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Malnutrition and associated factors among adults starting on antiretroviral therapy at PASADA Hospital in Temeke District, Tanzania

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Abstract
Background: Malnutrition is known to play a significant role in HIV/AIDS progression. Severe malnutrition has been previously found to be associated with early mortality among people living with HIV/AIDS (PLHIV) undergoing anti-retroviral therapy (ART) in Sub-Saharan Africa. The objective of this study was to determine the prevalence and factors associated with malnutrition among adult PLHIV attending care and treatment centre (CTC) in Temeke District, Tanzania.
Methods: The cross-sectional descriptive study involved consecutive eligible patients attending the CTC for initiating in ART, between January and April, 2014. All participants who agreed to sign a consent form were enrolled. The participants had undergone baseline workup for ART initiation (by CTC), which included blood tests for liver and renal function tests, and CD4+ cell count, using calibrated instruments and standard techniques. In all patients the weight and height were measured to calculate the body mass index (BMI), denoting the nutritional status. This parameter was recorded in the study instrument together with the CD4+ count for each patient. A structured questionnaire was used to obtain more information, namely demographic and lifestyle data.
Results: A total of 125 patients were included in this study**.** The prevalence of malnutrition among participants was 19.4%. Those with severe malnutrition comprised of 9%. Significant association was noted between malnutrition and irregular income (OR= 3.8, CI: 1.2-11.5) and also inability to get at least two meals a day (OR= 3.4, CI: 1.2-9.2). Severe malnutrition was significantly associated with the CD4+ counts of <200 cells/mm (OR =7.6; CI: 1.7-34.6).
Conclusion: About 19% of participants were malnourished at the time of initiation of ART and among them 9% were severely malnourished. The most important risks for malnutrition were found to be irregular income and inability to get adequate feeding. This calls for routine nutritional assessment at CTCs prior to initiation of ART so as to identify those who need immediate intervention, including those with severe malnutrition.

Keywords: malnutrition, HIV/AIDS, anti-retroviral therapy, Tanzania

Introduction

Adequate nutrition, which is best achieved through consumption of a balanced healthy diet, is vital for health and survival of all individuals regardless of HIV status. In the case of HIV infection there occurs a rapid replication of the virus, requiring larger amounts of energy and nutrients which are actually taken from the host's body because the virus depends entirely on the host for survival (WHO, 2003). The HIV infection causes increased requirement for nutrients by 20 to 30%, but, at the same time exacerbates reduced food intake through hyperpyrexia, anorexia and thus leading to malnutrition (WHO, 2003). Malnutrition, in turn, leads to impairment of the immune system and a rapid progression of HIV infection to AIDS. Therefore, it becomes clear that malnutrition and HIV are related and aggravate one another in a vicious cycle (MoHSW, 2012).

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Adult malnutrition, as exemplified by wasting is defined as a body mass index (BMI) of < 18.5 kg/m^2 in adults (WHO, 2003; Koethe & Heimburger, 2010). Despite confounding factors in the African setting the BMI indicator has proved to be the most reliable measure of wasting in adults. Among adults with advanced HIV infection in sub-Saharan Africa the magnitude of malnutrition (BMI-below 18.5) was shown to be between 10 and 30%, where social factors like income, employment, inadequate food intake, and sanitation were implicated as risk factors (Niyongabo *et al.*, 1999; Dannhauser *et al*., 1999; Uthman, 2008; Hailemariam *et al.,* 2013). The prevalence of malnutrition (BMI<18.5), among PLHIV who are receiving ART in Tanzania has been reported to be 18.4 % and was mainly associated with the pattern of food intake (Ritte & Kessy, 2012).

On the other hand, severe malnutrition is associated with early mortality among People Living with HIV/AIDS (PLHIV), initiating on ART, where a low BMI was pointed out as a strong independent factor of that mortality. Also pointed out is that increasing grades of malnutrition plus decreasing CD4+ cell count accelerate the risk of mortality. Meanwhile, weight gain, after the initiation of ART is shown to be strongly associated with improved survival (Koethe & Heimburger 2009; Koethe *et al*., 2010; Liu *et al.*, 2011). Malnutrition has bad effects on the progress of disease in PLHIV, as is indicated in the above mentioned studies. Since information about the status in Tanzania is limited, this study was carried out to assess the prevalence of malnutrition and associated factors among PLHIV who are starting on ART.

Materials and Methods

Study area

The study was carried out in Temeke District in Dar es Salaam, Tanzania. Temeke has several approved Care and Treatment (CTC) Centres for HIV/AIDS management. For the purposes of this study only PASADA Hospital was purposively selected due to the fact this place also provides palliative care in Temeke district and that the majority of patients needing the CTC services receive them at this hospital. PASADA is an acronym for Pastoral Activities and Services for people with AIDS in Dar es Salaam Archdiocese. This is mainly a CTC hospital which provides holistic care to PLHIV including the Prevention of mother-to-child transmission of HIV (PMCTC) issues. PASADA takes care of about 3,000 adults and 6,000 children monthly. The CTC turnover per day is about 65 patients.

Study design and population

An exploratory descriptive survey involving patients attending the CTC at PASADA hospital between January and April, 2014 was conducted. All consecutive patients reporting to PASADA and having been eligible for the initiation of ART were considered and enrolled, after their consenting. A purposeful sampling was employed whereby all eligible, consecutive patients attending CTC at the time of this study plus those who had been recruited two weeks back and coming for more drugs were recruited. The inclusion criteria were male or female >18 years; confirmed CD4+ count< 200/mm^3 or WHO stage IV; and eligible to start on ART and no history of taking concurrent or alternative medicine. The exclusion criteria were life threatening opportunistic infections, treatment with immune modulating medications and refusal to sign informed consent form.

This study depended on the baseline workup for ART initiation done by the CTC, in accordance with the National Guidelines for Care and Treatment of PLHIV- Tanzania. The workup included blood tests for liver function tests (LFTs), renal function tests (RFTs) and CD4+ cell count, using calibrated instruments and standard techniques. In all patients the weight and height were measured to calculate the body mass index (BMI), which was recorded in the study instrument together with the CD4+ count for each patient. A structured questionnaire was used to obtain more information, namely demographic, and lifestyle data. The sample size was calculated by adopting the fact that wasting with

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the body mass index (BMI) of <18.5 in adults with advanced HIV infection is 20-30 %. A maximum likely error of7% with significance level of 5%were used. Therefore the minimum sample size was 125clients.

Data collection

Baseline data on demographic and social characteristics such as age, sex, marital status, occupation, educational level, income, and meal frequency were obtained from participants by using a researcher administered questionnaire. For each participant weight and height were measured. Height was measured when the patient was standing erect against a wall marked with measurement, while weight was measured on a standing scale. The body-mass index for each patient was calculated as weight (kg)/height $(m)^2$. Information on the CD4+ count was obtained from available data in the patients' files.

Data analysis

Collected data were subsequently pre-coded and entered into the computer using Microsoft Excel Spreadsheet before exporting to SPSS version 20 for analysis. Information was summarized by using frequency tables and cross tabulations. The chi-squared test was used to establish association between the dependent variable, namely malnutrition and independent variables.

Ethical considerations

The research protocol was submitted to Hubert Kairuki Memorial University's Ethics Review Committee, which granted the ethical clearance, after review and approval. Permission to conduct the study at PASADA was sought from the Medical Director of the hospital. Prior to taking part in the study participants were provided information about the purposes of the study plus expected outcomes and potential benefits. Respondents who agreed were asked for consent by signing the consent form, before administering the questionnaire and taking measurements of weight and height.

Results

A total of 125 patients were included in this study. Majority of them were aged between 30-39 years. A comparison of the younger groups with older people shows that 67% of the participants were aged between 29 and 39 years. Majority (80%) were females (Table 1).

Table 1: Socio-demographic characteristics of the study population

Variable	Characteristics	Number	Percentage
Sex	Female	100	80
	Male	25	20
Age (years)	20 – 29	21	16.8
	30 – 39	55	44
	40 – 49	33	26.4
	50 – 59	9	7.2
	60 +	7	5.6
Marital status	Married	38	30.4
	Single	46	36.8
	Divorced	21	16.8
	Widowed	20	16
Occupation	Unemployed	36	28.8
	Business	72	57.6
	Employed	17	13.6
Education level	Primary	99	79.2
	Secondary	24	19.2

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	Tertiary	2	1.6
Residence	Rural	54	43.2
	Urban	71	56.8
Income	Irregular	59	47.2
	Regular	66	52.8
Meal frequency	< 2 per day	29	23.2
	3 + per day	96	79.8
Haemoglobin level	Severe anaemia	14	11.2
	Moderate	78	62.4
	Normal	33	26.4

Nutritional status of research participants

The overall prevalence of malnutrition in this study was 19.2% (24/125), while severe malnutrition, BMI <16 was 8.8% (11/125). Participants with underweight (BMI= 16—18.5) were 10.4% (13/125) while the majority, 80.8% (101/125) had normal nutrition (Table 2).

Table 2: Participants by nutritional status (body mass index, BMI)

Nutritional status	BMI	Number of patients	Percentage
Severe Malnutrition	< 16.0	11	8.8
Under weight	16.0 - 18.5	13	10.4
Normal weight	18.5 – 25.0	101	80.8

Table 3 indicates that the proportion of those with malnutrition among males was 43% compared to 14% among females (χ^2 = 10.055, p= 0.02), meaning that the difference between males and females with regard to malnutrition was statistically significant. This means, males were more likely to be malnourished than females (p< 0.05). However, the proportions of malnutrition between different age groups were not statistically significant (χ^2 = 3.903, p= > 0.05). Irregular income showed a significant association with malnutrition (χ^2 = 6.234, p< 0.05) and so was the number of meals per day being less than 3 (χ^2 = 6.605, p< 0.05).

Table 3: Nutritional status in relation to age, sex, income, meal frequency, CD4 count and anaemia

Variable	Variable category	Nutritional Status		χ^2	P-value
		Normal: BMI=18.5-25	Underweight BMI=16- 18.5		
Sex	Male	57.1	42.9	10.055	0.002
	Female	86.5	13.5		
Age	20-29	68.9	31.8	3.903	0.419
	30-39	81.5	18.5		
	40-49	87.9	12.1		
	50-59	88.9	11.1		
	60+	85.7	14.3		
Income	Regular	90.3	9.7	6.234	0.013
	Irregular	73.0	27.0		
Meal frequency	3+ per day	86.8	13.2	6.056	0.02
	< 3+ per day	67.6	32.4		
CD4 Count	<100	56.0	44.0	20.033	<0.001
	100-199	74.2	25.8		
	200-299	97.5	2.5		
	300+	89.7	10.3		
Anaemia	Normal	90.9	9.1	2.843	0.241
	Moderate Anaemia	79.0	21.0		

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	Severe Anaemia	72.7	27.3

After controlling for all important independent variables it was established that only irregular income, (OR= 3.8 (CI 1.2-11.5) and the number of meals per day (OR=3.4 (CI 1.2-9.2) had a significant association with malnutrition, as is indicated in Table 4 below.

Table 4: Detailed association between Nutritional status and other parameters

Variable	Variable category	Crude			Adjusted		
		OR	95% CI	p-value	OR	95% CI	P-value
Sex	Female	1			1		
	Male	4.8	1.7-13.5	0.003	5.1	1.7-14.7	0.003
Age	20-29	1			1		
	30-39	0.48	0.2-1.5	0.212	0.5	0.2-1.6	0.265
	40-49	0.29	0.1-1.2	0.083	0.2	0.1-1.1	0.550
	50-59	0.26	0.1-2.5	0.254	0.1	0.1-1.8	0.140
	60+	0.35	0.1-3.5	0.380	0.2	0.1-3.1	0.279
Income	Regular	1			1		
	Irregular	3.5	1.2-9.4	0.016	3.8	1.2-11.5	0.017
Meal	3+ per day	1			1		
frequency	< 3+ per day	3.1	1.2-8.0	0.017	3.4	1.2-9.2	0.015
CD4 Count	300+	1			1		
	200-299	0.2	0.2-2.2	0.203	0.24	0.1-2.5	0.234
	100-199	3.0	0.7-12.7	0.133	3.7	0.8-16.4	0.083
	<100	6.8	1.6-28.5	0.009	7.6	1.7-34.6	0.008
Anaemia	Normal	1			1		
	Moderate Anaemia	2.6	0.7-9.7	0.141	2.3	0.6-8.8	0.203
	Severe Anaemia	3.7	0.6-22.2	0.146	3.1	0.5-18.8	0.220

Table 5 (a): Distribution of CD4+ count among participants with and without malnutrition: 4 categories

CD4+ counts	Nutritional status (BMI						
	Under Nutrition (BMI<16 –18.5)		Normal Nutrition (BMI 18.5—25)		Total		
	Number	(%)	Number	(%)	Total	Odds ratio	95%CI
< 100	13	(52.0)	12	(48.0)	25		
100 – 199	7	(23.3)	23	(76.7)	30	3.6	0.18 -0.92
200 – 299	3	(7.3)	38	(92.7)	41	3.75	0.2 - 0.94
300 +	1	(3.5)	28	(96.5)	29	2	0.07 - 0.67
Total	24	(86.1)	101	(319.5)	125		

Table 5(b) Distribution of CD4+ count among participants with and without malnutrition: two categories

CD4+ counts	Nutritional status					
	Under Nutrition (BMI < 16—18.5)		Normal Nutrition (BMI 18.5—25)		Total	
	Number	Percentage %	Number	Percentage %	Total	Percentage %
< 200	20	(62.5)	12	(37.5)	32	(100)
200 – 299	4	(4.3)	89	(95.7)	93	(100)
Total	24		101		125	100

Odds Ratio= 37.08 (CI= 0.79—28.99)

Table 5a shows among people with CD4 count below 100, the proportion of malnourished people was 52% but as the cell count reads between 200 and 300 the proportion of malnutrition drops to 3.5%

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indicating that people with CD4 < 100 were more likely to have under nutrition than their counterparts with the CD4 count of >200. Recategorising the distribution of CD 4 count among participants into a two by two table (table 5b) shows also that the proportion of people with malnutrition was higher (62.5%) among those with low CD4 counts (CD4 <200) than in those with CD4 >200 (4.3%) but the difference was not statistically significant, OR=37.08, 95% CI= 0.79; 28.99.

Discussion

In this study the overall prevalence of malnutrition was 19.2% while severe malnutrition was about 9 %. The results were almost consistent with those obtained from a similar study in Tanzania: 18.4% (Ritte & Kessy, 2012). The results did not differ much from those in other low-and-middle income countries including Kenya (23.6%), Nepal (19.9%) and Ethiopia (23.2%) (Kuria, 2008; Thapa *et al.,* 2015; Mitiku *et al*., 2016). These results however, differ from analyses done in 11 Sub-Saharan countries where the prevalence was lower (Uthman, 2008). Similarly, studies in referral hospitals in Ethiopia and Nigeria, reported relatively lower prevalence rates (5.8-12.3%) (Hailemariam *et al*., 2013; Folasire *et al.*, 2015). However, severe malnutrition, which is clearly highlighted by this study was not addressed in those previous studies.

Another major finding of this study was the demographic characteristic of study participants which showed that among all participants two thirds were young. The age groups (20—40years) involved as PLHIV in this study are similar to those found in other studies in Tanzania and Ethiopia (Semali *et al*., 2011; Ritte & Kessy, 2012). Attendees to CTCs as noted in this study and in several others are predominantly young women between 20 and 39 years (Uthman, 2008; Semali *et. al.,* 2011; Ritte & Kessy, 2012). For Tanzania, this could probably be explained by the community–based HIV/AIDS surveys which reveal that the prevalence of HIV infection is highest among females aged 25 and 34 years compared to males in the same age group (THMIS, 2013). These figures from surveys could probably explain the highest proportion of females attending the CTCs as observed in this study.

This study showed that there was a statistically significant association between malnutrition and the lack of regular income. Also independently associated with malnutrition was the inability to get more than two meals a day. In this context previous studies showed that reporting of two or less meals per day increased the likelihood of food insecurity among people living with HIV and AIDS (Semali *et al*., 2011). In this study, food insecurity was found to have significant association with under nutrition. Similar studies in Ethiopia and Nepal found that adult people HIV positive on ART or household with food insecurity had the highest odds of being undernourished (Thapa *et al*., 2015; Dedha *et al*., 2017).

Regarding CD4, there was a significant association between low CD4 counts with under nutrition. Patients who had CD4 count <300 cell/mm^3 were approximately five times more likely to be undernourished as compared to those with CD4 >300 cell/mm^3. This is due to low immunity against infection. Similarly, the findings from Senegal and Ethiopia have also indicated that CD4 has significant effect on under nutrition (Benzekri *et al*., 2015; Mulu *et al.,* 2016; Dedha *et al*., 2017). In contrary, a previous study in southern part of Ethiopia showed that CD4 counts has no significant effect on under nutrition (Hailemariam *et al*., 2013). The difference between the findings of the study reported here are probably due to variations in study population and period.

In conclusion, the prevalence of both under nutrition and severe malnutrition among PLHIV attending CTC in Temeke is still high. Furthermore, food insecurity, irregular income and having a CD4 count of less than 300 cells/mm^3 were positively associated with under nutrition. Therefore, efforts should be strengthened to alleviate the higher burden of under nutrition by considering the identified determinants. Assessment during follow-up and routine nutritional supplement therapy for under nutrition in conjunction with early start on ART need to be initiated.

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