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The evolving burden of liver disease in the ART era: magnitude and determinants among HIV sero-positive patients at Asella Referral and Teaching hospital, Ethiopia, 2026

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Abstract

As global HIV programs achieve high rates of virological suppression, non-AIDS comorbidities—particularly liver diseases—are emerging as primary threats to long-term survival. In resource-limited settings, the drivers of this "post-ART" hepatic burden are poorly understood. This study determined the prevalence and determinants of liver disease among 288 HIV sero-positive adults at a major referral center in Asella, Ethiopia, during 2025/2026. Liver disease was defined by persistent biochemical abnormalities or imaging evidence of steatosis, fibrosis, or malignancy. Despite an 87.8% viral suppression rate, the prevalence of liver disease was 27.4%, indicating a "decoupling" of virological success from physiological health. The most powerful predictor of liver injury was undernutrition (AOR = 5.00), followed by a history of tuberculosis (AOR = 3.94) and male sex (AOR = 2.7). These findings demonstrate that in the modern ART era, hepatic health is dictated more by socioeconomic status and clinical history than by HIV viral load itself. Integrated strategies prioritizing nutritional security and long-term metabolic monitoring are essential to improve patient survival.

Introduction

Globally, chronic liver disease affects approximately 1.5 billion people and has emerged as a leading non-AIDS cause of death among people living with HIV (PLHIV), accounting for 14–18% of all-cause mortality [1, 2]. As the availability of antiretroviral therapy (ART) has transitioned HIV into a manageable chronic condition, organ-specific toxicities and non-AIDS comorbidities have replaced opportunistic infections as the primary determinants of long-term outcomes [2, 3]. The liver, in particular, is frequently involved, with clinical presentations ranging from asymptomatic enzyme elevations to end-stage liver disease [2, 4].

The scientific rationale for prioritizing hepatic health in HIV care lies in the acceleration of the natural history of liver disease by the virus itself [4, 5]. Even with suppressed viral replication, persistent immune activation and systemic inflammation promote the activation of hepatic stellate cells and the deposition of extracellular matrix proteins, leading to accelerated fibrosis and cirrhosis [2, 6, 7]. Furthermore, HIV viral proteins such as gp120 may interact directly with hepatocytes, triggering cellular stress responses that foster a pro-inflammatory and potentially cancer-conducive environment [5, 8].

The clinical challenge is particularly pronounced in Ethiopia, where an estimated 630,000 people are living with HIV and national systematic reviews estimate the prevalence of hepatotoxicity at 25.45% [4, 9, 10]. This problem is exacerbated by high regional rates of hepatitis B (HBV) and C (HCV) co-infection, with reported rates ranging from 8% to 15% in Sub-Saharan Africa [11, 12]. Tuberculosis (TB) co-infection further increases vulnerability, with Ethiopian data demonstrating nearly threefold higher odds of severe hepatotoxicity among HIV/TB co-infected patients receiving treatment [4, 13, 14].

Existing literature indicates that hepatic vulnerability is intensified by aging, profound immunosuppression (CD4 + counts < 200 cells/mm³), and high viral loads [15–19]. Behavioral factors such as alcohol and khat use, along with environmental stressors like food insecurity and undernutrition,

further impair hepatic metabolic capacity in resource-limited settings [11, 16, 18, 19, 20–22, 23–29]. Despite numerous studies conducted at Asella Referral and Teaching Hospital (ARTH) on metabolic outcomes, there was no localized evidence regarding the magnitude of liver disease or its determinants among its 3,799 adult ART patients until this investigation [30, 31].

Therefore, the objective of this study was to determine the magnitude of liver disease and assess the associated demographic, clinical, behavioral, and environmental factors among HIV sero-positive patients on follow-up at ARTH in 2025/2026. By addressing this knowledge gap, the study aims to support clinicians in identifying high-risk patients, tailoring screening protocols, and prioritizing nutritional interventions to improve patient survival and quality of life in this semi-urban setting.

Results

Socio-demographic Characteristics

A total of **294** patients were initially screened for eligibility. Following the exclusion of six individuals due to documented non-HIV/ART-related liver disease, advanced non-HIV cancers, or a history of hepatobiliary surgery, a final analytical sample of **288** participants was reached (98% response rate). The mean age of the cohort was **45.6 ± 12.7** years. The study population was predominantly female (61.1%) and urban-dwelling (75.7%). Detailed demographics are presented in Table 1, and the complete de-identified dataset is available as **Supplementary Data S1**.

Table 1
Socio-demographic characteristics (N = 288)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Female	176	61.1
Age	≤ 50 years	193	67.0
Residence	Urban	218	75.7
Marital Status	Married	142	49.3
Education	Grade 1–8	109	37.8
Monthly Income	≥ 3000 ETB	207	71.9

Behavioral and Clinical Characteristic

Substance use was low: 3.5% smoked tobacco, 8.7% used khat, and 16.7% consumed alcohol. Clinical success was high, with **87.8%** achieving viral suppression and 91.7% maintaining CD4 counts ≥ 200 cells/mm³. Dolutegravir (DTG)-based regimens were used by 81.2% of participants. Notably, 31.3% had a

history of tuberculosis. Nutritional assessment showed 18.4% were undernourished and 18.1% were overweight/obese (Table 2).

Table 2
Behavioral and clinical characteristics (N = 288)

Variable	Category	Frequency (n)	Percentage (%)
Khat use	Yes	25	8.7
Alcohol use	Yes	48	16.7
ART Adherence	Good	246	85.4
TB History	Yes	90	31.3
Viral Load	Undetectable	253	87.8
CD4 Count	≥ 200 cells/mm³	264	91.7
Nutritional Status	Undernutrition	53	18.4
ART Regimen	DTG-based	234	81.2
ART Duration	≥ 3 Years	170	59.0

Prevalence and Predictors of Liver Disease

Of the 288 participants included in the final analysis, 79 (**27.4%**; 95% CI: 22.2%–32.6%) met the clinical criteria for liver disease, representing a significant comorbidity burden (Fig. 1).

Note

The figure illustrates the 27.4% (n = 79) prevalence of hepatic impairment compared to 72.6% (n = 209) with no detectable liver disease.

Multivariable logistic regression identified three independent predictors of hepatic injury (Table 3). **Undernutrition** emerged as the most potent risk factor, with an adjusted odds ratio (**AOR**) of **4.996** (95% CI: 2.373–10.518; P < 0.001). A **history of tuberculosis** was associated with a nearly four-fold increase in risk (**AOR = 3.944**; 95% CI: 2.044–7.611; P < 0.001), while **male sex** remained a significant demographic predictor (**AOR = 2.698**; 95% CI: 1.340–5.431; P = 0.005). Notably, current viral load and specific ART regimens did not reach statistical significance in the final adjusted model.

Table 3
Bivariable and multivariable analysis of independent predictors for liver disease (N = 288)

Variables	Category	Liver Disease (n,%)	COR (95% CI)	AOR (95% CI)
Sex	Female	34 (19.3%)	1	1
	Male	45 (40.2%)	2.80 (1.65, 4.75)***	**2.70 (1.34, 5.43)****
TB history	No	34 (17.5%)	1	1
	Yes	44 (48.9%)	4.49 (2.61, 7.72)***	**3.94 (2.04, 7.61)*****
Nutritional status	Normal	37 (20.2%)	1	1
	Undernutrition	28 (52.8%)	4.44 (2.39, 8.24)***	**5.00 (2.37, 10.52)*****
Viral load	Undetectable	64 (25.3%)	1	1
	Detectable	14 (51.9%)	3.19 (1.44, 7.04)**	1.16 (0.39, 3.51)
CD4 count	≥ 200 cells/mm³	69 (26.1%)	1	1
	< 200 cells/mm³	10 (45.5%)	2.36 (0.99, 5.59)*	1.37 (0.42, 4.45)
ART regimen	DTG-based	59 (25.2%)	1	1
	Non-DTG based	20 (37.0%)	1.73 (0.94, 3.19)	1.80 (0.83, 3.90)

Note: *** very highly significant at P < 0.001 ** highly significant at P < 0.01 * significant at P < 0.05

Discussion

The prevalence of liver disease identified in this study was 27.4%, which aligns closely with the 2022 Ethiopian national meta-analysis estimate of 25.45% [4]. This finding confirms that despite the nationwide transition to modern, Dolutegravir (DTG)-based antiretroviral therapy (ART), chronic liver injury remains major non-AIDS comorbidity in Ethiopia. Notably, this prevalence is higher than recent reports from urban centers like Addis Ababa [21], likely due to the specific socio-demographic and nutritional challenges faced by patients in the Arsi Zone. The results indicate a "decoupling" of viral replication from hepatic health; while 87.8% of this cohort achieved viral suppression, liver disease remained common. This suggests that the current burden is driven by "host environment" factors rather than active HIV replication [19].

Undernutrition emerged as the strongest independent predictor of liver disease (AOR = 5.00). Biologically, protein-energy malnutrition leads to hypoalbuminemia and the depletion of hepatic glutathione—the liver's primary antioxidant required to detoxify ART metabolites and neutralize oxidative

stress [23, 27]. This clinical vulnerability is underscored by the current Ethiopian economic landscape, where soaring food price inflation and high poverty rates mean even middle-income patients face significant food insecurity [2, 24, 32]. In this context, undernutrition represents a clinical manifestation of macroeconomic strain that directly accelerates hepatic injury by impairing the liver's ability to metabolize medications [21, 33]. Furthermore, participants with a history of tuberculosis (TB) were nearly four times more likely to exhibit liver disease (AOR = 3.94), supporting the "double hit" theory of hepatic injury [34, 35]. Initial toxic insult from hepatotoxic anti-TB drugs, such as isoniazid and rifampicin, likely leaves the liver with reduced functional reserve [36, 37], making the organ more susceptible to the long-term metabolic demands of chronic HIV care [9].

Male sex was associated with a 2.7-fold higher odds of liver disease (AOR = 2.69), which is consistent with regional studies identifying higher rates of metabolic dysfunction-associated steatotic liver disease (MASLD) in men [14, 15]. Cultural behaviors such as khat chewing, prevalent in the Arsi region, may also act as a unique regional modifier by inducing oxidative stress or autoimmune-like patterns of liver injury [26]. Unexpectedly, age, viral load, and specific ART regimens were not significantly associated with liver injury, suggesting that environmental stressors and clinical history are more influential than biological aging or the specific drug backbone in mature ART programs [1, 17, 20].

While this study benefited from a comprehensive clinical diagnostic framework and high data completeness via digital tools (KoboToolbox), several limitations remain. The cross-sectional nature precludes establishing temporal or causal relationships. Additionally, the absence of FibroScan or liver biopsy—the gold standards for staging fibrosis—may have resulted in an underestimation of early-stage injury. Finally, as the study was conducted at a single referral center, the findings may not be fully generalizable to primary healthcare settings with different adherence levels or rural populations.

Conclusion and Recommendations

This study demonstrates that chronic liver disease affects more than one in four HIV patients at ARTH, with undernutrition and TB history as the primary modifiable determinants. These findings highlight that achieving viral suppression is insufficient without integrated nutritional care and metabolic screening. We recommend that ARTH prioritize routine BMI and Mid-Upper Arm Circumference (MUAC) assessments during follow-up visits. Furthermore, policy-makers must link HIV care with national food security programs to preserve the clinical gains of the national ART program. Future longitudinal studies should investigate the impact of nutritional interventions on liver enzyme stabilization.

Methods

Study design

An institution-based cross-sectional study was conducted.

Study setting

The study was conducted at Asella Referral and Teaching Hospital (ARTH), the primary clinical affiliate of Arsi University's College of Health Sciences. The hospital is situated in Asella town, located approximately 175 km southeast of Ethiopia's capital, Addis Ababa. Established in 1964, ARTH serves as the sole referral hub for the Arsi Zone and surrounding regions, managing a vast catchment population of approximately 3.5 million people. The facility has 310 beds and multiple specialized departments, including Internal Medicine, which operates a dedicated ART follow-up clinic functional five days a week. At the time of the study, the ART clinic had 3,911 patients on regular follow-up, 3,799 of whom were adults. The average monthly patient flow for adults was approximately 1,114.

Study Period and Population

The study was conducted from October 1 to December 30, 2025. The source population consisted of all patients living with HIV who were followed at the ARTH ART clinic. The study population included all adult patients living with HIV who had scheduled follow-up visits during the three-month study period and were selected through systematic random sampling.

Inclusion and exclusion criteria

Adults (age > 18 years) with at least one recent CD4 count and two liver function test (LFT) results separated by six months were eligible. Patients with documented non-HIV/ART-related liver disease, advanced non-HIV cancers, or a history of hepatobiliary surgery were excluded.

Variables

- **Dependent Variable**: The outcome variable was liver disease,
- **Independent Variables**: Socio-demographic factors, clinical factors, behavioural factors and environment-related factors.

Variables and Definitions

- **Liver Disease (Primary Outcome)**: Defined by the presence of one or more of the following[38]:
    - **Biochemical markers**: Persistent elevation of ALT/AST (> 1.5× the upper limit of normal) for ≥ 6 months, total bilirubin > 2.5× ULN, or an INR > 1.5.
    - **Imaging**: Evidence of hepatic steatosis, fibrosis, cirrhosis, or hepatocellular carcinoma via ultrasound, CT, or MRI.
- **ART Adherence** - Categorized using the ACTG Adherence Questionnaire; "Good" adherence is defined as missing 0 doses in the past month (100%).
- **Food Insecurity** - An affirmative response to experiencing insufficient meals (≤ 1 meal/day) or as categorized by the Household Food Insecurity Access Scale **(HFIAS)** [39].

- **HIV Disease Stage**: Participants were categorized according to the **WHO Clinical Staging System (Stages I through IV)** [40].
- **Undernutrition**: Classified as a Body Mass Index (BMI) < 18.5 kg/m² or a Mid-Upper Arm Circumference (MUAC) indicating acute malnutrition [21].
- **Tuberculosis History**: Documented previous diagnosis and treatment for pulmonary or extra-pulmonary TB, regardless of current cure status [41].
- **Khat Use**: Current or past regular consumption of *Catha edulis*, assessed through the structured behavioral questionnaire to identify its role as a regional modifier of liver injury [26].
- **Alcohol-Associated Risk**: Categorized by the AUDIT score: low-risk (0–3), moderate (4–5), or high-risk (≥ 6), where a score of ≥ 4 combined with imaging/biochemical evidence suggests alcohol-associated liver disease [31, 42].
- **Viral Load Suppression**: A plasma HIV RNA level < 1,000 copies/mL, indicating successful virological response to ART [19].
- **Socioeconomic Status (Monthly Income)**: Categorized based on the World Bank (2022) Ethiopia Poverty Assessment of Ethiopian Birr (ETB) thresholds: <1,000 (below poverty line), 1,000–3,000 (low income), > 3,000 (middle/high) [43].

Bias

To minimize selection bias, systematic random sampling was used. To minimize information bias, data collectors underwent intensive training and utilized a digitized tool in the Kobo Toolbox mobile application to ensure standardized data capture.

Sample size

The sample size was determined using the single population proportion formula with a 95% confidence level, a 5% margin of error, and an expected proportion (p) of 25.45% [4]. The initial sample size after correcting for finite population < 10,000 was 267, which was increased to 294 medical records after adding a 10% non-response rate.

Sampling procedure

A systematic random sampling technique was employed to recruit 294 participants from the ART clinic registry between October 1 and December 30, 2025. Based on the previous month's facility report of 1,114 eligible patients, a sampling interval (k) of 11 was established (N = 1114/n = 98 per month). The first participant each month was selected via a lottery method from early arrivals, with every 11th patient recruited thereafter. If a selected candidate met exclusion criteria or declined to participate, a sequential sampling method was used to recruit the immediate next eligible patient to maintain statistical power.

Data Collection Instruments and Procedures

A dual-track data collection strategy was utilized to capture a comprehensive clinical and behavioral profile for each participant. Primary data were gathered through **interviewer-administered structured**

questionnaires using a digitized **Kobo Toolbox** workflow. This instrument included validated scales such as the Alcohol Use Disorders Identification Test (AUDIT) for alcohol-associated risk [42] and the Household Food Insecurity Access Scale (HFIAS) for nutritional assessment [39]. The questionnaire was translated into Afaan Oromo and Amharic and back-translated into English to ensure linguistic and conceptual consistency.

Simultaneously, a **retrospective clinical data abstraction** was performed on the corresponding medical records using a tool developed based on World Health Organization guidelines. This allowed for the extraction of longitudinal biochemical markers (ALT/AST, bilirubin, INR), virological status, clinical history (including Tuberculosis history) [41], and imaging results (ultrasound/CT). All primary and secondary data points were integrated using unique identification codes to ensure patient anonymity.

Data Quality Assurance

To ensure methodological rigor, the data abstraction tool was pre-tested on 5% (n = 15) of the total sample size. A trained team consisting of two medical interns and two nurses, overseen by a General Practitioner, conducted the data collection following a two-day intensive training session. During the collection phase, the principal investigator performed daily audits of the digitized forms. Prior to analysis, the dataset underwent a rigorous cleaning process to identify and manage outliers and ensure internal consistency.

Data processing and analysis

Data were cleaned, coded, and initially managed in Epi-Data version 4.6 before being exported to SPSS version 27.0 for comprehensive statistical analysis. Descriptive statistics, including frequencies and measures of central tendency, were used to characterize the study population. To identify independent predictors of liver disease, a staged logistic regression approach was employed. Potential risk factors were first screened in a bivariable analysis and variables with a P-value < 0.25 were entered into the multivariable model to control for confounding. Statistical significance was defined at a P-value < 0.05 and the strength of associations were reported as Adjusted Odds Ratios (AOR) with 95% Confidence Intervals (CI). Model fitness was verified using the Hosmer-Lemeshow goodness-of-fit test (P > 0.05).

Declarations

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Author contributions

Conceptualization: YZ. Methodology: YZ, AD, TA. Software: YZ, AD, TA, TG. Validation: AD, TA, TG. Formal analysis: YZ. Investigation: YZ. Resources: YZ, PM. Data curation: YZ. Writing—original draft preparation: YZ, AD. Writing—review and editing: YZ, AD, TA. Supervision: AD, TA. All authors have read and agreed to the published version of the manuscript.

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Competing Interests

The authors declare no conflicts of interest. While Arsi University provided institutional support, the university had no role in the study design, data collection, analysis, interpretation of data, or the decision to submit this work for publication.

Transparency Statement

The authors affirm that this manuscript is an honest, accurate, and transparent account of the study being reported. No significant aspects of the study have been omitted, and any deviations from the original study plan have been explained.

Data Availability

All relevant data supporting the findings of this study are included within the manuscript and its **Supplementary Information** files.

Ethics approval and Informed Consent

Institutional ethical clearance was granted by the **Ethical Review Committee of the College of Health Sciences, Arsi University (Protocol Number: COHS/R/180/2025)** (see **Supplementary Information** for the clearance certificate). Following this approval, formal authorization was obtained from the data management office and the ART clinic coordinator at ARTH.

Informed consent was managed through a rigorous **digital workflow using the Kobo Toolbox platform**. Prior to any data extraction or questionnaire administration, potential participants were provided with comprehensive information regarding the study's objectives, the voluntary nature of their involvement, and their right to withdraw at any time without penalty. **Informed Consent** was formally captured through a mandatory electronic validation step; the digital research interface only allowed the investigator to proceed with the interview and medical chart review after an affirmative response was recorded.

To maintain data security and confidentiality, all personally identifiable information, including patient names and medical record numbers, was excluded from the research database. Participants were assigned **unique identification codes** to ensure complete anonymity, adhering strictly to the **Declaration of Helsinki** and national ethical standards for research involving human subjects. All collected data were stored on a password-protected server, and access was restricted to the principal investigator to ensure no information was disclosed to third parties.

References

1. Abere, S. T., Oyan, B., Azukoye-Amadi, B. & Amachree, E. E. Chronic liver disease in HIV patients: Determinants and clinical manifestations. *Niger J. Gastroenterol. Hepatol.* **14** (1), 55–59 (2022).
2. World Health Organization. *Epidemiological fact sheet HIV statistics, globally and by WHO region, 2023* (WHO, 2025).
3. Pol, S. & Lebray, P. HIV infection and hepatic enzyme abnormalities: Intricacies of the pathogenic mechanisms. *Clin. Liver Dis.* **38** (Suppl 2), 65–72 (2004).
4. Mohammed, O. et al. Prevalence of hepatotoxicity among HIV-infected patients in Ethiopia: a systematic review and meta-analysis. BMC Infect Dis. ;22(1):1–14. (2022). Available from: https://doi.org/10.1186/s12879-022-07838-w
5. Kaspar, M. B. & Sterling, R. K. Mechanisms of liver disease in patients infected with HIV. *BMJ Open. Gastroenterol.* **4** (1), e000166 (2017).
6. Wondemagegn, M. & Abera, B. Hepatotoxicity and associated risk factors in HIV-infected patients receiving antiretroviral therapy at Felege Hiwot Referral Hospital. *Ethiop. J. Health Dev.* ;**27**(4). (2013).
7. Qin, F. et al. Liver damage in patients living with HIV on antiretroviral treatment with normal baseline liver function and without HBV/HCV infection: an 11-year retrospective cohort study. *BMC Infect. Dis.* **19** (1), 1–10 (2019).
8. Tesfaye, B. T., Feyissa, T. M., Workneh, A. B., Gudina, E. K. & Yizengaw, M. A. Chronic liver disease in Ethiopia with a particular focus on the etiological spectrums: A systematic review and meta-analysis of observational studies. *PLoS One*. **16** (10), e0259112 (2021).
9. Darge, T., Babusha, A., Chilo, D., Dukessa, A. & Teferi, S. Predictors of severe hepatotoxicity among retroviral infected adults on HAART regimen in Ilubabor Zone, Southwest Ethiopia. Sci Rep. ;14(1):1–9. (2024). Available from: https://doi.org/10.1038/s41598-024-57900-7 9
10. World Health Organization. *Global hepatitis report, 2017* (WHO, 2017).
11. Andualem, B. D. & Ayele, B. T. Progression of HIV disease among patients on ART in Ethiopia: Application of longitudinal count models. *HIV AIDS (Auckl)*. **12**, 1–9 (2020).
12. Iacob, D. G. et al. Liver fibrosis progression in a cohort of young HIV and HIV/HBV co-infected patients: A longitudinal study using non-invasive APRI and FIB-4 scores. *J. Clin. Med.* **11** (13), 3645 (2022).

13. Kardashian, A. et al. Sex-specific associations of visceral adiposity with metabolic dysfunction-associated steatotic liver disease in adults living with HIV. *Clin. Gastroenterol. Hepatol.* **24** (1), 112–121 (2026).
14. Wei, J. et al. The prevalence of nonalcoholic fatty liver disease in people living with HIV: a systematic review and meta-analysis. *Front. Endocrinol.* **16**, 1342 (2025).
15. Cholankeril, G. et al. Longitudinal changes in fibrosis markers are associated with risk of cirrhosis and hepatocellular carcinoma in non-alcoholic fatty liver disease. *J. Hepatol.* **78** (3), 493–500 (2023).
16. Kardashian, A. et al. Sex differences in the association of visceral adipose tissue with liver fat in HIV-infected and uninfected adults. *AIDS* **32** (11), 1469–1477 (2018).
17. Sherman, K. E. & Thomas, D. L. HIV and liver disease: A comprehensive update. *Clin. Liver Dis.* **26** (3), 365–383 (2022).
18. Gandhi, R. T. Cirrhosis is associated with low CD4 + T cell counts: Implications for HIV-infected patients with liver disease. *Clin. Infect. Dis.* **44** (3), 438–440 (2007).
19. Mata-Marín, J. A. et al. Correlation between HIV viral load and aminotransferases as liver damage markers in HIV infected naive patients: a concordance cross-sectional study. *Virol. J.* **6**, 148 (2009).
20. Otwombe, K. & Browne, S. H. Decreased hepatic steatosis in South African adolescents with perinatal HIV switching to dolutegravir-containing regimens. *Pediatr. Infect. Dis. J.* **43** (7), 564–572 (2024).
21. Adal, M., Howe, R., Kassa, D., Aseffa, A. & Petros, B. Malnutrition and lipid abnormalities in antiretroviral naïve HIV-infected adults in Addis Ababa: A cross-sectional study. *PLoS One*. **13** (4), e0196045 (2018).
22. Piroth, L. Hepatitis B virus vaccination in HIV-infected people: A review. *Hum. Vaccin Immunother*. **13** (6), 1304–1313 (2017).
23. Barve, S. & Kapoor, R. Focus on the liver: alcohol use, highly active antiretroviral therapy, and liver disease in HIV-infected patients. *Alcohol Res. Health*. **33** (3), 229–236 (2010).
24. World Health Organization. *Tobacco and HIV: WHO tobacco knowledge summaries* (WHO, 2024).
25. Helleberg, M. et al. Smoking and life expectancy among HIV-infected individuals on antiretroviral therapy in Europe and North America. *AIDS* **29** (2), 221–229 (2015).
26. Orlien, S. M. S., Ismael, N. Y. & Ahmed, T. A. Khat chewing increases the risk for developing chronic liver disease: A hospital-based case-control study. *Hepatology* **79** (2), 321–332 (2024).
27. Proikaki, S., Georgiadis, N., Sergentanis, T. N., Kornarou, E. & Vassilakou, T. Nutritional status of adult people living with HIV: A narrative review. *Diseases* **13** (2), 56 (2025).
28. Olakunde, B. O. et al. Barriers to hepatitis B virus screening of pregnant women in primary healthcare centers in Nigeria: health workers' perspective. *BMC Health Serv. Res.* **23** (1), 1–8 (2023).
29. Ferede, G., Tiruneh, M., Abadoni, M. & Zelalem, M. Etiology of chronic liver disease in Asella Teaching Hospital, South Eastern Ethiopia. *Ethiop. J. Health Dev.* **29** (1), 48–57 (2015).

30. Sado, A. G., Chakso, S. W. & Obsie, G. W. Human immunodeficiency virus viral load suppression and associated factors among clients on anti-retroviral therapy in Asella Teaching and Referral Hospital, Ethiopia. HIV AIDS (Auckl). ;**14**:61–68. (2022).
31. Bizuneh, G. K. et al. Impact of alcohol use disorder on antiretroviral therapy adherence in adults with HIV/AIDS at University of Gondar, Northwest Ethiopia. *BMC Health Serv. Res.* **24** (1), 1–9 (2024).
32. Ethiopian Statistics Service (ESS). *Monthly Report on Consumer Price Index and Inflation Rate for 2025/26* (ESS, 2025).
33. Nzaramba, D. et al. Low aspartate aminotransferase / alanine aminotransferase ratio as an indicator of metabolic syndrome among HIV patients on dolutegravir therapy in Southwestern Uganda. *BMC Endocr. Disord.* **25** (1), 1–23 (2025).
34. Ramachandran, R. & Swaminathan, S. Safety and efficacy of anti-tuberculosis drugs in HIV-infected patients. *Int. J. Tuberc Lung Dis.* **19** (10), 1131–1142 (2015).
35. Saukkonen, J. J. et al. An official ATS statement: hepatotoxicity of antituberculosis therapy. *Am. J. Respir Crit. Care Med.* **174** (8), 935–952 (2006).
36. Zeleke, A., Misiker, B. & Yesuf, T. A. Drug-induced hepatotoxicity among TB/HIV co-infected patients in a referral hospital. BMC Res Notes. ;13(1):1–5. (2020). Available from: https://doi.org/10.1186/s13104-019-4872-1
37. Moges, S. & Lajore, B. A. Mortality and associated factors among patients with TB-HIV co-infection in Ethiopia: a systematic review and meta-analysis. *BMC Infect. Dis.* **24** (1), 215 (2024).
38. Abera, W. & Wube, T. B. The association of aspartate transaminase-to-alanine transaminase ratio and metabolic syndrome among HIV patients in Sidama. *J. Clin. Med. Res.* **15** (3), 142–151 (2023).
39. Coates, J., Swindale, A. & Bilinsky, P. *Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide (v. 3)* (Fanta, 2007).
40. World Health Organization. *WHO Case Definitions of HIV for Surveillance and Revised Clinical Staging and Immunological Classification of HIV-Infected Adults and Children* (WHO, 2007).
41. World Health Organization. *Definitions and reporting framework for tuberculosis – 2013 revision (updated December 2014 and January 2020)* (WHO, 2020).
42. Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B. & Monteiro, M. G. *AUDIT: The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Health Care* 2nd edn (World Health Organization, 2001).
43. World Bank. *Ethiopia Poverty Assessment: Harnessing Continued Growth for Accelerated Poverty Reduction* (World Bank, 2022).

Figures

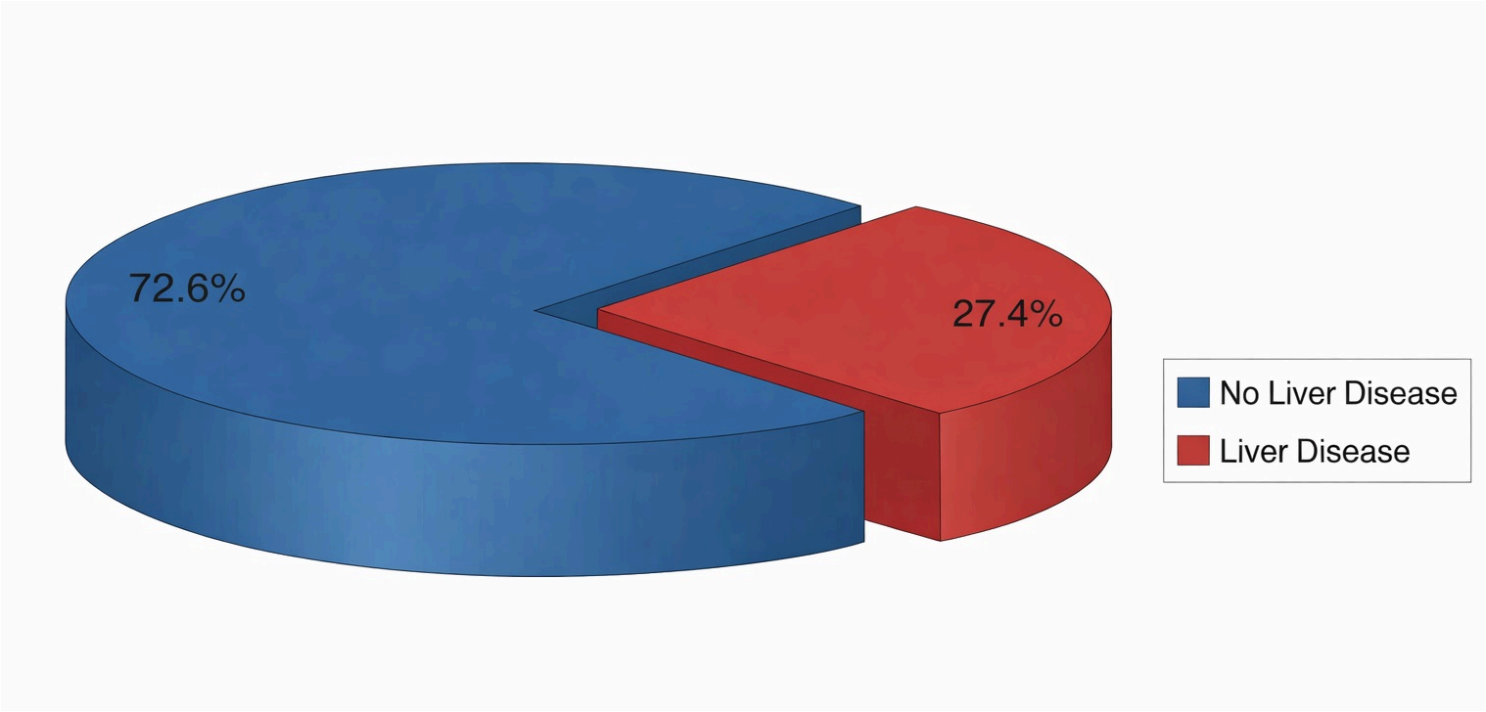


Figure 1

Overall prevalence of liver disease among HIV patients at ARTH (N=288)

Note: The figure illustrates the 27.4% (n=79) prevalence of hepatic impairment compared to 72.6% (n=209) with no detectable liver disease.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryDataS1.csvRawData.xlsx