



# Prevalence and Associated Factors of Human Immune Deficiency Virus and Tuberculosis Co-Infection in Patients Attending Kolla Diba Health Center, Dembia District, Northwest Ethiopia

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Tadesse Asmamaw Dejenie<sup>1</sup>   
Worku Mamo Degu<sup>2</sup>  
Setognal Birara Aychiluhm<sup>3</sup>  
Endeshaw Chekol Abebe<sup>4</sup>   
Markeshaw Tiruneh G/Medhin<sup>1</sup>

<sup>1</sup>Department of Biochemistry, School of Medicine, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia; <sup>2</sup>Department of Public Health, College of Medicine and Health Sciences, Samara University, Samara, Ethiopia; <sup>3</sup>Carter Center, Atlanta, Ethiopia; <sup>4</sup>Department of Biochemistry, College of Health Sciences, Debre Tabor University, Debre Tabor, Ethiopia

**Background:** TB-HIV co-infection is the most common problem of African countries, especially, Sub-Saharan countries including Ethiopia. So this study aimed to assess TB-HIV co-infection with its associated factors in patients with Tuberculosis in Northwest Ethiopia. Although the prevalence of TB-HIV was low, the need for strengthening the health extension program especially in urban dwellers also needed to include TB-HIV testing.

**Objective:** This study aimed to assess TB-HIV co-infection with its associated factors in patients with Tuberculosis in Northwest Ethiopia.

**Methodology:** Institutional based cross-sectional study has been done and a total of 638 subjects participated in the study. The data of the study subjects were collected from the tuberculosis logbook using two trained data collectors who were work in the TB DOTS program and by using a well-prepared checklist and SPSS was used for analyzing data.

**Results:** 9.7% (62/638) of TB patients were found to be co-infected with HIV. Among these 32 (11.4%) were females and 30 (8.4%) were males. More infected individuals were found in urban residents 44 (20%) than rural residents and age groups 30–40 years 31 (22.5%) are more infected than the other age group. TBforms, age, and residence were associated with HIV/TB co-infection significantly.

**Conclusions and Recommendations:** Although the prevalence of TB-HIV was low, the need for strengthening the health extension program especially in urban dwellers is needed to include TB-HIV testing. Further surveys involving HIV infected TB patients to strengthen and scale-up for TB and HIV is needed.

**Keywords:** TB-HIV co-infection, Kolla Diba, Northwest Ethiopia

## Background

TB-HIV co-infection is the most common problem of African countries, especially, Sub-Saharan countries including Ethiopia.<sup>1</sup> Tuberculosis (TB) is the leading cause of death among adults living with HIV/AIDS. Late diagnosis of TB is a major contributor. HIV decreases the disease protection capability of the individual which increases the chance of infecting with TB. The latent TB can progress to active TB in individuals infected with HIV. This virus can also alter the usual sign/symptom of TB and its connection with TB induces a high magnitude of drug-resistant TB.<sup>1</sup>

Correspondence: Tadesse Asmamaw Dejenie  
Tel +251 909045760  
Email as24tadesse@gmail.com

Without HIV infection, the chance of changing to active TB is about 10%. But for those HIV-infected individuals, it can be tenfold. Smear-negative pulmonary TB (PTB) and extrapulmonary TB (EPTB) are the most common problems in HIV co-infected individuals.<sup>2</sup>

The burden of TB-HIV co-infection is higher in developing countries. In African countries, 82% of TB cases are reported in individuals co-infected with HIV.<sup>3,4</sup> In Ethiopia, which is under sub-Saharan African countries, the magnitude of new cases had raised from 55,000 to 100,000 in the last 10 years. The HIV/AIDS pandemic has substantially altered the epidemiology of tuberculosis. The findings of different studies showed that for individuals co-infected with TB and HIV the annual risk of developing active TB is 5–8%.<sup>5</sup> In general, the human immunodeficiency virus (HIV) leads to a serious challenge to control tuberculosis (TB).<sup>6</sup> The late screening and diagnosis are the major cause of this. Compared to other opportunistic infections, TB occurs earlier in the course of HIV infection even when the immune system is fairly competent.<sup>7</sup> In Ethiopia, the burden of TB/HIV co-infection is increasing and deserves special attention.

Therefore, data about the extent and trends of the dual infection is important for effective prevention and control programs. However, there are limited studies that describe the association between the two diseases in Ethiopia still now.

This study aimed to assess TB-HIV co-infection with its associated factors in patients with Tuberculosis in Northwest Ethiopia.

## Methods and Materials

### Study Area

The study was done at Kolla Diba health center (the first health center in Ethiopia), Dembia district, which is located in North Gondar, Amhara region. The distance of the study area is 729 km away from Addis Ababa (Capital City of Ethiopia).

### Study Design and Period

A cross-sectional document review study was done using the data from November 2018 –December 2019 by reviewing TB registration Logbook reports at Kolla Diba health center and the study was conducted from January 15/2019 to February 30/2019.

### Source Population

All TB patients that were registered from TB room in the logbook form in Kolla Diba health center from 2018– 2019.

## Study Population

TB patients who were tested for HIV registered from November 2018 to December 2019.

## Sample Size and Sampling Method

A sample size of 638 TB patients that were registered in the logbook and tested for HIV from February 2018 to December 2019 was participated in the study by using a consecutive sampling technique.

## Study Variables

### Dependent Variable

- HIV co-infection

### Independent Variable

- Age
- sex
- Weight
- Residence (urban/rural),
- Type of Tuberculosis,
- TB category

## Eligibility Criteria

- All cases registered in the TB clinic logbook from February 2018-December 2019 and tested for HIV were included in the study.

## Data Collection Tool and Procedure

The data collection tool (checklist) was prepared based on the variables found in the patient record book, and then data was collected by using the checklist tool by reviewing patient history.

## Data Quality Control and Management

The data was maintained using a data collection tool which is adapted from the national standard. Close supervision during the data collection period was done by the principal investigator and using well-trained data collectors (two clinical nurses) who work in TB room classes. Data were managed using a statistical package (SPSS) and were cleaned and coded in line with previous literature.

## Data Analysis and Management

The data were checked, cleared, coded, and entered into Statistical Package for the Social Sciences (SPSS) for analysis. The data was presented by using tables, graphs, and charts. Proportions and summary statistics such as

mean, the standard deviation was calculated for variables. The determinant factors were identified using binary logistic regression. The univariate was first checked, and then variables that were significant at a p-value of <0.05 were used for multivariable analysis.

## Ethical Consideration

The study was based on the Declaration of Helsinki. Collaboration letter for data collection was obtained from North Gondar Zonal Health Department with protocol number 1996/05/18. The study protocol was approved by North Gondar Zonal Health Department. Informed consent was obtained from the participants before sample collection. Patient identifiers like the name of patients were not used during the entire work process and data were not used for other purposes.

## Results

### Socio-Demographic Characteristics of Study Subjects

A total of 638 TB patients have participated in the study. Among these 357 (56%) were males and 281 (44%) were females. The mean ( $\pm$ SD) age of respondents enrolled in the study was  $31.7 \pm 17.7$  years. Nearly more than half of the study participant 421 (66%) were residing in rural while 217 (34%) were from the urban setting (Table 1)

### Clinical Feature of the Study Participants

During intensive anti-tuberculosis treatment, the mean initial weight was found to be 42.7 Kg (SD $\pm$  12.1). Concerning with type of tuberculosis majority of tuberculosis cases, 268 (42%) were extra-pulmonary TB, and the rest pulmonary smear-negative TB and Smear positive pulmonary TB are 240

**Table 1** Socio-Demographic Characteristics of the Study Participants; Kolla Diba Health Center, Gondar, Ethiopia, 2018–2019

Characteristics		Frequency	Percent
Sex	Male	357	56
	Female	281	44
Age in years	<19	138	21.6
	19–29	197	30.9
	30–40	138	21.6
	$\geq$ 41	165	25.9
Residence	Urban	217	34.0
	Rural	421	66.0

(37.6%) and 130 (20.4%) respectively. Regarding with type of tuberculosis category, almost all the study participants 628 (98.2%) were new TB in case of treatment outcome, majority of the 68.3% (436) were treatment completed, 14.7% (94) were cured and 63 (90.9) transfer out. But 27 (4.2%) of them were died (Table 2).

### Prevalence and Its Associated Factors of HIV Infection Among Patients with TB

In a total of 638 study participants prevalence of HIV was 9.7% (62/638) among this study female 11.4% (32/281) more affected than males 8.4% (30/357). A higher rate of the virus was observed among urban residents 20% (44/217) than rural residents and age groups 30–40 years 22.5% (31/138) are more infected than the other age group. From this study the TB category result is shown their homogeneity of data due to this it cannot be comparable with HIV status. The associated factors of HIV co-infection in multivariate analysis were Residence AOR 5.19 with 95% CI (2.85–9.46), age group (<19yrs AOR 0.19 with 95% CI (0.04–0.74), and 30–40 AOR 2.87 with 95% CI (1.38–5.96)) and smear-positive pulmonary TB at AOR 2.09 with 95% CI (1.08–4.04) are associated with HIV co-infection with P<0.05 (Table 3).

**Table 2** Frequency Distribution of Clinical Feature for Assessment and Associated Factor of HIV Among TB Patients in Kolladiba Health Center, 2018–2019

Characteristics (Code)		Frequency	Percent
Weight in kg	<37	132	20.7
	37–42	126	19.7
	43–48	162	25.4
	>48	218	34.2
TB category	New	628	98.4
	Relapse	6	0.9
	Default	4	0.6
TB treatment outcome	Cured	94	14.7
	Died	27	4.2
	Failure	2	0.3
	Defaulter	16	2.5
	Transfer out	63	9.9
	Treatment complete	436	68.3
	Type of TB	PTB+ve	130
PTB-ve		240	37.6
EPTB		268	42.0

**Table 3** Risk Factors That Associated with HIV Co-Infection Attended Among TB Patients at Kolla Diba Health Center, Gondar, Ethiopia 2018–2019

Characteristics (Code)		HIV Status No		COR (95% CI)	P-value	AOR (95% CI)	P-value
		Yes	No				
		No (%)	No (%)				
Sex	Male	30(8.4%)	327(91.6%)	1 0.72(0.42–1.21)	0.208		
	Female	32(11.4%)	249(88.6%)				
Age in Years	<19	2(1.5%)	136(98.5%)	0.17(0.04–0.78)	0.022	0.16(0.04–0.74)	0.019*
	19–29	16(8.1%)	181(92.9%)	1.03(0.48–2.22)	0.932	0.84(0.38–1.87)	0.676
	30–40	31(22.5%)	107(77.5%)	3.39(1.69–6.78)	0.001	2.87(1.38–5.96)	0.005*
	≥41	13(7.9%)	152(92.1%)	1		1	
Residence	Urban	44(20%)	173(80%)	5.69(3.20–10.14)	0.000	5.19(2.85 –9.46)	0.000 *
	Rural	18(4.3%)	403(95.7%)	1		1	
Weight in Kg	<37	22(10.8%)	182(89.2%)	0.69(0.19–2.52)	0.570		
	37–42	24(8.8%)	248(91.2%)	0.55(0.15–2.01)	0.364		
	43–48	13(9.2%)	129(90.8%)	0.57(0.15–2.21)	0.417		
	>48	3(15%)	17(85%)	1			
TB category	New	59(9.4%)	569(90.6%)	1			
	Relapse	1(16%)	5(84%)	0.104(0.02–0.75)	0.025		
	Default	2(50%)	2(50%)	0.200(0.011–3.66)	0.278		
Type of TB	PTB+ve	15(11.5%)	115(88.5%)	1.81(0.88–3.72)	0.106	1.45(0.64–3.15)	0.349
	PTB-ve	29(12.1%)	211(87.9%)	1.91(1.03–3.53)	0.040	2.09(1.08 –4.04)	0.028*
	EPTB	18(6.7%)	250(93.3%)	1		1	

Note: \*Statistically significant.

## Discussion

In the present study, the prevalence of HIV co-infection was found to be 9.7%. The finding was similar to other studies conducted at Northwest Ethiopia, Dabat (11.4%), and 2012 WHO report (13.0%).<sup>8</sup> But the finding was lower than the studies conducted in Addis Ababa (45.3%), Debre Markos Hospital 20 (44.8%), Felege Hiwot Hospital, revealed 21 (33.5%), FMOH annual report (31%),<sup>6</sup> Cameron 14 (23.8%), Asia 10 (22%) And it was higher other studies.<sup>11,13</sup> The difference might be due to the increasing public awareness, study area, study design, health system infrastructure.

About 51.6% of HIV co-infected TB patients were females. This was in line with another study.<sup>12</sup> This might be due to the higher exposure of females for sexual activities earlier than men in case of economic reasons.

The prevalence of HIV co-infection among TB patients was found to be higher (53%) in younger age groups (<19 years) and in the age group of 30–40 years which is 2.87 times more risk than the other age group. The age group is

significantly associated with HIV co-infection ( $P < 0.05$ ). This is consistent with other studies conducted at Dabat and Debre Markos hospital.<sup>9,13</sup>

This study showed that urban residents of TB patients have a fivefold chance of being HIV co-infected. The finding was found to be strongly and significantly associated with HIV co-infection. This was similar to the study which was done in the Southern Nations, Nationalities, and Peoples' Region (SNNPR).<sup>14</sup> These associations might be due to the problem of urban health extension programmed implementation and displacement of peoples from rural to urban because of their labor work.

In this study, higher HIV co-infection 29 (46.7%) was found in pulmonary negative individuals which were 2.09 folds risk of being HIV co-infected and the extrapulmonary type was found to be 18 (29%). HIV co-infection is significantly associated with smear-negative pulmonary tuberculosis cases. This was similar to the study done in Northern Ethiopia.<sup>9,10</sup>

## Conclusions and Recommendations

In the study, HIV co-infection was statistically and significantly associated with age, residence, and type of TB. In urban dwellers, HIV co-infected was higher than in rural dwellers. To alleviate those problems further studies strengthening, and scale-up for TB and HIV collaborative activities (prevention and control aspects) is recommended. In the study area (Ethiopia) there is a disease prevention program called the Health Extension Program. To strengthen the health extension program, creating awareness about HIV-TB co-infection in the community should be recommended.

## Abbreviations

AIDS, Acquired Immunodeficiency syndrome; ART, Anti-Retroviral Therapy; CPT, Cotrimoxazole Preventive Therapy; EPTB, Extra-pulmonary Tuberculosis; FMOH, Federal Ministry of Health; HIV, Human Immunodeficiency Virus; OIs, Opportunistic Infections; OR, Odds Ratios; PLWHA, People Living with HIV/AIDS; PTB, Pulmonary Tuberculosis; SPSS, Statistical Package for Social Sciences; STD, Sexually Transmitted Diseases; TB, Tuberculosis; TDR, Tropical Disease Research; WHO, World Health Organization.

## Data Sharing Statement

The datasets used during the current study are available from the corresponding author on reasonable request.

## Author Contributions

All authors made a significant contribution to this work, in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no conflicts of interest for this work.

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