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Prevalence of *Mycobacterium bovis* Infection in Fulani Nomadic Cattle Herds Based on Intradermal Tuberculin Test at Rano, Kano State, Nigeria

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Abstract: A cross-sectional study was conducted in Rano, Kano State to estimate the prevalence of *Mycobacterium bovis* infection in *Fulani nomadic* cattle herds based on Intradermal Tuberculin test. A total of two hundred and four cattle, consisting 82 males and 122 females were tested. Overall, 26 out of 204 cattle tested positive giving a prevalence rate of 12.7% out of which 10 were males (10/204; 4.9%) while 16 were females (16/204; 7.8%). The χ^2-test of significance based on sex shows the difference was not statistically significant ($p<0.05$). This study has shown that the effect of age and body condition score of cattle tested on the prevalence of *M. bovis* infection as reflected by Intradermal Tuberculin test is statistically significant at ($p<0.05$). In conclusion, this study highlight the importance of *M. bovis* infection and it public health implications in the *Fulani nomadic* cattle herds in particular. Measures for control are also been suggested.

Key words: *Mycobacterium bovis*, prevalaence, Intradermal Tuberculin test, cattle, Nigeria

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by strains of the Mycobacterium tuberculosis complex and has been a major health risk to humans and animals for more than a century (Abubakar *et al*., 2012). It is widely distributed throughout the world affecting all age group of humans and animals, causing significant economic loses and providing difficult to control (Cosivi *et al*., 1998). Bovine TB, caused by *M. bovis* is a chronic infectious and contagious disease of cattle spreading within and between animal species including humans mainly by aerosol and ingestion (Abubakar *et al*., 2011a, b).

Nigeria has an estimated cattle population of over 20 million with the Zebu breed constituting over 90% of the total national herd. The first report of the existence of Mycobacterium in West Africa as a causative agent of bovine TB was in 1913 by Ziemann in Cameroon. But, the first report of the existence of bovine TB in Nigeria based on tuberculin test results and then followed by post mortem and laboratory examination was in 1929 (Alhaji, 1976). Other studies have further confirmed the existence of bovine TB in the West African region and Nigeria in particular.

Human Tuberculosis (HTB) of animal origin, particularly *M. bovis* is becoming increasingly important in developing countries since, the emergence of HIV/AIDS. In Sub-Saharan Africa, humans and animals share the same micro-environment and waterholes, especially during drought and dry season (Abubakar *et al*., 2011a, b). According to Cosivi *et al*. (1998), 60% of the African, 47% of the Asian and 38% of the Latin America and Caribbean countries reported the occurrence of bovine TB from sporadic to enzootic. Here in Nigeria, studies in humans have also shown the involvement of *M. bovis* causing TB for instance in a study of 102 *M. tuberculosis* complex from patients with pulmonary TB, 4 (3.9%) were *M. bovis*. Cadmus *et al*. (2006) have also isolated 3 *M. bovis* strains in a study of

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55 human sputum samples in Ibadan, Nigeria. In countries, where bovine TB is still common and pasteurization of milk is not practice, an estimated 10-15% of HTB is caused by *M. bovis* (Ashford *et al*., 2001).

The objective of this study is to estimate the prevalence of *Mycobacterium bovis* infection in nomadic cattle herds cattle based on Intradermal Tuberculin test and also to assess the effect of potential risk factors on its occurrence in the Fulani herds of cattle.

MATERIALS AND METHODS

Study area: The study was performed in Rano, Kano State Sahel part of Northern Nigeria. Kano state is located between longitude 12-14°North and latitude 9-11°East which shares boundaries with Jigawa State to the East, Kaduna/Bauchi States to the South and Katsina State to the Southwest (Kano State Dairy, 2007). The source of cattle for this study was Fulani nomadic herds who owed the majority of cattle in Kano State of Northern Nigeria.

Cattle restraint: Fulani cattle herds were always in open field with no animal handling facilities. All cattle were paired before testing started. One pair of cattle was handled at a time. Three to four people were required per pair, one man applied head restraint to the animal not being tested while the rest of the men restrained the animal being tested using a rope on the head and a milker's hobble on the rear legs. All restraint procedures were performed by the Fulanis themselves because the cattle were more familiar with them and the Fulanis preferred to do it themselves.

Cattle identification: The majority of cattle tested had no permanent identification. An oil based paint was used to serially number the cattle in each herd. The paint was applied on the back after the animals were restrained. The numbers were large enough that they were easily read for at least 1 week after application.

Tuberculin test procedure: Tuberculin testing was conducted using Purified Protein Derivative (PPD) obtained from Prionics Lelystad, Netherlands to screen cattle for *M. bovis*. The technique used was the Single intradermal Coudal Fold test (SCF) applied as described by Monaghan *et al.* (1994). A 2 mL automatic syringe with 26G needle was used. A distance of 5-7 cm away from the base of the tail on the left site was cleaned with dry cotton and 0.1 mL of bovine PPD tuberculin was carefully deposited intra-dermally.

Reading and interpretation of the test: The test was read 72 h post-injection, the restraint procedures for the reading was as described for the application of the test. The technique of reading the test has been described by Alhaji (1976). The injection site of each animal was examined both visually and by palpation. All responses to the tuberculin test were recorded on tuberculin test form. D-symbols were used for diffuse response while N-symbols were used for circumscribed or nodular responses.

For this study, in which most of the herds tested had no previous tuberculin test recorded, all reactions, nodular or diffuse were interpreted as positive. All responses that were inconclusive which were not prominent enough were interpreted as suspect. All animals with no reaction to the tuberculin test were interpreted as negative. All tuberculin test, reading and interpretation were conducted by a veterinarian.

Data analysis: The Chi-square (χ^2) was used to calculate the expected values with their appropriate degrees of freedom (df). The calculated Chi-square values were compared with the tabulated Chi-square values to specify the level of significance or association between sex and *M. bovis* infection. Analysis of Variance (ANOVA) was used to analyze the association between the ages and body condition scores of cattle tested for *M. bovis* infection. Prevalence was calculated using the equation:

$$\text{Prevalence} = \frac{\text{No. of cattle tested positive}}{\text{Total number of cattle tested}} \times 100$$

RESULTS

The result of intradermal tuberculin test for *M. bovis* infection is presented in Table 1. A total of 204 cattle, consisting 82 males and 122 females were tested. The overall positives out of 204 cattle were 26 with a prevalence rate of 12.7% (Fig. 1). Based on sex 10 were males with a prevalence rate of 12.2% while 16 were females with a prevalence rate of 13.1% (Table 1). The χ^2-test of significance based on sex shows the difference was not statistically significant ($p<0.05$).

Based on age, 7 were from 1-4 years with a prevalence rate of 9.7%, 13 were from 4-6 years with a prevalence rate

Table 1: Prevalence and Chi-square comparison between sex for *M. bovis* infection, based on Intradermal Tuberculin test result

Sex	Cattle tested	Positive	Suspect	Negative	Prevalence (%)	p-value
Male	82	10	1	71	12.2	0.327
Females	122	16	4	102	13.1	
Total	204	26	5	173	12.7	

$p<0.05$ regarded as significant

Fig. 1: Intradermal Tuberculin test positive result

Table 2: Prevalence and Analysis of Variance (ANOVA) comparison between age of cattle for *M. bovi* infection, based on Intradermal Tuberculin test

Age	Cattle tested	Positive	Suspect	Negative	Prevalence (%)	p-value
≤4 years	72	7	1	64	9.7	0.035
<4-6 years	85	13	3	69	15.3	
>6 years	47	6	1	40	12.8	
Total	204	26	5	173	12.7	

Table 3: Prevalence and Analysis of Variance (ANOVA) comparison between body condition score of cattle for *M. bovi* infection, based on Intradermal Tuberculin test

BCS	Cattle tested	Positive	Suspect	Negative	Prevalence (%)	p-value
Good	69	6	1	62	8.7	0.047
Fair	97	11	2	84	11.3	
Poor	38	9	2	27	23.7	
Total	204	26	5	173	12.7	

$p<0.05$ regarded as significant

of 15.3% and 6 were from 6 years and above with a prevalence rate of 12.8%. The Analysis of Variance (ANOVA) was used to determine the association between ages of cattle tested (Table 2). There was a significant difference between the age at $p<0.05$.

Based on body condition scores 6 were in good condition with a prevalence rate of 8.7%, 11 were in fair condition with a prevalence rate of 11.3% and 9 were in poor condition with a prevalence rate of 23.7%. The Analysis of Variance (ANOVA) was used to determine the association between body condition scores of cattle tested (Table 3). There was a significant difference between the body condition scores at $p<0.05$.

DISCUSSION

The Intradermal Tuberculin test result obtained in this study showing 12.7% prevalence rate for *M. bovis* infection in Fulani nomadic herds of cattle is of great epidemiological and public health significance. This is important because it has been documented that humans can contract the disease from their cattle as a result of close association (Cosivi *et al*., 1995). This is a major problem especially where cultural practices exist such as exemplified by the Fulani herdsmen who live their entire lives with their animals, offering ample opportunity for zoonotic transmission of infection. Also, *M. bovis* infection has been recognized as potential occupational risk for farm and abattoir workers. The result obtained from this study is slightly higher than the 11.8% recorded in a similar study conducted by Shehu (1988) but does not differ much from other studies conducted in other parts of the country. This indicates that bovine tuberculosis infection is prevalent in all parts of Nigeria and might suggest the existence of foci of infection in different parts of the country. The reason for these foci are unknown but might be attributed to management practices such as migration of nomads between the North and Southern regions in search of greener pasture during the dry and the raining seasons and the presence and build up of Mycobacterial infections in the environment.

No significant relationship was found between sexes at $p<0.5$. This could be probably because *M. bovis* infection does not discriminate between sexes, even though, the result shows that there were more females tested during the study yet the prevalence rate is slightly higher in males than in females compare to number of males tested. Abubakar (2007) has reported similar findings in cattle which could be as a result of the fact that male's were usually subjected to more stressful activities.

This study has shown that the effect of age on the prevalence of bovine TB as reflected by PPD is statistically significant. Fewer reactors were recorded in the younger age and reactivity to the test increased with age, up to 4-6 years of age, after which it declined. This accords with findings by other researchers (Asseged *et al*., 2001; Ameni *et al*., 2003). It is possible that the infection may not become established in young animals but as they get older, their chance of acquiring infection also increases due to the increased time of exposure. Tizard (1996) stated that the lower prevalence rate to Intradermal Tuberculin test response in older animals is due to the immunodepression occurring during old age or poor condition. A similar observation was also made in a study conducted by Shehu where he reported 20.9% tuberculin positive reactors among middle and old age group. This finding has both epidemiological and public health importance because Fulani herders normally sell middle and very old cattle to other livestock farmers for fattening and later sold for slaughter. The implication of this is that it could facilitate the spread of the disease to other herds both at the cattle market and also when introduced into the new herd. If sold for slaughter in

abattoirs or private slaughter on the other hand, the risk of transmission from infected carcass to meat handlers which has been documented is possible especially where butchers and meat inspectors process and inspect meat and meat products with minimal protective clothing and process offal from diseased carcasses with bare hands.

The high prevalence rate of *M. bovis* infection recorded in cattle with poor body condition compare to fair and good body condition is in agreement with previous reports (Asseged *et al*., 2001; Ameni *et al*., 2003). Poor body condition offers opportunity for transmission of *M. bovis* infection and development of the disease and subsequently contributing to the variations in the prevalence of the disease among cattle under different body condition score.

CONCLUSION

From this study, 12.7% prevalence rate of a sample of 204 cattle at Rano, Kano State in Sahel part of Northern Nigeria were found to be infected with *M. bovis*. Control could only be achieved when all susceptible domestic species are considered together and intergovernmental co-operation is initiated to prevent cross-border spreads. Proper abattoir hygiene, proper post-mortem meat inspection and clean handling of milk and meat before consumption are necessary to prevent infection in humans. However, this study indicates that a widespread and detailed epidemiological study is needed to ascertain the true extent of tuberculosis in Nigerian livestock before initiation of a control program.

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