

# Prevalence of Mycobacterium tuberculosis antibodies in a healthy population in a South-Eastern State of Nigeria

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## Abstract

**Objective:** To determine the seroprevalence of Mycobacterium tuberculosis in apparently healthy residents of two densely-populated and model settlement nucleated towns of Akwakuma and Orji in Owerri North Local Government Area of Imo State, South Eastern Nigeria.

**Methods:** Antibodies to M. tuberculosis in human serum or plasma were qualitatively detected in four hundred and eighty individuals using the one step TB 1gG/1gM two sided-lateral flow chromatographic immunoassay.

**Results:** The prevalence of M. tuberculosis antibodies in the study population was 6.67%. However, the prevalence was significantly higher ( $p < 0.05$ ) in sera of inhabitants of Orji (8.33%) than in those of Akwakuma (5.56%). Generally, in both communities, the females were significantly ( $p < 0.05$ ) more sero-positive for M. tuberculosis antibodies (8.57%) than the males (4.0%). The antibodies were most prevalent (22.2%) in persons between the ages of 20 and 29 years. No M. tuberculosis antibody was detected in individuals that were in the 1-9, 30-39 and 50-59 year age groups. Amongst the study population, the bacterial antibodies were only detected in 25.0% of the males in Orji that were between 20 and 29 years. Comparatively, the antibodies were prevalent (16.7%) in female residents of Akwakuma that were within the 10-19 and 40-49 years age group.

**Discussion:** The high prevalence of M. tuberculosis in the study population is worrisome as the sero-positive individuals are not only at risk of having full blown tuberculosis later on, but are also a source of spreading the bacteria to the populace. Therefore, there is an urgent need for further epidemiological survey to be undertaken in the study area and, to initiate appropriate preventive and control measures (JPMA 58:8;2008).

## Introduction

Tuberculosis (TB) is an infection with the Mycobacterium tuberculosis, which most commonly affects the lungs (pulmonary TB). It can also affect the central nervous system (meningitis), lymphatic system, circulatory system (miliary TB), genitourinary system, bones and joints. TB is the leading cause of death associated with infectious diseases globally especially with its interaction with the human immunodeficiency virus (HIV).<sup>1,2</sup> The bacterium is spread primarily through aerosolized infectious particles generated from coughing and sneezing by individuals with tuberculosis and less commonly via skin wounds.<sup>3</sup>

Due to primary route of transmission, early diagnosis of tuberculosis is essential in limiting the spread of Mycobacterium tuberculosis within the human population.<sup>4,5</sup> An optional diagnostic test for tuberculosis would be able to detect early infection with high sensitivity and specificity, and rapidly yield results whilst being inexpensive and causing little or no patient discomfort.<sup>6</sup> The currently available methods for the diagnosis of tuberculosis, including microscopic examination of sputum smears, culturing of sputum samples, PCR-based detection system, detection of lipoarabinomannan in sera, chest x-ray, and the mantoux test, all fail to satisfy at least one of the above requirements.<sup>6</sup> An attractive methodology that continues to be explored is the

detection of *M. tuberculosis* specific antibody in patients' sera, since a serodiagnostic test could potentially satisfy all of the requirements for an optimal diagnostic test for tuberculosis.<sup>7,8</sup>

According to the World Health Organization, the burden of TB in Nigeria is not precisely known, but the steady rise in notifications since 1995, and the relatively high case rates among young adults, probably reflects a real increase in incidence associated with HIV, and strong continuing transmission. DOTS (directly observed therapy) was available, in principle, to only 65% of the Nigerian population at the end of 2004.<sup>9</sup>

As at present, no literature that provides the prevalence data of *M. tuberculosis* in the study area is available, therefore this work was designed to determine the prevalence of *M. tuberculosis* antibodies in an apparently healthy urban population in a South Eastern State of Nigeria

### Patients and Methods

The study was carried out in nucleated towns of Akwakuma and Orji located in Owerri North Local Government Area of Imo State, South Eastern Nigeria. These towns are densely populated and serve as model settlement areas. Imo state has a total population of 2,485,635 comprising of approximately 1,666,448 males and 1,319,187 females. The total population of Akwakuma is 273 587 comprising of approximately 136 788 males and 136 799 females while that of Orji is 354 622 comprising of approximately 159 544 males and 195 078 females. These study areas are inhabited by people who are mostly farmers, traders, hunters and civil servants.<sup>10</sup>

A random selection was made with the inclusion criteria being subjects with no active TB symptoms or past history of TB while the exclusion criteria were subjects with active TB symptoms or past history of TB.

After obtaining an informed consent, whole blood was collected, via venepuncture, from each individual of the study population. These participants did not present with any of the

common symptoms associated with tuberculosis (persistent cough for 3 weeks or more, usually with expectoration, haemoptysis, tiredness, fever, shortness of breath, chest pain, night sweats, weight loss, swelling of the joints and stiff neck).

The blood samples were transferred into separate blood collection tubes (without anticoagulants) and allowed to clot. Thereafter, the sera were separated by centrifugation. The serum in each tube was carefully withdrawn and labeled appropriately and set aside for immunoassay. Antibodies to *M. tuberculosis* in human serum or plasma were qualitatively detected using the one step TB 1gG/1gM 3-line Rapid Test. This test is a two sided-lateral flow chromatographic immunoassay giving results within 15 minutes.

### Results

The prevalence of *M. tuberculosis* antibodies in the study population was 6.67% (Table 1). However, the

**Table 1. Sex-related prevalence of *M. tuberculosis* in Akwakuma and Orji.**

Sex	Number examined			Number infected			Prevalence (%)		
	Orji	Akwakuma	Total	Orji	Akwakuma	Total	Orji	Akwakuma	Total
Male	104.0	96.0	200.0	8.0	0	8.0	7.69	0	4.00
Female	88.0	192.0	280.0	8.0	16.0	24.0	9.09	8.33	8.57
Total	192.0	288.0	480.0	16.0	16.0	32.0	8.33	5.56	6.67

**Table 2. Age-related prevalence of *M. tuberculosis* in Orji and Akwakuma**

Age (years)	Number examined			Number infected			Prevalence (%)		
	Orji	Akwakuma	Total	Orji	Akwakuma	Total	Orji	Akwakuma	Total
1-9	24.0	40.0	64.0	0	0	0	0	0	0
10-19	80.0	72.0	152.0	0	8.0	8.0	0	11.1	5.26
20-29	40.0	32.0	72.0	16.0	0	16.0	40.0	0	22.2
30-39	32.0	64.0	96.0	0	0	0	0	0	0
40-49	16.0	56.0	72.0	0	8.0	8.0	0	14.3	11.1
50-59	0	24.0	24.0	0	0	0	0	0	0
Total	192.0	288.0	480.0	16.0	16.0	32.0	8.33	5.56	6.67

**Table 3. Sex-related prevalence of *M. tuberculosis* in Akwakuma and Orji.**

Age (years)	Male									Female									Total			
	Number examined			Number infected			Prevalence (%)			Number examined			Number infected			Prevalence (%)			Prevalence (%)			
	O	Ak	T	O	Ak	T	O	Ak	T	O	Ak	T	O	Ak	T	O	Ak	T	O	Ak	T	
1-9	16	16	32	0	0	0	0	0	0	8	24	32	0	0	0	0	0	0	0	0	0	0
10-19	48	24	72	0	0	0	0	0	0	32	48	80	0	0	8	0	16.7	10.0	0	11.1	5.26	
20-29	32	8	40	8	0	8	25.0	0	20.0	8	24	32	8	8	8	100	0	25.0	40.0	0	22.2	
30-39	8	24	32	0	0	0	0	0	0	24	40	64	0	0	0	0	0	0	0	0	0	
40-49	0	8	8	0	0	0	0	0	0	16	48	64	0	8	8	0	16.7	12.5	0	14.3	11.1	
50-59	0	16	16	0	0	0	0	0	0	0	8	8	0	0	0	0	0	0	0	0	0	
Total	104	96	200	8	0	8	7.69	0	4.0	88	192	280	8	16	24	9.09	8.33	8.57	8.33	5.56	6.6	

prevalence was significantly higher ( $p < 0.05$ ) in sera of inhabitants of Orji (8.33%) than those of Akwakuma (5.56%). Generally, as shown in Table 1, in both communities, the females were significantly ( $p < 0.05$ ) more sero-positive for M. tuberculosis antibodies (8.57%) than the males (4.0%). However, while no male in Akwakuma locality was seropositive, 7.69% of them were sero-positive in Orji.

Table 2 shows that only individuals between the ages of 20 and 29 years were sero diagnosed with M. tuberculosis (40.0%) in Orji alone whilst the antibodies were prevalent in persons in the 10-19 and 40-49 years age bracket living in Akwakuma only.

No M. tuberculosis antibody was detected in individuals that were in the 1-9, 30-39 and 50-59 year age groups. The antibodies were most prevalent (22.2%) in persons between the ages of 20 and 29 years.

The results in Table 3 reveal that amongst the study population, the M. tuberculosis antibodies were only detected in 25.0% of the males in Orji that were between 20 and 29 years. Comparatively, the antibodies were prevalent in 16.7% of the female residents of Akwakuma within the 10-19 and 40-49 years age group.

## Discussion

About one-third of the world's population has latent tuberculosis caused by M. tuberculosis. From this pool, roughly 9 million cases of active tuberculosis emerge annually, resulting in 2-3 deaths.<sup>1,9</sup> The results of this present study show that the M. tuberculosis antibody is prevalent in apparently healthy residents of Imo State, Nigeria. The high prevalence of the bacteria in this study population is worrisome as it is known that 5% of patients exposed to M. tuberculosis will progress to active disease within two years and another 5% to 10% will develop the disease sometime later in life.<sup>11-13</sup> Moreover, since tuberculosis is known to be most prevalent in densely populated communities, it is expected that the spread of the bacteria from infected individuals to the uninfected populace will be rapid.<sup>3</sup> The study area is one of such populated countries.

The rate of infection expressed by the presence of M. tuberculosis antibodies varied amongst different age groups with the highest prevalence occurring in the adult population (>18 years). This age group is at high risk of exposure to the infection due to its high level of physical outdoor activities. However, no reason could account for the higher prevalence in females.

The diagnosis of tuberculosis mainly depends upon initial clinical suspicion and radiographic findings with subsequent bacteriological confirmation by sputum smear examination and culture. Lack of sensitivity in smear examination, non-specificity of radiological findings, prolonged M. tuberculosis culture and difficulties in the diagnosis of extrapulmonary tuberculosis, has necessitated the use of immunodiagnosis as a convenient and time and cost effective test to supplement clinical information for definite diagnosis of tuberculosis.<sup>11,14</sup> Many commercial tests are available in the market for diagnosis of TB. Most of these tests are based on the detection of IgG, IgA and IgM antibodies to specific mycobacterial antigen or mixture of antigens.

Early detection will ensure that the individuals found to be infected are properly isolated and/or treated. A vigorous enlightenment campaign should be mounted in the study area to educate the people on the risk factors, mode of acquisition of the bacteria and the available control measures.

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