



Tuberculosis transmission amongst Pastoralists in Kaduna State, Nigeria

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ABSTRACT

This study was undertaken to investigate the possible transmission methods of tuberculosis (TB) infection among household members of pastoralists, previously diagnosed and treated for tuberculosis. Retrospective study was carried out to identify pastoralists being treated and or have been treated for TB. This was undertaken through the careful review of records between the year 2006 and 2007 for TB clinics' attendees. 666 (46 %) patients had TB out of 1,437 patients that attended TB clinics during the study period. 4 (0.6 %) TB patients were herd owners in the study area following the trace-back result of TB patients' record. After the retrospective study, a questionnaire survey of the household members was conducted. From the questionnaire survey, 13(59 %) were male household members. 3(14%) had BCG vaccination and 2(9%) had awareness of TB symptoms. 18(82%) consume unpasteurized milk and 20(91%) had close contact with cattle. This survey was able to find out two local methods which are possible ways of transmission of TB amongst pastoralists, that is, lubrication of teats prior to milking using saliva and drinking milk directly from cow's udder. Pastoralists should be educated on the dangers of consumption of unpasteurized milk to prevent zoonotic transmission of TB.

Keywords: Contamination, cow milk, questionnaire, tuberculosis, zoonosis.

Introduction

Tuberculosis (TB) is one of the most important infectious diseases in the world and is one of the leading causes of death among adults in the world (Cosivi *et al.*, 1998; Jann-Yuan *et al.*, 2007). Tuberculosis has a worldwide distribution and in many countries, bovine tuberculosis remains a major chronic infectious disease among cattle, other domesticated animals, and certain populations of wildlife (Ayele *et al.*, 2004). *Mycobacterium tuberculosis* is the most common cause of human TB, but an unknown proportion of cases are due to *Mycobacterium bovis* (*M. bovis*) (Acha & Szyfres, 1987). The principal agent of zoonotic tuberculosis is *M. bovis* which is of animal origin and its transmission to humans constitutes an important public health problem (Acha & Szyfres, 1987; Thoene & Steele, 1995, Cadmus *et al.*, 1999, OIE, 2000). *M. bovis* is the cause of bovine tuberculosis (TB), which is a major zoonosis. *M. bovis* has a broad range of hosts that

includes humans (OIE 2000). Livestock populations are known to become infected within and between herds through their infected pastoral herders (OIE, 2000). Pastoralists could also suffer from tuberculosis which could be from contacts with infected human or cattle. The close relationship between pastoralists and their herds makes them prone to *M. bovis* infection. Furthermore, the close association between herders and heads of cattle is exemplified by the Fulani herdsman, who live their whole lives with their cattle, offering several opportunities for zoonotic transmission of tuberculosis (Aliyu *et al.*, 2001). Studies conducted have showed that bovine tuberculosis is endemic in cattle herds in Nigeria (Cadmus *et al.*, 2010a). Therefore, this study was undertaken to investigate possible methods by which zoonotic TB could be transmitted amongst pastoralists.

Materials and Methods

During October 2007 - December 2007, a retrospective study and questionnaire survey were carried out to identify tuberculosis positive pastoralists. This was undertaken through a careful review of records of TB clinics' attendees. TB clinic records between year 2006 and 2007 were used. The TB clinics were all located in Zaria, Kaduna State. Of a total of 1,437 patients who attended the TB clinics in the years 2006 and 2007, 666 patients were diagnosed with tuberculosis (Table 1).

Secondary data on patients' health records in TB clinics in Zaria were used to access the patients' addresses and were traced back. There were a lot of concerted efforts made to locate patients who were herd owners amidst the difficulties posed by the incomplete and vague addresses which were documented. The addresses were used as guides for all the trips made to locate TB positive pastoralists' herds. The transhumance lifestyle of the pastoralists posed a challenge but amidst this difficulty, contacts were made with four patients who were herd owners in the area of study following the trace-back result of TB patients' record.

Sampling method

The study included 4 households with a total of 22 household members. There were 7 household members (5 males and 2 females) at Herd 1, 5 household members (2 males and 3 females) at Herd 2, 4 household members (3 males and 1 female) at Herd 3 and 6 household members (3 males and 3 females) at Herd 4. The pastoralists' household was the primary sampling unit. There was an initial resistance by the pastoralists but after the consent of the ruling Head of their society (Miyetti Allah Cattle Rearing Association) was sought and the cattle owners were educated on the benefits of the study, they allowed the study to be conducted in their herds.

Questionnaire Survey

The head of each household was interviewed along with members of his household using a structured, open and closed ended, pre-tested questionnaire (available on request from the corresponding author) which contained questions focused on determining the respondent's awareness about zoonotic transmission of tuberculosis from cattle to humans and vice-versa, habits of milk and meat consumption, recent

history and type of tuberculosis in the family and questions related to general livestock husbandry.

Collection and storage of sputum samples

Sputum samples (sputa) were collected from 22 household members of the 4 TB patients traced back to their homes. Three sputa samples were collected from each patient i.e. 1st spot was collected on the first day of visit, an overnight sputum sample and 2nd spot was collected the following day during next visit. The samples were labeled and kept upright in a cooler box containing ice before it was conveyed to the laboratory and refrigerated at 4°C prior to processing.

Processing of sputum samples

The collected sputum samples were processed under a bio-safety hood cabinet according to the procedures described by Kazwala *et al.*, (1998). Using a sterile, 50 ml centrifuge tube with screw cap, equal amounts of specimen and activated NALC (i.e. N-acetyl-L-cysteine)-NaOH (Sodium hydroxide) of 5ml each were added. The centrifuge tube was capped and mixed using vortex mixer until the specimen was liquefied. The mixture allowed to stand at room temperature for 15 minutes with occasional gentle shaking. Prepared phosphate buffer (pH 6.8) was added up to the 15 ml and was mixed, followed by centrifugation at 3000g for 15 minutes. The supernatant was carefully decanted into a container with 3 % Lysol, and a small quantity of phosphate buffer pH 6.8 (2.0 ml) was added to resuspend the sediment. The suspension was used for the preparation of smears stained by the Ziehl-Neelsen (ZN) procedure to detect acid-fast bacilli (AFB). ZN acid-fast stain method was utilized for staining the slides prepared based on procedures outlined by Kazwala *et al.*, (1998). The slides were then examined for acid-fast bacilli (AFB) under a microscope using its oil immersion lens (x 100). The positive bacilli stained red, straight or slightly curved rods which appeared as dispersed single bacilli and in small groups. The blue stained (negative) parts were cell nuclei or other microorganisms.

Results

The result of the retrospective study is presented in Table 1 while the results of the questionnaire and sputum test are presented in table 2 and 3 respectively.

Table 1: TB clinic record indicating the period of study, number of patients who attended TB clinics and number of TB positive patients

Period	Number of Patients	Tb Positive Patients
2006 (February – December)	699	319 (46 %)
2007 (February – December)	738	347 (47 %)
TOTAL	1,437	666 (46 %)

Table 2: Pastoralists' questionnaire result

Herder's details	Number	Percentage (%)
Sex		
Male	13	59
Female	9	41
BCG History		
Yes	3	14
No	19	86
TB symptom awareness		
Yes	2	9
No	20	91
TB zoonotic nature awareness		
Yes	11	50
No	11	50
Contact with cattle		
Yes	20	91
No	2	9
Consume raw milk		
Yes	18	82
No	4	18
N=22		

1,437 patients attended the TB clinics in the years 2006 and 2007 and 46 % patients were diagnosed with tuberculosis.

Table 3: Sputa test results of four households in sampled areas

Herd	Sex	Total tested	No. ZN-positive	% positive
Herd 1	Male	5	3	13.6
	Female	2	1	4.5
Herd 2	Male	2	0	0
	Female	3	0	0
Herd 3	Male	3	0	0
	Female	1	0	0
Herd 4	Male	3	0	0
	Female	3	0	0
		22	4	18.1

From the Pastoralists' herds visited, there were more male household (59%) members during the questionnaire survey. Very few of them had BCG vaccination (14%) and awareness of TB symptoms (9%). A large percentage of the household members affirmed the fact that they consume raw (unpasteurised) milk (82%) and close contact with cattle (91%)

Four pastoralists (herd 1 household members) were sputa test positive following Ziehl-Neelsen (ZN) procedure to detect acid-fast bacilli (AFB).



Plate I. Drinking milk directly from the udder prior to milking

Discussion

The results of this study indicated that out of 22 household members of the 4 herds visited, 9 (41%) were female and 13 (59%) were male (Table 2). The survey showed that 14% of the household members' were vaccinated with Bacille Calmette Guerin (BCG) compared to 86% who were not vaccinated. This differs from earlier reports by Aliyu *et al.*, (2001) who reported in their study that 88% of the household members were vaccinated. Hitherto, even if they were vaccinated during childhood, a conferment of immunity would have diminished in 5 years (Martin & Lazarus, 2000) therefore, the likelihood of infection with tuberculosis is high. The questionnaire also revealed that 20 (91%) of the household members were not aware of the symptoms of TB and 11 (50%) of the household members were not aware of the zoonotic nature and importance of the disease. This agrees with the findings of Cadmus *et al.*, (2010b) which found out that most cow milk consumed in north-central Nigeria is from livestock owners who are unaware of the public health risks associated with bovine tuberculosis. This lack of awareness of the zoonotic nature of tuberculosis is one of the major problems related to the control of tuberculosis. This is consistent with the report of Aliyu *et al.* (2001). The questionnaire administered also revealed that 20 (91%) have close contact with cattle while only 2 (9%) of the cattle herders do not have contact with the herds; which means there was the high risk of acquiring TB infection from both cattle and man due to increased contact. This was observed by MacIntyne & Plant (1998) whose work emphasized the preventability of TB cases in exposed contacts. The high physical contact and closeness between herders and or milkers and potentially infected

cattle represent the population at risk for *M. bovis* which is similar to the findings of Cosivi *et al.* (1998) and Akam *et al.* (2008).

A large percentage 18 (82%) consumes unpasteurized milk which is a well known source of infection and they serve as the major vehicles or source of infection. This agrees with earlier reports by Aliyu *et al.* (2001). This is largely due to their carefree habit and lack of awareness of the resultant effect of consuming unpasteurized milk. Sputa collected from the pastoralists' household members indicated 4 (18.1%) positive acid fast bacilli (AFB) following ZN test. However, the four cattle herders who were already infected with TB may contaminate the collected milk during coughing, sneezing and talking. These were commonly observed during the survey; whereby infected saliva droplets may drop into milk containers and thereby helping in the transmission of TB infection to other consumers of the milk. It was observed that the herders during milking, they tend to spit into palms, massage the teats of the four quarters before 'streaking' the milk from the udders. When they were questioned for reasons why they do this, they replied that it was for lubrication of the teats. This, from a personal observation, can be said to be another potent source of human-to-human transmission of TB infection through milk contamination from infected saliva of a TB infected herder. A bad social habit of drinking directly from the udder was also observed in this study (Plate 1). Strange as it was, it could be a direct link of infection transfer from TB infected cattle to herder (cattle-to-human transmission) and to others who might unluckily purchase and drink the milk in the form of 'fura da nono', a local delicacy made from millet and cow milk. Majority of the pastoralists were either not vaccinated against TB or are not aware of TB

symptoms, yet had high physical contact with cattle and consume unpasteurized milk. There was evidence of tuberculosis infection amongst pastoralists.

This particular survey was able to find out two local methods which are possible ways of transmission of tuberculosis amongst pastoralists, that is,

1. Saliva spat into palms for lubrication of teats prior to milking and
2. Drinking directly from cow's udder.

The survey confirmed other known methods through which tuberculosis can be transmitted as a zoonosis. These are;

1. Consumption of unpasteurized milk.
2. Contamination of milk during milking through droplet infection after sneezing and coughing.

3. Physical contacts between cattle and herders (pastoralists).

These have public health significance because they could sell TB contaminated milk and milk products to the consumers who are in most cases unaware of the danger posed by the purchase of such milk and milk products. This has to be of invaluable concern to the government and the general public in Kaduna State and Nigeria in general, owing to the danger of tuberculosis infection. TB infection on the populace could invariably lead to loss of revenue and reduced work-force in the state especially when hitherto unhealthy staff (or patients) are hospitalized and treated for TB.

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