PRINT ISSN 1119-8362
Electronic ISSN 2659-1502

Full-text Available Online at
https://www.ajol.info/index.php/jasem
http://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 26 (7) 1239-1244 July 2022

Prevalence of Intestinal Parasites among Tuberculosis and Non-Tuberculosis Patients Attending Hospitals in Yola, Adamawa State, Nigeria

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ABSTRACT: Tuberculosis and intestinal parasites are mostly affecting poor people. They are in a vicious cycle since one is the risk factor for the other. A hospital based cross-sectional study was carried out on the prevalence and co-infection of intestinal parasites on tuberculosis and non-tuberculosis patients in Specialist Hospital, Jimeta and Federal Medical Centre, Yola, between April-July, 2021. Demographic data was collected using structured questionnaire, while stool samples was collected and processed using wet mount and formol ether concentration technique for the detection of intestinal parasites. Data was analyzed using SPSS Version 26.0 software packages. Chi-squared test at 95% level of significance was used to measure the strength of an association. Out of the 250 participants, 150 (60%) had tuberculosis, while 100 (40%) were non-TB patients. A total of 34 (13.6%) were infected with intestinal parasites: 8.4% of TB patients and 5.2% of non-TB patients were positive for intestinal parasites. There was no statistically significant difference in the prevalence of infection between the patient's ($p>0.05$). *Ascaris lumbricoides* was the highest occurring parasite (4.4%), followed by *Schistosoma mansoni* and *Entamoeba histolytica*, both having a prevalence of 2.8% each, *Hymenolepsis nana* (2.0%), *Trichomonas hominis* (1.2%) and *Entamoeba coli* being the least with a prevalence of 0.4%. Age related infection showed that the 21-30 year old had the highest prevalence of infection (4.0%) with the least among the 11-20 year old age group (0.4%). There was a statistically significant difference in the association between the age groups and infection ($p<0.05$). Males had the higher prevalence of infection (8.4%) compared to their female counterpart (5.2%), there was no statistically significant difference in the association between infection and gender ($p>0.05$). With respect to patient's occupation and level of education, those with tertiary education and farmers had the highest prevalence (6.0%, 5.9%), respectively. The prevalence of intestinal parasites was higher in persons with tuberculosis, and there was evidence that tuberculosis increased susceptibility to intestinal parasites in this study. Though the prevalence in this study is low, the lack of knowledge of the mode of transmission of these parasite can lead to further infection of both those already infected and those not infected.

DOI: https://dx.doi.org/10.4314/jasem.v26i7.8

Impact factor: http://sjifactor.com/passport.php?id=21082

Google Analytics: https://www.ajol.info/stats/bdf07303d34706088ffffbc8a92c9c1491b12470

Dates: Received: 16 June 2022; Revised: 07 July 2022; Accepted: 17 July 2022

Keywords: Tuberculosis; Intestinal parasite; *Entamoeba histolytica*; *Entamoeba coli*

Intestinal parasite infections (IPIs) are among the world's most frequent infections, causing significant morbidity and mortality. Intestinal helminths are believed to infect approximately 1,400 million people worldwide, making them one of the world's most serious health issues, particularly in underdeveloped nations. Ascariasis, trichuriasis, and hook worm infections are all common intestinal helminthic infections in Nigeria. Low socio-economic position and poor sanitation are blamed for the broad spread of intestinal helminthiasis (Alemayehu et al., 2014).

Pulmonary tuberculosis (PTB) has remained one of the leading causes of death from infectious diseases over the years. Several research have looked into the co-infection of tuberculosis with IPIs, particularly those caused by protozoans and helminths, in recent years. According to published data, the co-existence of these pathogenic pathogens has become a public health concern, especially in developing nations. Furthermore, Pullan et al., (2010) calculated that 438.9 million, 819 million, and 467.6 million persons were infected with Hookworm, *Ascaris lumbricoides*, and *Trichuris trichiura*, respectively, according to global reports. Presumably, in terms of the widespread distribution of intestinal parasites, low-income populations' socio-economic and sanitary living

conditions are linked to an increase in the incidence of tuberculosis and IPIs; without improvements in the environment, sanitation, housing, education, and health services, the co-infection of TB and IPIs will continue to rise (Pulan et al., 2010). Immunodeficiency problems, on the other hand, are likely to worsen the complications in TB patients. The high prevalence of IPIs in immunocompromised tuberculosis (IC-TB) patients could be due to a variety of circumstances, including a low CD4 T-cell count, poor hygiene, rural living, a lack of nutritional diets, and the unavailability of portable drinking water (Ali et al., 2018). Co-infection in humans has become a serious emergent public health hazard in the world's poorest regions due to the geographic overlap of intestinal helminth infections and tuberculosis. Previous research has found a strong link between active pulmonary tuberculosis (PTB) and helminthiasis. The helminth species and co-infection with PTB, on the other hand, differ from place to place. Climatic conditions, socio-demographic characteristics and living standards of the population are believed to determine the type of helminths existing in various TB endemic areas. This demands the study's purpose as well as data collection on co-infection and common co-infecting helminth species in this geographical area, because the information will be used by policymakers to adjust TB case management protocols at the local level depending on the current situation. As a result, the goal of this study is to identify the various parasites that infect tuberculosis patients, as well as the association between TB and intestinal parasite infection, in order to provide information to the health sector responsible for tuberculosis management and control.

MATERIALS AND METHODS

A hospital based cross-sectional study was conducted in selected hospitals: Federal Medical Centre, Yola, and Specialist Hospital, Jimeta, situated in Yola South and Yola North Local Government Areas (LGAs) respectively, of Adamawa, Nigeria between April 2021 to July, 2021.

Study Population: All patients attending the outpatient (OPD) and in-patient (IPD) of the tuberculosis clinic, who were clinically diagnosed to be suffering from TB and patients from non-TB clinic were involved in this study. Socio-demographic information was collected from the patient using structured questionnaires.

Ethical Clearance: Ethical clearance was obtained from the State Ministry of Health (ADHREC 2/03/2021/040) and Federal Medical Center, Yola, Ethical Committee. Verbal and signed consent was sought from the volunteering participants before commencement of the study.

Sample Size: A total of 250 patients enrolled for the study: 150 TB-patients and 100 non-TB.

Collection of Stool Specimen, Processing and Laboratory Examination: The appropriate amount of stool sample was collected from all study participants and delivered to the Federal Medical Center's laboratory for parasitic examination using direct saline and iodine (wet mount) method and formol-ether concentration technique. For wet mount method, slides were labeled and a drop of saline was placed on one end of the slide and a drop of iodine was placed on the other end of the slide. An applicator stick was used to mix small amount (pea size) of stool specimen and 2mg of the specimen was picked and emulsified on each drop of the saline and iodine, respectively, to make a smooth thin preparation. Each preparation was covered with a cover slip. The preparation was mounted on the microscope and examined using 10X and 40X objectives with the condenser iris closed to give good contrast for the detection and identification of eggs, cysts and oocyst of parasites (Cheesbrough, 2005).

For formol-ether concentration technique, centrifuge tubes were labeled and 4mls of 10% formol water was dispensed in each tube. An applicator stick was used to pick 1g (pea size) of the stool specimen and emulsified in each tube. Three milliliters of 10% formol water was added to each tube, mixed well and shaked. The emulsified faeces was sieved into another centrifuge tubes using a fine mesh guaze. Four milliliters of diethyl-ether was added into each tube. The tubes were covered with stopper and mixed for 1min, the stopper was removed using tissue paper. The tube containing the stool suspension was centrifuged at 3000 resolution for 1min. An applicator stick was used to loosen the layers of faecal debris from the side of the tubes and the tubes were inverted, and the ether, faecal debris and formol water were discarded. The sediments remained and the tubes were returned to their upward position to allow the liquid from the side to drain to the bottom. The bottom of each tube was tapped to re-suspend and mix the sediments. The sediments of each tube was transferred to a clean glass slide and covered with a cover slip, mounted on a microscope and examined using the 10X and 40X objectives for detection and identification of eggs and cysts of parasites (Cheesbrough, 2005).

Data Analysis: The data collected was recorded and analyzed using SPSS Version-26.0. Chi-square test was used to determine if there was any association between variables at a confidence level of 95%.

RESULTS AND METHODS

Out of the 250 participants, 34 (13.6%) were infected with intestinal parasites (Table 1), while 216 (86.4%) were not infected.

Prevalence of Intestinal Parasite in Relation to TB Status: Table 2 shows prevalence of intestinal parasites in relation to TB status. Out of the 150 TB patients, 21 (8.4%) were infected, while 13 (5.2%) non-TB patients were infected with intestinal parasite. The TB patients had higher prevalence (8.4%) compared to the non-TB patients (5.2%). There was however no statistically significant difference in the prevalence of infection between the patients ($\chi 2$=0.051, p>0.05).

Prevalence of Intestinal Parasites Among the Study Population: Prevalence of intestinal parasites among the study subjects as shown in Table 3, *Ascaris lumbricoides* was the highest occurring parasite 11(4.4%), followed by *Schistosoma mansoni* and *Entamoeba histolytica*, both having a prevalence of 2.8% each, *Hymenolepsis nana* with a prevalence of 2.0%, *Trichomonas hominis* 1.2% and *Entamoeba coli* being the least with a prevalence of 0.4%.

Table 1: *Frequency of intestinal parasite infection*

	Frequency	Percentage
Positive	34	13.6
Negative	216	86.4
Total	250	100.0

Table 2: *Prevalence of intestinal parasite infection in relation to TB-status*

TB-Status	Number Examined	Number Infected (%)
Positive	150	21 (8.4)
Negative	100	13 (5.2)
Total	250	34 (13.6)

*Distribution of the Intestinal Parasites in Relation to TB Status of the Patients***:** Tuberculosis patients recorded higher prevalence with *Ascaris lumbricoides* (20.6%), followed by *Schistosoma mansoni* (14.7%) and *Hymenolepsis nana* as the least (2.9%).

Table 3: *Prevalence of intestinal parasite among the study population*

Intestinal Parasite Identified	Frequency	Percentage
Ascaris lumbricoides	11	4.4
Schistosoma mansoni	7	2.8
Hymenolepsis nana	5	2.0
Entamoeba histolytica	7	2.8
Entamoeba coli	1	0.4
Trichomonas hominis	3	1.2
Total	34	13.6

While the non-TB patients had a higher prevalence with *Entamoeba histolytica* (20.6%), followed by *Ascaris lumbricoides* and *Hymenolepsis nana* with 11.8% respectively, *Trichomonas hominis* (8.8%), *Schistosoma mansoni* (5.9%) and the least was *Entamoeba coli* (2.9%). There was a statistically significant difference in the distribution of the parasitic infection ($\chi 2$ Cal=0.01, p=0.05) among TB and non-TB patients (Fig. 1).

Parasite Intensity Among Patients in Relation to Different Parasites: For the level of intensity of each parasitic infection, *Ascaris lumbricoides* had 11 (32.4%) mild infection with no moderate or severe infection, *Schistosoma mansoni* had 7 (20.6%) mild infection with no moderate or severe infection, *Hymenolepsis nana* had 3 (8.8%) mild infection, 2(5.9%) moderate infection, *Entamoeba histolytica* had 2 (5.9%) mild infection, 4 (11.8%) moderate and 1 (2.9) severe infection. *Entamoeba coli* had 1 (2.9%) moderate infection with no mild or severe infection and *Trichomonas hominis* had 2 (5.9%) mild and 1 (2.9%) severe infection. There was however a statistically significant difference between the levels of intensity of infection ($\chi 2$=0.0009, p=0.05) (Table 4).

Prevalence of Intestinal Parasite Infection with Respect to Age: Table 5 shows the prevalence of infection with respect to age. The 21-30 years had the highest level of infection (4.0%), followed by 41-50 years (3.6%), 51 and above (3.2%) and the least were 11-20 year old (0.4%) ($\chi 2$ Cal= 0.007, p= 0.05).

Demographic characteristics of participants with relation to Intestinal Parasite infection: Table 6 show the prevalence of infection in relation to gender. Males had a higher prevalence 21 (8.4%) than females 13 (5.2%) ($\chi 2$ Cal=1.384, p>0.05). The relationship between the level of education of the patients and prevalence of intestinal infection show that those having tertiary education having the highest prevalence (6.0%), followed by non-formal (4.0%), secondary and primary having same prevalence of 1.6%, respectively ($\chi 2$ Cal= 15.785, p<0.05). Farmers had the highest prevalence (5.9%), followed by civil servants (4.5%), students (2.4%) and those working in private organization had the least prevalence (1.2%), ($\chi 2$ Cal=8.245, p<0.05). The prevalence of infection with respect to place of residence of the patient demonstrated that those in urban settlement had the higher prevalence of infection (10.0%) and rural (3.6%), ($\chi 2$ Cal=0.046, p>0.05).

This hospital based cross-sectional study was done with the objectives to find out the prevalence of intestinal parasite infection among TB and non-TB patients. Among 250 participants, the prevalence of infection was 13.6 % (34): the co-infection for TB

patients was 5.2% while non-TB patient had an intestinal parasite infection of 8.4%. Findings from this study was lower than studies conducted in different areas. A study conducted by Idu et al., (2016) in Benue State, Nigeria reported a prevalence of 38.4%, Alemu *et al.,* (2017) and (2019) in Ethiopia had a prevalence of 26.3% and 34%, respectively, Alemayehu *et al.,* (2014) got a prevalence of 33.3%, Ali *et al.,* (2018) in Iran (34%) and Kumudini *et al.,* (2019) in India (27.1%), while Yalekwagyter et al., (2014) in Ethopia had a much lower prevalence of 2% The findings of Xin-xu *et al.,* (2014) in China had a prevalence of 14.9% which is close to that from this study. The difference in prevalence may be due to the difference in study period, method of stool examination, geographical area, sample size and differences in the selection criteria of study participants: The study participants for this study were patients who had been diagnosed with TB and were already receiving treatments and those who did not have TB, while the other writers used patients who had just been diagnosed with TB and had not started receiving treatments.

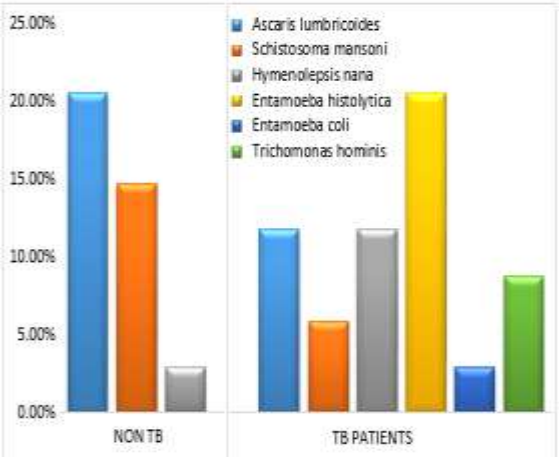

Fig. 1: *Distribution of the different intestinal parasite in relation to TB-status of the patients.*

Table 4: Intensity of infection among patients in relation to the different parasites.

Severity of Infection	Mild (%)	Moderate (%)	Severe (%)	Total (%)
Ascaris lumbricoides	11 (32.4)	0	0	11 (32.4)
Schistosoma mansoni	7 (20.6)	0	0	7 (20.6)
Hymenolepsis nana	3 (8.8)	2 (5.9)	0	5 (14.7)
Entamoeba histolytica	2 (5.9)	4 (11.8)	1 (2.9)	7 (20.6)
Entamoeba coli	0	1 (2.9)	0	1 (2.9)
Trichomonas hominis	2 (5.9)	0	1 (2.9)	3 (8.8)
Total	25 (73.5)	7 (20.6)	2 (5.9)	34 (100)

Table 5: Prevalence of infection with respect to age

Age (Years)	Number Examined	Number Infected (%)
0-10	19	0
11-20	28	1 (0.4)
21-30	79	10 (4.0)
31-40	61	6 (2.4)
41-50	35	9 (3.6)
51>	28	8 (3.2)
Total	250	34 (13.6)

$\chi 2$ Cal= 0.007, $\chi 2$ Tab= 0.05, df= 5 ($p< 0.05$)

Table 6: Demographic characteristics of participants with relation to Intestinal Parasite infection Relation

Variables	Number examined	Number infected (%)	P-value
Gender			
Male	131	21(8.4)	0.239
Female	119	13(5.2)	
Total	250	34(13.6)	
Educational status			
Primary	44	4(1.6)	0.003
Secondary	78	4(1.6)	
Tertiary	31	11(4.4)	
Non-formal	94	15(6.0)	
None	3	0	
Total	250	34(13.6)	
Occupation			
Civil servant	52	11(4.5)	0.04
Private organization	40	3(1.2)	
Farmers	73	14(5.9)	
Students	85	6(2.4)	
Total	250	34(13.6)	
Residence			
Urban	70	9(3.6)	0.831
Rural	180	25(10.0)	
Total	250	34(13.6)	

Results from our study which show that *Ascaris lumbricoides* was the predominant parasitic infection in the study, was however lower than that of a similar study reported by Alemayehu *et al.,*(2014) and Yalekwagyter *et al.,* (2014) who reported a prevalence of 7.7% and 5.9%, respectively. What our study and these other authors had in common was *Ascaris lumbricoides* being the most predominant parasitic infection. While findings from other writers had Hookworm infection as their most predominant parasite. However, there was no significant difference in the prevalence of intestinal parasite infection among TB and non-TB patients with both having a prevalence of 5.2% and 8.4%, respectively. The prevalence of infection was higher in non-TB patients than in the TB patients. Previous studies focusing only on the effect of helminth infections on TB suggested that helminth infections may be the risk factor for active TB in addition to HIV infection, as well as having a negative influence on human immunity against TB (Elias *et al.*, 2006 and Resende *et al.,* 2007). Tuberculosis and parasitic diseases were shown to be risk factors for each other (Li *et al.,* 2013) Therefore, TB was hypothesized to also increase the risk of intestinal parasite infections. The hypothesis was supported by

results of this study, in which infection with intestinal parasites was higher in TB patients than non-TB patients. Our findings agree with that of Xin-Xu *et al.*, (2014) carried out in China where there was no significant difference in infection between TB and non-TB patients. This could be attributed to the timing of the start of anti-TB chemotherapy before stool examination. The prevalence of intestinal parasites infection showed a significant association among different age groups. The age group of 21-30 years was the most affected age group. This might be due to occupational related exposures of this age group. Thus agreeing with Kumudini *et al.*, (2019) and Alemayehu *et al.*, (2014) who stated that the 11-20 and 25-29 year old, respectively, had the highest infection. Even though there was no statistically significant association in the prevalence of intestinal parasites infections with gender of the respondents, the prevalence of intestinal parasite was relatively higher in males than females. Studies done by Idu *et al.*, (2016), Kumudini *et al.*, (2019), Alemayehu *et al.*, (2014), Ali *et al*., (2018) and Alemu *et al.*, (2019) agrees with our findings. There was statistically significant difference in infection with regards to the educational status and occupation of the participants, were those with non-formal education had the highest infection followed by those with tertiary education (6.0% and 4.0%), respectively. For occupation, farmers had the highest level of infection, followed by civil servants (5.7% and 4.5%). This could be due to the fact that even the educated in our society indulge in farming activities alongside their jobs in order to augment their monthly earnings and to cope with the harsh economic situation in our society. This agrees with the study carried out by Xin-Xu *et al.*, (2014) where farmers had a high level of infection. The residence and income of the participants had no significant association in the level of parasitic infection. Studies by Kumudini *et al*., (2019) agrees with this while those by Alemu *et al.*, (2019) and Yalekwayker *et al.*, (2018) disagree with our findings.

Conclusion: The study result reiterates the fact of co-infection of tuberculosis and intestinal parasites. Though the prevalence in this study is low, the lack of knowledge on the co-infection and the mode of transmission of these parasite, poor sanitation or poor hygiene and low socio-economic status of individuals in developing countries can lead to further infection of both those already infected and those not infected.

*Acknowledgement***:** Our appreciation go to the management of specialist Hospital and Federal medical Center, Yola for permission to carry out the study. We also thank the patients who volunteered for the study, as well as the laboratory staff of Federal Medical Center, Yola, Adamawa State, Nigeria.

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