Magnitude of anemia and its associated factors among adult patients with HIV/AIDS on anti-retroviral therapy at Jinka town public health facilities, South Omo zone, Southern Ethiopia; cross-sectional study

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Abstract

Background: Anemia is Public health problem in persons living with Human immune virus/acquired immune deficiency syndrome particularly in peoples taking antiretroviral therapy. It has effect on their quality of life and disease progression to acquired immune deficiency syndrome (AIDS). Studies regarding anemia among Human immune virus/acquired immune deficiency syndrome (HIV/AIDS) patients taking antiretroviral therapy (ART) and its associated factors are scarce specifically in remote areas.

Method: An institution based Cross-sectional study was employed in Jinka town public health facilities from Feb 18, 2019-March 29, 2019. Systematic random sampling method was used, and a total sample size was 422 were determined. Data was entered using Epi data version 4.4 and analyzed by using SPSS version 25 statistical software. Variables which had a p-value ≤ 0.25 in bivariate analysis were considered as candidates for multivariable regression analysis and variables which had a p-value of ≤0.05 in the multivariable analysis were considered as statistically significant.

Result: The overall magnitude of anemia was 33.5 %(95%CI: 28.8, 38.1). Multivariable analysis showed that unable to read and write (AOR:4.3; 95%CI:1.56,11.96), AZT users(AOR:3.0;95%CI:1.73,5.36), CD4 count less than 200 cells/mm3 (AOR:3.6;95%CI:1.63,8.09) and history of opportunistic infection (AOR:4.3; 95%CI:2.43,7.68) were significantly associated with the occurrence of anemia.

Conclusion: More than one third of study participants were anemic. Unable to read and write, AZT users, CD4 count less than 200cells/mm^3 and history of opportunistic infection were significantly associated with anemia.

Background

Anemia is a condition in which the number of red blood cells and consequently their oxygen carrying capacity is being insufficient to meet the body's physiologic needs(1, 2). Specific physiologic needs vary with person's age, gender, residential elevation above sea level (altitude), smoking behavior and different stages of pregnancy(1).

The world health organization (WHO) classifies persons living at sea level as anemic with hemoglobin value below 13 g/dl in men 15 and above years of age, below 12 g/dl in non-pregnant women over 15 years old and below 11 g/dl in pregnant women(3). Globally in 2013, anemia affects 1.93 billion people, which correspond to 27% of the population and developing countries account for more than 89% of the burden (4).

HIV infected individuals are at higher risk of developing hematological abnormalities like anemia. It is the most common hematologic abnormalities in patients with HIV infection and those taking anti-retroviral therapy(5). Prevalence of anemia among adult HIV/AIDS patients taking ART ranging from 23–50% in worldwide (6, 7) and 24–58% in Africa (8, 9).Anemia among adult HIV/AIDS patients taking ART in Ethiopia common problem, with prevalence ranging from 11.4–70.1% (10, 11). It occurs at any stage of HIV infection and severity are correlated with progression of the disease(12). The existence of co-morbid infections,

malnutrition, the effect of ART as well as other therapeutics drugs and additional potentially predisposing or worsening conditions increase the probability of anemia in this population(13).

Beside its commonness in people living with HIV, there has been recognized linkage between anemia and decreased survival in this population. Studies have found an association between anemia during established infection and a faster progression to AIDS and death (14–16).The risk of death is up to 70% greater in anemic patients with AIDS compared with their non-anemic counterparts. With anemia in HIV, the need for transfusions is greater(17).

Anemia in HIV/AIDS patients cause fatigue, pale skin, shortness of breath, dizziness and other symptoms associated with impaired physical functioning, psychological distress, and decrements in quality of life, increases HIV disease progression and leads to shorter life expectancy(18). Thus, early diagnosis and treatment of anemia is essential to improve quality of life of the patients.

Though studies on the prevalence of anemia and its associated factors are available, to the best of our knowledge, there is no study conducted in the study area and previous studies did not consider important variables like dietary diversity, meal frequency and coffee or tea drinking, immediately after meal, Viral load. Therefore, this study tries to fill this gap.

Methods

Study Design, setting and period

Institution based cross sectional study was conducted in Jinka town public health facilities. Jinka is located as 820 km to the south of Addis Ababa (the capital city of Ethiopia). There are 3,145 (2,140 are females and 1,005 are males) peoples living with HIV/AIDS. Jinka General Hospital started providing ART services to HIV/AIDS patients in October 2005. The study conducted from February 18, 2019 to March 29, 2019 G.C.

Population

All adult PLWHA on anti-retroviral therapy in Jinka town public health facilities of South Omo zone were the source populations and all the selected adults PLWHA who were attending anti-retroviral service during the time of the study were the study populations.

Sample size determination and procedures

A systematic random sampling technique was used to recruit a predetermined 422 samples that has been determined through single population proportion formula. The sample size was proportionally allocated to both health facilities based on the profile of their ART attendants. An average of 30 adults in (Jinka general hospital) and 8 adults in (Millennium health center) were getting ART service. Nine hundred study participants in Jinka general hospital and two hundred forty-study participant in millennium health center were visit the ART clinics during the study period. The study participants were chosen at regular intervals from their sequence of ART clinic visit at appropriate sampling interval of two (900/422) for Jinka general hospital and interval of one (240/422) for millennium health center. The first sample was selected by lottery

method from the first two orders of adults who were visiting ART clinic of Jinka General Hospital. Thereafter, at every second interval study participants were included in the study until total sample size was achieved.

Operational definitions

Anemia: - WHO classification criteria hemoglobin concentration (Hgb) less than 13 g/dl for males and less than 12 g/dl for females (3).

For Men

Hgb value 11–12 .9 g/dl is mild,
Hgb value 8-10.9 g/dl is moderate and
Below 8 g/dl is severe anemia For Women (Non-pregnant)
Hgb value 11-11.9 g/dl is mild
Hgb value 8-10.9 g/dl is moderate
Below 8 g/dl is severe anemia
Body mass index (BMI): Defined as weight of the individual divided by height in meter square.

Data tool and procedures

Structured pretested Amharic version questionnaire was used and some clinical information retrieved from patient records. Questions related to dietary diversity was measured by qualitative recall of all foods consumed within 24 hour based on food and agriculture organization(FAO) guidelines in addition meal frequency was recorded. Anthropometric measurements recorded for each study participants on the intended format attached to the questionnaire following standard anthropometric techniques.

Hgb concentration determined by Hemo cue HB 301 + analyzer from capillary blood sample according to Standard operating procedures (SOP). Data were collected by face to face interview and reviewing the patient's medical records. Pretesting of the questionnaire was done on small sample (5%).

Data processing, management and analysis

The collected data were coded, cleaned and entered into Epi data version 4.4 and exported to SPSS version 25 for analysis. Multicolinarity among independent variables were checked. Bivariate and multivariate logistic regression was performed to see the association between the dependent and independent variables. Variables which have P-value less than 0.25 in bivariate analysis were entered into multivariable logistic regression model. Model fitness was checked by Hosmer and lemeshow with P-value greater than 0.05. Crude odd ratio, adjusted odd ratios and 95% confidence interval were used to assess the strength of association and statistical significance. Variables that had a p-value ≤ 0.05 in the multivariable analysis were considered as significantly associated with anemia.

Ethical consideration

The ethical clearance was obtained from ethical review board of Arba Minch University, college of medicine and health sciences Institutional review board. Support letter was obtained from South Omo zone health Bureau. After explaining the purpose of the study, permission was obtained from the Hospital administrators

and the medical Director. Written informed consent was obtained from all study participants. Privacy and Confidentiality were maintained throughout the whole period.

Results

Socio-demographic and economic characteristics of study participants

A total of three hundred eighty eight study participants were involved; with a response rate of 92%. From the total participants, 250(64.4%) were females and the mean age was 34.74(SD± 9.23) years'. Among the total study groups, 146(37.6%) were in the age group of 30-39 years. More than half (64.4%) of the respondents were females. Regarding their residence, maximum of the respondents (89.7%) were come from urban area (**Table 1).**

Medication Related factor

From the total participants, 182 (46.9%) were taking ART containing AZT and 144(37.1%) of the respondents taken ART for 6-20 months and small proportion of respondents (16.2%) taken for more than five years (Table 2).

WHO staging and Comorbidity

The proportion of respondents categorized under WHO stage I, II, III and IV were 58%, 17%, 19% and 6% respectively. Forty-six (11.9%) of study participants had a history of malaria, 83(21.4%) of the study participant had a history of intestinal parasites and 23 (5.9%) of study participant had history of chronic illness. From the total participants, 163(42.0%) have had an opportunistic infection and 382(98.5%) were in working functional status.

Hematological and Nutritional Factor

The mean CD4 count of the respondents was 401± 186.5. The majority of the respondents (85.6%) have CD4 count $\geq$200cells/mm^3 and 30 (7.7%) have had viral load >1000. Regarding the study participants nutritional status, nearly two third of the respondents (67%) had BMI at range of 18.5-24.9kg/m^2 and the remaining 15.2% and 7.8% of the respondents have a BMI under the category of below 18kg/m^2 and 25kg/m^2 and above respectively.

The mean dietary diversity among study participant was 5.5±1.8. The number of food group consumed ranged from 1-9 and 52.8% of study participants having consumed above the mean (**Table 3**). Mean meal frequency among study participants was 3.6(±0.8). The range of meal frequency was 1-7 (**Table 4**).

Magnitude of Anemia among adult PLWHA patients taking ART

The mean ±SD hemoglobin level of study participant was 12.6 (±1.7). The overall magnitude of anemia among PLWHA in Jinka town public health facilities was130 (33.5%) ;(95% CI: 28.8-38.1). Among those who

were anemic, 69(17.8%) ;(95% CI 14.0-21.6) had mild form of anemia, 53(13.7%); (95% CI: 10.3-17.1) moderate form of anemia and eight (2.1%) ;(95% CI: 0.7-3.5) had severe form of anemia.

Among those who were anemic magnitude of anemia among adult male PLWHA, taking ART was 31.5% and female adult PLWHA taking ART was 68.5%.

Factors Associated with Anemia among study participant

Educational statuses, Type of ART drugs, CD4 count, History of opportunistic infection were significantly associated with Anemia. In this study, the odds of anemia among those participants who were unable to read and write were 4 times higher as compared to odds of anemia among college and above (AOR=4.33, 95% CI: 1.56, 11.96). The odds of anemia among participants who were taking AZT containing regimen were 2.9 times higher as compared to not taking AZT containing regimen (AOR=3.0, 95% CI: 1.73, 5.36). The odds of the likelihood of anemia among those participants with CD4 count less than 200 cells/mm^3 were 3.6 times higher as compared to participants with CD4 count $\geq$200 cells/mm^3 (AOR=3.6, 95% CI: 1.63, 8.09). The odds of anemia among participants having a history of opportunistic infection were 4.3 times higher as compared to odds of those without history of opportunistic infection (AOR=4.3, 95% CI: 2.43, 7.68) (**Table 5**).

Discussion

This study assessed magnitude and factors associated with anemia among people living with HIV/AIDS taking ART in Jinka town public health facilities, southern Ethiopia. It is clear that anemia is most common hematologic abnormalities in persons with HIV patients taking ART. The finding of this study revealed that, 33.5% of HIV/AIDS patients taking ART developed anemia. This study finding is higher than the research finding from Addis Abeba and Debretabor(10, 19). The higher magnitude of anemia in this study might be attributed to a relatively higher proportion of AZT users which is one of the factors for development of anemia.

However, this figure is lower than the studies conducted in Arba Minch and Gondar (11, 20). This variation may due to, in this study, the number of participant with CD4 count less than 200cells/mm^3 is relatively lower than from Arba Minch and the other reason for the difference with study in Gondar may be selection of study participants where only 86% were on ART. This finding is also much lower than study from Iran, Nepal and Nigeria, ranging from 55.8% and 71% (21–23). This variation may be attributed to in our study participants in late WHO HIV/AIDS staging were lower and there is difference in study participants.

In this study, significant association between educational status and anemia were observed. Accordingly, participants unable to read and write were four times more likely to develop anemia as compared to participants with college and above educational status. This finding is consistent with study in Gondar (11). This may be due to participants who have college and above are aware about the benefit of appropriate nutrition consumption/and or have high socioeconomic condition compared to those who were unable to read and write.

Type of ART drugs was significantly associated with occurrence of anemia in this study. As a result, patients who were taking AZT containing regimen were nearly 3 times more likely to develop anemia as compared to patients who were not taking AZT containing regimen. This finding supported by study done in South Africa (24), North western Tanzania (25), Tikur Anbessa specialized hospital (26) and Debretabor hospital (19). This is usually due to the side effect of the ART drug AZT resulting in manifestation of granulocytopenia, anemia, malaise, fatigue, and other gastrointestinal symptoms(27).

CD4 count found to be significantly associated with the occurrence of anemia in this study. Those patients who have had CD4 count of less than 200cells/mm3 were 3.6 times more likely to have anemia as compared to patients who have had CD4 count of 200cells/mm3 or more. Similar results reported in studies done at South Africa (24), Debretabor hospital (19) and Arba Minch town public health facilities(20). The possible explanation for this association might be due to the decrease in CD4 count of HIV infected individuals lead to increase in progression of the disease(28).

Opportunistic infection was associated with likelihood of developing anemia in this study. Those patients who have had history of opportunistic infection were 4.3 times more likely to have anemia as compared to patients who have no history of opportunistic infection. The possible reason might be, these opportunistic infections may also cause dietary problems which would led to nutritional deficiencies and problems of absorbing nutrients which in turn would led to anemia(29).

Conclusion

More than one third of study participants were anemic. In multivariable analysis participants who were unable to read and write, participants taking AZT based regimen, having CD4 count less than 200cell/mm3 and history of opportunistic infection were factors that increase the odds of anemia.

Therefore, strength the procedures for the early diagnosis of opportunistic infection, frequent monitoring of HIV-infected individuals CD4 count and in addition monitor hemoglobin level on each of the follow up periods by focusing on those people taking ART drug regimen containing AZT and take appropriate action to combat anemia if detected.

Abbreviations

AIDS: Acquired immune deficiency syndrome

AOR: Adjusted odd ratio

ART: Anti retro viral therapy

AZT: Zidovudine

BMI: Body mass index

CD4: Cluster of differentiation 4

COR: Crude odd ratio

Hgb: Hemoglobin

HIV: Human Immune virus

OI: Opportunistic infections

PLWHI: Peoples living with HIV/AIDS

WHO: World health organization

Declarations

Ethics approval and consent to participate

The ethical clearance was obtained from ethical review board of Arba Minch University, college of medicine and health sciences Institutional review board. Support letter was obtained from South Omo zone health Bureau. After explaining the purpose of the study, permission was obtained from the Hospital administrators and the medical Director. Written informed consent was obtained from all study participants. Privacy and Confidentiality were maintained throughout the whole period.

Consent for publication

Not applicable

Availability of data and materials

The data sets generated and/or analyzed are available with a reasonable request through the corresponding author.

Competing interest

I declare that all the authors have no any conflict of interest.

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Author’s contribution

YS conceived and designed the study, supervise the data collection, analyze the data and draft the manuscript. SD, MG and EZ supervise the data collection, analyze the data and reviewed the manuscript critically. All authors read and approve the final manuscript.

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References

1. Benoist Bd, McLean E, Egll I, Cogswell M. Worldwide prevalence of anaemia 1993-2005: WHO global database on anaemia Available at who.int/vmnis Accessed on November 18, 2018 WHO Global Database on Anaemia. Geneva, switzerland 2008.
2. Alli N, Vaughan J, Patel M. Anaemia: Approach to diagnosis (part 2). SAMJ: South African Medical Journal. 2017;107(2):96-100.
3. WHOWHO,2011,Geneva(WHO/NMH/NHD/MNM/11.1), (http://www.who.int/vmnis/indicators/haemoglobin., pdf a. Haemoglobin concentraton for diagnosis of anemia and assessment of severity. Vitamin and MineralNutriton Informaton System .
4. kassebaum N. Global burden of anemia. Hematology/oncology April 2016;30(2):247-308.
5. Pande A, Bhattacharyya M, Pain S, Ghosh B, Saha S, Ghosh A, et al. Anemia in antiretroviral naïve HIV/AIDS patients: a study from Eastern India. Online Journal of Health and Allied Sciences. 2012;10(4 (4)).
6. Bhattad D, Kulkarni V, Bhave A, Balasubramanian M, Upase DP, Khude S. Refractory anaemia in an immunocompromised patient–what is it? J Assoc Physicians India. 2013;61(9):673-5.
7. Wisaksana R, Sumantri R, Indrati AR, Zwitser A, Jusuf H, de Mast Q, et al. Anemia and iron homeostasis in a cohort of HIV-infected patients in Indonesia. BMC infectious diseases. 2011;11(1):213.
8. Quaye W, Addai-Mensah A. Prevalence of anaemia and immunological markers among Ghanaian HAART-naïve HIV-patients and those on HAART. African Health Sciences. 2011;11(1).
9. Denue BA, Kida IM, Hammagabdo A, Dayar A, Sahabi MA. Prevalence of anemia and immunological markers in HIV-infected patients on highly active antiretroviral therapy in Northeastern Nigeria. Infectious Diseases: Research and Treatment. 2013;6:IDRT-S10477.
10. Woldeamanuel GG, Wondimu DH. Prevalence of anemia before and after initiation of antiretroviral therapy among HIV infected patients at black lion specialized hospital, Addis Ababa, Ethiopia: a cross sectional study. BMC hematology. 2018;18(1):7.
11. Alem M, Kena T, Baye N, Ahmed R, Tilahun S. Prevalence of anemia and associated risk factors among adult HIV patients at the anti-retroviral therapy clinic at the University of Gondar Hospital, Gondar, Northwest Ethiopia. J Interdiscipl Histopathol. 2013;1(3):137-44.
12. De Santis GC, Brunetta DM, Vilar FC, Brandao RA, de Albernaz Muniz RZ, de Lima GMN, et al. Hematological abnormalities in HIV-infected patients. International Journal of Infectious Diseases. 2011;15(12):e808-e11.
13. James A SR, Yasawini B, Manimalika K, Kumar TRA, Sivakumar T. ;. A case report on zidovudine induced anemia and its management in HIV-1 infected patient. Int J Pharm sciRevRes. 2014; 27((10):): 67-8.

14. Ferede G, Wondimeneh Y. Prevalence and related factors of anemia in HAART-naive HIV positive patients at Gondar University Hospital, Northwest Ethiopia. BMC Blood Disorders. 2013;13(1):8.
15. Santiago-Rodríguez EJ, Mayor AM, Fernández-Santos DM, Ruiz-Candelaria Y, Hunter-Mellado RF. Anemia in a cohort of HIV-infected Hispanics: prevalence, associated factors and impact on one-year mortality. BMC research notes. 2014;7(1):439.
16. Tesfaye Z, Enawgaw B. Prevalence of anemia before and after initiation of highly active antiretroviral therapy among HIV positive patients in Northwest Ethiopia: a retrospective study. BMC research notes. 2014;7(1):745.
17. Smith Jr RE. The clinical and economic burden of anemia. Am J Manag Care. 2010;16(Suppl Issues):S59-S66.
18. Volberding PA, Levine AM, Dieterich D, Mildvan D, Mitsuyasu R, Saag M, et al. Anemia in HIV infection: clinical impact and evidence-based management strategies. Clinical infectious diseases. 2004;38(10):1454-63.
19. Melese H, Wassie MM, Woldie H, Tadesse A, Mesfin N. Anemia among adult HIV patients in Ethiopia: a hospital-based cross-sectional study" open access to scientific and medical research. 2017.
20. Alamdo AG, Fiseha T, Tesfay A, Deber MK, Tirfe ZM, Tilahun T. Anemia and its associated risk factors at the time of antiretroviral therapy initiation in public health facilities of Arba Minch town, Southern Ethiopia. " scientific research publishing 2015;7(12):1657.
21. Meidani M, Rezaei F, Maracy MR, Avijgan M, Tayeri K. Prevalence, severity, and related factors of anemia in HIV/AIDS patients. Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences. 2012;17(2):138.
22. Martin C, Poudel-Tandukar K, Poudel KC. 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. 2014;9(12):e116263.
23. Pennap GR, Abubakar K. Prevalence of Anemia among Human Immunodeficiency Virus Infected Patients Accessing Healthcare in Federal Medical Center Keffi, Nigeria. " International Journal of TROPICAL DISEASE & Health" 2015;10.((3):):1-7.
24. Takuva S, Maskew M, Brennan AT, Sanne I, MacPhail AP, Fox MP. Anemia among HIV-infected patients initiating antiretroviral therapy in South Africa: improvement in hemoglobin regardless of degree of immunosuppression and the initiating ART regimen 2013. "Journal of tropical medicine". 2013;26(19):1-6.
25. Gunda DW, Kilonzo SB, Mpondo BC. Magnitude and correlates of moderate to severe anemia among adult HIV patients receiving first line HAART in Northwestern Tanzania: a cross sectional clinic based study. Pan African Medical Journal. 2016;23(1).
26. Gebremedhin KB, Haye TB. Factors Associated with Anemia among People Living with HIV/AIDS Taking ART in Ethiopia. Advances in Hematology. 2019;2019.
27. Sperling R. Zidovudine. Infectious diseases in obstetrics and gynecology. 1998;6(5):197-203.
28. Langford SE, Ananworanich J, Cooper DA. Predictors of disease progression in HIV infection: a review. AIDS research and therapy. 2007;4(1):11.

29. P. A report on HIV/AIDS and malnutrition locked in vicious cycle. Washington File, available at http://aids.immunodefence. com/2006/10/hivaids-and-malnutrition-locke.html. 16 October 2006

Tables

Table 1: Socio demographic and economic characteristics of PLWHA on ART in Jinka town public health facilities, South Omo zone, Southern Ethiopia, June 2019(n=388)

Variables	Category	Frequency(n)	Percent (%)
Age(years)	18-29	132	34.0
	30-39	146	37.6
	≥40	110	28.4
Ethnic group	Ari	184	47.4
	Maale	35	9.0
	Goffa	61	15.7
	Amhara	93	24.0
	Other*	15	3.9
Religion	Protestant	193	49.7
	Orthodox	173	44.6
	Catholic	4	1.0
	Muslim	18	4.6
Marital status	Single	59	15.2
	Married	260	67.0
	Divorced	45	11.6
	Widowed	24	6.2
Educational status	Unable to read and write	125	32.2
	Read and write	70	18.0
	Primary school	76	19.6
	Secondary school	71	18.3
	College/university	46	11.9
Occupational status	Pastoralist	8	2.1
	Agro pastoralist	30	7.7
	Merchant	84	21.6
	Civil servant	91	23.5

	Housewife	24	6.2
	Daily laborer	104	26.8
	Student	24	6.2
	Others**	23	5.9
Monthly income	< 500	65	16.8
	501-3000	250	64.4
	>3000	73	18.8

Table 2:Medication related PLWHA taking ART in Jinka town public health facilities, South Omo zone, Southern Ethiopia, June 2019(n=388)

Variables	Category	Frequency(n)	Percent (%)
Type of ART drug	AZT containing ART	182	46.9
	Non AZT containing ART	206	53.1
ART category	1c	118	30.4
	1d	64	16.5
	1e	141	36.3
	1f	65	16.8
Duration of ART	6-20 months	144	37.1
	21-36 months	83	21.4
	37-60 months	98	25.3
	>60 months	63	16.2

N.B: 1c=AZT+3TC+Nevirapine, 1d=AZT+3TC+Evaferenz, 1e=TDF+3TC+Evaferenz, 1f=TDF+3TC+Nevirapine

Table 3: Most frequent consumed food groups during 24 hour recall among total sample size (n=388) in Jinka town public health facilities, southern Ethiopia, June 2019.

Food group	Percent(Yes)	Number
Starchy and staples	86.1	334
Dark green leafy vegetables	71.6	278
Other vitamin A	81.2	315
Other Fruits and vegetables	84.5	328
Organ meat	15.5	60
Meat and fish	49.0	190
Eggs	53.1	206
Legumes, nuts and seeds	63.9	248
Milk and milk products	49.5	192

Table 4: Meal frequency among PLWHA in Jinka town public health facilities), Southern Ethiopia, 2019(n=388).

Meal time of respondent	Percent(Yes)	Number
Any food Before a morning meal?	8.5	33
Morning meal?	95.6	371
Any food between morning and midday meals?	13.1	51
A midday meal?	95.4	370
Any food between midday and evening meal?	49.0	190
Any evening meal?	99.7	387
Any food after the evening meal?	3.1	12

Table 5:Bivariate and multivariable analysis of factor associated with anemia among adult PLWHA taking ART in Jinka town public health facilities, South Omo zone, Southern Ethiopia, 2019 (n=388)

Variables	Category	Status		COR(95%CI)	AOR(95%CI)
		Anemic	Not Anemic		
Sex	Male	41(29.7%)	97(70.2%)	1	1
	Female	89(35.6%)	161(64.4%)	1.30(0.83,2.04)	1.3(0.75,2.35)
Age(years)	18-29	51(38.6)	81(61.4)	1	1
	30-39	50(34.2)	96(65.8)	1.75(1.01,3.01)	0.8(0.45,1.61)
	≥40	29(26.4)	81(73.6)	1.45(0.84,2.50)	0.6(0.28,1.30)
Educational Status	Unable to read & write	51(40.8)	74(59.2)	2.83(1.25,6.37)	4.3(1.56,11.96)*
	Able Read & write	26 (37.1)	44 (62.9)	2.42(1.01,5.82)	3.3 (1.00,9.90)
	Primary school	25 (32.9)	51 (67.1)	2.01(0.84,4.81)	3.0 (0.96,8.12)
	Secondary school	19 (26.8)	52(73.2)	1.50 (0.61,3.68)	1.7(0.60,5.01)
	College and above	9 (19.6)	37(80.4)	1	1
Income of participant	<500 Birr	29(44.6)	36(55.4)	2.46(1.19,5.07)	1.1(0.41,3.02)
	500-3000 Birr	83(33.2)	167(66.8)	1.51(0.83,2.75)	1.1(0.50,2.45)
	>3000 Birr	18(24.7)	55(75.3)	1	1
BMI	<18.5	26(44.0)	33(56.0)	3.74(1.66,8.39)	2.1(0.79,5.60)
	18.5-24.9	92(35.4)	168(64.6)	2.60(1.32,5.09)	2.3(1.02,5.19)
	≥25	12(17.4)	57(82.6)	1	1
Types of ART drugs	AZT containing	84(46.2)	98 (53.8)	2.98(1.92,4.62)	3.0 (1.73, 5.36)*
	Non AZT containing	46(22.3)	160(77.7)	1	1
CD4 count	<200	41(73.2)	15(26.8)	7.46(3.9,14.1)	3..6(1.63,8.09)*
	≥200	89(26.8)	243(73.2)	1	1
History of OI	Yes	91(55.8)	72(44.2)	6.02(3.79,9.58)	4.3(2.43,7.68)*
	No	39(17.3)	186(82.7)	1	1
Viral load	Undetectable	34(23.9)	108(76.1)	1	1
	150-1000	72(34.0)	140(66.0)	1.63(1.01,2.63)	0.8(0.44,1.47)
	High copy(>1000)	24(70.5)	10(29.5)	7.02(3.3,17.5)	1.3(0.47,3.77)