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# PREVALENCE OF PULMONARY TUBERCULOSIS AMONG CHILDREN LIVING IN SAMARU, ZARIA, NIGERIA: A CASE STUDY OF 'AL MAJIRI' CHILDREN

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**ABSTRACT**
Tuberculosis is an infectious disease caused by *Mycobacterium tuberculosis*, and it is still a major health problem in Nigeria especially among people with poor socio-economic status. This study was conducted with the aim of determining the prevalence of tuberculosis among two study subjects living in Hayin Dogo community of Samaru, Zaria, Kaduna state: "Al majirai" (Qur'anic school children) and children showing respiratory symptoms The major focus of this study is the al majirai, due to their unhygienic, overcrowded living environments and poor nutritional status. Two hundred sputum samples were collected from the al-majirai, and one hundred from the other children; convenience sampling method was employed. The samples were stained using the Ziehl Neelsen technique and observed microscopically for the presence of acid fast bacilli. The prevalence of acid fast bacilli (AFB) among the Al majirai was 0%, and 12% among the children attending the medical center. Symptoms such as night sweat and bloody sputum, as well as risk factors such as malnutrition and poor housing hygiene were found to be significantly associated with the infection in the children showing respiratory symptoms and attending the Ahmadu Bello University medical center ($P<0.05$). Highest occurrence of the AFB was observed in children within the ages, 15-18 years, as well as among the male children. Even though a high percentage of the Almajirai were exposed to overcrowding (86%) and poor housing hygiene (79%), there were no positive cases among them. Perhaps, other diagnostic methods other than Ziehl Neelsen could provide more comprehensive information.

**Keywords**: Acid fast bacilli; Samaru; al-majirai; children, tuberculosis

## INTRODUCTION

Tuberculosis (TB) is a disease spread by the inhalation of infectious droplets in the air; it has a high mortality rate even though the vaccine is being administered globally. Predisposing factors of the disease include overcrowding, malnutrition, poor living conditions, smoking, consumption of unpasteurized milk, HIV infection, and contact with infected animals (Mahon *et al.*, 2000) Sputum smear microscopy is the most common method of detecting the disease among suspected cases of pulmonary tuberculosis in countries with high occurrence rates of the disease (Anthony *et al.*, 2004). Tuberculosis is favored or overcrowded environment, as well as pathogenicity of the strain, intensity of exposure and immune status of exposed individual (Chigbu and Iroegbu, 2010)

Tuberculosis generally affects the lungs, but it also affects other parts of the body, when the latter occurs, it is called extra- pulmonary tuberculosis. Some TB infections do not show symptoms; in which case it is known as latent tuberculosis. *Mycobacterium tuberculosis* infects about one third of the world's population. Forty percent of deaths caused by AIDS is also attributed to tuberculosis (Olaniran *et al*., 2011). Other species of *Mycobacterium* that are important medically are *Mycobacterium bovis* and *Mycobacterium africanum*. *Mycobacterium bovis* is the main cause of tuberculosis in cattle and other mammals. *Mycobacterium africanum* includes a heterogeneous group of strains which have properties intermediate between *Mycobacterium tuberculosis* and *M. bovis*. It can also cause human tuberculosis (Arora and Arora, 2008). People at risk for being infected with TB include health care professionals, people living in homeless shelters, prisons, HIV patients, smokers, alcoholics, as well as people on immunosuppressive medication.

The "almajiri" system is an informal educational structure whereby children migrate to a different city to study and learn the Qur'an, under the supervision and care of an Islamic school teacher ("mallam"). Thus, an "almajiri" is a young child who leaves his parents to study the Qur'an, and they usually move from rural parts to big cities or towns (Zakir *et al.*, 2014). The almajirai (plural form of almajiri) usually depend on the Islamic school teacher for accommodation and food; thus, they most often live in overcrowded and unhygienic rooms due to their large number. They also suffer from malnutrition due to the poor feeding arrangement; as a result of this, they have a low immune status and are susceptible to many diseases, including helminthic infections, skin diseases, and gastrointestinal infections. (Shuaibu and Jimoh, 2011; Mohammed *et al*., 2015; Yandoma and Yohanna, 2019).

The aim of this study is to determine the prevalence of tuberculosis in Almajiri school children and as well as other children living in Hayin-Dogo community, Samaru, Zaria.

## MATERIALS AND METHOD

### Study site

The study was conducted in Hayin Dogo, a neighbourhood in Samaru in Zaria, Kaduna State, Nigeria. Kaduna State is located in the north western part of Nigeria; and has an estimated population of 6 million. Samaru is the location of Ahmadu Bello University (A.B.U), the largest university in West Africa, and the second largest university in Africa.

The first set of study subjects includes one hundred Almajirai (plural form of "al majiri") whose living quarters is in their school; their place of residence was observed to be overcrowded and poorly ventilated. The second group of subjects is children with respiratory infection living in Hayin Dogo, Samaru Zaria.

### Ethical consideration

Permission for conducting the study was sought from the head-tutor (Mallam) of "Almajiri" school in Hayin Dogo, Samaru, Zaria, approval and also from hospital management of A.B.U Medical Centre before commencement of the study.

### Sample collection

Sputum samples were collected from "Almajirai" and children with respiratory infection from Hayin Dogo Samaru, Zaria, in clean, wide mouthed, transparent, dry containers (sputum cups).

The sputum cups were labeled and given to the "Almajirai" and children with respiratory infection who were then ask to move to a well-ventilated area, direct to the sunlight to produce sputum by giving a deep (hacking) cough. The produced sputum was collected in the cup and sealed, then transported immediately to the laboratory in an icebox for analysis. For both "Almajirai" and children with respiratory infection, samples were collected on two different occasions in the following order:

- Day 1: Sputum samples were collected from the "Almajiri" and children with respiratory infection. This was labeled as X1. They were then given another container *with which to void (void) a second sample the following morning (the early morning sample).*
- Day 2: (Early morning sample): Sputum samples produced early in the morning before the "Almajiri" and children with respiratory infection brush their teeth or eat any food. This was labeled X2.

Sputum Smear preparation and Staining.

An application stick was used to smear a purulent part of the sample on a clean, grease – free slide, the smears were allowed to air-dry. The air-dried smears were then transferred to the staining rack for heat-fixing and staining. The smears were stained using the Ziehl Neelsen technique, subsequently, the air dried slides were then mounted on a light microscope and observed under oil immersion objective. The morphology of the cells observed under the microscope were recorded.

### Questionnaire Administration

Questionnaires were administered to the study subjects at the point of sample collection in order to determine possible association between the infection and certain demographic and risk factors, as well as symptoms of the disease. The demographic factors highlighted in the questionnaire are: age and gender; while the risk factors include smoking, malnutrition, overcrowding and poor housing hygiene. The symptoms of tuberculosis analyzed are: cough, bloody sputum, fever, night sweat and chest pain. Every study subject was assigned the corresponding sample number of his/her sputum sample. Information regarding the factors listed above were obtained from the study subjects by asking them the questions stated in the questionnaire and their responses were recorded appropriately.

## RESULTS

The prevalence of tuberculosis among the Al majirai and children with respiratory symptoms attending A.B.U Medical Centre was found to be 0% and 12% respectively (Table 1). Figures 1 and 2 show the risk factors and symptoms of tuberculosis observed in almajirai respectively. As a result of the fact that the children showing respiratory symptoms showed some positive cases, the data on the questionnaires was used to determine if their gender and age played a role in the infection. The prevalence of Acid Fast Bacilli in relation to the gender and age of children with respiratory symptoms are as shown in tables 2 and 3 respectively. Males were observed to have higher rates (13.8%) compared to the females (9.5%). It would appear that the number of positive cases increases with the age of the subjects as children in the age group, 7 – 10 years had no AFB in their sputum, those aged 11 – 14 years had a rate of 6.3%; while those aged 15 – 18 years had the highest percentage of 20%. This might be due to the fact this group are likely to produce sputum better than the other groups.

The prevalence of AFB in relation to risk factors among the children with respiratory symptoms was examined in table 4; those with malnutrition recorded the highest percentage of 38.5% compared to the other factors which include, smoking (25%), poor housing hygiene (36.4%) and living in overcrowded residents (18.8%). Also, evaluation of the frequency of symptoms of tuberculosis among the children (Table 5), it was observed that bloody sputum was the most common symptom with a value of 57.1% among those having AFB in their sputum. While night sweat was also observed to have a significantly relevant percentage of 35.3%, the other symptoms exhibited by the children include: cough, chest pain, and fever.

**Table 1: Prevalence of acid fast bacilli among Almajirai and children with respiratory symptoms living in Samaru, Zaria.**

| Study subject | No. examined | No. positive | % positive |
|---|---|---|---|
| Al majiri school children | 100 | 0 | 0 |
| Children with respiratory infection | 50 | 6 | 12 |

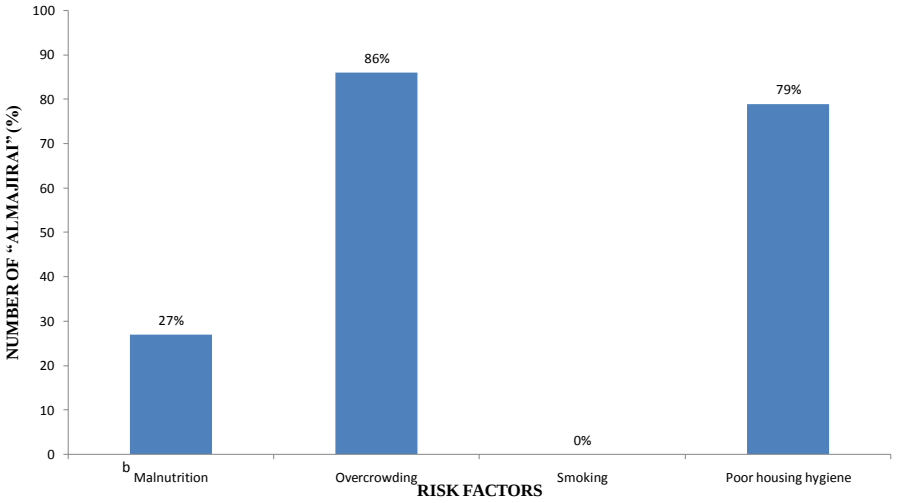


Fig. 1**:** Risk factors associated with tuberculosis among Almajirai living in Samaru, Zaria. Superscript[b]: Based on Body Mass Index

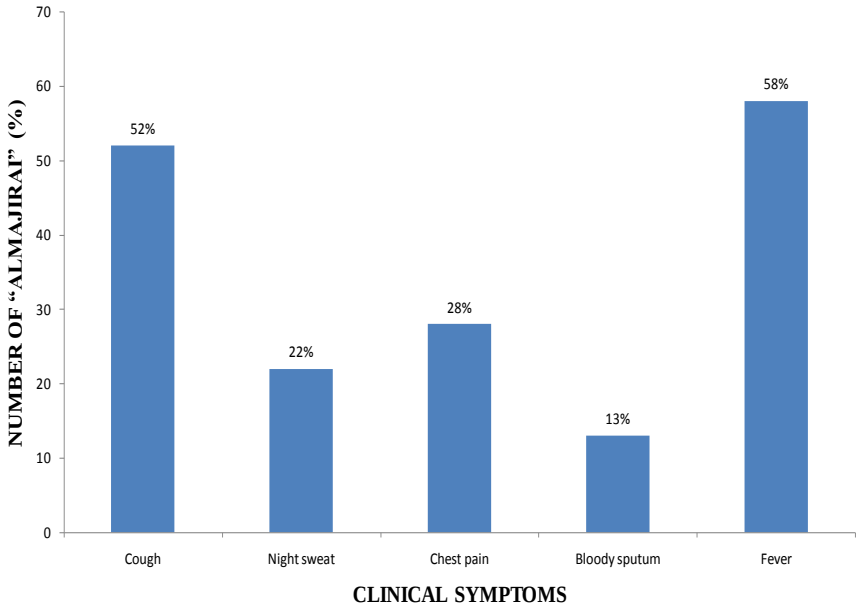


Fig. 1**:** Clinical symptoms associated with tuberculosis among "Almajiri" school children in Hayin Dogo, Samaru, Zaria.

**Table 2: Prevalence of acid fast bacilli among children with respiratory symptoms in relation to gender.**

| **Sex** | **No. examined** | **No. positive** | **% positive** | $\chi^2$ | **P-value** |
|---|---|---|---|---|---|
| Male | 29 | 4 | 13.8 | 0.210 | 0.647 |
| Female | 21 | 2 | 9.5 | | |
| Total | 50 | 6 | 12.0 | | |

Statistically insignificant (P > 0.05)

**Table 3: Prevalence of acid fast bacilli among children with respiratory symptoms in relation to age.**

| Age (years) | No. examined | No. positive | % Positive | $\chi^2$ | P-value |
|---|---|---|---|---|---|
| 7-10 | 9 | 0 | 0.0 | 4.230 | 0.238 |
| 11-14 | 16 | 1 | 6.3 | | |
| 15-18 | 25 | 5 | 20 | | |
| Total | 50 | 6 | 12.0 | | |

Statistically insignificant (P>0.05)

**Table 4: Prevalence of acid fast bacilli among children with respiratory symptoms in relation to risk factors.**

| Risk factors | No. Examined | No. Positive | %Positive | $\chi^2$ | P-Value |
|---|---|---|---|---|---|
| [b]*Malnutrition | | | | | |
| Yes | 13 | 5 | 38.5 | 19.406 | 0.000 |
| No | 37 | 1 | 2.7 | | |
| **Overcrowding | | | | | |
| Yes | 16 | 3 | 18.8 | 1.015 | 0.314 |
| No | 34 | 3 | 8.8 | | |
| **Smoking | | | | | |
| Yes | 4 | 1 | 25.0 | 0.696 | 0.404 |
| No | 46 | 5 | 10.9 | | |
| *Poor housing hygiene | | | | | |
| Yes | 11 | 4 | 36.4 | 7.927 | 0.005 |
| No | 39 | 2 | 4.1 | | |
| Total | 50 | 6 | 12.0 | | |

Superscript[b]: Based on Body Mass Index

*: Statistically significant (P< 0.05) **: Statistically insignificant (P> 0.05)

**Table 5: Prevalence of acid fast bacilli among children with respiratory symptoms in relation to clinical symptoms.**

| Clinical Symptom | No. Examined | No. Positive | %positive | $\chi^2$ | P-Value |
|---|---|---|---|---|---|
| **Cough | | | | | |
| Yes | 46 | 5 | 10.9 | 0.696 | 0.404 |
| No | 4 | 1 | 25.0 | | |
| *Night sweat | | | | | |
| Yes | 17 | 6 | 35.3 | 13.235 | 0.000 |
| No | 33 | 0 | 0.0 | | |
| **Chest pain | | | | | |
| Yes | 39 | 6 | 15.4 | 1.923 | 0.166 |
| No | 11 | 0 | 0.0 | | |
| *Bloody sputum | | | | | |
| Yes | 7 | 4 | 57.1 | 15.708 | 0.000 |
| No | 43 | 2 | 4.7 | | |
| **Fever | | | | | |
| Yes | 34 | 5 | 14.7 | 0.737 | 0.391 |
| No | 16 | 1 | 6.3 | | |
| Total | 50 | 6 | 12.0 | | |

*: Statistically significant (P< 0.05) **: Statistically insignificant (P>0.05)

## DISCUSSION

The fact that none of the almajirai had AFB in their sputum samples despite showing signs and symptoms of tuberculosis might be an indication that there are other infections sharing similar symptoms as tuberculosis. It could also be due to improper sample collection as the subjects may have produce saliva instead of sputum. The subjects were also predisposed to risk factors that could make them susceptible to tuberculosis, such as, overcrowding, poor nutritional status and poor living conditions. The almajirai showed respiratory symptoms such as bloody sputum, night sweats; with cough and fever being the most common among them. However, fever is a common symptom in most infections thus it is not as related to tuberculosis as the other symptoms. It is possible that testing the subjects with a diagnostic procedure that is more sensitive than the Ziehl Neelsen staining procedure might reveal some positive cases among the almajirai. Although the conventional technique, Ziehl-Neelsen staining, is cheap and easy to perform, its low sensitivity is a major drawback as the technique detects only 30-60% of smear

positive cases (Vancleef *et al.*, 2000). Thus current methods such as Gene Xpert and other molecular techniques are more sensitive and specific thus, providing more accurate results. Currently, tests with higher specificity and sensitivity have been developed. They are nucleic acid-based identification such as polymerase chain reaction (PCR) to detect mycobacterial DNA and also antibody assays to detect the release of gamma interferon in response to mycobacteria (Nahid *et al*., 2006).

The poor living conditions of almajirai should serve as an impetus for the conduct of more studies on possible spread of tuberculosis and other respiratory infections in their areas of residence. It will also be useful if the "mallams" (Qur'anic school teachers) are educated about the importance of maintaining sanitary standards and cross ventilation in order to reduce possible transmission of respiratory diseases such as tuberculosis. This has been proven in a study by Nura *et al.* (2018) in which the findings of their study showed that training of Qur'anic school teachers improved TB referral behavior for both symptomatic and non-symptomatic almajirai.

The 12% prevalence of tuberculosis observed in children with respiratory symptoms attending A.B.U. Medical Centre is lower than the previous report of 23% in Northern Nigeria by (Aliyu *et al*. 2015). The prevalence is also lower than the previous report of Non-Tuberculosis Mycobacterium (NTM) of 23.08% in Jos by Mwalsk *et al*. (2006) and Gumel *et al.* (2001) in HIV/AIDS patients in Zaria, Nigeria. The difference may be because the investigation was conducted on HIV patients with compromised immune system, while this study focused on Almajirai and children with respiratory infection who have relatively higher immunity compared to HIV/AIDS patients. Malnutrition and poor housing hygiene were found to be associated with the infection in children with respiratory symptoms living in Hayin Dogo Samaru, Zaria. The malnourishment of the children could have arisen due to poor socioeconomic conditions thus leading to eating an unbalanced diet lacking in the required nutrients. This has a direct bearing on the immune status of the children thus making them susceptible to the disease. Poor housing hygiene entails but not limited to poor ventilation, which could greatly compromise the respiratory tract and allow pathogens causing respiratory infections to thrive. Almajirai were predisposed to risk factors such as malnutrition, poor housing hygiene, living in overcrowded environment. Based on Body Mass Index, twenty-seven (27%) Almajirai were found to be malnourished, seventy-nine (79%) were found to have poor housing hygiene and eighty-six (86%) were living in overcrowded environment. Even though 0% was found to be the prevalence of this study, but two (2%) out of the hundred Almajirai examined have history of tuberculosis in previous years.

In the second study group, that is children showing respiratory symptoms, males were observed to have a higher occurrence of AFB than their female counterparts. However, there was no significant association between gender and the infection ($P > 0.05$). This may be as a result of males being more exposed to high risk socio-epidemiological factors than females. It may also be due to certain biological mechanisms and as such further investigation into differences between male and female susceptibility to tuberculosis may prove useful (Khan *et al.,* 2002). In relation to age group, the findings revealed that children aged 15 – 18 years had the highest number of positive AFB cases compared to the other age group. However, there was no statistically significant difference between the prevalence of infection and age. This may be indication that all the age groups analyzed in this study were equally exposed to the infection. However, the youngest age group had no positive cases, perhaps because they are less likely to interact with people outside their homes unlike the older children.

The risk factors found to be significantly associated with occurrence of AFB in children presenting with respiratory symptoms are malnutrition and poor housing hygiene. This implies that in this study, these two symptoms are more indicative of pulmonary tuberculosis as opposed to overcrowding and smoking. Malnutrition had a much stronger association than poor housing hygiene inferring that the former plays a major role in making the children susceptible to tuberculosis. Malnutrition in the study subjects was determined by calculating their body mass index, a poor index denotes malnourishment which inevitably leads to a low immune status. Poor immunity in the children further exposes them to high morbidity of tuberculosis and other diseases. The positive cases had strong association with the symptoms, bloody sputum and night sweat. This is not surprising as these two symptoms are specifically linked to pulmonary tuberculosis while chest pain, fever and cough could also occur with other respiratory illnesses.

## CONCLUSION

At the end of this study, prevalence of tuberculosis among "Almajiri" school children in Hayin Dogo and children with respiratory symptoms attending A.B.U Medical Centre Samaru, Zaria was found to be 0% and 12% respectively. Findings of the present study suggest that, children with respiratory infection in Hayin Dogo, Samaru, Zaria are at high risk of the disease while Almajirai were predisposed to the risk factors and showed some of the clinical symptoms. Malnutrition, poor housing hygiene, night sweat and bloody sputum were found to be significantly associated ($P<0.05$) with the infection in children presenting with respiratory symptoms. Based on the findings of this study, it is hereby recommended that other methods such as Tuberculin skin test, Gene Xpert, and X-ray should be used in screening of tuberculosis on Almajirai in Northern Zaria, in order to aid early diagnosis and prevent transmission of the disease. Policies should also be put in place to ensure the tests are affordable. Direct Observed Therapy (DOT) should include Almajirai school children as part of their investigation as a means of controlling spread of the disease. Parents should ensure that their infants are given the Bacilli Chalmette Guerin (BCG) vaccine.

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**REFERENCES**

Aliyu, M.S., Olonitola, O.S., Jatau, E.D., Okpapi, U.J., Abdulkadir, I.A., Tijanni, M.B., Doko, M.H.I. (2015) Prevalence of pulmonary tuberculosis (PTB) in Kaduna State, Nigeria. *BEST Journal*; **12**(1):703-708.

Anthony, H., Dermot, M., Stephen, G. (2004). TB/HN *A Clinical manual.* WHO Publication, Geneva; 27-39, 137-154

Arora, D.R., Arora, B. (2008) *Textbook of Microbiology*. 3rd Edition. Satishkuniar jain 481 / xi Prahad street, 24 An Sari Road Darya Ganj, New Delhi – 110002 India; pp. 290-303.

Chigbu, LN, Iroegbu, C.U. (2010). Incidence and spread of *Mycobacterium tuberculosis* associated infection among Aba Federal Prison inmates Nigeria, *J Health popul Nutr*. **28**:327-332.

Gumel, A.B., Shivakumar, P.N., Sahai, B.M. (2001) *A mathematical model for dynamics of HIV -1 during the typical cause of infection*. In: Proceeding of the Third World Congress of non linear Analyst, **47**: 2073-2083.

Khan, M.C., Dar, O., Sisnandis, C., Godfrey, P. (2007). *Improvement of Tuberculosis Case Detection of Discrepancies Between Men and Women*; **369**(9577): 1955-1960.

Mahon, M., Lehman, D., Manuselis, G. (2000). *A Textbook of Diagnostic Microbiology*. American Society Press, p. 576.

Mohammed, M., Vantsawa, P.A., Abdullahi, U.Y., Muktar, M.D. (2015). Nutritional status and prevalence of intestinal schistosomiasis among al-majiri population in Kawo district of Kaduna metropolis, Kaduna State-Nigeria. *Journal of Bacteriology and Parasitology*; doi: 10.4172/2155-9597.1000237.

Murray, P., Baron, E.P., Faller, M., Tenover, C., Yoken, R. (2006). *Manual of Clinical Microbiology* 7th ed. ASM Press; p. 399-402.

Mwalk, J., Gomwalk, N., Bello, C., Kandakai-Olukemi, Y. (2006) Human Pulmonary infections with Bovine and Environment (Atypical) Mycobacteria in Jos, Nigeria. *Ghana Medical Journal*; **40**: 132-136.

Nahid, P., Pai, M., Hopewell, P. (2006). Advances in Diagnosis and Treatment of Tuberculosis *Proc. Thorac. Soc*.; **3**(1): 103-110.

Nura, M.S., Tijjani, H., Babashani, M., Bot, T.C., Mitchell, E.M.H., Gidado, M., Habib, A. (2018). Training and Transport Improve TB Referral of Almajiri Youth by Qur'anic Teachers in Residential Schools of Kano State, North-western Nigeria. https://www.kncvtbc.org/uploaded/2015/11/Training-and-Transport-improve-TB-referral-of-youth-by-teachers-schools-nw-Nigeria.pdf.

Olaniran, O., Hassan-Olajokun, R.E., Oyouwevotu, M.A., Agunlejik, a R.A. (2011). Prevalence of tuberculosis among HIV/AIDS patients in Obafemi Awolowo University Teaching Hospital complex OAUTHC, Ile-Ife. *International Journal of Biological Medical Research*; **2**(4):874-877. -

Shuaibu, H.A. and Jimoh, A.O. (2011). Assessment of socioeconomic, demographic and health problems of al-majiri in Sokoto state, North-Western Nigeria. *International Journal of Tropical Medicine*; **6**(3):58-60.

Vancleef, R., Githui, W.A., Roos, B.R., Kiuhiya, L., Ndugga, D.K. (2000). Cost Effectiveness of PCR Versus Smear Experimentation in TB Diagnosis in Kenya. *New Diagnostic Tools for Tuberculosis*; **2**:235-241.

Yandoma, R.I. and Yohanna, S. (2019). Risk factors for intestinal parasitosis among Almajiri pupils in Zaria, North Western Nigeria. *Nigerian Journal of Basic and Clinical Sciences*; **16**(1):60-63.

Zakir, A., Abubakar, U., Lawal, U.S., Imrana, H., Habibu, I.T., Hassan, I.H., Harande, M.M. (2014) The practice of Almajiri: Prospect and socio-medical challenges in Northern part of Nigeria. *Journal of African Studies and Development*; **6**(7): 128-131.