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Prevalence of Anemia Before and After Initiation of Antiretroviral Therapy on HIV Infected Patients at Ras Desta Damtew Memorial Hospital, Addis Ababa, Ethiopia

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ABSTRACT

Objective: The aim of this study is to determine the prevalence of anaemia before and after initiation of antiretroviral therapy (ART) in HIV infected patients.

Methods: A retrospective study was conducted on HIV infected patients before ART and was on follow up at the ART Clinic of Ras Desta Damtew Memorial Hospital Addis Ababa, Ethiopia. Haemoglobin, Hematocrit, Red Cells and Red Cell Indices measurement and CD4+ T cell count was measured using standard methodology at baseline and after every 4 months of Three Visit antiretroviral therapy (ART). Paired t-test was used to assess mean differences for Haemoglobin, Hematocrit, Red Cell and CD4+ T cell count before and after ART initiation.

Results: Prevalence of anemia at baseline was 24.1% (261/1082). However, prevalence of anemia after ART was significantly decreased in all three visits as follows; first visit of ART was 11.98% (134/1118) ($p<0.05$), after second visit was 9.33% (91/975) ($p<0.05$), after third visit was 2.85% (23/805)) ($p<0.05$), The prevalence of anemia was higher in females than in males at baseline (62.9% *vs.* 37.1%) (P=0.00), and after first visit of ART (15.66% *vs.* 5.76%) (P=0.00), after second visit was (9.61% *vs.* 8.83%), after third visit was (3.39% *vs.* 1.81%) (P=0.00). Mean CD4+ T cell count of study subjects was 139 cells/μl ± 96.21 ($P<0.05$) at baseline. The mean CD4+ T cell count is significantly increased after ART in three visits and found to be after the first visit of ART was 244 cells/μl ± 135.4 ($P<0.05$), after the second visit was 294 cells/μl ± 169.79 and after third visit 354 cells/μl ± 182.8 ($p<0.05$). Significance association was observed between Hgb, Hct and CD4+ T cell count after ART.

Conclusion: The prevalence of anemia based on the hematological parameter (Hgb, HCT) decrease after the initiation of ART except for RBC count. At the same time, mean CD4 cell count significantly increased among patients who started ART. This indicates that the use of HAART in HIV/AIDS patients significantly increase CD4 count and decrease viral load along with decreasing prevalence of anemia.

INTRODUCTION

Hematologic abnormalities are among the most common manifestations of advanced HIV infection and AIDS. In established HIV infection, lower hemoglobin levels have been shown to correlate with decreasing CD4+ cell counts and many studies have found an association between anemia during established infection and a faster progression to AIDS and death. Anemia has been

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reported to influence the natural history of HIV disease by increasing the rate of HIV-infected persons. Disease progression and mortality in both developed and developing countries The consequences of untreated anemia may lead to multisystem disabling symptoms and fatigue, exhaustion, increased risk of HIV dementia, poor quality of life and possibly even exacerbates poverty in communities with a high HIV prevalence. On the other hand, survival time in HIV-infected persons may be enhanced after recovery from anemia [1].

Anemia is defined as a hemoglobin concentration lower than the established cutoff defined by the World Health Organization. This cutoff figure ranges from 110 g/L for pregnant women and for children 6 months–5 years of age, to 120 g/L for non-pregnant women, to 130 g/L for men. In addition to sex, age, and pregnancy status, other factors influence the cutoff values for hemoglobin concentration. These include altitude, race, and whether the individual smokes. Anemia can be diagnosed by analyzing the hemoglobin concentration in the blood or by measuring the proportion of red blood cells in whole blood (hematocrit). Hemoglobin is an iron-containing protein in red blood cells that carries oxygen from the lungs to cells throughout the body. Without sufficient oxygen, the physical capacity of individuals is reduced [2].

Ineffective RBC production, anemia may result from nutritional deficiencies—most commonly, deficiencies in iron or other conditions that affect the gastric mucosa in HIV-infected patients [folic acid, or vitamin B12] [3-7]. In patients with HIV disease, folic acid deficiency is generally caused by either dietary deficiency or jejunal pathology. Vitamin B12 deficiency may result from malabsorption in the ileum or from gastric pathology caused by an array [3]. HIV infection may lead to anemia in many ways: changes in cytokine production with subsequent effects on hematopoiesis; Decreased erythropoietin concentrations; Opportunistic infectious agents, such as Mycobacterium aviumcomplex1 and parvovirus B-19; Administration of chemotherapeutic agents such as Zidovudine, Ganciclovir, and Trimethoprim-sulfamethoxazole; and Myelophthisis caused by cancers such as lymphosarcoma [1].

MATERIALS AND METHODS

Study setting and design

The study was conducted at Ras Desta Dametew Memorial Hospital, which is found in Addis Ababa Arada sub city. A retrospective cross-sectional study was used to study the prevalence of anemia in HIV positive patients before and after the initiation of ART from 2011- 2016. All Patients visiting Ras Desta Damtew memorial hospital from 2011-2016 and seek HIV. The study population of this study was those patients who are HIV positive and have full data at Ras Desta memorial hospital. The sample size was 1155 that was taken conveniently from the patient cards.

Data collection and analysis

Data were extracted from the patient's card in Ras Desta Damtew Memorial Hospital. Purposive sampling technique was conducted in all patients requested for the hematological tests during the study period. To assure the quality and reliability of data, the data was extracted by using a double entry and checklist was prepared using age, sex, CD4. Then cleaning done using SPSS version 16 and also the advisors follow and correct the progress of the research. A univariate (frequency distribution of each variable) and bivariate (chi-square test of association between the dependent and independent variable) data analysis techniques were done using SPSS version 16 statistical software.

RESULTS

Data of 1155 HIV infected patients who visited and attended a follow up in Ras Desta Damtew Memorial Hospital ART clinic were included. Of these, 37.1% were males (n=429) and 62.9% (n=726) were female patients. The age range for both males and females was 15-71 years. The mean age of male patients was 39.3 ± 0.43 years while 35.07 ± 0.348 years for females. Among the study subjects, 41.99% belong to the age group of 26-35 years. The highest number of male patients belongs to the age group of 36-45 years that accounted for 49.8%. On the other hand, the highest number of female patients belongs to the age group 26-35 and accounted 72.16% (**Table 1**).

Table 1. Distribution of study subjects by age group at ART clinic of Ras Desta Damtew Memorial Hospital.

Age group (years)	Male's n (%)	Female's n (%)	Total n (%)
15-25	14 (14.28)	84 (85.71)	98 (0.08)
26-35	135 (27.83)	350 (72.16)	485 (41.99)
36-45	195 (49.8)	196 (50.12)	67 (50)
46-55	67 (50)	67 (50)	134 (11.6)
>55	18 (38.29)	29 (61.7)	47 (4.06)
Total	429 (37.14)	726 (62.85)	1155 (100)

The result of hemoglobin measurement

The baseline hemoglobin measurement of the study subject ranges from 5 g/dl to 23.9 g/dl with a mean hemoglobin value of 12.87 g/dl ± 2.16. The mean hemoglobin level for males was 13.39 g/dl ± 0.1089 and for females, it was 12.56 g/dl ± 0.75. Based on Federal Ministry of Health ART Laboratory Test Request Format for classification of anemia patients with hemoglobin levels less than or equal to 11.4 g/dl were considered as anemia. Thus the overall prevalence of anemia in the study subject be-

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fore ART was 24.1% (261/1082). The prevalence of anemia among females was 72.63% (188/261) which is higher than males whose prevalence was 27.96% (73/261).

The hemoglobin measurement of the study subject after the first visit ranges from 4.52 g/dl to 23.50 g/dl with a mean hemoglobin value of 13.61 g/dl ± 2.07. The mean hemoglobin level for males was 14.39 g/dl ± 0.104 and for females, it was 13.15 g/dl ± 0.07. Thus the overall prevalence of anemia in the study subject at first visit was 11.98% (134/1118). Prevalence of anemia among females was 15.66% (110/702) which is higher than males whose prevalence was 5.76% 24/416). The hemoglobin measurement of the study subject after the second visit ranges from 4.54 g/dl to 23.8 g/dl with a mean hemoglobin value of 14.1 g/dl ± 2.1. The mean hemoglobin level for males was 14.73 g/dl ± 0.123 and for females, it was 13.78 g/dl ±0.07. Thus the overall prevalence of anemia in the study subject after the second visit was 9.33% (91/975). Prevalence of anemia among females was 9.61% (60/624) which is higher than males whose prevalence was 8.83% (31/351). The hemoglobin measurement of the study subject after the third visit ranges from 6.8 g/dl to 21 g/dl with a mean hemoglobin value of 14.65 g/dl ± 1.81. The mean hemoglobin level for males was 15.34 g/dl ± 0.11 and for females, it was 14.16 g/dl ± 0.07. Thus the overall prevalence of anemia in the study subjects after the third visit was 2.85% (23/805). Prevalence of anemia among females was 3.39% (18/530) which is higher than males whose prevalence was 1.81% (5/275). From our result, HGB has a significant association in all visits with sex (Female), age category (26-35) and CD4+ T cell count after the second and third visit, but there is no significant association between hemoglobin level with the CD4 count at baseline and first visit (**Table 2**).

Table 2. Hemoglobin level of study subjects by gender before and after initiation of ART and their association at ART clinic of Ras Desta Damtew Memorial Hospital, 2011- 2016.

	Hgb level (g/dl)	Hgb level (g/dl)				
	<11.5	11.5-15	>15	Total	Total	X^2
At baseline						
Sex					0.0001	39.406
F	188 (27)	479 (68.8)	29 (4.2)	696 (100)		
M	73 (18.9)	258 (66.8)	55 (14.2)	386 (100)		
Total	261 (24.1)	737 (68.1)	84 (7.8)	1082 (100)		
CD4					0.934	5.611
1st visit						
Sex					0.0001	96.639
F	110 (15.7)	503 (71.7)	89 (12.67)	702 (100)		
M	24 (5.8)	241 (58.2)	151 (36.3)	416 (100)		
Total	134 (12)	744 (66.5)	240 (21.5)	1118 (100)		
CD4					0.016	24.83
2nd visit						
Sex					0.0001	84.239
F	60 (9.6)	441 (70.3)	123 (19.7)	624 (100)		
M	31 (8.8)	154 (43.9)	166 (47.3)	351 (100)		
Total	91 (9.3)	595 (61)	289 (29.6)	975 (100)		
CD4					0.0001	54.816
3rd visit						
Sex					0.0001	85.912
F	18 (3.4)	384 (72.5)	128 (24.2)	530 (100)		
M	5 (1.8)	113 (41.1)	157 (57.1)	275 (100)		19.257
Total	23 (2.9)	497 (61.7)	285 (35.4)	805 (100)		
CD4					0.083	19.257
TB					0.003	11.598
POS	82 (29.5)	503 (71.7)	11 (4)	278 (100)		
NEG	179(22.3)	241(58.2)	73(9.1)	804(100)		
Total	261 (24.1)	744 (66.5)	84 (7.8)	1082 (100)		

The result of hematocrit measurement

The baseline hematocrit measurement of the study subject ranges from 15.8% to 75.5% with a mean hematocrit value of 38.72% ± 5.943. The mean HCT level for the male was 40.258% ± 0.299 and for females, it was 37.81% ± 0.208. Based on the Federal Ministry of Health ART Laboratory Request Format HCT level less than or equal to 33.9% were considered as anemic. Thus the overall prevalence of anemia in the study subject at baseline was 19.93%. Prevalence of anemia among females was 23.27% (168/722) which is higher than males whose prevalence was 14.28% (61/427).

The hematocrit measurement of the study subject at first visit ranges from 14.2% to 81.10% with mean HCT value of 40.26% ± 5.93. The mean HCT level for the male was 42.3% ± 0.30 and for females, it was 39.04% ± 0.205. The overall prevalence of anemia in the study subject at first visit it was 10.54% (117/1110). Prevalence of anemia among females was 12.87% (90/699)

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which is higher than males whose prevalence was 6.57% (27/411). The HCT measurement of the study subject at second visit ranges from 14.8% to 82.3% with mean HCT value of 41.73% ± 6.05. The mean HCT level for males was 43.54% ± 0.31 and for females, it was 40.73% ± 0.24. The overall prevalence of anemia in the study subject on the second visit was 6.83 % (65/951). Prevalence anemia among female was 7.98% (49/614) which is higher than males whose prevalence was 4.74% (16/337). The HCT measurement of the study subjects at third visit ranges from 13.9% to 65.7% with a mean hemoglobin value of 42.76% ± 5.58. The mean HCT level for males was 45.14% ± 0.36 and for females, it was 41.53% ± 0.22. The overall prevalence of anemia in the study subject at the third visit was 3.63% (28/770). Prevalence of anemia among females was 4.12% (21/509) which is higher than males whose prevalence was 2.68% (7/261).

From our result HCT has a significant association in all visits with sex (Female), age category 26-35) and CD4+ T cell count (**Table 4**).

Table 3. Hematocrit level of the study subjects by gender before and after initiation of ART and its association at ART clinic of Ras Desta Damtew Memorial Hospital, 2011-2016.

	HCT level (%)				Association	
	<34	34-44	>44	Total	P value	X^2
At baseline						
Sex					0.0001	80.037
F	168 (23.3)	491 (68)	63 (8.7)	722 (100)		
M	61 (14.3)	245 (33.3)	121 (28.3)	427 (100)		
Total	229 (19.9)	736 (64.1)	184 (16)	1149 (100)		
CD4					0.735	8.625
1st visit						
Sex					0.0001	89.43
F	90 (12.9)	519 (74.2)	90 (12.9)	699 (100)		
M	27 (6.6)	233 (56.7)	151 (36.7)	411 (100)		
Total	117 (10.5)	752 (67.7)	241 (21.7)	1110 (100)		
CD4					0.005	28.067
2nd visit						
Sex					0.0001	82.948
F	49 (8)	752 (67.7)	119 (19.4)	614 (100)		
M	16 (4.7)	446 (72.6)	160 (47.5)	337 (100)		
Total	65 (6.8)	161 (47.8)	279 (29.30	951 (100)		
CD4					82.948	44.359
3rd visit						
Sex					0.0001	64.14
F	21 (4.1)	346 (68)	142 (27.9)	509 (100)		
M	7 (2.71)	104 (39.8)	150 (57.5)	261 (100)		
Total	28 (3.6)	450 (58.4)	292 (37.9)	770 (100)		
CD4					0.438	12.097
TB					0.001	13.472
POS	77 (26.1)	185 (62.7)	33 (11.2)	295 (100)		
NEG	152 (17.80)	551 (64.5)	151 (17.7)	854 (100)		
TOTAL	229 (19.9)	736 (64.1)	184 (16)	1149 (100)		

The result of RBC measurement

The baseline RBC measurement of the study subjects ranges from 1.40 cells/µl to 11.9 cells/µl with mean RBC value of 4.50 cells/µl ± 0.711. The mean RBC level for the male was 4.61 cells/µl ± 0.03 and for females, it was 4.44 cells/µl ± 0.025. Based on the Federal Ministry of Health ART Laboratory Test Request Format RBC value less than or equal to 3.7 cells/µl were considered as anemic. Thus the overall prevalence of anemia in the study subjects before ART was 11.6% (120/1036). Prevalence of anemia among females was 11.86% (77/649) which is higher than males whose prevalence was 11.1% (43/387).

The RBC measurement of the study subjects at first visit ranges from 1.24 cells x 1012/L to 14 cells x 1012/L with mean RBC value of 4.07 cells x 1012/L ± 0.736. The mean RBC value for the male was 4.22 cells x 1012/L ± 0.035 and for females, it was 3.98 cells x 1012/L ± 0.029. The overall prevalence of anemia in the study subjects at first visit was 2.95% (286/969). Prevalence of anemia among females was 3.45% (207/600) which is higher than males whose prevalence was 2.14% (79/369). The RBC measurement of the study subjects at second visit ranges from 2.05 cells x 1012/L to 9.41 cells x 1012/L with mean RBC value 4.13 cells x 1012/L ± 0.68. The mean RBC value for male 4.27 cells x 1012/L ± 0.03 and for females it was 4.04 cells x 1012/L ± 0.029. The overall prevalence of anemia in the study subjects at the second visit was 25.54% (211/826). Prevalence of anemia among females was 30.16% (162/537) which is higher than males whose prevalence was 16.95% (49/289). The RBC measurement of the study subject at third visit ranges from 2.19 cells x 1012/L to 13.7 cells x 1012/L with mean RBC value of 4.22 cells x 1012/L ± 0.77. The mean RBC value for males was 4.5 cells x 1012/L ± 0.06 and for females, it was 4.08 cells x

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1012/L ± 0.027. The overall prevalence was anemia in the study subjects at the third visit was 21.73% (150/690). Prevalence of anemia among females was 26.88% (121/450) which is higher than males whose prevalence was 12.08% (29/240). From our result, RBC has a significant association in all visits with sex (Female), age category (26-35) and CD4 cell count.

Table 4. RBC level of the study subjects by gender before and after the initiation of ART at Ras Desta Damtew Memorial Hospital, 2011-2016.

	RBC level Cell x 1012/L				Association	
	<3.8	3.8-5.1	>5.1	Total	P value	X^2
At baseline						
sex					0.0001	18.41
F	77 (11.9)	511 (78.9)	61 (9.4)	649 (100)		
M	43 (11.1)	272 (70.3)	72 (18.6)	387 (100)		
Total	120 (11.6)	783 (75.6)	133 (12.8)	1036 (100)		
CD4					0.254	14.768
1st visit						
sex					0.0001	25.225
F	207 (34.5)	364 (60.7)	29 (4.8)	600 (100)		
M	79 (21.4)	252 (68.3)	38 (10.3)	669 (100)		
Total	286 (29.5)	616 (63.6)	68 (6.9)	668 (100)		
CD4					0.108	18.261
2nd visit						
sex					0.0001	17.719
F	162(30.2)	336(60.5)	39(7.3)	537(100)		
M	49 (17)	219 (75.8)	21 (7.3)	289 (100)		
Total	211 (25.5)	555 (67.2)	60 (7.3)	826 (100)		
CD4					0.67	16.567
3rd visit						
sex					0.0001	31.111
F	121 (26.9)	305 (67.8)	24 (5.3)	450 (100)		
M	29 (12.1)	177 (73.8)	34 (14.2)	240 (100)		
Total	150 (21.7)	482 (69.9)	58 (8.4)	690 (100)		
CD4					0.436	12.117
TB					0.11	4.417
POS	40 (14)	212 (74.4)	33 (11.6)	285 (100)		
NEG	107 (13.2)	566 (70)	136 (16.8)	809 (100)		
Total	147 (13.4)	778 (71.1)	169 (15.4)	1094 (100)		

CD4 level before at 1st, 2nd and 3rd visit

The baseline CD4 measurement of the study subjects ranges from 1 cells/µl to 711 cells/µl with the mean CD4 value of 139 cells/µl ± 96.21. The mean CD4 value for males was 131 cells/µl ± 4.60 and for females, it was 144 cells/µl ± 3.57.

The CD4 measurement of the study subjects at first visit ranges from 8 cells/µl to 1009 cells/µl with the mean CD4 value of 244 cells/µl ± 135.4. The mean CD4 value for males was 238 cells/µl ± 6.67 and for females, it was 248 cells/µl ± 4.96. The CD4 measurements of the study subjects at second visit range from 9 cells/µl to 2482 cells/µl with the mean CD4 value of 294 cells/µl ± 169.79. The mean CD4 value for males was 284 cells/µl ± 9.09 and for females, it was 3 cells/µl ± 5.84. The CD4 measurements of the study subjects at third visit range from 3 cells/µl to 1438 cells/µl with the mean CD4 value of 354 cells/µl ± 182.8. The mean CD4 value for males was 334 cells/µl ± 9.14 and for females, it was 366 cells/µl ± 6.60.

From the **Table 4**, we can see that there is no significant association with hemoglobin level and CD4 cell count at baseline (p=0.934) and during the first visit (p=0.917). However, there was a significant association between hemoglobin and CD4 cell count after ART initiation in the second and third visit (p 0.0001, 0.083) respectively. Also, the hematocrit association with CD4 cell count is not significant at baseline (p=0.735) but after ART initiation there is a significant association between HCT and CD4 cell count (p=0.005, p=0.0001, p=0.435 in the 1st, 2nd, and 3rd visit respectively). Lastly RBC value has shown association with CD4 cell count in all visits.

The result of LFT and RFT

We have also observed that the liver function test of study subjects. The ALT value of the study subjects at baseline, 1st, 2nd, 3rd visit ranges from 3 IU/L to 343 IU/L; 3 IU/L to 414 IU/ L; 6 IU/L to 263 IU/L and 2 IU/L to 350 IU/L respectively. The mean ALT value of the study subjects at 1st, 2nd, 3rd visits were 31.82 IU/L ± 30.67, 30.11 IU/L ± 29.07, 29.34 IU/L ± 21.13 and 30.59 IU/L ± 25.19 respectively. The AST value of the study subjects at baseline, 1st, 2nd, 3rd visit ranges from 2 IU/L to 505 IU/L; 0.55 IU/L to 494 IU/L; 0.72 IU/L to 503 IU/L; 6 IU/L to 337 IU/L respectively. The mean ALT value of the study subject before, at 1st, 2nd, 3rd visits were 42.1 IU/L ± 42.14; 34.9 IU/L ± 32.46; 32.70 IU/L ± 26.40, and 32.58 IU/L ± 26.01 respectively. The ALP

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value of the study subject before, at 1st, 2nd, 3rd visits ranges from 14 IU/L to 2624 IU/L; 22 IU/L to 240 IU/L; 17 IU/L to 1132 IU/L and 11 IU/L to 772 IU/L respectively. The mean ALP value of the study group before, at 1st, 2nd, 3rd visits were 2.317 IU/L ± 216.57; 2.52 IU/L ± 150.11; 2.4 IU/L ± 113.7 and 2.36 IU/L ±102.96 respectively.

Also from the study subject the renal functional test was done and the result show that the creatinine value of the study group before, at 1st, 2nd, 3rd visits ranges from 0.1 mg/dl to 17 mg/dl, 0.1 mg/dl to 23 mg/dl, 0.01 mg/dl to 13 mg/dl, 0.20 mg/dl to 13 mg/dl respectively. The mean creatinine value of the study group before, at 1st, 2nd, 3rd visits were 1.025 mg/dL ± 1.60, 1.03 mg/dL ± 2.128, 0.92 mg/dL ± 1.33 and 0.83 mg/dl ± 1.04 respectively. The BUN value for the study group before at 1st, 2nd, 3rd visits ranges from 0.94 mg/dl to 60.6 mg/dl; 3 mg/dl to 85 mg/dl; 2 mg/dl to 48 mg/dl and 0.4 mg/dl to 69 mg/dl respectively. The mean BUN value for the study groups before, at 1st, 2nd, 3rd visits were 20.79 mg/dl ± 9.94, 19.12 mg/dl ± 10.81, 18.57 mg/dl ± 10.33 and 18.80 mg/dl ± 11.18 respectively. We also assess the TB status of the study group and the result shows that from a total of 1115 subject 25.6% (296/1155) were TB positive among those 64.9% (192/296) were female and 35.1 % (104/296) were males.

DISCUSSION

In this study, we have observed that the prevalence of anemia before the initiation of ART is higher than after the ART treatment is started, which is similar to a study conducted by Takuva S et al. in South Africa, the prevalence was 25.8% at baseline and 14.6% after the treatment and a study done by Yilma D et al. in southwest Ethiopia, which is 29.9% at baseline and 16.2% after the treatment [8-23]. When we define anemia using hematocrit, the results show that the overall prevalence of anemia was (19.93%) before and 10.54%, 6.83% and 3.63% at 1st, 2nd and 3rd visits respectively. This may imply that the administration of HAART improves the CD4 cell count by decreasing the viral load of HIV infected patients which result in minimizing hematological cell intoxication. Also, we look at the RBC value and from the total 11.6% before and 2.95%, 25.54% and 21.73% at the 1st, 2nd and 3rd visits respectively have RBC value lower than the normal value. As we see from the result the RBC value increase at the first visit but after the second visit, it starts to decrease. The patients RBC level did not improve after ART treatment. This fluctuation may be due to RBC distraction by the treatment and other opportunistic infection [3].

The prevalence of anemia with (hemoglobin level <11.4 g/dl) was 24.1%and an HCT value of 19.93% before and 11.98%, 9.99%, 2.85% of Hgb value and a HCT value of 10.54%, 6.83% and 3.63% at 1st, 2nd, 3rd visit respectively after the initiation of ART which is lower than the study done by Quaye L et al. On Ghanaian people the incidence of anemia (Hb less or equal to 10.5 (63%) and PCV <30% (37.6%)) and in HAART-naïve patients were significantly higher compared to their counterparts on HAART (46%, 15.2%) respectively [24,25]. A study was done by Mildvan D et al. in Beth Israel Medical Center, NY, USA. The prevalence of anemia among 1721 patients receiving no ART, 39.7% were anemic; among 7252 receiving HAART, 35.5% were anemic, which is a higher value, compare with our finding which is 24.1% before ART and 11.98%,9.33%, 2.85% at 1st, 2nd, 3rd visit after the initiation of ART. This might be due to a cut off value difference and the sociocultural difference between the two studies [6].

The overall prevalence of anemia seems higher in female than in males (72.63% before and 15.66%, 9.61 %, 3.39 at 1st, 2nd and 3rd visits of ART initiation by using hemoglobin measurement which is similar to the study done by Adane A et al. at ART center of Minilik II Hospital, Addis Ababa with the overall prevalence of 70.25% *Vs*. 29.75% for females and males, respectively [7]. This may due to ministerial and many deliveries in female where there is a high blood loose during this process and the difference in sample size between the two studies.

Initiation of HAART among HIV/AIDS patients significantly reduces the prevalence of anemia. HGB level increase in those three visits after the initiation of ART (from a baseline of 12.87 ± 2.16 to 13.61 ± 2.07 to 14.1 ± 2.1 to 15.34 ± 0.11). At the same time, the mean CD4+T cell count is significantly increased (from a baseline of 1.39 ± 96.2 to 2.44 ± 135.4 to 2.94 ± 169.79 to 3.54 ± 182.8) among patients who started ART drugs, which is supported by Adane A et al. and Maskew M et al. [1,22].

There is a significant improvement in mean hemoglobin level among patients before and after the initiation of HAART in this study. This may imply that HAART can improve the life of HIV/AIDS patients by minimizing hematologic cell intoxication. Following patients for months and years is important to see the effect of ART on the hematopoietic tissues and the real degree of improvement of hemoglobin. This is observed in this finding.

In this study, we have observed that there are significant differences in terms of hemoglobin restoration after the initiation of ART. This is a good opportunity for HIV patients to adhere to the drugs. In our study, we also see that as the patients start using the therapy, their CD4 count starts increasing with decreasing incidence of anemia, which is supported by a study done by Adane A et al. show that anemia is more prevalent in patients with lower CD4 counts than higher CD4 count [7]. A study conducted by Johannessen A et al. in Tanzania showed that anemia is one of the predictors of mortality among HIV infected patients starting ART therapy in a rural hospital. Initiation of HAART among HIV/AIDS patients is significantly improving the overall living conditions of patients. This is observed from the finding with an increment of both hemoglobin concentration and CD4 count in the majority of patients compared to a baseline investigation which agrees with our finding [20].

In this study, we also try to document the TB status of patients and we found that from the total of 1155 study participants, 25.6% were TB positive among this 64.9% were female & 35.1% were male patients which are higher than a study done by Urassa W et al. in Tanzania (49% *vs*. 24% for females and males, respectively) [24]. This may have an effect on the mortality rate of HIV/AIDS patients in association with anemia. Additionally, we add the RFT and LFT results of the study group before and after the

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initiation of ART and shows fluctuation from the normal range and this may due to the effect of other treatments for opportunistic infections. Soria and Lazzarini also mentioned that interaction of ART drugs and drugs for the treatment of opportunistic infection challenges for the success of HAART in general [11].

REFERENCES

1. Ferede G, et al. Prevalence and related factors of anemia in HAART naive HIV positive patients at Gondar University Hospital, Northwest Ethiopia. BMC Hematology 2013;13:pp:8.
2. Mata-MarIn JA, et al. Risk factors and correlates for anemia in HIV treatment naïve infected patients: A cross-sectional analytical study. 2010;3:pp:230.
3. Gilks C, et al. Antiretroviral therapy for HIV infection in adults and adolescents: Recommendations for a public health approach. Of WHO/HTM/HIV, Geneva, Switzerland, WHO Library Cataloguing-in-Publication Data. 2006.
4. Takuva S, et al. Anemia among HIV-Infected Patients Initiating Antiretroviral Therapy in South Africa: Improvement in Hemoglobin regardless of Degree of Immunosuppression and the Initiating ART Regimen. J Trop Med 2013;6.
5. Patrick S, et al. Epidemiology of Anemia in Human Immunodeficiency Virus (HIV)-Infected Persons: Results from the Multistate Adult and Adolescent Spectrum of HIV Disease Surveillance Project Washington DC. Blood 2013.
6. Stohr W, et al. Prevalence, incidence, and predictors of severe anemia with zidovudine-containing regimens in African adults with HIV infection within the DART trial. Kampala, Uganda. Antivir Ther 2006;11:741-749.
7. Adane A, et al. HIV-associated anemia before and after initiation of antiretroviral therapy at Art Centre of Minilik II Hospital, Addis Ababa, Ethiopia. Ethiop Med J 2012;50:13-21.
8. Gedefaw L, et al. Anemia and Risk Factors in HAART Naïve and HAART Experienced HIV Positive Persons in South West Ethiopia: A Comparative Study. PLoS 2013;8.
9. Mildvan D, et al. Prevalence of anemia and correlation with biomarkers and specific antiretroviral regimens in 9690 human immunodeficiency virus-infected patients. 2007;23:343-355.
10. Martinez RE, et al. Risk factors and correlates for anemia in HIV treatment-naïve infected patients: A cross-sectional analytical study, Mexico. BMC Res 2010;3:pp:230.
11. De Santis GC, et al. Hematological abnormalities in HIV-infected patients. 2011;12:pp:e808-e811.
12. Van der Werf MJ, et al. Prevalence, incidence, and risk factors of anemia in HIV-positive and HIV-negative drug users. Addiction 2000;95:383-392.
13. Bunupuradah T, et al. Incidence and predictors of severe anemia in Asian HIV infected children using first-line antiretroviral therapy. Int J Infect Dis 17:e806-e810.
14. Shen Y, et al. Prevalence of anemia among adults with newly diagnosed HIV/AIDS in China. PLoS 2013;8.
15. Rezaei F, et al. Prevalence, severity, and related factors of anemia in HIV/AIDS patients. J Res Med Sci 2012;17:138-142.
16. Agarwal D, et al. High incidence of zidovudine induced anemia in HIV infected patients in eastern India. Indian J Med Res 2010;132:386-389.
17. Wisaksana R, et al. Anemia and iron homeostasis in a cohort of HIV-infected patients in Indonesia. BMC Infect Dis 2011;11:pp:213.
18. Sali F, et al. Prevalence, incidence and predictors of severe anemia with zidovudine-containing regimens in African adults with HIV infection within the DART trial. Kampala, Uganda. Antivir Ther 2006;11:741-749.
19. Denue BA, et al. Prevalence of Anemia and Immunological Markers in HIV-Infected Patients on Highly Active Antiretroviral Therapy in Northeastern Nigeria. Infectious Diseases: Research and Treatment 2013;pp:625.
20. Johannessen A, et al. Antiretroviral treatment reverses HIV-associated anemia in rural Tanzanian. BMC Infect Dis 2011;11:pp:190.
21. Renne LA, et al. Anemia and zidovudine-containing antiretroviral therapy in pediatric antiretroviral programmes in the IeDEA Paediatric West African Database to Evaluate AIDS. J Int AIDS Soc 2013;16:pp:18024.
22. Daka D, et al. Prevalence of anemia before and after the initiation of antiretroviral therapy at ART center of Hawass University Referral Hospital, Hawassa, South Ethiopia. Schol J Med 2013;3:1-6.
23. Takuvas S, et al. Anemia among HIV infected patients initiating ART in South Africa: Improvement in the degree of immunosuppression and the initiation of ART Regimen South Africa. J Trop Med 2013.
24. Saathoff E, et al. Anemia in adults with tuberculosis is associated with HIV and anthropometric status in Dar es Salaam, Tanzania. Int J Tuberc Lung Dis 2011;15:925-932.
25. Owiredu W, et al. Prevalence of anemia and immunological markers among Ghanaian HAART naive HIV patients and those on HAART. Ghana Afr Health Sci 2011;11:2-15.