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Predictors of stunting among pediatric children living with HIV/AIDS, Eastern Ethiopia

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ABSTRACT

Globally, there were about 3.4 million pediatric children (<15 years of age) who were living with HIV/AIDS. Ethiopia has one of the highest rates of malnutrition in Sub-Saharan Africa. As of 2013, there were about 160,000 pediatric children living with HIV/AIDS in Ethiopia. Even though undernutrition makes it difficult to combat HIV/AIDS, there is paucity of information on the magnitude of stunting and its predictors among seropositive pediatric children in low-income countries like Ethiopia. Institution based quantitative cross sectional study design was employed on 414 randomly selected pediatric (5-15 years) children living with HIV/AIDS in Harari Region and Dire Dawa City Administration Public Hospitals, Eastern Ethiopia. Pretested interviewer administered questionnaire and patient card review was held to collect data. Data were entered through Epi-data and exported to SPSS for analysis. The WHO Anthros plus software was used to calculate the anthropometric indices. Bivariate and Multivariable analysis along with 95%CI were done to identify predictors of stunting. Level of statistical significance was declared at P-value <0.05. The prevalence of stunting was found to be 30.9% (95%CI: 26.0-36.0%). Rural residence [AOR=4.0, (95%CI: 2.22, 7.17)], family monthly income of ≤500 ETB [AOR=5.79, (95%CI: 2.82, 11.60)], being anemic [AOR=3.17, (95% CI: 2.13, 4.93)] and the presence of diarrhea [AOR=6.21, 95% (CI: 3.39, 9.24)] were predictors of stunting. Thus, collaborative measures should be undertaken (to decrease frequent infections and to improve the economic status) to combat chronic malnutrition during HIV/AIDS treatment.

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1. INTRODUCTION

Malnutrition and HIV/AIDS worsen one another. Malnutrition contributes to immune system weakening, making the body vulnerable to frequent illness and increasing its energy and nutrient demand, there by accelerating the disease progression. In turn, HIV infection exacerbates malnutrition through its attacks on the immune system and its impact on the reduced food intake [1, 2]. Nutritional status controls the immunological response to HIV infection, affecting the overall clinical outcomes [3]. Malnutrition further weakens the immune system, increasing susceptibility to opportunistic infections. Even on ART, there is a continuous need for PLHIV to consume a nutritious diet to maintain weight and prevent micronutrient deficiencies [4, 5]. The links between malnutrition and HIV/AIDS increase the negative effects of HIV infection on human development at individual, household, community and national levels [6].

Nutrition is a critical component of HIV treatment, care, and support, as recommended by different international organizations (such as, WHO, UNAIDS, and others) which are working on HIV/AIDS. Nutritional support has a role within clinical and community services in case of commitment, adherence and retention in care and treatment of patients on ART [7, 8]. Clinical studies show that pediatric children (<15 years) living with HIV/AIDS have poor nutritional status, mostly due to the presence of infections (diarrhea) and OIs like candidiasis, which can cause pain during swallowing, and further impedes normal eating patterns [9]. People living with HIV need to consume additional 30% calories than uninfected counterparts, making nutritional support a key component [10]. Undernutrition and its connection with food insecurity, poverty, and co-infections pose a serious challenge to efforts to combat HIV/AIDS by denying access to a nutrition-rich diet [11, 12]. Undernutrition is a significant factor affecting HIV/AIDS care and treatment in resource limited settings [13, 14]. Individuals at each stages of HIV disease are at risk of developing undernutrition and their nutritional status is a strong predictor of the progression, survival rate and functional status of individuals [15]. Several studies have demonstrated the link between undernutrition and HIV/AIDS disease progression [16, 17]. Globally, there were about 3.4 million children (<15 years of age) who were living with HIV/AIDS; and 340,000-450,000 new infections in this age group per year [18]. The greatest proportion (>90%) of children who acquired HIV infection live in Sub-Saharan Africa [19].

Ethiopia has one of the highest rates of malnutrition in Sub-Saharan Africa, and faces acute and chronic malnutrition and micronutrient deficiencies [20]. As of 2013, there were about 160,000 children (<15 years) living with HIV/AIDS in Ethiopia [21]. While rates of stunting have dropped in many areas of the country over the past decade, Ethiopia still faces a huge burden from chronic malnutrition with 37% of under five children stunted, of whom about 12% are severely stunted [22]. The high levels of stunted growth among pediatric children (living with HIV) have been reported in many developing countries. A study in Uganda revealed 36.2% of adolescents living with HIV/AIDS as stunted; of whom, 11.1% were severely stunted [23]. Another study conducted among HIV positive children at two referral hospitals in northwest Ethiopia, revealed the magnitude of malnutrition as 42.9% [24]. Even though there are ample literatures regarding the nutritional status of different age groups of people, little emphasis is given and little is understood about the burden of malnutrition in pediatric children living with HIV/AIDS. Therefore, this study aimed to assess the predictors of stunting among pediatric children living with HIV/AIDS in eastern Ethiopia.

2. RESEARCH METHOD

2.1. Study area and design

Institution based cross sectional study design was employed among pediatric children in Harari region and Dire Dawa city administration, Ethiopia in February 2017. Harar town (Capital of Harari region) and Dire Dawa city administration are located in the eastern part of Ethiopia around 526 and 515-kilo meters from Addis Ababa respectively. Harari region had a total population of 183,344 (Ethiopian central statistics authority’s 2007 report) and the total population in Dire Dawa city administration was 405,808 (unpublished city administration’s 2006 Ethiopian calendar report). Harari region has 5 governmental hospitals, 2 private hospitals, 8 health centers, 33 higher and medium private clinics, and 31 health posts. Dire Dawa city administration has 2 government hospitals, 15 government health centers, 4 private hospitals and more than 10 private clinics. In Harari region, there were about 5814 HIV positive persons who were on HAART treatment and 183 of them were pediatric children who were on ART (Unpublished report of Harari regional health Bureau, 2015/16). Similarly, in Dire Dawa city administration there were about 9815 HIV positives and 440 of them were pediatric children who were on ART in public hospitals (Unpublished report of Dire Dawa health bureau, 2016). All pediatric age children (5-15 years) who were living with HIV/AIDS and were on follow-up at the ART clinics of the selected health facilities participated in the study. Children who could not stand due to physical deformities and children with incomplete registered data were excluded from the study.

2.2. Sample size and sampling procedures

After comparing the sample size for the first and second specific objectives (to take the larger sample size), the sample size was finally determined using a formula for estimation of single population proportion, taking degree of precision 5%, magnitude of undernutrition among HIV positive children as 42.9 % [24] and 10% non-response rate. Accordingly, the sample size was estimated to be 414. In Harari region there are two public hospitals (Hiwot Fana specialized university hospital and Jugala hospital). Similarly, in Dire Dawa city administration, there are two public hospitals (Dile Chora hospital and Sabian hospital). By taking the total number of pediatric children (5-15 years) who were attending ART clinic in those four hospitals as 623, the sample size was proportionally allocated to each hospital. Then, study participants were selected using the simple random sampling technique (considering the registration book as a good source of the sampling frame).

2.3. Data collection tool and procedures

Data were collected using a pretested structured questionnaire. The tool was developed by reviewing various literatures and efforts were made to include important predictors. The questionnaire was initially developed in English and translated into local language spoken in the study area ("Amharic, Afan Oromo, and Somali"). Then it was retranslated back to English language. Comparison was made to check for its consistency. Data were collected using face-to-face interview and review of medical records. Four female diploma graduate Nurses who were working in health facilities other than the selected public health facilities did the interview and chart review. Pediatric children (5-15 years) medical record charts were obtained and lists of children were provided to ART care provider to inform the data collectors, when they come to the hospital during the study period. Since pediatric children (5-15 years) living with HIV/AIDS were appointed every two weeks for follow up, all children were accessed in a month (the data collection period). When the health care provider referred the patient to the data collectors, the collectors informed the study participants and parents (caretakers) about the purpose of the study and both written informed consent from the caretakers and assent from the children were taken. Then after, interview was done in private room in the facility. The study ensured individual information will not be disclosed and will be kept confidential.

2.4. Data quality management

Two days training was given for all data collectors and discussion was made on the objective of the study, familiarization on data collection tool and each variable on the questionnaire and its implication. There was demonstration and practical session on interviewing and anthropometric measurements. The questionnaire was pretested at Haramaya hospital (not part of the study area), on 5% of the total sample size and after the pretest, all necessary adjustments were made. Relative technical error of measurement (percentage TEM) was calculated to minimize anthropometric measurement errors. Data collectors' accuracy of anthropometric measurements was standardized with their trainer during training and pretesting. During data collection, data collectors took at least two separate height measurements for an individual and repeat when the variation of the two measures is greater than 0.1 centimeter. The anthropometric measurements were taken by following standard anthropometric techniques [25]. During the actual data collection, the supervisors made close supervision. The collected data were cross checked on each day of activity for consistency and completeness. Then the data were double entered into Epi data software with two data clerks independently and consistency between the two data sets was checked. Then mismatched data were crosschecked with the hard copy and corrected accordingly.

2.5. Anthropometric measurements

The anthropometric data were collected using the procedure stipulated by the WHO (2006) for taking anthropometric measurements. Before taking anthropometric data for children, first their age was determined in order to ensure the target population. All pediatric children aged 5-15 years height was measured using a stadiometer with the nearest 0.1 centimeter. Height was measured with subjects standing straight on a smoothly flat surface with their heels together, eyes straight forward, and touching the standing board at the heels, buttocks and the back of the head. For a child, two separate measurements were collected and the average values were used for analysis. Z-score was determined using the Anthro-Plus software. Based on the Z-score, a child was considered as stunted or not. A child was considered as being stunted when the height-for-age Z score was <-2SD.

2.6. Data processing and analysis

After the data were checked for completeness and consistency, it was entered through Epi data version 3.1 software. Then after, the data were exported to SPSS version 22 for analysis. For anthropometric variables, WHO Anthro plus software was used and after the Z-score was calculated, it was exported to SPSS for further analysis. Descriptive analysis, including frequency and cross tabulations were done to describe the characteristics of study participants. Dietary diversity was calculated and the mean score was used to classify the adequacy of nutrient intake [26, 27]. The household food insecurity access scale (HFIAS) categories were calculated and households were categorized as food secured or not [28]. Data of the study subjects' were expressed as means±SD. Bivariate analysis was done to identify candidate variables for multivariable logistic regression then those variables having a p-value <0.2 were entered in multivariable logistic regression model. The outcome variable was stunting. Results were reported by using Odds Ratio and 95% CI. P-value less than 0.05 indicated a statistically significant association.

3. RESULTS AND DISCUSSION

3.1. Socio-demographic characteristics

A total of 405 Pediatric children (5-15 years) patients attending ART clinic at public hospitals of Harari town and Dire Dawa City Administration eastern Ethiopia were participated making a response rate of 97%. More than half (54.6%) were females and 263 (64.9%) of the participants were in the age group of 10-15, with a mean age of 10.62 (±2.3years). One hundred ninety-two (47.4%) participants were Orthodox Christianity followers. Regarding the ethnicity, more than half (52.2%) were from Oromo ethnic group. Three hundred (74.1%) were resided in urban areas. Regarding the parental status of the children, 235(58.0%) children have both parents (mother and father), and 74(18.3%) have neither mother nor father alive. The majority (91.4%) of study participants have caregiver. Two hundred thirty four (57.8%) of the families have average monthly income of ≥1000 ETB and 15.8% have average monthly income of ≤500 ETB that can be seen in Table 1.

Table 1. Socio-demographic characteristics of pediatric children living with HIV/ADIS

Variables	Category	Frequency	Percentage
Age (years)	5-9	142	35.1
	10-15	263	64.9
Sex	Male	184	45.4
	Female	221	54.6
Religion	Orthodox	192	47.4
	Muslim	138	34.1
	Protestant	74	18.3
	Catholic	1	0.2
Ethnicity	Oromo	214	52.8
	Amhara	145	35.8
	Harari	17	4.2
	Somali	5	1.2
	Tigre	17	4.2
	Other ¥	7	1.7
Residence	Rural	105	25.9
	Urban	300	74.1
Parental status	Both parents (Mother and Father)	235	58.0
	Only one parent	96	23.7
	Both absent	74	18.3
Presence of caregiver	Yes	370	91.4
	No	35	8.6
Caregiver	Both parents	288	71.1
	Other ©	117	28.9
Family monthly income (in birr)	≤500	64	15.8
	501-999	107	26.4
	≥1000	234	57.8
Source of drinking water	Pipe	367	90.6
	Protected well	38	9.4
Latrine availability	Yes	375	92.6
	No	30	7.4

¥=referee to Guraghe, and Siltie © =referee to any to the nearby relatives

3.2. Food security status and dietary practice of participants

Nearly two third (66.4%) of the respondents' households were food insecured and 384(94.8%) have good dietary diversity score that can be seen in Figure 1.

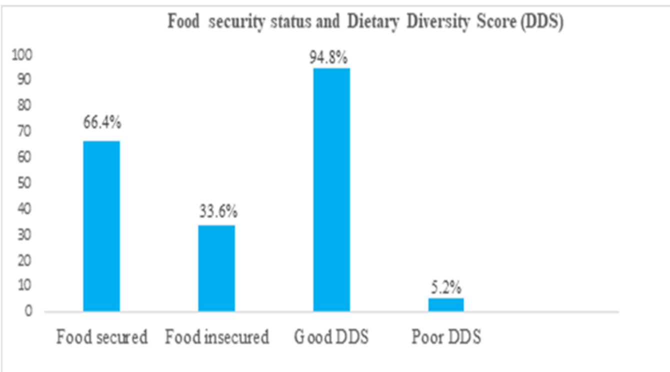

Figure 1. Household food security status and DDS among children living with HIV/AIDS

3.3. Medical characteristics

Only less than one fourth (22.7%) of the participants had therapeutic food during the course of ART treatment and 247(61.0%) had no history of dietary counseling. More than one third (34.3%) had eating problems and 110(27.2%) reported loss of appetite. Only sixty one (15.1%) of the respondents had any of the opportunistic infections, of which nearly half (46.7%) was pneumonia. Most of study participants (93.8%) were in the WHO clinical stage one. One hundred eighty four (45.4%) had ≥7 years' duration of ART follow up. Eighty nine (22.0%) were anemic. About 166(41%) and 345(85.1%) had baseline and current CD4 counts of ≥500 respectively. Three hundred fifty-four (87.4%) of the children had good adherence of the drug and 369(91.1%) had no history of diarrhea in the past two weeks that can be seen in Table 2.

Table 2. Medical characteristics among pediatric children living with HIV/ADIS

Variables	Category	Frequency	Percentage
Presence of therapeutic food during the course of ART treatment	Yes	92	22.7
	No	313	77.3
Dietary counseling	Yes	158	39.0
	No	247	61.0
Presence of eating problem	Yes	139	34.3
	No	266	65.7
Type of eating problem	Loss of appetite	110	27.2
	Swallowing difficulty	29	7.1
Presence of opportunistic disease	Yes	61	15.1
	No	344	84.9
Type of opportunistic disease	Pneumonia	30	7.4
	Tuberculosis	3	0.7
	Skin infection	22	5.4
	Gastro enteritis	6	1.5
WHO clinical stage	Stage 1	380	93.8
	Stage 2	24	5.9
	Stage 3	1	0.2
Duration of ART follow up(in years)	1-3	63	15.6
	4-6	158	39.0
	≥7	184	45.4
Hemoglobin level in mg/dl	No anemia	316	78.0
	G-I	51	12.6
	G-II	31	7.7
	G-III	4	1.0
	G-IV	3	0.7
Base line CD4 count	<200	44	10.9
	200-349	85	21.0
	350-499	110	27.0
	≥500	166	41.0
Current CD4 count	<200	4	1.0
	200-349	12	3.0
	350-499	44	10.9
	≥500	345	85.1
Adherence of the drug	Good	354	87.4
	Fair	44	10.9
	Poor	7	1.7
Experience diarrhea in the past two weeks	Yes	36	8.1
	No	369	91.1

3.4. Magnitude of Stunting among pediatric children living with HIV/ADIS

About 30.9%, 95% CI (26.0%, 36.0%) of the respondents were stunted (HAZ) that can be seen in Figure 2.

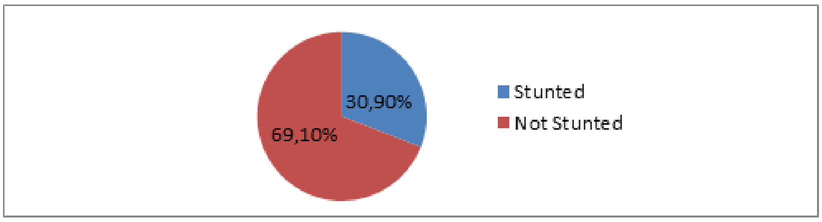

Figure 2. Magnitude of stunting among pediatric children living with HIV/AIDS

3.5. Predictors of Stunting among pediatric children living with HIV/AIDS

From the various explanatory variables rural residence, family monthly income of ≤500 ETB, benig anemia, presence of diarrhea, duration of ART treatment follow-up, follow-up interval of ART treatment were found to had a p-value of <0.2 (in the Bivariate analysis) and were a candidate for the multivariate logistic regression. Accordingly, being rural resident, having family monthly income of ≤500 ETB, being anaemic and having diarrhea were found to predictors of stunting. Children who resided in rural area were four times [AOR=4.00, 95% CI (2.22, 7.17)] more likely to be stunted than those children who were urban residents. Those children who had an average family monthly income of ≤500 ETB were 5.79 times [AOR=5.79, 95% CI (2.82, 11.60)] more likely to be stunted compared to those who had an income of ≥1000 ETB. Children who were anemic were 3.17 times [AOR=3.17, 95%CI (2.13, 4.93) more likely to be stunted than those children who had no anemia. Those children who had diarrhea in the past two weeks were 6.21 times [AOR=6.21, 95% CI (3.39, 9.24)] more likely to be stunted than those children hadn't diarrhea that can be seen in Table 3.

Table 3. Binary logistic regression that shows the association of variables with stunting, among Pediatric children living with HIV/ADIS

Variables	Stunting		COR(95%CI)	AOR(95%CI)
	Yes (%)	No (%)		
Age (in years)				
5-9	67(36.8)	115(63.2)	1.65(1.08,2.53)	1.64(2.45, 7.96)
10-15	58 (26.0)	165 (74.0)	1	1
Residence				
Rural	59(43.8)	46(56.2)	4.54(2.83,7.29)	4.0(2.22, 7.17)*
Urban	66(22.0)	234(78.0)	1	1
Family income				
≤500 Birr	49(48.0)	53(52.0)	3.49(2.08,5.87)	5.79(2.82, 11.60)*
501-999 Birr	35(32.7)	72(67.3)	1.84(1.08,3.12)	3.00(1.42, 6.34)
≥1000 Birr	41(20.9)	155(79.1)	1	1
Dietary counseling				
Yes	37(23.4)	121(76.6)	1	1
No	88 (35.6)	159(64.4)	1.17(0.77,1.79)	1.79(0.46, 1.37)
Presence of eating problem				
Yes	45(32.4)	94 (67.6)	1.11(0.72,1.73)	1.07(0.60, 1.90)
No	80(30.1)	186 (69.9)	1	1
Duration of ART treatment follow up				
1-3 years	17(27.0)	46(73.0)	0.55(0.29,1.03)	1.23(0.05, 1.18)
4-6 years	34(21.5)	124(78.5)	1.41(0.25,0.66)	0.39(0.17, 1.91)
≥7 years	74(40.2)	110(59.8)	1	1
Hemoglobin level in mg/dl				
Anemic	36(40.4)	53(59.6)	1.94(1.20, 3.15)	3.17(2.13, 4.93)*
Non Anemic	89(28.2)	227(71.8)	1	1
Diarrhea				
Yes	14(38.9)	22(61.1)	8.63(4.92,15.15)	6.21(3.39, 9.24)*
No	111(30.1)	258(69.9)	1	1
Food security status				
Food secured	86(32.0)	183(68.0)	1	1
Food insecured	39(28.7)	97(71.3)	1.86(0.54, 1.34)	0.82(0.40, 1.68)
Dietary Diversity				
<4 food groups	5(23.8)	16(76.2)	0.69(0.25, 1.92)	1.01(0.29, 3.54)
≥4 food groups	120(31.2)	264(68.8)	1	1

*=Statistically Significant (P-value < 0.05), CI = Confidence Interval, COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, ART=Antiretroviral Therapy

Ethiopia has prioritized nutrition as a critical component of HIV treatment, care, and support by setting guidelines and developing implementation manuals [29]. Even though efforts are being made, the magnitude of stunting in this study is found to be 30.9% (95%CI: 26.0-36.0%); which is higher than the studies done in Ethiopia (24.7%) [30] and Nigeria (17.1%) [31]. However, the magnitude is lower than the studies conducted in two referral hospitals in Northwest Ethiopia (65%) [24], in Uganda (68%) [32], and in Mozambique (57.4%) [33]. These variations might be due to the difference in the study setting, study groups, sample size, and quality of care in the facility (including nutritional support).

In this study, children who had diarrhea in the past two weeks were 6.21 times more likely to be stunted compared to their counter parts. This finding is supported by a study done in Ethiopia [30], in which children who experienced diarrhea were 2.1 times more likely to be stunted. The probable reason is that frequent infections like diarrhea, increases nutrient loses and has also its own role in reducing food intake by decreasing appetite and eagerness to eat. The presence of anemia was also another predictor variable for stunting; those pediatric children who were anemic were 3.17 times more likely to be stunted compared to those children who had no anemia. This finding is supported by a study done in Ethiopia [30]. This is due to the fact that children with chronic diseases like HIV/AIDS have a compromised immunity; which can further predispose to different infections/diseases. On the other hand, lower family monthly income was another predictor variable; those pediatric children who had monthly family income of ≤500 ETB were 5.79 times more likely to be stunted compared to those children whose family monthly income was ≥1000 ETB. The finding is supported by a study done in Arba Minch, Ethiopia [34]. This could be possibly due to, children from the poor families (lower family income) will be at risk of getting enough food, which further predisposes to infection/illness, and ultimately contribute to the development of malnutrition. Rural residence was significantly associated with stunting; those children who resided in rural area were four times more likely to be stunted, compared to their counter parts. The finding is consistent with many other studies conducted in Ethiopia. The primary reason might be, since the study is conducted in the hospitals (found in urban areas), those children living with HIV/AIDS will suffer from travel costs, which will further exert its negative effect on follow ups and treatment adherence. Those children who resided in the rural areas probably have a decreased media coverage, which will lead them to have inadequate knowledge and awareness about the issue.

4. CONCLUSION

There is high level of stunting among children (living with HIV/AIDS) in the study area. Being rural resident, lower family monthly income (≤500 ETB), being anemic and the presence of diarrhea were significantly associated with stunting. Thus, collaborative measures should be undertaken (to decrease frequent infections, thereby improving the quality of care), efforts should also be made to improve the economic status and ultimately, to combat chronic malnutrition during HIV/AIDS treatment.

ABBREVIATIONS

AIDS: Acquired Immune Deficiency syndrome
AOR: Adjusted Odds Ratio
CI: Confidence Interval
ETB: Ethiopian Birr
OIs: Opportunistic Infections
PLWHA: People Living With HIV/AIDS
ART=Antiretroviral Therapy
COR: Crude Odds Ratio
HIV: Human Immunodeficiency Virus
SPSS: Statistical Package for Social Sciences
WHO: World Health Organization

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