

Article

Cross sectional study of bovine and avian tuberculosis in Bangladesh Livestock Research Institute (BLRI) cattle farm

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Abstract: The present study was carried out to determine the prevalence of bovine and avian tuberculosis in cattle by using bovine and avian PPDs at Bangladesh Livestock Research Institute (BLRI) Cattle Farm, Savar, Dhaka. Cattle of different breeds, ages and sexes (n=183) were tested using bovine and avian PPDs. In caudal Fold Tuberculin (CFT) test, 16 (8.74%) cases were showed positive reaction among 183 sample. The overall percentages of positive reactors to Comparative cervical tuberculin (CCT) test of bovine and avian tuberculosis were 7.10% and 1.64% respectively. An insignificant variation ($P>0.05$) on prevalence of bovine tuberculosis on different age group of cattle was observed. Age group >7 years showed a higher prevalence (10.91%) than those of other age groups. In CCT test, 7.55% and 4.17% positive reactors were found in female and male cattle respectively. The association between different breeds of the animal was found significant ($P<0.05$). The local breed showed higher prevalence (9.77%) than those of Red Chittagong and cross breed. The highest percentage (10.45%) of positive reactors in CCT test was recorded in milking cows than in dry cows (2.32%), heifer (9.52%) and calf (5.77%) were observed. Mixed infection (bovine and avian type of tuberculosis) was recorded 1.64%.

Keywords: tuberculosis; caudal fold tuberculin test; comparative cervical tuberculin test

1. Introduction

Bovine tuberculosis is one of the most important zoonotic diseases (Thoen *et al.*, 2006) of cattle and other farm animals, known to exist in all part of the world. It is an infectious disease caused by *Mycobacterium bovis* that has a broad host range (Wedlock *et al.*, 2002). Bovine tuberculosis was responsible for approximately 6% of total human tuberculosis deaths in 1930-1940 (Vordermeier *et al.*, 2001). *Mycobacterium bovis* can be transmitted from cattle to human, human to human and from human to cattle (Griffith and Munro, 1944). Thus, it is a great concern to determine the prevalence of bovine tuberculosis in Bangladesh. The several countries or farms does this survey regularly. The most popular, easy and cheap technique for detection of tuberculosis is tuberculin test (Ameni and Erkihun, 2007; Fikru *et al.*, 2005). The prevalence is 6.8% in Zambia (Munyeme *et al.*, 2009), 7.3% in Pakistan (Aranaz *et al.*, 1996), 10% in Kenya (Kang'ethe *et al.*, 2007), 19% in Ethiopia (Laval and Ameni, 2004), 26.4% in Eritrea (Omer *et al.*, 2001) and 13.2% in Tanzania (Kazwala *et al.*, 2001).

Bovine tuberculosis is economically important for cattle farming and very few studies were conducted in cattle in Bangladesh as yet. The use of tuberculin test among cattle, of Mymensingh and Pabna districts showed 1.22% (Yakub, 1974), which indicated the prevalence of this infection in animals of Bangladesh. Samad and Rahman (1986), at Bangladesh Agricultural University Dairy Farm (BAUDF) conducted tuberculin test in cattle to detect the incidence of bovine tuberculosis in unorganized and organized farms of Bangladesh revealed 3.05% overall incidence of tuberculosis. That's why the need was strongly felt to have a new data about the situation of tuberculosis in cattle on the basis of tuberculin testing at Bangladesh Livestock Research Institute (BLRI). The main objectives of this study are to find out the prevalence of bovine tuberculosis in cattle in Bangladesh Livestock Research Institute (BLRI), to compare the prevalence of tuberculosis among the different breeds of cattle and to compare the prevalence of tuberculosis in different age, types and sex groups of cattle.

2. Materials and Methods

The whole study was conducted in the Bangladesh Livestock Research Institute (BLRI) Cattle Farm, Savar, Dhaka during the period from January to June, 2010 to determine the prevalence of bovine and avian tuberculosis. Total 183 cattle were divided into several groups on the basis of age, breed, sex and types of animals. Out of the 183, 44 cattle were Red Chittagong (RCC), 133 were Local (Pabna) and 6 were Cross breed cattle. 159 cattle were female and 24 nos. were male cattle. Date of birth and other necessary information were recorded in a questionnaire from the register book of the farm. Cattle were tested by Caudal Fold Tuberculin Test (CFT) which is a single Intradermal tuberculin test using bovine Purified Protein Derivatives (bPPD) at the caudal fold. Among the 183 Cattle, the positive responders were further subjected to Comparative Cervical Tuberculin Test (CCT) using both bovine (bPPD) and avian Purified Protein Derivatives (aPPD). The results were recorded in questionnaire and finally analyzed to determine the prevalence and risk factors associated with the prevalence of tuberculosis in cattle.

The bPPD was given two times in each and every cattle (primary and confirmatory test). The first dose was given with an equivalent dosage of 10,000 tuberculin unit/ml at caudal fold and after a period of 10 days the comparative intradermal inoculation was made by 10,000 tuberculin unit/ml of bovine type PPD and 2,500 tuberculin unit/ml of avian type PPD in separate way on one side (upper and lower) of the neck region. Method described by Welch, (1915) was followed throughout the experiment for inoculating the animals. Reading was taken for one time after 72 hours (± 6 hours) after the inoculation of PPD. The positive tuberculin reaction was evident from an inflammation of sensitive nature at the point of inoculation. The area of the characteristic swelling ranged from the size of a small pea to that of an orange. The reaction sites indicated the organism responsible for the sensitization. The swelling was either soft and edematous or somewhat hard in nature. The swelling was estimated by palpation at the site of inoculation, while the animal showed the sign of pain. In Comparative Cervical Tuberculin (CCT) test two injections were made intradermally; bPPD at upper site and aPPD at lower site at neck region. Initial skin thickness was measured before inoculation PPD. Reading was taken after 72(± 6) hours with slide calipers. The difference of skin thickness was measured and recorded. The data collected by questionnaire and was analyzed in MS excel and SPSS.

3. Result

Out of 183 cattle, 16 cattle positively responded with a percentage of 8.74% to CFT test with bovine type tuberculin (Table 1).

Comparative Cervical Tuberculin (CCT) test which revealed that the overall percentage of reactors were 7.10% and 1.64% with bovine type of PPD and avian type of PPD respectively and doubtful cases were 1.09% and 0.54% with bovine and avian type of PPD respectively (Table 2).

Table 1. Result of Caudal-fold tuberculin (CFT) test.

Total animal	Name of reaction	Cases	Percentage (%)
183	Positive	16	8.74
	Negative	167	91.26

Table 2. Comparative cervical tuberculin (CCT) test with bovine and avian type of PPD in Cattle.

Total number of animals	Tuberculin type	Name of reaction	Cases	Percentage (%)
183	bPPD	positive	13	7.10
		Suspect	2	1.09
	aPPD	positive	3	1.64
		Suspect	1	0.54

Out of the 183 cattle which were subjected to Comparative cervical tuberculin (CCT) test, the number of male reactor was 1 having a percentage of 4.17% while the numbers of female reactors were 12 having a percentage of 7.55% (Table 3).

Table 3. The overall percentage of Comparative cervical tuberculin (CCT) test with bovine type of PPD on the basis of sex.

Sex	Number of animal tested	Number of positive reactors	Percentage (%)
Female	159	12	7.55
Male	24	1	4.17

Likelihood -ratio chi-sq. =0.411; P>0.05

Among the 183 cattle of different ages those were subjected to comparative cervical tuberculin (CCT) test, highest percentage (10.91%) of reactor cattle were observed in the age group >7 years and lowest percentage (0.00%) of reactors observed in the age group 5-<7years. Age group <3 and 3-<5 showed prevalence 7.81% and 4.35% respectively (Table 4).

Table 4. The overall percentage of Comparative cervical tuberculin (CCT) test with bovine and avian type of PPD on the basis of age.

Age (years)	Number	Reactors	Percentage (%)
<3	64	5	7.81
3-<5	46	2	4.35
5-<7	18	0	0.00
>7	55	6	10.91

Likelihood -ratio chi-sq. =4.358; P>0.05

Among the 183 cattle of different breeds, the overall percentages of reactors were 0.00%, 9.77%, 0.00% for the Red Chittagong, Local (Pabna) and Cross breed respectively (Table 5).

Table 5. The overall percentage of Comparative cervical tuberculin (CCT) test with bovine type of PPD on the basis of breed.

Name of breed	Number	Reactors	Percentage (%)
Red Chittagong (RCC)	44	0	0.00
Local (Pabna)	133	13	9.77
Cross	6	0	0.00

Likelihood -ratio chi-sq. =8.666; P<0.05

The highest percentages (10.45%) of positive reactors in Comparative cervical tuberculin (CCT) test were found in milking cows. The percentages of positive reactors in dry cows, heifer and calves were recorded 2.32%, 9.52% and 5.77% respectively (Table 6).

Table 6. The overall Comparative cervical tuberculin (CCT) test with bovine type of PPD on the basis of type of animal.

Type of animal	Number	Reactor	Percentage (%)
Milking cows	67	7	10.45
Dry cows	43	1	2.32
Heifer	21	2	9.52
Calf	52	3	5.77

Likelihood -ratio chi-sq. =3.300; P>0.05

4. Discussion

In this study 7.10% positive reactors in CCT test are in close agreement with the findings of Munyeme *et al.*, 2009 and Aranaz *et al.*, 1996 who found 6.8% and 7.3% bovine TB positive cases respectively by CCT test. The percentages of reactors to tuberculin tests in cattle were found almost moderate in this study. In our study positive reactors (7.10%) were much lower than that reported by Kang'e the *et al.*, 2007, Ameni and Erkihun, 2007, Omer *et al.*, 2001 and Kazwala *et al.*, 2001 who found 10%, 11%, 14.5% and 13.2% positive reactors respectively by CCT test. On the other hand, positive reactors (7.10%) obtained in this study were higher than those obtained by Laval and Ameni, 2004, Fikru *et al.*, 2005 and Solmaz *et al.*, 2009 who reported 4.1%, 3.4% and 1.42% bovine TB respectively.

In CCT test, 7.55% and 4.17% positive reactors were found in female and male cattle respectively. No significant relation was found (P>0.05) between tuberculosis and sex of the animal. However, the male cattle showed relatively low incidence than female cattle in this study. It may be due to the fact that male cattle are reared in individual pen and grazing is not practiced so there is a low chance of infection which may be one of the reasons of low prevalence of bovine tuberculosis in male cattle.

In this study, 9.77% of bovine TB reactors by CCT test were found in local (Pabna) breed. However, no positive reactors were found in Red Chittagong and Cross breed cattle. The association between different breeds of the animal was found significant (P<0.05). This result revealed that Red Chittagong (RCC) has greater resistance than that of local (Pabna) breed. Although cross breed exhibited no reactors which might be due to the fact that a very few cross breed (n=6) animals have been tested. In case of RCC, it may be concluded that the body structure of RCC are strong and stout and more resistance to all types diseases, which may be one of the reasons of low prevalence of bovine tuberculosis in RCC.

The present study showed a non-significant variation (P>0.05) on prevalence of bovine tuberculosis on different age group of cattle. Age group >7 years showed a higher prevalence (10.91%) than those of other age groups. It may be stated that cattle of ages more than 7 years are most prone to the infection due to decrease of immune status because of their old age and low resistance to tuberculosis infections and malnutrition. However, the younger and older animals of the study area were found more infected with tuberculosis than the animals of middle age. The greater incidence in younger animals was in accord with the results of Rashid *et al.*, 1970 and Lubrini, 1963.

No significant relation was found (P>0.05) between tuberculosis and the types of animal. Milking cows showed relatively high positive reactors than those of dry cow, heifer and calves. It may be concluded that during lactation period animals remain in stress condition and this may be one of the reasons for higher prevalence in milking cows.

Mixed infection (bovine and avian type of tuberculosis) 1.64% was observed in the study area (Table 2). It may be due to close contact with the various indigenous and migratory birds present in the lakes of BLRI campus.

It may not represent the actual incidence of Bovine Tuberculosis in this country. Because, the rate of incidence of bovine tuberculosis is influenced by many factors such as geographical situation of a country, and weather, hygienic status of men and animals, and control measure taken by Public Health and Veterinary Public Health sector.

5. Conclusions

This study was undertaken to determine the prevalence of bovine and avian tuberculosis in Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka. In the Caudal Fold Tuberculin (CFT) test the percentage of positive responder was found to be 8.74. In the Comparative Cervical Tuberculin (CCT) test the percentage of positive reactors were 7.10 and 1.64 to the test with bovine PPD and avian PPD respectively. Mixed infection was recorded in 1.64% cattle. The cross breeds showed minimum (0.00%) and the local (Pabna) breed showed

maximum (9.77%) percentage of positive reactors. The Red Chittagong (RCC) breed also exhibited 0.00% of positive reactors in the Comparative Cervical Tuberculin (CCT) test. In general the female, the younger and the older animals were found to be higher positive reactors than the male and adult animals in this study. In comparison with relevant literature that in general the percentage of reactors to tuberculin was low in this study in comparison with those of other parts of the world.

Conflict of interest

None to declare.

References

- Ameni G and A Erkihun, 2007. Bovine tuberculosis on small scale dairy farms in Adama Town, central Ethiopia, and farmer awareness of disease. *Rev. Sci. et Tech. Off. Int. des Epiz.*, 26: 711-719.
- Aranaz A, E Liebana, A Matoes, L Dominguez, D Vidal, M Domingo, O Gonzolez, EF RodriguezFerri, AE Bunschoten, JDA Vanembden and D Cousins, 1996. Spacer oligonucleotide typing of *Mycobacterium bovis* strains from cattle and other animals: A tool for studying epidemiology of tuberculosis. *J. Clin. Microbiol.*, 34: 2734-2740.
- Fikru R, P Bonnet and W Moges, 2005. Prevalence of bovine tuberculosis in indigenous Zebu cattle under extensive farming system in Western Ethiopia. *Bullet. Ani. Heal. and Produc. in Africa*, 53: 85-88.
- Griffith AS and WT Munro, 1944. Human pulmonary tuberculosis of bovine origin in Great Britain. *J. Hyg.*, 43: 229-40.
- Kang'ethe EK, CE Ekuttan and VN Kimani, 2007. Investigation of the prevalence of bovine tuberculosis and risk factors for human infection with bovine tuberculosis among dairy and non-dairy farming neighbour households in Dagoretti Division, Nairobi, Kenya. *E. African Med. J.*, 84: S92-S95.
- Kazwala RR, DM Kamarage, CJ Daborn, J Nyange, SFH Jiwa and JM Sharp, 2001. Risk factors associated with the occurrence of bovine tuberculosis in cattle in the Southern Highlands of Tanzania. *Vet. Res. Comm.*, 25: 609-614.
- Laval G and G Ameni, 2004. Prevalence of bovine tuberculosis in zebu cattle under traditional animal husbandry in Boji district of western Ethiopia. *Rev. Med.Vet.*, 155: 494-499.
- Munyeme M, JB Muma, KL Samui, E Skjerve, AM Nambota, IGK Phiri, L Rigouts and M Tryland, 2009. Prevalence of bovine tuberculosis and animal level risk factors for indigenous cattle under different grazing strategies in the livestock/wildlife interface areas of Zambia. *Trop. Ani. Heal. Produc.*, 41: 345-352.
- Omer MK, E Skjerve, Z Woldehiwet and G Holstad, 2001. A cross-sectional study of bovine tuberculosis in dairy farms in Asmara, Eritrea. *Trop. Ani. Heal. Produc.*, 33: 295-303.
- Samad MA and MS Rahman, 1986. Incidence of bovine tuberculosis and its effect on certain blood indices in dairy cattle of Bangladesh. *Indian J. of Dairy Sci.*, 39: 3 - 6.
- Solmaz H, Z Ilhan, A Aksakal, T Gulhan and IH Ekin, 2009. Detection of bovine tuberculosis by tuberculin test and polymerase chain reaction in Van, Turkey. *Turkish J. Vet. Ani. Sci.*, 33: 229-233.
- Thoen C, P Lobue and ID Kantor 2006. The importance of *Mycobacterium bovis* as a zoonosis. *Vet. Microbiol.*, 112: 339-345.
- Vordermeier HM, A Whelan, PJ Cockle, L Farrant, N Palmer and RG Hewinson, 2001. Use of synthetic peptides derived from the antigens ESAT-6 and CFP-10 for differential diagnosis of bovine tuberculosis in cattle. *Clin. Diag. Lab. Immunol.*, 8: 571- 578.
- Wedlock DN, MA Skinnee, GW De-Lisl and BM Buddle, 2002. Control of *Mycobacterium bovis* infections and the risk to human population. *Microb. Infect.*, 4: 471-480.
- Yakub, 1974. Study on the incidence of tuberculosis in cattle in and around the Bangladesh Agricultural University, Mymensingh. M. Sc. Thesis, Department of Medicine, Faculty of Veterinary Science, B. A. U. Mymensingh.