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PREVALENCE OF PULMONARY TUBERCULOSIS IN FENTALE DISTRICT, OROMIA REGIONAL STATE, ETHIOPIA

Tilahun Bogale Moreda[1,2*], Vijayalakshmi Muvva[2], Gobena Ameni[3] and Krishna Naragani[2]

[1]Department of Public Health, Ambo University, Ethiopia.
[2]Department of Microbiology, Acharya Nagarjuna Universty, Guntur, A.P. India.
[3]Aklilu Lema institute of Pathobiology, Addis Ababa University, Ethiopia.

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***Correspondence for Author**
Tilahun Bogale Moreda
Department of Microbiology, Acharya Nagarjuna Universty, Guntur, A.P. India.

ABSTRACT

The study was designed to generate preliminary epidemiological information on Pulmonary tuberculosis (PTB) and mainly aimed for determining the prevalence of Mycobacterium tuberculosis among patients visiting Merti Hospital in Fentale district, Eastern Ethiopia. It was conducted between July, 2014 and August, 2015. Three consecutive sputum samples (spot, morning, spot) were collected from each patient and tested by Ziehl–Neelsen staining (ZN staining). After ZN testing the remaining sputum was kept in refrigerator at 4^0C until transported to Aklilu Lemma Institute of Pathobiology, Addis Ababa University to culture on Lowenstein Jensen medium. A total of 390 new PTB suspected or diagnosed as PTB patients including 227 men and 163 women of the age group from 10 to 90 years belong to different ethnic groups participated. Out of 390 participants, 89 individuals (50 men and 39 women) were found to be positive to PTB. Individuals of the age group 16-30 years were mostly culture positive to PTB.

KEY WORDS: Prevalence, Pulmonary Tuberculosis, Ethiopia.

1. INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by strains belonging to the Mycobacterium tuberculosis complex. The majority of people afflicted with TB live in developing countries, where lethal synergy with human immunodeficiency virus (HIV) infection also fuels the TB pandemic.[1] As a result of the interaction between TB and HIV infection, TB incidence is

rising in sub-Saharan Africa. It has also led to an increase in drug resistance and poor treatment outcomes.[2] Geographically, the burden of TB is highest in Asia and Africa. TB transmission occurs by airborne spread of infectious droplets, the source of infection is a person with TB of the lung who is coughing. Coughing produces tiny infectious droplets (droplet nuclei). One cough can produce 3,000 droplet nuclei. Bovine tuberculosis (BTB) is a chronic, granulomatous mycobacterial infectious disease caused mainly by Mycobacterium bovis, which is a member of MTC.[3,4] TB is a major global health problem which causes ill-health among millions of people each year and ranks alongside the HIV as a leading cause of death worldwide. The number of TB deaths is unacceptably high due to HIV epidemics. The spread of Multidrug resistant TB (MDR-TB) is one of the major obstacles for the successful control of TB and in this regard, Africa is lagging behind in achieving to halve the 1990s mortality by 2015.[5]

The World Health Organization estimated that there were nine million new cases in 2011 and 1.4 million TB deaths worldwide (990 000 among HIV negative and 430 000 HIV-associated TB deaths).[5] India and China together account for almost 40% of the world's TB cases. About 60% of cases are in the South-East Asia and Western Pacific regions. The African Region has 24% of the world's cases and the highest rates of cases and deaths.[5] There was an estimated report of 9.6 million new TB cases (5.4 million men, 3.2 million women and 1.0 million children). There were also 1.5 million TB deaths (1.1 million HIV-negative and 0.4 million HIV-positive), which includes approximately 890 000 men, 480 000 women and 140 000 children.[6] The disease caused 1.5 million deaths as compared to 1.2 million lives claimed by HIV which makes TB as the number one infectious killer. The new report estimated that there were roughly half a million cases of MDR- TB during the last year. Conventional antibiotics can't cure MDR-TB. Treatment can take two or more years with these drugs along with sever side- effects.[7]

TB most commonly affects the lungs, but can also spread to affect the central nervous system, lymphatic system, circulatory system, genitourinary system, bones and joints. Tuberculosis is a mycobacterial infection that affects a wide range of mammals. Mycobacterim belongs to the family of Mycobacteriaceae and the order Actinomycetales. Of the pathogenic species belonging to the M. tuberculosis complex (MTC) which includes M. tuberculosis, M. Bovis, M. africanum and others, the most common and important agent of human disease is M. tuberculosis.

Information from South India shows that directly observed treatment, short-course (DOTS) reduces TB incidence [8]. However, in many other countries, the case detection rates are too low to reduce the incidence of TB. Tuberculosis diagnosis in many countries is still depending at on older tools. Ethiopia among the 27 high-burden MDR-TB countries ranks 9th with the drug resistance MDR-TB, extensive drug resistance TB (XDR-TB) and seroprevalence of HIV.[7] One of the main aims of effective TB control is the prevention of drug resistance resulting from a variety of programmatic, health provider and patient related factors. Subsequent transmission of resistant bacilli is facilitated by inadequate infection control, especially in congregate settings. MDR-TB and XDR-TB outbreaks have almost invariably been linked with HIV infection.[9,10] Irregular drug supply, poor drug quality, clinical errors in drug prescription and lack of patient adherence to treatment are known determinants of anti-TB drug resistance.[11]

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Fentale district, Oromia Regional State which is 210 km east of the capital city Addis Ababa. The district has an area of 24000 km^2 and 71,740 population.

2.2. Study Design and Study Participants

A health facility-based cross-sectional study was conducted between July, 2014 to August 31, 2015, at Merti Hospital. A total of 390 pulmonary TB suspects (≥10 years of age) during the study period came to the selected health facilities with cough lasting more than 2 weeks were included consecutively. TB patients who were already taking anti-TB drugs for more than two weeks were excluded.

2.3 Data Collection

Data were collected with pretested questionnaire on basic sociodemographic characteristics as well as clinically relevant symptoms. Three sputum samples (spot-morning-spot) were collected and smear examination for AFB was done at the respective health facility according to the National TB and Leprosy control program.[12] The patients suggestive of pulmonary TB or clinically diagnosed provided voluntarily the consent form and recruited to the study planned. From each of study participant concerned, sputum was collected for three consecutive days in sterilized vials and smear examination for AFB (Ziehl–Neelsen) staining was done.[13] The rest of the sputa were stored at 4°C and transported to Aklilu Lemma

Institute of Pathobiology (ALIPB), Addis Ababa University within one week for further work.

2.4 Culturing of Mycobacterium

All the samples were homogenized and decontaminated before culturing on solid Löwenstein–Jensen medium supplemented with glycerol (0.6%) and sodium pyruvate (0.6%). The decontamination process was carried out by adding an equal volume of NaOH (4%) followed by centrifugation at 3000 rpm for 15 minutes. The supernatant was discarded and the sediment was neutralized by 1% HCl (0.1N). Phenol red was used as an indicator. Neutralization was achieved when the color of the solution changed from purple to yellow as described by WHO.[14] The inoculated tubes were incubated in slant position for seven days at 37^{o}C. Cultures were kept in incubator in up-right position for about 5-12 weeks with weekly observation for growth of colonies. All laboratory activities were carried out under safety cabinet world class II.

2.5 Ethics Statement

This study was reviewed and approved by the Institutional Ethics Review Committee of Oromia Regional State Health bureau. Participants of the study were informed about the purpose of the study as well as risks and benefits associated with it and their issues reserved confidentially.

2.6 Statistical Analysis

Statistical analysis was carried out by using SPSS version 20 (IBM, USA). The presence or absence of association between culture positive and other data were analyzed.

3. RESULT AND DISCUSSION

1.1 Demographic Characteristics of Study Participants

Totally 390 (Men 227 and Women 163) individuals were diagnosed for new case of PTB. Age of the participants, ethnic group, marital status and others sociodemographic characteristics of participants are given in Table 1.

Out of the 390 PTB suspected patients, 96 were smear positive new TB cases, or positive to acid fast bacilli (AFB). Of which 89 patients culture positive for pulmonary TB are included for further analysis. Conversely, 294 and 301 of samples were negative for AFB and Mycobacterium culture respectively. All the positive participants were new cases of

pulmonary TB. This finding is in consonance with reported by Zerihun, et al.[15] but this result is slightly less than earlier reports from Afar region, Ethiopia.[16] This variation may be due to sample size, population diversity, season and duration of the study period.

Table 1. Sociodemographic characteristics of participants (Total sample size: 390)

Characteristics	Participants	Percentage (%)
Sex		
Men	227	58.2
Women	163	41.8
Age of the participants		
15 – 30	25	6.4
16-30	146	37.4
31-45	144	36.9
≥46	75	19.2
Marital status of the participants		
Single	102	26.21
Married	253	64.9
Divorced	21	5.4
Widow	14	3.6
Religion of the participants		
Orthodox	152	39
Catholic	17	4.4
Protestant	128	32.8
Muslim	90	23.1
Other	3	0.8
Ethnicity of the participants		
Amhara	80	20.5
Oromo	122	31.3
Hadiya	55	14.1
Tigre	8	2.1
Gurage	12	3.1
Wolayita	38	9.7
Kambata	75	19.2
Level of Education of the participants		
Can't read and write	93	23.8
Can read and write	58	14.9
Primary school	134	34.4
Secondary school	85	21.8
Higher education	20	5.1
Occupation of the participants		
Merchant/Trader	33	8.5
Employee	182	46.7
Unemployed	36	9.2
Student	42	10.8
House wife	57	14.6
Others	40	10.3

Among the 89 new PTB culture positive patients, men and women distribution was 50 and 39 respectively (Table 2). Similar studies conducted in Ethiopia and other countries like Rwanda and Myanmar reported that smear positive PTB is more common among the men than the women.[17,18,19,20,21]

The incidence of PTB positive cases was high in Amhara ethnic group followed by Walayita, Gurage, Tigre and Hadiya. The low incidence was recorded in Kambata and Oromo (Table 3). And also incidence of PTB positive participants was high in Christian orthodox, Christian catholic and Muslim. The low incidence was in Christian protestant (Table 4). Two out of three tested from other religions found to be positive. The category between 16 and 30 years was highly infected followed by >=46 compared to other age groups (Table 5). This finding is in agreement with earlier studies.[20,15,21,22] Among stratified marital status, the highest incidence of PTB was found in single participants followed by married and widowed (Table 6). This result was similar to results reported by Zerihun, et al.[15]

The dominant positive group among occupational distribution of culture positives cases was merchants followed by employees (Table 7). This is contrary to the results reported by Zerihun, et al.[15] This difference may be due to the study area, nature of participant's livelihood, season and period of study. Considering the education level, the incidence of culture positive participants was highest in elementary level followed by High school and University graduates (Table 8). This result is in agreement with earlier reports.[15] It is probably due to the majority of the society of the country also belonging to this category level of education.

Table2. **Sex distribution of culture positive participants**

S.No	Sex	Number of participants	Positive	Percentage (%)
1	Men	227	50	56.2
2	Women	163	39	43.8

The relationship between sex and culture positive participants is statistically significant (p=0.036).

Table 3: Ethnicity of culture positive participants

S.No	Ethnic group	Number of Participants	Number of culture positive	Percentage (%)
1	Amhara	80	25	31.25
2	Oromo	122	22	18.03
3	Tigre	8	2	25
4	Gurage	12	3	25
5	Walayita	38	10	26.31
6	Hadiya	55	13	23.63
7	Kambata	75	14	18.66

Statistically significant association between ethnic group and culture positive (p=0.017).

Table 4: Religion wise distribution of PTB positive participants

S.No	Religion	Number of Participants	Number of culture positive	Percentage (%)
1	Christian Orthodox	125	43	34.4
2	Christian Catholic	17	4	23.52
3	Christian Protestant	128	20	15.62
4	Muslim	90	20	22.22
5	Other	3	2	66.66

The relationship between religion and culture positive participants there is no significant difference (p=0.11)

Table 5: Relationship between age and culture positive participants

S.No	Age groups	Number of Participants	Number of culture positive	Percentage (%)
1	10-15	25	3	12
2	16-30	146	37	25.34
3	31-45	144	31	21.52
4	>=46	75	18	24

Relationship between age group and culture there is no significant difference, (p=0.19)

Table 6: Marital status to culture positive participants

S.No	Marital status	Number of participants	Number of culture positive	Percentage (%)
1	Single	102	25	24.5
2	Married	253	58	22.92
3	Divorced	21	3	14.28
4	Widowed	14	3	21.42

Relationship between marital status and culture positive participants there is statically significant association (p=0.037)

Table 7: Occupational distribution of PTB positive participants

S.No	Occupation	Number of Participants	Positive participants	Percentage (%)
1	Merchant	33	10	30.3
2	Employee	182	47	25.82
3	Unemployed	36	7	19.44
4	Student	42	9	21.42
5	Housewives	57	10	17.54
6	Others	40	6	15

The relationship between occupation and culture positive participants there is statically high significant (p= 0.00).

Table 8: Relationship between education and culture positive

S.No	Level of education	No of participants	Number of culture positive	Percentage (%)
1	Illiterate	93	19	20.43
2	Can read and write	58	8	13.79
3	Elementary	134	35	26
4	High school	85	22	25.88
5	University graduate	20	5	25

Relationship between education and culture positive participants statically highly significant (p= 0.009)

4 CONCLUSION

This study provided important findings and recommendations that can be incorporated into the current practices in the control of TB. The highest rate of PTB in the vulnerable youth productive age group 16-30 years of age requires immediate attention for proper protective measures, along with further enhancement of case detections, continuous surveillance of PTB, DOTs program based drug regimen and study on strain of Mycobacterium tuberculosis circulating in the area as well as in the country.

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