

RESEARCH

Open Access

Under-nutrition and its associated factors among adult second-line antiretroviral treatment users in Northern Ethiopia

Seteamlak Adane Masresha^{1*}, Atitegeb Abera Kidie¹, Getahun Fentaw Mulaw¹, Fentaw Wassie Feleke¹, Mesfin Wudu Kassaw²

(AIDS)-related deaths. The nutritional status of second-line antiretroviral treatment (SLART) users in Ethiopia has not been thoroughly investigated. So, this study aimed to assess the nutritional status of HIV/AIDS patients who were on SLART and its associated factors in Northern Ethiopia.

Methods A retrospective cross-sectional study was conducted on 366 HIV-infected adults who had been on SLART for at least six months in northern Ethiopia. Clients who had documented Weight and height at six months of therapy were included. Data was entered and cleaned by using EpiDATA version 4.6.0.2 and statistical analysis was done by STATA version 17. Multiple imputation method was applied to manage variables having up to 25% missing values by using R-Version 3.6.2 software. Binary logistic regression was used with $P < 0.05$ as a significant predictor in the final analysis. Data was collected from February 01 to April 30, 2021.

Results The magnitude of undernutrition among adults who were on SLART in the study area was 38.52% (95%CI: 33.65–43.64). Those populations also had a baseline undernutrition status of 39.1% (95%CI: 34.11–44.15) during their transition to SLART. The risk of being malnourished at six months of SLART initiation was fifteen times higher among those who were undernourished at SLART start (AOR:15.099, 95%CI: 8.532, 26.720) reflecting the high burden of the problem in the advanced courses of HIV/AIDS treatment and care.

Conclusions The proportion of undernutrition among SLART users in Northern Ethiopia is high. During HIV therapy, a client's overall nutritional health is predicted by their prior undernutrition condition. This highlights the need for comprehensive nutritional assessment, counseling, and monitoring of the nutritional status of SLART users in the area with emphasis on an early identification of possible barriers to the improvement of such conditions. Promoting the consumption of nutrient-dense local foods and appropriate food preparation methods in addition to nutritional support are vital in this setting.

Keywords Adult, Antiretroviral, Ethiopia, Secondline, Treatment, Undernutrition

Background

Despite the advancements in treatment, diagnosis, and supportive care in Human Immunodeficiency Virus (HIV) infections, many Acquired Immune Deficiency Syndrome (AIDS) deaths are associated with malnutrition and its management [1]. Human Immunodeficiency Virus plays a significant role in the development of malnutrition through multifaceted ways. Firstly, low dietary intake, loss of appetite, mouth ulcers, and food insecurity, cause weight loss which leads to severe and moderate malnutrition. Secondly, because of the malabsorption of macronutrients and altered metabolism infected individuals could be malnourished [2].

Undernutrition is common among HIV patients in the

Study design

at second-line ART initiation respectively. Around 18% of participants developed opportunistic infections (OIs), of which 10% were respiratory. More than half (52%) of the subjects were on ART for six years or less. (Table 2).

Undernutrition and its associated factors among SLART users in Northern Ethiopia

According to the result of this study, the magnitude of adult undernutrition among SLART clients is 38.52% (95%CI: 33.65–43.64). Accordingly, the patient's previous malnutrition status increases the risk of second-line undernutrition by more than 15-fold (Table 3).

Discussion

A low BMI is linked with undernutrition-related immune system dysfunction, higher vulnerability to opportunistic infections, and metabolic and cardiovascular dysregulation which are all related to poor immunological recovery and increased mortality in HIV care [40].

The magnitude of undernutrition among SLART patients in northern Ethiopia was 38.52% (95%CI: 33.65–43.64) which is consistent with the previous study in Tigray (42.9%) [36] and Jimma (34%) [41]. However, the finding is higher than a study conducted in Nepal (18.3%) [42], South Africa (13%) [43], the systematic review and meta-analysis result of adult undernutrition in SSA countries (23.72%) [4], in Chiro Hospital (22.20%) [44] and a study in Southern Ethiopia (24.1%) [45]. This might be due to the differences in the study population whereby only recently diagnosed patients were included in the South African study and also this study included only

patients who have follow-up in second-line HIV care with protease inhibitor (PI) based regimens. A study in adolescents and children revealed that PI-based regimens increase the occurrence of being underweight [46]. In PI-based regimens, drug-induced gastrointestinal side effects, such as diarrhea, are often encountered issues [47, 48] which could increase the risk of undernutrition. The majority of HIV-positive individuals did not eat a healthy diet, which could have an impact on their immune system which is already being attacked by HIV and possibly lead to new infections [17]. In addition, the high prevalence of low dietary diversity and household food insecurity may contribute to the higher magnitude [11, 15]. A study conducted in Ethiopia showed that the magnitude of food insecurity among HIV clients is 62.4% [49]. In addition, the prevalence of undernutrition among the general adult populations in Ethiopia is more than 20% [

Table 2 Clinical characteristics of participants on undernutrition and its associated factors among HIV-infected individuals who are on SLART in Northern Ethiopia

Variables	Variable category	Frequency	Percentage
SLART regimen drug adherence	Good	301	82.2
	Moderate	24	6.6
	Poor	41	11.2
WHO clinical T-stage at SLART initiation	T1	272	74.3
	T2	57	15.6
	T3 and above	37	10.1
History of comorbidities	Yes	31	8.5
	No	335	91.5
Functional status at SLART initiation	Ambulatory/bedridden	42	11.5
	Working	324	88.5
History of OIs during SLART regimen	Yes	67	18.3
	No	299	81.7
Respiratory OIs	Yes	37	10.1
	No	329	89.9
History of taking INH prophylaxis	Yes	197	53.8
	No	169	46.2
History of taking CPT	Yes	319	87.2
	No	47	12.8
Baseline BMI at second-line ART (N = 364)	< 18.5	142	38.8
	18.5-24.99	201	54.9
	25.0 and above	21	5.7
Duration on ART	6 years	190	51.9
	> 6 Years	176	48.1
Baseline BMI at SLART initiation (N = 364)	< 18.5	142	39.01
	18.5-24.99	201	55.22
	25	21	5.77

Table 3

increase hospitalization and inpatient mortality rates to 11.2% [56] and SLART failure [57]. The OIs are one way that HIV/AIDS can directly or indirectly contribute to malnutrition [52]. Poor nutrition also increases the risk

of poor ART drug adherence [58] which lowers viral suppression and escalates drug-resistant genetic variants of HIV [59] and poor immune reconstitution secondary to deficient nutritional status [60] and affects immune

function that can reverse the progression of disease [52] which all contributes to the high SLART failure [61] and mortality rate from the disease [62]. Low BMI, poor adherence, and OIs raise the risk of SLART failure by seven, six, and four times respectively [63].

Based on the result of this study, the status of undernutrition among SLART patients is persistently evidenced by its magnitude which was 39.01 at SLART initiation and 38.52% after six months of follow-up reflecting the high burdens of the problem in HIV care and its significant association in second-line regimens [64]. This result was supported by a study conducted in North West Ethiopia that showed a recovery time from undernutrition to over six months in HIV care [65]. This might be due to the low dietary diversity among HIV patients [66] as a result of household food insecurity [67], poor drug adherence, and advanced disease stage at treatment initiation [65]. Nutritional problems in HIV care may be the direct and indirect effects of treatment [7] as ART medications are increasingly known to cause malnutrition in a variety of ways [52]. Moreover, the high prevalence of non-response (67.4%) and defaulting to nutritional programs (70%) could contribute to the high burden of SLART undernutrition [68].

The high prevalence of undernutrition among SLART

44. Teshome G, Teshome Ayalew. Prevalence of Malnutrition and its Associated factors among adult HIV positive clients on anti-retroviral therapy at Chiro Zonal Hosp. *J AIDS Clin Res*. 2020;11(2).
45. Saliya MS, Azale T, Alamirew A, Tesfaye DJ. Assessment of nutritional status and its associated factors among people affected by human immune deficiency virus on antiretroviral therapy: a cross sectional study in Siltie Zone, South Ethiopia. *Healthc Low-resource Settings*. 2018;6(1).
46. MT M, Yeo J, MSL H, MT K, Azhar RK, GL K. Nutritional status and the use of protease inhibitors among HIV-infected children in Klang Valley, Malaysia. *Malaysian J Med Health Sci*. 2011;73–9.
47. Boesecke C, Cooper DA. Toxicity of HIV protease inhibitors: clinical considerations. *Curr Opin HIV AIDS*. 2008;3(6):653–9.
48. Wu X, Li Y, Peng K, Zhou H. HIV protease inhibitors in gut barrier dysfunction and liver injury. *Curr Opin Pharmacol*. 2014;19:61–6.
49. Demisse A, Demena M, Ayele BH, Mengistu A. Food insecurity and associated factors among adult HIV patients on anti-retroviral therapy in Dessie referral hospital, South Wollo Zone, North central Ethiopia. *PLOS Global Public Health*. 2022;2(9):e0000445.
50. Yisak H, Zemene MA, Arage G, Demelash AT, Anley DT, Ewunetei A, et al. Undernutrition and associated factors among older adults in Ethiopia: systematic review and meta-analysis. *BMJ Open*. 2023;13(1):e062845.
51. Abate T, Mengistu B, Atnafu A, Derso T. Malnutrition and its determinants among older adults people in Addis Ababa, Ethiopia. *BMC Geriatr*. 2020;20(1):498.
52. Vangal KS, Rajneesh T. Malnutrition in HIV/AIDS: Aetiopathogenesis. In: Nancy D, editor. *Nutrition and HIV/AIDS*. Rijeka: IntechOpen; 2020. Ch. 3.
53. Alebel A, Demant D, Petrucka P, Sibbritt D. Effects of undernutrition on mortality and morbidity among adults living with HIV in sub-saharan Africa: a systematic review and meta-analysis. *BMC Infect Dis*. 2021;21(1):1.
54. Alebel A, Demant D, Petrucka P, Sibbritt D. Effects of undernutrition on opportunistic infections among adults living with HIV on ART in Northwest Ethiopia: using inverse-probability weighting. *PLoS ONE*. 2022;17(3):e0264843.
55. Hussien S, Belachew T, Hussein N. Nutritional status of HIV clients receiving HAART: its implication on occurrence of opportunistic infection. *Open Public Health J*. 2017;10(1).
56. Meng S, Tang Q, Xie Z, Wu N, Qin Y, Chen R, et al. Spectrum and mortality of opportunistic infections among HIV/AIDS patients in southwestern China. *Eur J Clin Microbiol Infect Dis*. 2023;42(1):113–20.
57. Alene M, Awoke T, Yenit MK, Tsegaye AT. Incidence and predictors of second-line antiretroviral treatment failure among adults living with HIV in Amhara region: a multi-centered retrospective follow-up study. *BMC Infect Dis*. 2019;19(1):599.
58. Berhe N, Tegabu D, Alemayehu M. Effect of nutritional factors on adherence to antiretroviral therapy among HIV-infected adults: a case control study in Northern Ethiopia. *BMC Infect Dis*. 2013;13:233.
59. Kalichman SC, Pellowski J, Kalichman MO, Cherry C, Deterio M, Caliendo AM, et al. Food insecurity and medication adherence among people living with HIV/AIDS in urban and peri-urban settings. *Prev Science: Official J Soc Prev Res*. 2011;12(3):324–32.
60. Sicotte M, Langlois EV, Aho J, Ziegler D, Zunzunegui MV. Association between nutritional status and the immune response in HIV + patients under HAART: protocol for a systematic review. *Syst Reviews*. 2014;3(1):1–8.
61. Zenebe Haftu A, Desta AA, Bezabih NM, Bayray Kahsay A, Kidane KM, Zewdie Y, et al. Incidence and factors associated with treatment failure among HIV infected adolescent and adult patients on second-line antiretroviral therapy in public hospitals of Northern Ethiopia: Multicenter retrospective study. *PLoS ONE*. 2020;15(9):e0239191.
62. Audain KA, Zotor FB, Amuna P, Ellahi B. Food supplementation among HIV-infected adults in Sub-Saharan Africa: impact on treatment adherence and weight gain. *Proceedings of the Nutrition Society*. 2015;74(4):517–25.
63. Seid A, Cherie N, Ahmed K. Determinants of Virologic failure among adults on second line antiretroviral therapy in Wollo, Amhara Regional State, Northeast Ethiopia. *HIV/AIDS - Res Palliat Care*. 2020;12null:697–706.
64. Murray J, Whitehouse K, Ousley J, Bermudez E, Soe TT, Hilbig A, et al. High levels of viral repression, malnutrition and second-line ART use in adolescents living with HIV: a mixed methods study from Myanmar. *BMC Infect Dis*. 2020;20(1):241.
65. Dires G, Moges NA. Nutritional recovery and its predictors among adult HIV patients on therapeutic feeding program at Finote-Selam General Hospital, Northwest Ethiopia: a retrospective cohort study. *AIDS Res Treat*. 2020;2020:8861261.
66. Weldegebreal F, Diga e T, Mes n F, Mitiku H. Dietary diversity and associated factors among HIV positive adults attending antiretroviral therapy clinics at Hiwot Fana and Dilchora hospitals, eastern Ethiopia. *HIV AIDS (Auckl)*. 2018; 2018(10).
67. Kalil FS, Kabeta T, Jarso H, Hasen M, Ahmed J, Kabeta S. Det.07nNin. *Proceedings of the Nutr4 BT*