Determinants for Tuberculosis in HIV Infected Patients in Debre Birhan Town, Amhara National Regional State, Ethiopia

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ABSTRACT

Objective: This study aimed to assess determinants for tuberculosis in HIV infected patients in Debre Birhan town, Amhara region, Ethiopia.

Design: Case control study

Setting: Public health facilities at Debre Birhan Town.

Participants: A total of 276 individuals participated in this study (92 cases and 184 controls). Cases were adult patients who were co-infected with Tuberculosis (TB) and Human Immune Deficiency Virus (HIV), and controls were adult HIV patients without TB.

Main outcome measure: The link between TB infection and determinants was assessed using logistic regression analysis. Sociodemographic, host, clinical and immunological determinants were studied.

Results: In this study participants who; earn low monthly income (AOR) 0.024; 95% CI 0.004 to 0.14), smoker (AOR 10.53; 95% CI 1.53 to 72.18), kerosene (AOR 2.49; 95% CI 1.22 to 5.07), alcohol (AOR=5.48; 95% CI 1.29 to 23.56), family history of TB (AOR=2.51; 1.03, 6.15) were at high risk of tuberculosis. While patients with opportunistic infections (AOR=3.35; 95% CI 1.62 to 6.91), bronchial asthma (AOR=14.77; 95% CI 6.25 to 34.91), diabetes mellitus (AOR 10.62; 95% CI 2.77 to 40.50) and low CD4 level (AOR=6.03; 95% CI 2.27 to 16.18) were at high risk of TB.

Conclusion: HIV patients with risk behaviors, opportunistic infections, diabetes, asthma, low CD4, kerosene user and poor were at risk of TB. To reduce the risk of TB health care providers and government should work to reduce risk behaviors early screening and initiation of treatment for opportunistic infections, health education for chronic diseases, early staging and initiation of treatment for HIV, working with poor to improve their life were recommended.

Strengths and limitations: This study gives cues of determinants of tuberculosis in the study area. The study identified factors for diagnosis, treatment and prevention of tuberculosis. As a limitation, temporal relationship of exposure and disease was not established.

Keywords: Multi Drug Resistant Tuberculosis (MDR TB); Diabetes mellitus; Bronchial asthma; Low CD4 count; Lymphocyte

Abbreviations: AIDS: Acquired Immunodeficiency Syndrome; ART: Anti-Retroviral Therapy; CD4: Cluster of Differentiation on T4Lymphocyte Cells; FMOH: Federal Ministry of Health; HAART: Highly Active Anti-Retroviral Therapy; HIV: Human Immunodeficiency Virus; IRB: Institutional Review Board; OIs: Opportunistic Infections; PLWHA: People Living With HIV/AIDS; PTB: Pulmonary Tuberculosis; TB: Tuberculosis; WHO: World Health Organization.

INTRODUCTION

Tuberculosis (TB) causes ill health for approximately 10 million people each year and is one of the top ten causes of death worldwide [1] and it shares 25% of all causes of the deaths [2]. Globally, one third of People Living with HIV (PLWH) is infected with the bacterium that causes TB [3]. In 2013, WHO estimated 9 million new TB cases and 1.5 million TB deaths occurred globally, of which 80% of the cases and 70% of deaths were reported in low income and middle income countries [4] and it was estimated that only 70% of notified TB patients co-infected with HIV were receiving Anti-Retroviral Therapy (ART) [5].The lifetime risk of developing active TB in HIV negative individuals is approximately 10%. Which similar with the annual risk of developing TB among HIV infected patients, while the lifetime risk of developing TB among HIV infected patients is nearly 50% [6]. Even though ART is known to decrease incidence of TB, still studies have reported TB incidences among HIV patients who are on ART [7,8]. TB and HIV co-infection is when people have both HIV infection and TB disease. When a person has both HIV and TB each disease speeds up the progress of the other [9]. The risk of death in co-infected individuals is twice that of HIV infected individuals without TB even when antiretroviral therapy is taken into account [10]. Tuberculosis is a leading cause of morbidity and mortality, and the first presenting sign in majority of people living with Human Immune deficiency Virus [11]. The HIV associated TB epidemic remains a huge challenge to the public in resource limited settings. Reducing half million TB related deaths per year has been identified as a key priority strategy to combat tuberculosis [12]. For adults with both TB and HIV infection the WHO guidelines recommend starting HIV anti-retroviral between 2 and 8 weeks after starting TB treatment for those individuals who have a CD4 count of less than 200 mm3 [13].Globally, more than 13 million people are TB/HIV co-infected. Among them 70% are living in sub-Saharan Africa. Ethiopia is among the 22 high TB and the 27 high Multi Drug Resistant Tuberculosis (MDR TB) burden Countries in the world [14]. In 2007, TB was the cause of 76,000 deaths, of which 30% were among HIV positive patients [15,16]. HIV infected peoples are more likely to have severe forms of TB than patients without HIV [17]. TB has been associated with excess mortality in HIV infected patients who were not treated with ART [18]. A study done in Bihar, India the prevalence of TB/HIV co infection was 28.6% [19], 11.4% in Dabat, Ethiopia [20], 27.7% Amhara region, Ethiopia [21], 20.3% Butajira Hospital, Ethiopia [22] and 2.6% in Dessie and Debre Birhan towns, Ethiopia [23].In Ethiopia from 2003 to 2016 TB treatment outcomes amounts to 83.7%. Treatment success rate was low Amhara region which was 19.0%. The unsuccessful TB treatment outcome was found to be two times higher among HIV/TB co-infected cases [24]. Studies showed the major determinants of HIV/TB co-infection were identified to be low CD4 counts, ART and WHO clinical stages, being divorced/widowed, not attending formal education, underweight, diabetic mellitus, smoking, TB in the family, alcohol consumption and chewing that were the determinants for tuberculosis in HIV-infected adults in Northwest Ethiopia [25-27].Therefore, this study was aimed to assess determinants of tuberculosis infection among HIV positive patients' public health facilities at Debre Birhan town, Amhara Regional state, Ethiopia, 2014.

MATERIALS AND METHODS

Study area and setting

A case control study was conducted from January 2014 to June 2014. The study was carried out in one public hospital and in one health centre found in Debre Birhan town, North Shoa, Amhara Region. It is located 130 km to the Northeast of Addis Ababa and 695 km far from Bahir Dar. The town has an estimated population of 81,776, from which 57.3% are males. There is one public and one private hospital and one public health centre. During the study period there were 1535 patients in the hospital and 410 patients in the health centre were receiving ART and among them 99 were TB/HIV co infected.

Sample size determination

The sample size was calculated using the two population proportion formula by considering the following assumptions. Proportion of CD4<2.00 cells/μl 73.2% among cases and 53.6% among controls in a study done in Addis Ababa [28], 5% significance level, 80% power, a case to control ratio of 1:2. The calculated sample size was 86 for cases and 172 for controls after adding 10% for non-response rate, the final sample size was 286 (92 cases and 194 controls). The sample size was calculated using different variables of significant predictors of tuberculosis; diabetes mellitus, body mass index (BMI<18 kg/m^2), CD4<200 cell/μl, and low Hgb level. Finally, CD4 count<200 cells/μl was used as it gave the largest sample size than other variables.

Sampling procedure

First identification of cases and controls was done by using ART and TB patient registers. All TB/HIV co-infected patients were found on anti TB treatment (cases) were included in the study. Controls (HIV patients without tuberculosis) were selected based on the number of cases available in each facility using case-based technique with the control to case ratio of 2:1. For each case the next two consecutive controls were used for the study.

Data collection and analysis

The data was collected by trained nurses and laboratory technologists using structured questionnaire, which was translated into Amharic from English, back translated and pre-tested for consistency. Fifteen questionnaires were pretested (ten from controls and five from cases). Data collectors were trained by preparing a training guide about the objective of the study, the study participants, collection techniques and procedures before the actual time of data collection for a day. Data were collected using two to one (2:1) ratio of controls to cases. The data were collected from two sources: The primary data collected by face to face interview of patients to assess: socio demographic variables, housing characteristics and personal behaviors using structured interviewer administered questionnaire which was constructed by adopting from previous research done on similar topic and modified accordingly [26,28,29]. Patient cards and logbooks were used to collect secondary data; clinical information like CD4 cell count, hemoglobin level, World Health Organization (WHO) clinical stage, opportunistic infection, chemoprophylaxis and other variables. The collected data were checked manually for completeness and consistencies. And it was coded and entered in EPI info version 3.5.1 and exported to SPSS version 16 for analysis. Bivariate analysis was performed to examine

the effect of each variable on the risk of tuberculosis. To identify factors associated with the risk of tuberculosis first bivariate analysis performed. Variables which have a P-value<0.25 in the bivariate analysis were included in the final multivariate logistic regression analysis. Strength of association was measured using odds ratio, and 95% confidence intervals. Statistical significance was declared at P-value <0.05.

RESULTS

Socio demographic characteristics of the study participants

A total of 286 (92 cases and 194 controls) study subjects were participated in this study. Majority (86%) of the study participants were urban residents (80 cases and 166 controls). More proportions of cases (32.6%) and controls (37.1%) were between the age group of 32-40 years. One hundred seventy (57 in cases and 113 controls) participants attended elementary school and above. Regarding to occupation, housewife and daily labourers covered more proportions (40.3% for cases and 41.7% for controls). Nearly half of the study subjects (48.8%) earn 20-43 United States Dollar (USD) month. From total participants the study, only 10 (8 from cases and 2 from controls) were smokers. While 18 (6.3%) were alcohol drinker (12 from cases and 6 from controls) and 23(18%) were chat chewers 11 from cases and 12 from controls (Table 1).

Table 1: Socio demographic characteristics and risk behaviour of the study participants on TB infection among HIV infected adults, in Debre Birhan town governmental health institutions, Ethiopia, 2014.

Variables	Cases n (%)	Controls n (%)	Total
Resident			
Urban	80 (87)	166 (85.6)	246 (86)
Rural	12 (13)	28 (14.4)	40 (14)
Age			
18-24	7 (7.6)	17 (8.8)	24 (8.4)
25-32	26 (28.3)	53 (27.3)	79 (27.6)
33-40	30 (32.6)	52 (37.1)	102 (35.7)
>40	29 (31.5)	52 (26.8)	81 (28.3)
Sex			
Male	36 (39.1)	73 (37.6)	109 (38.1)
Female	56 (60.9)	121 (62.4)	177 (61.9)
Religion			
Orthodox	83 (90.2)	169 (87.1)	252 (88.1)
Muslim	7 97.6)	19 (9.8)	26 (9.1)
Protestant	1 (1.1)	2 (1)	3 (1.1)
Catholic	1 (1.1)	4 (2.1)	5 (1.7)
Ethnicity			
Amhara	85 (91.3)	182 (93.8)	267 (93.4)
Oromo	4 (4.3)	8 (4.2)	12 (3.8)
Tigre	1 (1.1)	2 (1)	3 (1.1)
Afar	3 (3.3)	2 (1)	5 (1.7)
Marital status			
Single	13 (14.1)	22 (11.3)	35 (12.3)
Married	50 (54.4)	110 (56.7)	160 (55.9)
Divorced/ Widowed	29 (31.5)	62 (32)	91 (31.8)
Educational status			
No formal education	35 (38)	81 (41.8)	116 (40.6)
Elementary	43 (46.7)	72 (37.1)	115 (40.2)
Secondary	10 (9)	32 (16.5)	42 (14.7)
Above secondary	4 (4.3)	9 (4.6)	13 (4.5)
Occupation			
Farmer	14 (15.2)	22 (11.3)	26 (12.6)
Housewife	18 (19.6)	41 (21.1)	59 (20.6)
Daily labourer	19 (20.7)	40 (20.6)	59 (20.6)
Merchant	15 (16.3)	30 (15.5)	45 (15.7)
Governmental employed	12 (13.0)	26 (13.4)	38 (13.3)
Prostitute	14 (15.2)	35 (18.1)	49 (17.2)
Monthly income			
3-20 USD *	31 (33.7)	39 (20.1)	70 (24.5)
20-42.9 USD	42 (45.6)	97 (50)	139 (48.6)
43-73 USD	3 (3.3)	36 (18.6)	39 (13.6)
Above 73USD	16 (17.4)	22 (11.3)	38 (13.3)
Having own house			
Yes	60 (65.2)	112 (57.7)	172 (60.1)
No	32 (34.8)	82 (42.3)	114 (39.9)
Smoking status			
Smokers	8 (8.7)	2 (1)	10 (3.5)
Non-smokers	84 (91.3)	192 (99)	276 (96.5)
Alcohol drinking status			
Yes	12 (13)	6 (3.1)	18 (6.3)
No	80 (87)	188 (96.9)	268 (93.7)
Chat chewing status			
Yes	11 (12)	12 (6.2)	23 (8)
No	81 (88)	182 (93.8)	263 (92)

Note: * 1 USD= 27.72 Ethiopian birr.

Bivariable analysis

In the bivariate analysis; income less than 43 USD Crude Odds Ratio (COR) 0.105; 95% CI 0.029 to 0.373), smoking (COR 9.14; 95% CI 1.901 to 43.9), alcohol drinking (COR 4.7; 95% CI 1.71 to 12.96) were associated with risk of tuberculosis (Table 2). History of TB in the family (COR 2.79; 95% CI 1.496 to 5.206), using kerosene for cooking in the hose (COR 2.31; 95% CI 1.391 to 3.831), opportunistic infections (COR 3.46; 95% CI 2.058 to 5.81), bronchial asthma (COR 9.64; 95% CI 5.29 to 17.56), diabetes mellitus (COR 6.05; 95% CI 2.53 to 14.43), anemia (COR 4.15; 95% CI 2.007 to 8.586), low CD4 cell count (COR 2.61; 95% CI 1.301 to 5.23), WHO clinical stage III and IV (COR 1.96; 95% CI 1.162 to 3.303) were associated with the risk of TB infection (Table 3).

Table 2: Bivariate analysis of socio demographic characteristics and risk behaviour of the study participants on TB infection among HIV infected adults, in Debre Birhan town public health institutions, Ethiopia, 2014.

Variables	Cases n (%)	Controls n (%)	COR	95% CI	P-value
Resident					
Urban	80 (87)	166 (85.6)	1.12	0.544, 2.33	0.75
Rural	12 (13)	28 (14.4)	-	-	-
Age					
18-24	7 (7.6)	17 (8.8)	-	-	-
25-32	26 (28.3)	53 (27.3)	1.191	0.439-3.230	0.731
33-40	30 (32.6)	52 (37.1)	1.012	0.381-2.690	0.981
>40	29 (31.5)	52 (26.8)	1.35	0.503-3.647	0.548
Sex					
Male	36 (39.1)	73 (37.6)	0.94	0.564-5.56	0.81
Female	56 (60.9)	121 (62.4)	-	-	-
Religion					
Orthodox	83 (90.2)	169 (87.1)	1.96	0.216-17.85	0.549
Muslim	7 97.6)	19 (9.8)	1.47	0.14-15.55	0.747
Protestant	1 (1.1)	2 (1)	2	0.078-51.593	0.676
Catholic	1 (1.1)	4 (2.1)	-	-	-
Ethnicity					
Amhara	85 (91.3)	182 (93.8)	0.311	0.051-1.898	0.206
Oromo	4 (4.3)	8 (4.2)	0.25	0.027-2.319	0.223
Tigre	1 (1.1)	2 (1)	0.33	0.017-6.653	0.473
Afar	3 (3.3)	2 (1)	-	-	-
Marital status					
Single	13 (14.1)	22 (11.3)	0.769	0.359-1.649	0.5
Married	50 (54.4)	110 (56.7)	0.769	0.350-1.789	0.574
Divorced/Widowed	29 (31.5)	62 (32)	-	-	-
Educational status					
No formal education	35 (38)	81 (41.8)	0.972	0.281-3.369	0.965
Elementary	43 (46.7)	72 (37.1)	1.344	0.390-4.629	0.64
Secondary	10 (9)	32 (16.5)	0.703	0.178-2.782	0.616
Above secondary	4 (4.3)	9 (4.6)	-	-	-
Occupation					
Farmer	14 (15.2)	22 (11.3)	-	-	-
Housewife	18 (19.6)	41 (21.1)	0.69	0.289-1.646	0.403
Daily labourer	19 (20.7)	40 (20.6)	0.749	0.314-1.772	0.507
Merchant	15 (16.3)	30 (15.5)	0.786	0.315-1.957	0.605
Governmental employed	12 (13.0)	26 (13.4)	0.725	0.278-1.890	0.511
Prostitute	14 (15.2)	35 (18.1)	0.629	0.252-1.566	0.319
Monthly income					
Mar-20	31 (33.7)	39 (20.1)	-	-	-
20-42.9	42 (45.6)	97 (50)	0.545	0.301-0.987	0.34

43-73	3 (3.3)	36 (18.6)	0.105	0.029-0.373	<0.001
Above 73	16 (17.4)	22 (11.3)	0.915	0.412-2.033	0.827
Having own house					
Yes	60 (65.2)	112 (57.7)	1.37	0.82-2.97	0.2
No	32 (34.8)	82 (42.3)	-	-	-
Smoking status					
Smokers	8 (8.7)	2 (1)	9.14	1.901-43.9	0.009
Non-smokers	84 (91.3)	192 (99)	-	-	-
Alcohol drinking status					
Yes	12 (13)	6 (3.1)	4.7	1.71-12.96	0.003
No	80 (87)	188 (96.9)	-	-	-
Chat chewing status					
Yes	11 (12)	12 (6.2)	2.06	0.872-4.86	0.093
No	81 (88)	182 (93.8)	-	-	-

Table 3: Housing, host, clinical and immunological for the occurrence of TB among HIV infected adults, in Debre Birhan town governmental health institutions, Ethiopia, 2014.

Variable	Cases n (%)	Control n (%)	COR	95% CI	P-value
Presence TB patient in the HH					
Yes	26 (28.3)	24 (12.4)	2.79	1.496-5.206	0.001
No	66 (71.7)	170 (87.6)	-	-	-
Peoples in the HH					
05-Jan	84 (91.3)	181 (93.3)	1.33	0.53-3.32	0.547
>5	8 (8.7)	13 (6.7)	-	-	-
Types of walls of the house					
Mud/mud brick	82 (89.1)	174 (89.7)	0.94	0.422-2.1	0.885
Cement	10 (10.9)	20 (10.3)	-	-	-
Floor type					
Mud	75 (81.5)	156 (80.4)	1.08	0.57-2.6	0.824
Cement	17 (18.5)	38 (19.6)	-	-	-
Presence of separate kitchen					
Yes	77 (83.7)	160 (82.5)	1.09	0.56-2.12	0.79
No	15 (16.3)	34 (17.5)	-	-	-
Availability of electricity					
Yes	34 (37)	51 (26.3)	1.64	0.967-2.79	0.06
No	58 (63)	143 (73.7)	-	-	-
Using kerosene for cooking					
Yes	50 (54.3)	66 (34)	2.31	1.391-3.831	0.001
No	42 (45.7)	128 (66)	-	-	-
Availability of latrine					
Yes	83 (90.1)	166 (85.6)	1.56	0.702-3.443	0.277
No	9 (9.9)	28 (14.4)	-	-	-

Place of waste system					
In the compound	63 (68.5)	113 (58.2)	1.56	0.922-2.63	0.09
Outside the compound	29 (31.5)	81 (41.8)	-	-	-
Opportunistic infection					
Yes	52 (56.5)	53 (27.3)	3.46	2.058-5.81	<0.001
No	40 (43.5)	141 (72.7)	-	-	-
Bronchial asthma					
Yes	74 (80.4)	58 (29.9)	9.64	5.29-17.56	<0.001
No	18 (19.6)	136 (70.1)	-	-	-
Diabetes mellitus					
Yes	19 (20.7)	8 (4.1)	6.05	2.53-14.43	<0.001
No	73 (79.3)	186 (95.9)	-	-	-
Hemoglobin value (g/dl)					
<10	3 (3.3)	3 (1.6)	2.64	0.52-13.41	0.241
10-12.5	22 (23.9)	14 (7.2)	4.15	2.007-8.586	<0.001
>12.5	67 (72.8)	177 (91.2)	-	-	-
CD4 count (cells/μL)					
<200	34 (37)	42 (21.7)	2.61	1.301-5.23	0.007
200-350	23 (25)	52 (26.8)	1.43	0.693-2.932	0.336
351-500	17 (18.5)	42 (21.6)	1.31	0.602-2.824	0.5
>500	18 (19.6)	58 (29.9)	-	-	-
WHO clinical stage					
Stage I and II	29 (31.5)	92 (47.4)	1.96	1,162-3.303	0.012
Stage III and IV	63 (68.5)	102 (52.6)	-	-	-
Isoniazid therapy					
Yes	29 (31.5)	75 (38.7)	-	-	-
No	63 (68.5)	119 (61.3)	0.73	0.43-1.24	0.24
Cotrimoxazole prophylaxis					
Yes	90 (97.8)	188 (96.9)	-	-	-
No	2 (2.2)	6 (3.1)	1.44	0.284-7.256	0.66
Body Mass Index (BMI)					
<18.5	27 (29.3)	36 (18.6)	2.026	0.797-5.337	0.136
18.5-24.5	57 (62)	136 (70.1)	1.153	0.485-2.741	0.745
>24.5	8 (8.7)	22 (11.3)	-	-	-

Multivariable Analysis

Variables which have P-value of less than 0.25 in bivariate analysis were entered in the multivariate logistic regression analysis to measure the independent effect of each variable on the risk of tuberculosis. After adjusting for confounding variables; cigarette smoking (AOR 10.53; 95% CI 1.535 to 72.175), alcohol drinking (AOR 5.48; 95% CI: 1.287 to 23.564) were remained independent predictors for TB. History of TB in the family (AOR 2.51; 95% CI 1.027 to 6.150), presence of opportunistic infections (AOR 3.35; 95% CI: 1.622 to 6.912), bronchial asthma (AOR 14.77; 95% CI 6.246 to 34.91), diabetes mellitus (AOR 10.62; 95% CI 2.767 to 40.503), low CD4 count (<200 cells/µl) (AOR 6.03; 95% CI 2.266 to 16.178) and using kerosene or gas as energy source for cooking in the house (AOR 2.49; 95% CI 1.220 to 5.072) were independently associated with increased risk of TB infection. While participants who earn 43-73 USD per month were less likely to develop TB compared to those who earn less than 20 USD (AOR 0.24; 95% CI 0.04 to 0.14) (Table 4).

Table 4: Determinants for tuberculosis among HIV infected adults, in Debre Birhan town governmental health institutions, Ethiopia, 2014.

Variables	Cases n (%)	Controls n (%)	COR	AOR	95% CI	P-value
Monthly income						
3 - 20	31 (33.7)	39 (20.1)	-	-	-	-
20-42.9	42 (45.7)	97 (50)	0.43	0.21	0.079-0.555	0.002*
43-73	3 (3.3)	36 (18.6)	0.08	0.02	0.004-0.140	<0.001*
Above 73	16 (17.4	22 (11.3)	0.92	0.25	0.075-0.825	0.023*
Presence of TB patient in the HH						
Yes	26 (28.3)	24 (12.4)	2.79	2.51	1.027-6.150	0.044*
No	66 (71.7)	117 (87.6)	-	-	-	-
Smoking status						
Smokers	8 (8.7)	2 (1)	9.14	10.53	1.535-72.175	0.017*
Non smokers	84 (91.3)	192 (99)	-	-	-	-
Alcohol drinking status						
Yes	12 (13)	6 (3.1)	4.7	5.48	1.287-23.364	0.021*
No	80 (87)	188 (96.9)	-	-	-	-
Using kerosene for cooking						
Yes	50 (54.3)	66 (34)	2.31	2.49	1.220-5.072	0.012*
No	42 (45.7)	128 (66)	-	-	-	-
History of opportunistic infection						
Yes	52 (56.5)	53 (27.3)	3.46	3.35	1.622-6.912	0.001*
No	40 (43.5)	141 (72.7)	-	-	-	-
History of Bronchial asthma						
Yes	74 (80.4)	58 (29.9)	9.64	14.77	6.246-34.910	0.001*
No	18 (19.6)	136 (70.1)	-	-	-	-
History of Diabetes mellitus						
Yes	19 (20.7)	8 (4.1)	6.05	10.62	2.767-40.503	0.001*
No	73 (79.3)	186 (95.9)	-	-	-	-
CD4 lymphocyte count (cells/µL)						
<200	34 (37)	42 (21.6)	2.61	6.03	2.266-16.178	0.001*
200-350	23 (25)	52 (26.8)	1.43	3.04	1.106-8.378	0.031*
351-500	17 (18.5)	42 (21.6)	1.3	2.46	0.809-7.461	0.113
>500	18 (19.6)	58 (29.9)	-	-	-	-

Note:*P-value <0.05

DISCUSSION

Economic status was found to be significantly associated with the occurrence of TB which is consistent with the study in South West Ethiopia [29]. This might be due to those study participants with higher income or socio-economic status would have more health care seeking behaviors [30,31] to protect themselves from other HIV related infections than those having lower income status [4]. In this study smoking was the independent predictors for the occurrence of tuberculosis. On the other hand, using kerosene as a source of energy for cooking in the household increases the risk of tuberculosis among HIV patients. This could be since smokes from cigarette increases TB risk may be through decreasing immune response, mechanical disruption of cilia functions, defects in macrophage immune response and/or CD4$^+$ lymphopenia by increasing the susceptibility to pulmonary TB [18,21,23,27]. In line with the studies conducted in South West Ethiopia and Addis Ababa indicated that using Kerosene (gas) as energy source for cooking in the household was associated with TB as it was generally used as cooking fuels in urban areas [28,29]. It might be explained by increased indoor air pollution that could contribute to the respiratory infections including tuberculosis [26]. In this study alcohol drinkers were almost five times more likely associated with TB as compared to non-drinkers. This is similar with studies conducted in North West Ethiopia and Amhara region, Ethiopia [21,27]. This may be through direct toxic effects of alcohol on the immune system rendering the host more susceptible to TB disease, that cell mediated immunity and macrophage functions are directly impaired by chronic and acute alcohol consumption. Having past history of diabetic mellitus was seven times more likely associated with TB as compared to those who did not have known history of diabetic mellitus a study in Nekemte East Wollega [26,32]. This could be explained as diabetes mellitus related complications increase the acquisition of TB due to increase in both reactivated and recently transmitted infection. Diabetes Mellitus (DM) TB co-infection is associated with poor glycaemic control and decreased immunity. Reactive hyperglycemia often accompanies chronic infections like tuberculosis due to the associated proinflammatory state and release of counter regulatory stress hormones [33].Opportunistic infection was more common among TB/HIV co-infected patients compared to merely HIV infected patients. Similar findings were found in studies done in Gondar, North Ethiopia and South West Ethiopia [29,34]. This could be opportunistic infection can lead to the development of active TB through enhancing the helper T-cell type immune response and by further deceasing the immunity of the patient [11]. Similarly study participants having history of bronchial asthma was strongly associated with active TB compared to non-infected participants which was not consistent with a study in Addis Ababa [28]. This could be due to drugs/steroids used to control asthma are known to decrease the immunity and the inflammation of the lungs, which can lead to bronchospasm severe enough to suffocate and make it fertile for infection. Corticosteroids cause immune system suppression through peripheral blood monocytopenia and inhibition of monocyte functions, including chemotaxis, bactericidal activity, and production of interleukin [35]. Having family history of TB patient was significantly associated with TB which was consistent with previous findings [26,29,36]. This could be due to frequent contact with TB patients in a household could lead to increased transmission of TB. Besides, the presence of TB in families could also show a genetic susceptibility which could predispose an individual to TB infection [29]. In addition, the extent and persistence of contact with an infected person are the main factors for the transmission of TB. Thus, transmission of TB occurs most frequently because of prolonged contact in enclosed environments with an infectious person. Persons who are at the greatest risk of exposure to TB are those who live and sleep in the same household with infected person [37]. Low CD4 lymphocyte count was significantly associated with the risk of active TB which was consistent with many other studies [26,28,29,34,36-39]. Low CD4 cells in HIV infected persons indicate severely depressed immunity that makes them susceptible to TB infection or reactivation of latent infection and rapid degradation of clinical condition. Likewise it was well established that advanced clinical stages of HIV (WHO stages) and low hemoglobin value were major risk factors of TB. This could be due anaemia and advanced stage of HIV (stage IV) directly decreases the immunity of the person and deceases the ability to fight against tuberculosis infection. As a limitation, temporal relationship of exposure and disease could not be established due to the nature of the study design.

CONCLUSION

HIV infected adults with; risk behaviors (smoking, drinking), opportunistic infection, diabetes mellitus, bronchial asthma, low CD4 count, low monthly income and using kerosene for cooking in house should be screened for tuberculosis. Therefore, to reduce the impact of TB on HIV patients the health care providers and the government should work to reduce risk behaviors like smoking and alcohol drinking; early screening and initiation of treatment for opportunistic infections, and health education to and for those with other chronic diseases, appropriate staging and initiation of treatment for HIV, working with those who are poor to improve their life were recommended.

ETHICAL CONSIDERATION

Ethical clearance was obtained from the research ethical review committee of Debre Birhan University, and permission letter was obtained from each selected health institutions. The data collectors informed each respondent and confirmed the willingness of the participants by signing on the informed consent sheet. Therefore, consent was obtained from each study participants and confidentiality was assured for all the information provided. Moreover, personal identifiers were not being included on questionnaire

COMPETING INTERESTS

The author declared that there is not any competing interest.

PATIENT CONSENT

The data collectors informed each respondent about the study and verbal consent was obtained. Verbal consent was obtained from each study participants and confidentiality was assured for all the information provided. Moreover, personal identifiers were not being included on questionnaire.

ETHICS APPROVAL

Ethical approval was obtained from the research ethical committee of the Debre Birhan University, and permission letter was obtained from each selected health institutions.

DATA SHARING STATEMENT

The date of this study can't be shared publically due to presence of sensitive (confidential) participants' information

REFERENCES

1. World Health Organization. A global action framework for TB research in support of the third pillar of WHO's end TB strategy. World Health Organization; 2015.

2. World Health Organization. Tuberculosis Fourth Edition. The Essentials. Geneva Switzerland: World Health Organization; 2010.

3. The United States president's emergency plan for AIDS relief. Tuberculosis and HIV/AIDS. 2017.

4. World Health Organization. Global tuberculosis Report 2014. Geneva, Switzerland: WHO Library, 2014.

5. Global Tuberculosis Control 2014". World Health Organization, Geneva, 2014.

6. Preliminary report for the US Office of the Global AIDS Coordinator. Integrating HIV/AIDS & TB Efforts. The Challenge for the President's AIDS Initiative. Network Public Health. 2004.

7. Bonnet MM, Pinoges LL, Varaine FF, Oberhauser BB, DO O'Brien D, Kebede YY, et,al. Tuberculosis after HAART initiation in HIV-positive patients from five countries with a high tuberculosis burden. Aids. 2006; 20(9):1275-1279.

8. Habib AG. A clinical and epidemiologic update on the interaction between tuberculosis and human immunodeficiency virus infection in adults. Ann Afr Med. 2009; 8(3).

9. Mayer KH, Hamilton CD. Synergistic pandemics: Confronting the global HIV and tuberculosis epidemics. Clin Infect Dis. 2010; 50(Supplement_3):S67-70.

10. Suchindran S, Brouwer ES, van Rie A. Is HIV infection a risk factor for multi-drug resistant tuberculosis? A systematic review. PloS one. 2009; 4(5):e5561.

11. Mohammed A. Determinants for tuberculosis in HIV infected patients in Debre Birhan town, Amhara national regional state, Ethiopia.

12. Lienhardt C, Fielding K, Sillah J, Tunkara A, Donkor S, Manneh K, et,al. Risk factors for tuberculosis infection in sub-Saharan Africa: A contact study in The Gambia. Am J Respir Crit Care Med. 2003; 168(4):448-455.

13. World Health Organization. Antiretroviral therapy for HIV infection in adults and adolescents: Recommendations for a public health approach-2010 revision. World Health Organization; 2010.

14. World Health Organization. WHO Country Cooperation Strategy 2008-2011, Ethiopia. Brazzaville, Congo WHO Regional Office for Africa. 2009.

15. World Health Organization. Global tuberculosis control: Epidemiology, strategy, financing. WHO report. 2009.

16. Tuberculosis Profile in Ethiopia. USAID. 2009.

17. Columbia University Mailman School of Public Health. Screening for Tuberculosis in individuals with HIV infection. A clinical guide for HIV cares providers in resource-limited settings. USA.

18. World Health Organization. Guidelines for intensified tuberculosis case-finding and isoniazid Preventive therapy for people living with HIV in resource-constrained settings. Geneva, 2011.

19. Hamidi A, Ahmad S, Singh SN. Prevalence of pulmonary tuberculosis and HIV co-infection. Int J Med Health Res. 2017;3(1):113-117.

20. Sebsibe T, Takele T. HIV co-infection among tuberculosis patients in Dabat, northwest Ethiopia. J Infect Dis Immun. 2013; 5(3):29-32.

21. Mitku AA, Dessie ZG, Muluneh EK, Workie DL. Prevalence and associated factors of TB/HIV co-infection among HIV Infected patients in Amhara region, Ethiopia. Afr Health Sci. 2016; 16(2):588-595.

22. Mohammed S, Gebremariam TT. Tuberculosis among HIV-positive patients at Butajira hospital, south-Central Ethiopia. Int J Pharma Sci Res. 2015; 6(12):1406-1411.

23. Semunigus T, Tessema B, Eshetie S, Moges F. Smear positive pulmonary tuberculosis and associated factors among homeless individuals in Dessie and Debre Birhan towns, Northeast Ethiopia. Ann Clin Microbiol Antimicrob. 2016; 15(1):1-8.

24. Eshetie S, Gizachew M, Alebel A, van Soolingen D. Tuberculosis treatment outcomes in Ethiopia from 2003 to 2016, and impact of HIV co-infection and prior drug exposure: A systematic review and meta-analysis. PloS one. 2018; 13(3):e0194675.

25. Harshini N, Anuradha BA. Study on HIV/TB Co-Infection in and around Khammam, Telangana, India. Int J Curr Microbiol. App Sci. 2017; 6(11):3698-705.

26. Wondimeneh Y, Muluye D, Belyhun Y. Prevalence of pulmonary tuberculosis and immunological profile of HIV co-infected patients in Northwest Ethiopia. BMC research notes. 2012;5(1):1-6.

27. Alemu YM, Awoke W, Wilder-Smith A. Determinants for tuberculosis in HIV-infected adults in Northwest Ethiopia: a multicentre case–control study. BMJ open. 2016;6(4):e009058.

28. Kibret KT, Yalew AW, Belaineh BG, Asres MM. Determinant factors associated with occurrence of tuberculosis among adult people living with HIV after antiretroviral treatment initiation in Addis Ababa, Ethiopia: a case control study. PloS one. 2013;8(5):e64488.

29. Taha M, Deribew A, Tessema F, Assegid S, Duchateau L, Colebunders R. Risk factors of active tuberculosis in people living with HIV/AIDS in southwest Ethiopia: a case control study. Ethiop J Health Sci. 2011; 21(2):131-40.

30. Ahmed SM, Adams AM, Chowdhury M, Bhuiya A. Gender, socioeconomic development and health-seeking behaviour in Bangladesh. Social science & medicine. 2000;51(3):361-71.

31. Thorson A, Hoa NP, Long NH. Health-seeking behaviour of individuals with a cough of more than 3 weeks. The Lancet. 2000; 356(9244):1823-4.

32. Melkamu H, Seyoum B, Dessie Y. Determinants of tuberculosis infection among adult HIV positives attending clinical care in western Ethiopia: a case-control study. AIDS research and treatment. 2013.

33. García-Elorriaga G, Del Rey-Pineda G. Type 2 diabetes mellitus as a risk factor for tuberculosis. J Mycobac Dis. 2014; 4(144):2161-1068.

34. Mohammed A. Determinants for tuberculosis in HIV infected patients in Debre Birhan town, Amhara national regional state, Ethiopia: a case control study.

35. Lee CH, Kim K, Hyun MK, Jang EJ, Lee NR, Yim JJ. Use of inhaled corticosteroids and the risk of tuberculosis. Thorax. 2013; 68(12):1105-13.

36. Komati S, Shaw PA, Stubbs N, Mathibedi MJ, Malan L, Sangweni P, et al. Tuberculosis risk factors and mortality for HIV infected persons receiving antiretroviral therapy in South Africa. AIDS (London, England). 2010; 24(12):1849.

37. Giri PA, Deshpande JD, Phalke DB. Prevalence of pulmonary tuberculosis among HIV positive patients attending antiretroviral therapy clinic. N Am J Med Sci. 2013; 5(6):367.

38. Auld AF, Mbofana F, Shiraishi RW, Alfredo C, Sanchez M, Ellerbrock TV, et al. Incidence and determinants of tuberculosis among adults initiating antiretroviral therapy–Mozambique, 2004–2008. PloS one. 2013; 8(1):e54665.

39. van Rie A, Westerich D, Malope B, Badal-Faesen S, Rubel D. Risk factors for incident pulmonary tuberculosis after the initiation of HAART in the Themba Lethu Clinical Cohort. Johannesburg, South Africa. J Acquire Immune DeficSyndr. 2007.