

<http://dx.doi.org/10.4314/ajid.v8i2.1>

SOME RISK FACTORS ASSOCIATED WITH ACID-ALCOHOL-FAST BACILLI IN PATIENTS WITH SUSPECTED PULMONARY TUBERCULOSIS IN JOS, CENTRAL NIGERIA.

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Abstract

Background: *Mycobacterium tuberculosis* remains a very serious public health problem due to its high tendency of person to person transmission, morbidity, and mortality. This study aimed at determining some risk factors associated with the prevalence of acid-alcohol-fast-bacilli (AAFB) within the study area.

Materials and Methods: Sputum samples were collected from three hundred and three (303) patients with suspected cases of pulmonary tuberculosis in Jos. The samples were examined using Ziehl Neelson method. Structured questionnaires were administered to obtain some demographic data from patients that consented. Results were tested statistically for significance at $p < 0.05$ using Chi-square test.

Results: Out of the samples examined, 29 (9.60%), were positive for AAFB. The study showed that the prevalence of smear-positive increased with increase in number of persons sharing the same room. Statistically the study reveals that some risk factors such as alcoholism, cigarette smoking and number of persons staying in a household had a significant effects on the prevalence ($p < 0.05$), while HIV status had no significant effect on the prevalence ($p > 0.05$).

Conclusion: There was high prevalence of AAFB in the study area especially among people living in poor/congested housing facilities and people with HIV/AIDS. This calls for more collaborative efforts and political will by government and non-governmental agencies in order to eradicate the infection rate within the area, and the country at large.

Key words: Risks factors, pulmonary tuberculosis.

Introduction

Tuberculosis (TB) is a major air-borne infectious bacterial disease. It remains a major world health problem with global mortality ranging from 1.6 to 2.2 million lives per year. The situation is further exacerbated with the increasing incidence of drug resistant TB. After HIV, it is the leading cause of death in the world. Tuberculosis flourishes where ever there is poverty, crowding and chronic debilitating disease (McAdam and Sharpe, 2004).

TB infection is spread when an individual with active respiratory TB coughs or sneezes *M. tuberculosis* bacilli that become aerosolized droplets of less than 5 μm diameter. An increased density of droplet nuclei in the air leads to an increased risk of infection (Beggs *et al.*, 2003). As the number of inhaled bacilli increases, so too does the risk that disease will develop in individuals after they have become infected. An individual with active pulmonary TB (smear-positive), who is sneezing or coughing vigorously and frequently, will exhale 10^6 contaminated droplets (Iseman, 2000). Some, but not all, of the droplets will contain the *M. tuberculosis bacilli* (Begg *et al.*, 2003). The aerosolized droplets settle very slowly and can remain suspended in the air for many hours. Therefore, TB transmission occurs with greater prevalence in poorly ventilated and crowded spaces (Hawker *et al.*, 1999; Beggs *et al.*, 2003; Elender *et al.*, 1998; Valin *et al.*, 2005).

About one-third of the world's population has latent TB, which means people have been infected by TB bacteria but are not (yet), ill with disease and cannot transmit the disease. People infected with TB bacteria have a lifetime risk of falling ill with TB of 10%. However persons with compromised immune systems, such as people living with HIV, malnutrition or diabetes, or people who use tobacco, have a much higher risk of falling ill. When a person develops active TB (disease), the symptoms (cough, fever, night sweats, weight loss etc.) may be mild for many months. This can lead to delays in seeking care, and results in transmission of the bacteria to others. People ill with TB can infect up to 10-15 other people through close contact over the course of a year. Without proper treatment up to two thirds of people ill with TB will die (WHO, 2012).

The diagnosis of TB depends on the history, physical and radiographic evidence or the presence of AFB in acid fast smears and cultures (Powell and Hunt, 2006). Most standard laboratory text books and guidelines for laboratories suggest that at least three specimens, preferably collected on three consecutive days, should be submitted to the laboratory for acid-fast bacilli (AFB) smear and culture. The detection of AFB in direct smears prepared with concentrated sputa, urine and specimens of other body fluids has considerable clinical and epidemiological value and remains the most widely used rapid diagnostic test for TB in most developing countries (Kent and Hunt, 2006). Risk factors for tuberculosis include: Latent TB infection, Aging, Elderly, Young children, HIV, Diabetes mellitus, Alcoholism and smoking, Overcrowding, Migrants, Prisons, Air-borne droplet Transmission, Coughing etc. (Huntley, 2008). This study aimed at considering some risks factors associated with the prevalence of AAFB in patients with suspected cases of pulmonary tuberculosis in the study area.

Materials and Methods

Study area

Plateau State is the twelfth largest state in Nigeria, and is roughly located in the center of the country. It is geographically unique in Nigeria because its boundaries totally surround the Jos Plateau, having the Plateau in its central and northern part. Its capital is Jos. Plateau State is located in Nigeria's middle belt. With an area of 26,899 square kilometers, the State has a population of 3,178,712 people according to 2006 census. It is located

<http://dx.doi.org/10.4314/ajid.v8i2.1>

between latitude 80°24'N and longitude 80°32' and 100°38' east. Though situated in the tropical zone, a higher altitude means that Plateau State has a near temperate climate with an average temperature of between 18 and 22°C. Harmattan winds cause the coldest weather between December, and February. The warmest temperatures usually occur in the dry season months of March and April. The mean annual rainfall varies from 131.75 cm (52 in) in the southern part to 146 cm (57 in) on the Plateau (http://en.wikipedia.org/wiki/Plateau_State).

Ethical consideration

Ethical clearances were obtained from Jos University Teaching Hospital, Jos, Plateau Specialist Hospital, and Faith Alive Foundation before the commencement of the work.

Study population

The study population focused on all Patients within the age range of 15 years and above with suspected cases of pulmonary tuberculosis attending Plateau Specialist Hospital and Faith Alive Foundation. Patients below the age of 15 and those who failed to give their consent were excluded from this study.

Sampling methodology

A structured questionnaire was administered randomly to patients who gave their consent in order to obtain some vital demographic data.

Sample collection

The sample collections were done with the assistance of Medical personnel. The patients were given leak proof universal bottles in which they produced three samples (one spot, one early morning and one spot).

Sample analysis

Three consecutive sputum samples were collected in leak proof universal plastic containers and stained using Ziehl-Neelsen's method and examined in accordance with standard methods. Three smears were prepared from each patient, heat fixed and stained using Ziehl-Neelsen technique as follows: Strong carbol fuchsin was flooded on the slides and steamed, it was then allowed to stain for 5 minutes followed by de-colorization with 3% acid-alcohol and washed with water and then counterstained with 0.3% methylene blue for 1 minute, washed with water and allowed to air-dry before examination for AAFB (WHO, 2004).

Microscopic examination of slides

The stained smears were examined with the Olympus light, binocular microscope under the oil immersion objective, scanning all fields at high power field for the presence of bright red slender rods, the presence of which signified positive AAFB and the absence, negative. The microscopy revealed the tubercle bacilli being bright red on a blue background; straight or slightly curved, quite short (1-4µm) often granular, arranged in groups of 3-10 bacilli close together like bits of string.

Grading of microscopy results

This was done in accordance to standard method as shown below:
1-9/100 fields – 1+ ; 1-9/10 fields – 2+ ; 1-9/1 fields – 3+ ; 9/ 1 fields 4+ ; Negative – 0. The grading provides an idea on the degree of infectivity of the infection in the patient.

Results

Three hundred and three (303) sputum samples were examined for AAFB from the study area. Out of the 303 sputa, 29 (9.57%) were positive for AAFB.

Table 1 shows the prevalence of AAFB in relation to the number of persons staying together in a household. People living in the same household in a group of 3 and group of 4 and above had 6(12.50%) and 20(10.81%) respectively while persons staying alone had 2(6.89%) while those staying in twos had the lowest rate with 1(2.44%). The result showed that the number of people staying together have an effect on the prevalence ($p < 0.05$).

Table 2 shows the prevalence of AAFB in relation to Alcoholics and Smokers. The result reveals that of 96 alcoholics screened 8(8.33%) were positive while of the 207 non alcoholics screened 21(10.14%) were positive for AAFB. Similarly of the 60 Smokers screened 5(8.33%) were positive and of the 243 non-smokers screened 24(9.88%) were positive. There were statistically significant associations between these variables ($p < 0.05$).

Table 3 shows the prevalence of AAFB in relation to HIV status. The result reveals that of 136 HIV positive patients screened 13(9.56%) were positive for AAFB, of the 129 HIV negative patients screened 11(8.53%) were positive for AAFB, while of the 38 patients with unknown HIV status screened, 5(13.10%) were positive for AAFB. There were no statistically significant associations between these variables ($p > 0.05$).

<http://dx.doi.org/10.4314/ajid.v8i2.1>

Discussion

The result obtained in this study revealed that out of the three hundred and three (303) sputum samples examined for AAFB using Ziehl Neelsen staining technique, 29(9.60%) were positive for AAFB. Considering the fact that sputum smear microscopy is less sensitive to sputum culture in tuberculosis diagnosis, and with the number of positives obtained, it is obvious that the study area is endemic to tuberculosis. The result of this study agreed with the findings reported by Olowe and Famojuro (2010), who reported a prevalence of 10.5% in Osogbo, and Nwachukwu et al. (2009), who reported a prevalence of 16.83% in some parts of Abia. Aderemi et al. (2007), reported a prevalence of 7.1% among suspected new tuberculosis patients attending University College Hospital Ibadan while Itahl and Udofia (2005), reported a prevalence rate of 31.7% South Eastern Nigeria which is far higher than what was obtained in this study.

Table 1: Prevalence of Acid-Alcohol-Fast Bacilli in Relation to People Staying Together

No. of person(s)	No. Screened	No. positive (%)	X ² /P-Values
1	29	2(6.89)	X ² =31.83; DF=3
2	41	1(2.44)	P < 0.05
3	48	6(12.50)	
≥ 4	185	20(10.81)	
Total	303	29(9.60)	

Table 2: Prevalence of Acid-Alcohol-Fast Bacilli in Relation to Alcoholics and Smokers.

Habit	No. Screened	No. positive (%)	X ² /P-Values
Alcoholic			
Yes	96	8(8.33)	X ² =5.86; DF=1
No	207	21(10.14)	P < 0.05
Smoker			
Yes	60	5(8.33)	X ² =12.48; DF=2
No	243	24(9.88)	P < 0.05
Total	303	29(9.60)	

Table 3: Prevalence of Acid-Alcohol-Fast Bacilli in Relation to HIV Status.

HIV Status	No. Screened	No. positive (%)	X ² /P-Values
Positive	136	13(9.56)	X ² =3.60; DF=2
Negative	129	11(8.53)	P > 0.05
Unknown	38	5(13.10)	
Total	303	29(9.60)	

This work shows the prevalence of AAFB in relation to the number of persons staying together in a household. The findings indicates that people living in the same household in a group of 3 and group of 4 and above had 5 (13.5%) and 10 (12.0%) respectively, while persons staying in twos or alone had the lowest rate. The result of both findings indicates that people who are always in close contact or staying together in a household especially in endemic areas have a higher chances of contracting the infection. This result was in consonance with earlier reports that Persons who are at the greatest risk of exposure to TB are those who live and sleep in the same household with an infected person (Menzies et al., 1999; Singh, et al., 2005; Vital et al., 1997; Fennelly et al., 2004). A relationship has been confirmed between overnight cough frequency and increased transmission

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among household contacts (Fennelly *et al.*, 2004; Loudon and Spohn, 1969). People sharing the same bedroom or staying in the same household with an infected person are at risk of being infected. Likewise people staying in overcrowded and poor housing facilities are equally at risk.

The result of this work revealed that the prevalence of AAFB tends to be lower among the non alcoholics and non cigarette smokers, than the alcoholics and cigarette smokers. The findings showed a statistically significant association ($p < 0.05$). This study disagreed with report of Ekkrakene and Igeleke (2010), who stated that smokers showed a higher prevalence than non smokers. Like wise Lonnoth *et al.* (2010) reported that an often-overlooked risk factor driving TB is tobacco smoking. The attributable fraction of TB due to various risk factors has been estimated for high burden countries; these include tobacco smoking (15.8%), alcohol misuse (9.8%), among others. The disparity in the outcome of this study and the other researchers stated may be attributed to the differences in the sampling size.

The prevalence of AAFB in relation to HIV status in this study reveals that of 136 HIV positive patients screened 13 (9.56%), were positive for AAFB, of the 129 HIV negative patients screened 11 (8.53%), were positive for AAFB, while of the 38 patients with unknown HIV status screened, 5 (13.10%), were positive for AAFB. Although there was no statistically significant associations between these variables ($p > 0.05$), there was a higher prevalence of AAFB among HIV patients than in the other groups. This work agreed with Vignesh *et al.* (2007) who stated that HIV has a substantial influence on the incidence, clinical manifestations, treatment and disease outcome of tuberculosis. Miller *et al.* (2002) also stated that the resurgence of tuberculosis in industrialized countries since the mid-1980s primarily was due to the increased incidence of immuno-compromised patients with AIDS.

Conclusion

The 9.60% prevalence of AAFB in the study area obtained using the Ziehl Neelsen method is an indication that the area is endemic to the spread and transmission of tuberculosis, although the method is less sensitive when compared with the cultural method, the method is still the main stay of diagnosis of AAFB among patients with suspected cases of pulmonary tuberculosis in the area. The need for provision of standard tuberculosis laboratories with modern facilities for cultures can not be over emphasized; this can further compliment the on going work in the Direct Observed Therapy Short course (DOTS) centers in the study area and hence improve health care delivery.

This study also reveals that several risk factors can predispose people from coming down with the infection such as HIV/AIDS, and those staying together in a congested environment or poor housing conditions. This study suggest that with government's political will in eradicating poverty and provision of a good health care delivery system, the control and prevention of tuberculosis will be more effective in the country.

The need for serious enlightenment campaigns on the prevention and control strategies in the study area can be very useful in reducing the transmission of the infection. This can be effectively done if there will be some collaboration between the government, non-governmental, and religious organizations.

Acknowledgements

We thank the authorities of Plateau State Specialist Hospital and Faith Alive Foundation, for granting the permission to carryout the study among the study population in their facilities and also we appreciate all the support rendered to us by the staffs of the facilities.

References

1. McAdam, A.J., and Sharpe, A.H. (2004). Mycobacteria. In Robins and Cotran Pathological Basis of Disease. 7th Ed. Philadelphia: Saunders; p381–7.
2. Beggs, C.B., Noakes, C.J., Sleigh, P.A., Fletcher, L.A., and Siddiqi, K. (2003). The transmission of tuberculosis in confined spaces: An analytical review of alternative epidemiological models. *Int J Tuberc Lung Dis*; 7:1015-26.
3. Iseman, M. D. (2000). A clinician's guide to tuberculosis. Lippincott Williams and Wilkins, Philadelphia.
4. Hawker, J.I., Bakhshi, S.S., Ali, S., and Farrington, C.P. (1999). Ecological analysis of ethnic differences in relation between tuberculosis and poverty. *BMJ* 319:1031-34.
5. Elender, F., Bentham, G., and Langford, I. (1998). Tuberculosis mortality in England and Wales during 1982-1992: Its association with poverty, ethnicity and AIDS. *Soc Sci Med* 46(6):673-81.
6. Valin, N., Antoun, F., Chouaid, C., Renard, M., Dautzenberg, B., Lalonde, V., Ayache, B., Morin, P., Sougakoff, W., Thiolet, J.M., Truffot-Pernot, C., Jarlier, V., and Decludt, B. (2002). Outbreak of tuberculosis in a migrants' shelter, Paris, France, *Int J Tuberc Lung Dis* 2005; 9:528-33.
7. Huntley, A. (2008). Risk factors for Tuberculosis.4:10, Health Grades, Inc.
8. WHO 2012 Tuberculosis FACT SHEET 2011 PDF http://www.who.int/tb/publications/2011/factsheet_tb_2011.pdf. Accessed 1st June, 2012.
9. Powell, D.A., and Hunt, W.G. (2006). Tuberculosis in children: an update. *Adv Pediatr*; 53:279–322.
10. Kent, P.T., and Kubica, G.P. (1985). Public health mycobacteriology. A guide for the level III laboratory. US department of Health and Human Services, Centers for Disease Control and Prevention, Atlanta, Ga, http://en.wikipedia.org/wiki/Plateau_State. Accessed 15th January, 2013.
11. World Health organization (2004): TB monitoring, No. 30 strategy and Operation monitoring and evaluation. <http://www.who.int/gtb/en>. Accessed 24th June, 2009.
12. Olowe, O.A., and Famojuoro, H.B. (2010). Laboratory Identification of Pulmonary TB using simple rapid techniques in Osogbo South Western Nigeria. *Res J of Medical Sci* 4(3):227-230.
13. Nwachukwu, N.C., Orji, A., Kanu, I. and Okereke (2009). Epidemiology of Pulmonary Tuberculosis in some parts of Abia State, Federal Republic of Nigeria. *Asian J of Epid* 2(1):13-19.
14. Aderemi, O.K., Obaseki, F.A., Ishola, O.C., and Ibrahim, K.K. (2007). Multi drug Resistance to *Mycobacterium tuberculosis* in a tertiary Hospital. *JMA* 99(10):1185-1189.

<http://dx.doi.org/10.4314/ajid.v8i2.1>

15. Itahl, A.Y., and Udofia, S.M. (2005). Epidemiology and Endemicity of Pulmonary Tuberculosis in Southeastern Nigeria. *Asian Jour.Trop.Med Public Health* 36(2):317-23.
16. Menzies, D., Tannenbaum, T.N., and FitzGerald, J.M. (1999). Tuberculosis: 10. Prevention. *CMAJ* 161:717-24.
17. Singh, M., Mynak, M.L., Kumar, L., Mathew, J.L., and Jindal, S.K. (2005). Prevalence and risk factors for transmission of infection among children in household contact with adults having pulmonary tuberculosis. *Archives of Dis in Childhood* 90:624-28.
18. Vidal, R., Miravittles, M., Cayla, J.A., Torrella, M., de Gracia, J., and Morell, F. (1997). Increased risk of tuberculosis transmission in families with microepidemics. *Eur Respir J*; 10:1327-31.
19. Fennelly, K.P., Martyny, J.W., Fulton, K.E., Orme, I. M., Cave, D. M., and Heifets, L. B. (2004). Cough-generated aerosols of *Mycobacterium tuberculosis*: A new method to study infectiousness. *Am J Respir Crit Care Med*; 169:604-9.
20. Loudon, R, and Spohn, S. (1969). Cough frequency and infectivity in patients with pulmonary tuberculosis. *Am Rev Respir Dis*; 99:109-11.
21. Ekraene,T., and Igeleke, C.L. (2010). Prevalence of pulmonary tuberculosis among active and passive smokers of cigarette in Benin City, Nigeria. *Int J of Biomed and Hlth Sci* 6(1):91-96. Retrieved 26/07/10.
22. Lonroth, K., Castro, K.G., Chakaya, J.M., Chauhan, L.S., Floyd, K., Glaziou, P., and Raviglione, M.C. (2010). Tuberculosis control and elimination : cure, care, and social development. *Lancet* 375: 1814-1829.
23. Vignesh,R.,Balakrishnan,P.,Shankar,E.M.,Murugavel,S.H.,Cecelia,A.J.,Solomon,K., and Kumarasamy, N. (2007).Value of single acid-fast bacilli sputum smears in the diagnosis of tuberculosis in HIV-positive subjects. *JMed Microbiol* 56:1709-1710.
24. Miller, N., Cleary, T., Kraus,G.,Y oung, A.K., Spruill, G., and Hnatyszyn, H. J. (2002). Rapid and Specific Detection of *Mycobacterium tuberculosis* from Acid-Fast Bacillus Smear- Positive Respiratory Specimens and BacT/ALERT MP Culture Bottles by Using Fluorogenic Probes and Real-Time PCR. *J. of Clin Microbiol.* 40(11):4143-4147.