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Prevalence and Associated Factors of Anemia in Hiv-Infected Patients Attending Care and Treatment Clinic at Vwawa District Hospital in Mbeya Region-Tanzania

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Abstract

Background**:** AIDS related chronic opportunistic infections like TB may lead to anemia. ART may also cause insufficient food intake due to the side effect like nausea and vomiting. There is scarcity of data on the prevalence and factors associated with anemia among HIV-infected adult patients.

Methods**:** A cross sectional study was conducted at Vwawa district hospital CTC from January to March 2016. A questionnaire containing socio-demographic, clinical and associated factors information was administered to the study respondent. Blood and stool samples were collected in EDTA vacutainer tube and plastic clean container for complete blood count, CD4 T cell count, hemo-parasites and intestinal parasites, respectively. Data was analyzed using EPI INFO version 7. Univariate, bivariate and multivariate analysis was carried out where odds ratio was used as a measure of association to identify factors associated with anemia. Factors with $p<0.05$ at multivariate analysis was regarded as independently associated with anemia.

Results: A total of 350 HIV-infected patients aged 15 years and above were included in the study. The median age of the study participants was 36 years with a range of 16 to 70 years. Male participants contributed 42.3% while age group of 30 years and above contributed 70.6% (247). Six participants (1.7%) were receiving cotrimoxazole prophylaxis, and one hundred and eighty eight (53.7%) were on antiretroviral therapy. Ninety-five (27.1%) of the 350 participants were anemic (≤11.9g/dl) with a mean hemoglobin value of 12.9 g/dl ±2.2 S.D. The severe (Hb >8g/dl) anemia was observed in eight (2.3%) participants. Anemia increased with WHO HIV disease stages III & IV with the highest prevalence in stage IV with the prevalence of 31.8% and 62.5%, respectively (OR 1.97, 95%CI 1.02- 3.82). CD4 T cell count (OR 2.095% CI1.21- 3.18), fever (OR 2.22, 95% CI 1.03-4.77) and use of co-trimoxizole OR (OR 14.11, 95% CI 1.63-122.41) were significantly associated with anemia.

Conclusion The prevalence of anemia at Vwawa district hospital was found to be high. The factors associated with anemia among HIV-infected patients were multi-factorial and they included advanced WHO HIV stage, CD4 T cell count, presenting feature of fever and use of cotrimoxazole.

Keywords: Anemia; HIV; ART; Vwawa; Tanzania

Introduction

Anemia is a disease condition under which red blood cells fails to meet the body's oxygen-carrying capacity. Anaemia usually varies based on gender, in males anemia is diagnosed when hemoglobin is <13 g/dl and haematocrit is <39% where as in females anemia is when hemoglobin is of <12 g/dl and haematocrit of <36% are regarded as anemia. Anaemia also may vary with respect to individual's age, smoking behavior, altitude and stages of pregnancy [1].

WHO have estimated that about 2 billion people are anemic globally. Studies shows that about a quarter (30-40%) of the total anemia worldwide occurs in resource limited countries. According to the study which was conducted by Gretchen at el in 2011 and 2015 indicated that, the overall prevalence of anemia was estimated to 18-30% and the prevalence of severe anemia was estimated to be 2-5% worldwide. According to the study conducted by McLean E at el the prevalence of anemia in East Africa ranges from 15-93% [2].The Tanzania Demographic and Health Survey 2010, indicates that the overall prevalence of anemia in Tanzania is 50.4% (39.5-61.3%). In Southern highland it is 28.8% where as in Mbeya region it is reported to be 32.1%. Human Immunodeficiency Virus (HIV) is the virus that causes AIDS. HIV destroys certain blood cells that are crucial to the normal functioning of the immune system, which defends the body against illness. Acquired Immunodeficiency Syndrome (AIDS) occurs when the immune system is weakened by HIV to the point where a person is susceptible to opportunistic infections (OIs) or diseases. Having AIDS is defined as presenting with HIV and one or more opportunistic infections.

HIV and AIDS is one of the most destructive diseases humankind has ever faced. It brings with it profound social, economic and public health consequences. It has become one of the world's most serious health and development challenges. HIV is a leading cause of death worldwide. The first cases were reported in 1981 and since the beginning of the pandemic more than three decades ago; approximately 30 million people have died of AIDS-related illnesses. There is an estimated 35.3 million people living with HIV (PLHIV). The global prevalence rate (the percentage of people aged 15- 49 who are infected) was 0.8%. Globally it is estimated that 33.3 (30.9-36.1) million people were living with HIV/AIDS by the end of 2014.This estimate is increasing compared to the previous estimate due to increasing number of people who are taking the life-saving antiretroviral therapy. The global report of 2015 shows that, the number of deaths caused by AIDS was estimated to be 1.1 (940000-1.3) million and new infection was estimated to be 2.1(1.8-2.4) million.

There are an estimated 25.6 million [23.1-28.5 million] people living with HIV in sub-Saharan Africa, about two third of the global total. There are 2.9 million [2.6 million-3.4 million] young people (aged 15-24) and more than 2.5 million [2.4 million-2.7 million] people aged 50 years and older living with HIV in sub-Saharan [3].

In Tanzania according to the survey of THMIS of 2011-2012, it was estimated that there were 1.4(1.3-1.5) million adult people aged 15 to 49 that were leaving with HIV with a prevalence of 5.6% (5.3%-6.1%). Death due to AIDS was estimated to be 86,000 (69,000-110,000). Mbeya is one of the region in Tanzania with high prevalence of HIV with an estimate of 9.0% compared to Manyara region with a lowest prevalence of 2.0% [4-6].

There are various factors which may cause anemia; these include nutritional deficiencies (iron, vitamin B12 and folic acid), heamo-parasitic infection, intestinal parasitic infection, AIDS, inherited or acquired disorders that affect hemoglobin synthesis and heamopoesis defect among others.

A recent study has shown that anemia in HIV patients is the most common among blood disorders abnormalities, in HIV patients. It is estimated that the incidence of anemia is about 10% in people who have no HIV compared to 92% to people living with HIV. This may be due to infection of stroma cells and hemo-topoietic stem cells, AIDS chronic opportunistic infections like TB, bone marrow suppression by antiretroviral therapy and hemolytic anemia induced by oxidant drugs.

Materials and Methods

Study design and area

This was a cross sectional study that was conducted in the Vwawa district hospital HIV- CTC from January to March 2016.Vwawa District Hospital CTC which is found in Mbozi district in Mbeya region, Southern highland part of Tanzania. Mbozi district is located in the South Western corner of Mbeya Region, between Latitudes 80 and 90 12 South of the Equator and Longitudes 320 7' 30" and 330 2' 0" East of Greenwich Meridian. To the South the district is boarded by Ileje district, to the North, Mbozi district extends to Lake Rukwa where it is bordered by Chunya district, to the East by Mbeya Rural district at the mark of Songwe River, where as to the West it shares borders with Rukwa Region and the Republic of Zambia.

Study population

The study involved all HIV- infected patients aged 15 years and above who were attending Vwawa District Hospital CTC from January to March 2016 and who met the inclusion criteria rticipants.

Sample size and sampling technique

A total of 346 participants were randomly selected from patient's aged 15 years and above who were attending Vwawa District Hospital CTC from January to March 2016.

Blood sample collection:

Venous blood was collected for complete blood count and absolute CD4 T cell count using EDTA purple top tube. Data on the laboratory request forms included reason that samples were obtained as well as participant identification number, age, and sex of participant, date and time of specimen collected. All required materials for blood drawing were assembled before the procedure. Sterile, single-use needles and vacutainer tubes were used for each blood draw and after completion the needles were properly disposed in a puncture resistant container. Aseptic technique was used during phlebotomy.

Testing for complete blood count and CD4 T cell count

Blood sample collected was liquated into the following portions:

1 ml for Hemo-parasite investigations; 2mls for complete blood count and CD4 T cell counts. Standard Operating procedure was used for processing and investigations. Blood was well mixed and placed on a roller to prevent clotting and was processed within 8 hours for complete blood count and 24 hours for absolute CD4 T cell counts. Whole blood sample was analyzed using Sysmex KX-21 Hematology Analyzer to determine red blood cell count, hemoglobin concentration, red cell indices and red cell distribution width. The severity of anemia was based on WHO classification (Hb value 11-12 g/dl - mild, 8-10 g/dl – moderate and < 8 g/dl - severe anemia) regardless of age and sex. BD FACS Count System was used for enumeration of CD4 T cells according to manufacturer's instructions.

Blood film for malaria:

A drop of blood was made on a slide to make a thick film which was then stained with Giemsa stain for malaria parasites investigation. If a smear was positive for malaria parasites, quantification was made by counting the parasites per 200 WBCs on a thick smear. Density of parasites was determined using the following formula:-No. of parasites/200WBC x WBC counts/µL = parasitemia /µL 200.

Stool examination

A stool container with a scoop was given to the participant to collect a sample of approximately 2-5gm of stool using the scoop. Macroscopic examination for consistency and color was done. A sample of stool was prepared on a slide by putting two drops of normal saline by 1gram of stool and examining for ova/cyst, white and red blood cells using a microscope under x 10 power. Occult blood was tested by using haemat-occult method. This was done by mixing an activator and developer to a sample of emulsified stool, will be

applied on a test strip and color change was observed within 30 seconds. A blue color development indicated positive while absence of blue color on the test strip indicated a negative reaction. All positive result for occult blood in stool from individuals with a history of worm infections like hookworm, Entamoeba histolytica, and Schistosoma mansoni as well as with a history of bloody diarrhea were excluded from the test due to the fact that it may cause false positive results. All laboratory results were recorded in to laboratory logbooks before being transcribed into case record forms.

Quality control

All instruments used for study participant's sample investigation were validated against in Mbeya reference Laboratory certified equipment. Quality control for working equipment's and reagents was ensured using standard controls as well as Standard Operational Procedures. BD FACS Count Control bead sets, containing beads at four levels: zero, low, medium, and high, were added to samples prepared with normal blood to validate laboratory practices and methodology and system linearity for participant sample investigation. The result of each and every test was properly recorded. The research assistant was trained on how to collect the blood samples from the patients. To ensure the quality of the blood slides for malaria parasites and wet preparations for stool analysis, two different experienced laboratory technologists did separate readings. A third reader was consulted if there was still discordance observed between the two technologists.

Data management and analysis

Data was checked daily for completeness, cleared, edited, coded and double entered using spread sheet (excel) software then exported to EPI INFO version 7. Backup of the data was done. The questionnaire was pre-tested on 25 patients at the Vwawa hospital CTC. Based on the information obtained from the pretest, the questionnaire was then modified. Back up of the data and filled questionnaires were stored in a safe place under lock and key. Meetings with research assistants were held to sort out data collection problems. Finally the questionnaires were checked by investigators for their consistence and completeness every day.

The data was presented using tables, frequencies, cross tabulations and Chi-square test was used to summarize the descriptive statistics for dependent variable (presence of anemia) against independent variables (age, sex, presence of parasites or ova in stool, presence of iron deficiency, presence of malaria parasites and presence of malnutrition). Logistic regression was performed to assess the association between dependent and independent variables. Since there might be an interaction between the factors associated with to anemia, all the factors that had a p value of ≤ 0.2 were entered into the logistic model to establish those that were independently associated with anemia. Variables which had significant association were identified on the basis of Odds Ratio (OR) and 95% Confidence Interval (CI) and a p-value of <0.05.

Ethical Consideration

Ethical clearance for conducting this research was obtained from the Senate Research and Publications Committee of MUHAS. Permission to conduct the study was obtained from the office of the Medical Officer In-charge of Vwawa Hospital. Confidentiality of study subjects was ensured through the use of identification codes to conceal their identity. Informed consent was obtained from study participants prior to the enrolment in the study. Those who refused to participate in the study was given service equal to that of all the other who agreed to participate, regardless of their inclusion status in the study. Treatment was done according to the national guideline protocol for those who were identified to have hookworm infestation or anemia.

Results

A total of 365 HIV-infected patients aged 15 years and above were enrolled in the study from January to March 2016. Three were excluded from the study because they did not consent to have their blood samples to be taken, five individual were excluded from the study because they were less than 15 years of age, and seven were later excluded following a laboratory results failure due to blood clotting. Therefore, we hereby report results for 350 HIV-infected patients. Two hundred and two (57.7%) study participants were females. The overall median age was 36.0 years. The majority of the patients, 131(37.4%), were in the age group of 31-40 years. Two hundred and forty seven (70.6%) of the participants were 30 years and above. Two hundred and fifty nine (74.0%) participants were married. Six participants (1.7%) were receiving cotrimoxazole prophylaxis, and 188 (53.7%) were on antiretroviral therapy (Table 1).

Characteristics	Categories	Number	Percentage
Age, years	≤20	14	4
	21-30	89	25.4
	31-40	131	37.4
	41-50	67	19.1
	≥50	46	14.1
Sex	Female	202	57.7
	Male	148	42.3
Educational Status	Informal	29	8.3
	Primary	307	87.7
	Secondary	14	4

Table 1: Baseline social demographic characteristics of the study population (N=350).

Thirty participants (8.5%) presented with a fever, 22 (6.29%) had cough. Stool samples were received from 350 participants. There were 10 (2.86%) ova detected. Of 10 stool samples with ova, 4 hookworm, 4 Schistosoma mansoni and 2 Ascaris Lumbricoides were detected. Pus cells were seen in 13 (3.71%) stool samples and stool with red blood cells were 5 (1.4%). Ten stools (2.86%) had diarrhea and seven (2%) participants presented with bloody stools. The occult blood test was positive in 24 (6.86%) participants (Table 2).

Characteristics	Categories	Number	Percentage
HAART usage in years	<1	33	9.4
	01-May	115	32.9
	06-Oct	34	9.7
	Nov-15	6	1.7

WHO HIV disease stage	I	104	29.7
	II	90	25.7
	III	148	42.2
	IV	8	2.3
ART Regimen	AZT, 3TC, EFV	53	13.7
	AZT, 3TC, NVP	41	11.4
	TDF, 3TC, EFV	93	28
	TDF, FTC, FP/r	1	0.3
CD4 T cells Counts/μL	<350	125	35.5
	≥350	225	64.5
Fever	Yes	30	8.6
Intestinal parasites	Yes	10	2.9
Hemo parasites	Yes	9	2.6
Diarrhea	Yes	10	2.9
Blood in stools	Yes	7	2
Vomiting	Yes	11	3.1
Cotrimoxazole user	Yes	6	1.7
Chloramphenicol user	Yes	11	3.1
HAART user	Yes	188	53.7

Table 2: Clinical History, Physical examination and Laboratory results of the study population (N=350).

Ninety-five (27.1%) participants were anemic with a Mean hemoglobin 12.9 g/dl ± (S.D) 2.2. The prevalence of anemia was 29.7% (60/202) among female participants (Table 3).

Characteristics	Categories	Number	Percentage
HAART usage in years	<1	33	9.4
	01-May	115	32.9
	06-Oct	34	9.7
	Nov-15	6	1.7
WHO HIV disease stage	I	104	29.7
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ART Regimen	AZT, 3TC, EFV	53	13.7
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Intestinal parasites	Yes	10	2.9
Hemo parasites	Yes	9	2.6
Diarrhea	Yes	10	2.9
Blood in stools	Yes	7	2
Vomiting	Yes	11	3.1
Cotrimoxazole user	Yes	6	1.7
Chloramphenicol user	Yes	11	3.1
HAART user	Yes	188	53.7

Table 3: Prevalence of anaemia in HIV-Infected participants (N=350) by social demographic characteristics.

One hundred and eighty eight (53.7%) were on HAART whereas 162 (46.3%) were HAART naïve with anemia prevalence of 52.6% and 47.4%, respectively. Of the anemic participants, 7 (2.0%), 46 (13.1%), 42 (12%) had severe, moderate and mild anemia, respectively. Anaemia was common among participants in the age group of 21-30 years participants. Anaemia was also common among the cotrimoxazole users (Table 4).

Characteristics	Categories	Anaemia		
		Anemic N=95	Total N=350	%
Fever	Yes	13	30	43.3
Diarrhea	Yes	1	10	10
Intestinal parasite	Yes	5	10	5.3
Heamo parasites	Yes	5	9	5.3
Blood in stools	Yes	3	7	42.9
Vomiting	Yes	3	11	27.3
Use of cotrimoxazole	Yes	5	6	83.3
Use of Chloramphenicol	Yes	4	11	40
HAART Status	User	50	188	56.6
	Naive	45	162	47.4
HAART Usage in years	<1	9	33	27.3
	01-May	32	115	27.8
	06-Oct	8	34	23.5

	Nov-15	1	6	16.7
WHO HIV Stage	I	22	104	21.2
	II	21	90	23.3
	III	47	148	31.8
	IV	5	8	62.5
ART Regimen Combination	AZT, 3TC, EFV	21	53	39.6
	AZT, 3TC, NVP	10	41	25
	TDF, 3TC, EFV	19	93	20.4
	TDF, FTC, FP/r	0	1	0
CD4 T cell counts, u/L	<350	45	125	47.4
	≥ 350	50	225	52.6
Heamoparasite	Yes	5	9	5
Intestinal parasite	Yes	5	10	5.3

Table 4: Prevalence of anemia in HIV-Infected patients (N=350) by clinical history, physical examination and laboratory results.

The prevalence of severe anemia (Hb<8g/dl) among anemic participants was 8/95 (8.4%). Moderate anemia (Hb <10.9g/dl) was 42/95(44.2%). The prevalence of moderate to severe anemia (Hb<10.9g/dl) among the anemic HIV-infected patients was 8/50(16%). Severe anemia was the commonest in the age group of <20 years. Other distributions of anemia by socio-demographic and clinical characteristics are presented in Table 5.

Characteristics	Categories	Anaemia		
		Severe (Hb <8g/dl)	Moderate (Hb 8-10.9 g/dl)	Mild (11-11.9 g/dl) N=42 n (%)
		(N=8) n (%)	N=45 n (%)	
Sex	Female	3 (5.0)	30 (50.0)	27 (45.0)
	Male	5 (14.3)	15 (42.9)	15 (42.9)
Age, years	<20	1 (25.0)	0 (0.0)	2 (75.0)
	21-30	1 (6.3)	12 (36.4)	19 (57.6)
	31-40	4 (11)	19 (52.8)	13 (36.1)
	41-50	0 (0.0)	06 (54.5)	5 (45.5)
	>51	1 (9.1)	05 (45.5)	5 (45.5)
Religion	Christian	7 (7.9)	41 (46.1)	41 (46.1)
	Muslim	1 (25.0)	3 (75.0)	0 (0.0)
	Traditional	0 (0.0)	1 (50.0)	1 (50.0)
Education	Informal	1 (11.1)	4 (44.4)	4 (44.4)
	Primary	7 (8.4)	36 (43.4)	40 (48.2)
	Secondary	0 (0.0)	1 (33.3)	2 (66.7)
HAART	User	3 (6.0)	23 (46.0)	24 (48.0)
	naïve	5 (11.1)	22 (48.9)	18 (40.0)
ART Regimen	AZT	3 (9.7)	14 (45.2)	14 (45.2)
	Non AZT	0 (0.0)	9 (47.4)	10 (52.6)
Fever	Yes	2 (15.4)	2 (15.4)	9 (69.2)
Diarrhoea	Yes	0 (0.0)	1 (100)	0 (0.0)
Blood in stool	Yes	0 (0.0)	1 (33.3)	2 (66.7)
Vomiting	Yes	0 (0.0)	0 (0)	3 (100)
Cotrimoxazole	Yes	0 (0.0)	3 (60)	2 (40.0)
Chloramphenicol	Yes	0 (0.0)	2 (50)	2 (50.0)
Heamoparasite	Yes	2 (40)	1 (40)	2 (20.0)
Intestinal parasite	Yes	1 (20)	3 (60)	1 (20.0)
CD4 T cells counts	<350/µl ≥350/µl	5 (11.1) 3 (6.0)	25 (51.1) 22 (44.0)	17 (37.8) 25 (50.0)
Duration on	<1	1 (11.1)	4 (44.4)	4 (44.0)
HAART	1-5	2 (6.3)	16 (50)	14 (43.8)
	6-10	0 (0.0)	6 (75)	2 (25.0)
	11-15	0 (0.0)	1 (100)	0 (0.0)
Occult blood	Yes	0 (0.0)	7 (63.6)	4 (36.4)
WHO HIV stage	I	2 (9.1)	10 (45.5)	10 (45.5)
	II	1 (4.8)	8 (38.1)	12 (57.1)
	III	4 (8.5)	25 (53.2)	18 (38.3)
	IV	1 (20.0)	2 (40.0)	2 (40.0)

Table 5: Severity of anemia among the HIV-infected patients by social demographic characteristics (N=95) at Vwawa District Hospital.

In bivariate analysis, age group from 30 years and above, ART regimen with a combination of AZT and WHO HIV disease stages III & IV and CD4 T cell counts were associated with anemia. Anaemia increased with WHO HIV disease stages III & IV with the prevalence being 31.8% and 62.5%, respectively.

This shows factors associated with anemia on multivariate logistic regression analysis. Age group from 30 years and above, WHO HIV disease Stage III & IV, use of Cotrimoxazole, CD4 countless than 350 cells/µL and ART regimen combination containing AZT remained independently associated with anemia. Anaemia was 1.8 times more likely to occur in participants aged 30 years and above compared to those with aged below 30 years (OR 1.8, 95%CI 1.11-3.01, p=0.02). Participant with WHO HIV disease stage III & IV were twice likely to

have anemia (OR=1.8, 95% CI 1.09- 2.82, p=0.02) compared to those with WHO HIV disease stage I & II. Anaemia was about 2 times more likely to occur in participants with CD4 T cells counts below 350 cells/μL when compared to participants with CD4 T cells ≥ 350 cells/μL (OR=2, 95%CI 1.21- 3.18, p=0.005).

Discussion

Although anemia has been recognized as a public health problem for many years, little progress on decreasing the prevalence of anemia has been reported and the global prevalence of anemia remains unacceptably high.The study was aimed at determining the prevalence, severity and factors associated with anemia among HIV infected patients aged 15 years and above who were attending the HIV-CTC at Vwawa district hospital [7-9].

The overall mean age of this study population was 37.33 ± 11.18 years. This is comparable to the study done in the Northwest Ethiopia which reported the mean age of 34.6 ± 8.5 years. Previous study on prevalence, severity and related factors of anemia in HIV/AIDS patients in Isfahan, Iran showed that the mean age was 36.1 ± 9.1 years (51) given the fact that HIV affects more youths in the reproductive age. Fifty seven percent (57.7%) of study participants in this study were females, a study finding that is in line with several other studies. According to Tanzania HIV/AIDS and Malaria Indicator Survey of 2011-12, the HIV prevalence was higher among women (6.2%) than among men (3.8%) [9,10].

The prevalence of anemia in the current study was found to be 27.14%. This is in contrast with findings from a previous study that was done in Hydom, Tanzania in HIV-infected patients aged 15 years and above which found that 70.1% had anaemia [9]. The lower prevalence could be explained by the fact that change on first line HAART regimen combination containing zidovudine and stavudine to tenofovir could have decreased the occurrence of anaemia [12]. Secondly, since the previous study measured baseline hemoglobin of HIV-infected patients who were on zidovudine and Stavudine regimen combination alone while the current study involved HIV-infected patients who are both on HAART and who are not on HAART. Those who were on HAART the regimen combination contained Tenofovir (TDF, 3TC, EFV) and Zidovudine (AZT, 3TC, NVP) combination alone [13].

The prevalence of anaemia was (29.7%) among females compared to 23.6% in male participants. Many previous studies have revealed that the prevalence of anaemia was higher in females compared to the male participants (19,25,54,55).This may be explained by the fact that, women loose a significant amount of blood every month through their period (menses), which is obviously not something that affects men. The prevalence of anaemia among participants on HAART was 26.6% compared to 27.8% of those who were HAART naive. This could be due to the effect of HIV itself on bone marrow suppression, hematopoietic organs due to advanced stage of HIV disease and low CD4 T cell count which are likely to occur in the absence of ARV. High prevalence of anaemia was observed in patients with WHO HIV disease stages III & IV with the highest prevalence in stage IV with the prevalence of 31.8% and 62.5%, respectively [14]. This may also be supported by the severity of 20% which was observed in WHO HIV disease stage IV which might be caused by advanced WHO HIV disease stage.

The distribution of anaemia by severity was 12.0%, 12.9% and 2.3% for mild, moderate and severe, respectively. Severe anaemia was found in 2.3% of study participants. This is almost similar to the study which was conducted at the Hydom Hospital in Northern Tanzania where by severe anaemia was observed in 4%. The low prevalence of severe anaemia probably because in these two regions there is low prevalence of factors associated with severe anaemia including malaria infection, nutritional deficiencies and intestinal parasites. Recent studies have revealed that malaria, intestinal parasite and occult blood are important causes of severe anaemia [15].

Malaria is an important risk factor for development of severe anaemia. This is due to the fact that malaria cause anaemia by the mechanism of red blood cell lyses, organ sequestration and destruction of erythrocytes, phagocytosis of uninfected and infected red blood cells and dys-erythropoiesis. In the current study, malaria was not associated with anaemia. The lower prevalence of severe anaemia in this study could also be explained by the fact that most of the participants involved in this study were out patients. Most of them had HIV-co infection with TB which could be associated with increased severity of anaemia. In the current study, no participant reported a co-infection of HIV and TB.

The age group of ≥ 30 years was independently associated with anaemia. This could be explained by the fact that, intestinal parasites which is a major cause of anaemia occurred in (60%) of participants who were greater than 30 years and similarly (63.0%) of the occult blood of participants in this study were also greater than 30 years. Diarrhea in this study was also common in age group of 30 years and above. Diarrhea is one of the risk factor to anaemia because diarrhea causes low absorption of micronutrients like iron which is a raw material for the synthesis of hemoglobin. Studies in Boston and Nigeria have also found anaemia to be highly prevalent in the age from 30 years and above [9]. This could be due to the fact that as the age increases from 30 years the immunity of the individuals starts to be lowered as a result individual will become prone to HIV-TB co-infection [5].

Many studies show that most ART regimen combinations are risk factors for individual to be anemic. In the current study the regimen combination which was used in most participants was AZT, 3TC, NVP, TDF, 3TC, EFV and AZT, 3TC, EFV as the first line and one participant was on TDF, FTC, and FP/r as a second line regimen. The ART regimen containing AZT showed to be independently associated with anaemia. This is similar to the study which was conducted in Nigeria by Emeka at el. AZT is a well-known cause of drug-induced haemato-toxicity. ZDV causes anaemia by bone marrow suppression and inhibition of proliferation of blood cell progenitor cells in a time- and dose-dependent fashion. In the current study, of 50 anemic participants who were under ART, 62% was due to ART regimen containing AZT.

It appears that anaemia by itself is correlated with HIV disease progression in both retrospective and prospective studies. In this study the prevalence of anaemia in WHO/ HIV disease stage III and IV was higher compared to stage I and II. Several studies suggested that the anaemia in some advanced HIV/AIDS patients resulted from therapy-related toxicity but adverse drug effects alone are not sufficient to account for the consistent association between anaemia and HIV disease stage. Furthermore, several studies in a range of patient cohorts demonstrated that anaemia has prognostic significance for morbidity and mortality measures in HIV-infected patients, supporting the possibility that the virus itself may play an independent role in driving dysfunctional erythropoietin.

The prevalence of was significantly high in HIV-infected patients with CD4 count <350 cells/μL. A previous study conducted in Nigeria on the prevalence and risk factors of anaemia among ART naïve HIV-infected patients concluded that a CD4 T cell count of <200 cells/μL was associated with an increased risk of anemia. Risk of anaemia in HIV-infected patients with low CD4 T cell count may be due to suppression of erythropoietin by cytokines produced by HIV-infected lymphocytes, monocytes, and macrophages which increase with increase viral load and the increased number of HIV-infected lymphocytes, monocytes, and macrophages seen in advanced HIV disease.

Conclusion

The prevalence of anemia in Vwawa district hospital was found to be high. The factors associated with anaemia among HIV-infected patients were multi-factorial and they included advanced WHO HIV disease stage, CD4 T cell count, presenting feature of fever and use of cotrimoxazole.

HIV-infected patients should be evaluated routinely for the presence of anemia. Early recognition of HIV associated anemia may be achieved by HIV screening in adult patients presenting with unexplained anemia and strictly measuring hemoglobin level among HIV-infected patients in care as it is done for CD4 T cell count monitoring in local setting.

Findings from the study have shown that many HIV-infected adult patients who were ARV naive were less anemic as compared to their counterpart on ARV. It is recommended that patients with HIV timely receive ARV as per guideline. Further study should be done to identify the risk factors for anaemia in HIV-infected patients compared to those who are HIV infected patient under isoniazid preventive therapy.

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References

Makubi AN, Mugusi F, Magesa PM, Roberts D (2012) Risk factors for anaemia among HIV infected children attending care and treatment clinic at Muhimbili National Hospital in Dar es Salaam , Tanzania. Heal 141:1-9.

Gedle D, Gelaw B, Muluye D, Mesele M (2015) Prevalence of malnutrition and its associated factors among adult people living with HIV/AIDS receiving anti-retroviral therapy at Butajira Hospital, southern Ethiopia. BMC Nutr 11:5.

McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B (2019) Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. Public Health Nutr. 12:444-454.

Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, et al. (2013) Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: A systematic analysis of population-representative data. Lancet Glob Heal. 1:16-25.

Pasricha SR (2014) Anemia: A comprehensive global estimate. Blood. 123:611-612.

Kates J (2005) The Global HIV / AIDS Epidemic.650:13-14.

O'Brien ME, Kupka R, Msamanga GI, Saathoff E, Hunter DJ, et al. (2005) Anemia is an independent predictor of mortality and immunologic progression of disease among women with HIV in Tanzania. J Acquir Immune Defic Syndr. 40:219-225.

Van der Werf MJ, van Benthem BH, van Ameijden EJ (2000) Prevalence, incidence and risk factors of anaemia in HIV-positive and HIV-negative drug users. Addiction. 95:383-392.

Martin C, Poudel-Tandukar K, Poudel KC (2014) HIV Symptom Burden and Anemia among HIV-Positive Individuals: Cross-Sectional Results of a Community-Based Positive Living with HIV (POLH) Study in Nepal. PLoS One. 9:116-263.

Malamba S, Hladik W, Reingold A, Banage F, McFarland W, et al. (2007) The effect of HIV on morbidity and mortality in children with severe malarial anaemia. Malar J. 6:143.

Obirikorang C, Yeboah F A (2009) Blood haemoglobin measurement as a predictive indicator for the progression of HIV/AIDS in resource-limited setting. J Biomed Sci. 16:102.

Drain PK, Kupka R, Mugusi F, Fawzi WW (2007) Micronutrients in HIV-positive persons receiving highly active antiretroviral therapy. Am J Clin Nutr. 85:333-345.

Isanaka S, Spiegelman D, Aboud S, Manji KP, Msamanga GI, et al. (2012) Post-natal anaemia and iron deficiency in HIV-infected women and the health and survival of their children. Matern Child Nutr. 8:287-28.

Volberding P a, Levine AM, Dieterich D, Mildvan D, Mitsuyasu R, et al (2004) Anemia in HIV infection: clinical impact and evidence-based management strategies. Clin Infect Dis. 38:1454-1463.

Curkendall SM, Richardson JT, Emons MF, Fisher a E, Everhard F (2007) Incidence of anaemia among HIV-infected patients treated with highly active antiretroviral therapy. HIV Med. 8:483-490.