odds Ratio	
		OR	(95% CI)	OR	(95% CI)
Sex					
Female	32(27.59)	1.0			
Male	40(48.19)	2.0	1.4-4.4*	4.0	1.8- 7.0*
Residence					
Urban	15(18.07)	1.0			
Rural	57(49.14)	4.0	2.3-8.5*	6.0	2.7-12.2*

*Statistically significant relationship.

3.2. Prevalence and Factors Associated with Thinness

Table 5 reveals that 18% of the adolescents were thin 8% of them severely affected. Majority (58%) of the thin adolescents was aged 15-19 years as seen in Table 6. The percentage of adolescents who were thin was higher (52%) among males compared to females. Majority (69%) of the thin adolescents had achieved an education level of primary level and below. More than a half (53%) and 58% of the adolescents lived in urban areas as well as in households with five occupants or more respectively.

Table 5. Nutritional status as measured by BMI-for-Age (Thinness)

Characteristic	Nutritional Status			Total
	≤ -3 Z-scores n(%)	>-3≤-2 Z-scores n(%)	>-2 Z-scores n(%)	n(%)
Age (Years)				
10-14	6(3.0)	9(4.5)	44(22.0)	59(29.5)
15-19	10(5.0)	11(5.5)	120(60.0)	141(70.5)
Sex				
Female	7(3.5)	10(5.0)	106(53.0)	123(61.5)
Male	9(4.5)	10(5.0)	58(29.0)	77(38.5)
Residence				
Urban	9(4.5)	10(5.0)	60(30.0)	79(39.5)
Rural	7(3.5)	10(5.0)	104(52.0)	121(60.5)
Education level				
Primary	11(5.5)	14(7.0)	88(44.0)	123(61.5)
Secondary	4(2.0)	7(3.5)	76(35.5)	87(43.5)
All parents dead				
Yes	7(3.5)	7(3.5)	71(35.5)	85(42.5)
No	9(4.5)	13(6.5)	93(46.5)	115(57.5)
Number of people in household				
1-4	7(3.5)	8(4.0)	67(33.5)	82(41.0)
5 & above	9(4.5)	12(6.0)	97(48.5)	118(59.0)

Table 6. Bivariate analysis for thinness

Characteristic	Nutritional Status n=200		Total n(%)	P Value
	≤ -2 Z-scores n(%)	>-2 Z-scores n(%)		
Age (Years)				
10-14	15(41.7)	44(26.8)	59(29.5)	0.077
15-19	21(58.3)	120(73.2)	141(70.5)	
Sex				
Female	17(47.2)	106(64.6)	123(61.5)	0.052
Male	19(52.8)	58(35.4)	77(38.5)	
Residence				
Urban	19(53.0)	60(37.0)	79(40.0)	0.072
Rural	17(47.0)	104(63.0)	121(61.0)	
Education level				
Primary and below	25(69.4)	88(54.0)	113(56.5)	0.083
Above primary	11(30.6)	76(46.0)	87(43.5)	
All parents dead				
Yes	14(39.0)	71(43.0)	85(42.0)	0.628
No	22(61.0)	93(57.0)	115(58.0)	
Number of people in household				
1-4	15(42.0)	67(40.9)	82(41.0)	0.928
5 & above	21(58.0)	97(59.1)	118(59.0)	

4. Discussion

Our study revealed that one third of the adolescents were stunted with 11% severely affected. While male adolescents had a 4-fold risk of being stunted, those living in rural Uganda were 6 times more likely to be stunted as compared to their counterparts in urban areas. Eighteen percent of the respondents were thin with 8% of them being severely thin.

The prevalence of stunting reported by our study is higher than the 22.5% reported among adolescents studied in Uganda [14]. The high prevalence of stunting noted among HIV infected adolescents is not surprising given the pathophysiology of HIV/AIDS in relation to nutrition and health [15]. Stunting may be associated with chronic diarrhoea and mal-absorption caused by HIV enteropathy

which is a common occurrence in HIV infected individuals [1]. The relationship between diarrohea and stunting has been studied among children [16]. This observation indicates that dietary interventions are important in nutrition care of HIV infected individuals when combined with clinical management of HIV related conditions.

High levels of stunted growth among HIV infected children and adolescents have been reported in developing countries. A study done in Zimbabwe revealed that 62% of HIV infected children and adolescents aged 8-19 years were stunted [17]. In India, 58% of the 0-15 year old HIV infected children were stunted [18]. Similarly, a study conducted in Brazil revealed a higher (25.5%) prevalence of stunting among HIV infected children and adolescents compared to only 6% in those not infected [19]. Several factors including secondary infections and inadequate dietary intake have been implicated in the causation of stunted growth among those infected with HIV [20,21]. Furthermore, an inverse relationship between viral burden and linear growth has been noted indicating that use of antiretroviral medications that reduce viral load would lead to improvements in anthropometric indices of growth [22]. Reduction of viral load is however, associated with adherence to ART [23,24]. Poor adherence to ART reported among adolescents may therefore partly explain the existence of stunted growth among this age group [4]. However, this study did not evaluate the impact of adherence and ART on nutritional status, an area that requires further assessments.

Adolescents living in rural settings were 6 times more likely to be stunted as compared to their counterparts in urban areas. Our findings (49%) are somewhat similar to Uganda's general prevalence of stunting (41.8%) occurring among children aged below 5 years in rural Uganda as compared to only 16.9% in urban settings [25].This may be attributed to the higher levels of food insecurity and poverty common in rural settings as noted in the recent comprehensive food security and vulnerability analysis done in Uganda [26]. This observation suggests a need for development of programs specifically designed to economically empower HIV infected and affected individuals especially those living in rural areas.

The study revealed significantly higher levels of stunting among boys than girls. Studies by Lwanga et al and Ingunn et al revealed similar observations in the general population of children and adolescents in Uganda [14,27]. This difference may be explained by the increased caloric requirements experienced by males due to the greater increases in height, weight, and lean body mass as opposed to that occurring among females [7]. However, although this biological explanation stands, some behavioral factors specific to boys may influence their health and nutritional status. Adolescent males are more likely to get involved in substance abuse than girls; a condition that may compromise the food intake and bioavailability of nutrients both of which result in malnutrition [28,29]. Drug use among HIV infected individuals is reported to be associated with lower Body Mass Index (BMI) as well as CD4 counts which are key indicators for survival [30]. The findings suggest that boys should receive more attention in any program geared at improving the health and nutrition of adolescents.

We found that 18% of the adolescents enrolled in our study were thin. This prevalence is higher than that documented in many of the studies conducted among the general populations of adolescents in countries of the Sub-Saharan region. Studies conducted in Southern Nigeria and Cameroon found that 8.3% and 9.5% of the adolescents studied were thin [31,32]. The higher prevalence rate of thinness revealed in our study is attributed to HIV related factors affecting dietary intake as well as nutrients bioavailability and diseases [1,20,33]. Ramalho et al, reported a 4.7 fold risk of thinness among HIV infected children and adolescents with Protease Inhibitor Antiretroviral (ARV) drug usage being related to thinness [20]. Thinness related to ARV usage may be a result of a number of biochemical reactions including insulin resistance (33). This observation shows a critical aspect of drug-nutrient interaction which has been a subject of intensive research suggesting a need for routine monitoring and evaluation of ARV drug regimen to avoid development of severe forms of thinness which lead to increased morbidity and mortality. Severe forms of malnutrition have been reported to be potential risk factors for HIV-related morbidity and mortality [33, 34, 35, 36]. The findings suggest that, efforts to minimize the development of severe forms of malnutrition among HIV infected adolescents will tremendously reduce HIV related adolescents deaths which have been on increase [3].

5. Study Limitations

Our study had some limitations. We did not examine some potentially important factors that could influence the nutritional status of HIV infected adolescents including antiretroviral therapy, co-infections as well as dietary intake. However, the findings of our study highlight nutrition as an important element of care for HIV infected adolescents and will inform larger studies to fully ascertain predictors and interventions to mitigate the problem of malnutrition in HIV infected adolescents.

6. Conclusion

The prevalence of stunting and thinness was high among the HIV infected adolescents. Male sex and residing in rural Uganda are risk factors for malnutrition among the HIV infected adolescents. The findings suggest development of comprehensive care and support systems that integrate adequate nutritional support for HIV infected adolescents.

Statement of Competing Interests

The authors declare no competing interests.

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