Journal of Life Sciences Research
ISSN : 2408-9184
Vol. 1, No. 1, 1-4, 2014
http://asianonlinejournals.com/index.php/Lifsc/index

Investigation of Bovine Tuberculosis in Rangpur Division of Bangladesh

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Abstract

This study was designed with a view to determine the prevalence and risk factors associated with bovine tuberculosis infection at several dairy farms of Rangpur division of Bangladesh. In this study, 150 calves of different age, breed and sex of several dairy farms in Rangpur division of Bangladesh were examined to determine the prevalence of tuberculosis by caudal fold tuberculin test (CFT) using bovine purified protein derivatives (bPPD) obtained from a licensed laboratory in India (Span diagnostics ltd*)*. In the CFT, the percentage of positive reaction (reactors) was found 33.73. In general the younger cattle (6-12 months age) were found to be less infected than the older (5-7 years age) cattle in this study. Because of the danger of bovine tuberculosis to the public health, directly or indirectly and because of the apparently low incidence of bovine tuberculosis, it might be suggested that the infected animals should be slaughtered and destroyed without delay. It might be suggested that for obviously complete eradication of tuberculosis from the country, there should be very well coordination in activities among the public health and veterinary public health personnel.

Keywords: Tuberculosis, Local cattle, Cross bred cattle, Prevalence, Caudal fold tuberculin test, Risk factors.

1. Introduction

Bovine tuberculosis is an important infectious disease that can affect an wide variety of animal species including cattle and buffaloes and is transmitted horizontally. The disease is caused by *Mycobacterium bovis*, known to exist in all part of the world. It has been recognized from 176 countries as one of the important bovine diseases causing great economic loss [1, 2].The disease is also transmitted by aerosol and ingestion [3]. *M. tuberculosis, M. bovis and M. avium* all the three species are capable of causing disease and show positive reaction to tuberculin [4]. The disease affects cattle, other domesticated animals and certain free or captive wildlife species. It is usually characterized by formation of nodular granulomas known as tubercles. Although commonly defined as a chronic debilitating disease, bovine tuberculosis can occasionally assume a more progressive course. Any body tissue can be affected, but lesions are most frequently observed in the lymph nodes (particularly of the head and thorax), lungs, intestines, liver, spleen, pleura, and peritoneum.

One billion people are infected with the tubercle bacillus, and there are eight million new cases and three million deaths annually [2]. Transmissions of tuberculosis in humans are mainly by inhalation and ingestion raw milk or unpasteurized dairy products. In Bangladesh so far the single intradermal (SID) skin test with purified protein derivative (PPD) has been used to detect the prevalence of bTB, and an overall 5.9% cattle in the district of Pabna [5], 3.05% cattle in the district of Mymensingh [6] and 27.5% breeding bulls [7] showed positive reaction to the tuberculin test. However, there are many limitations to the SID tuberculin test have been reported for the diagnosis of bTB. In countries with tuberculosis eradication programmes, clinical evidence of tuberculosis in cattle is seldom encountered because the intradermal tuberculin test enables presumptive diagnosis and elimination of infected animals before signs appear. Prior to the national tuberculosis eradication campaigns, however, clinical signs associated with tuberculosis were commonly observed.

Adequate information regarding the incidence of TB in bovine calves and its economic impact on livestock industry is not available. There is little empirical data regarding how the prevalence of infection changes over time in large, free-ranging mammals. No serious efforts are underway to estimate the gravity of risk and its threat to the public health. The existing situation calls for a comprehensive program to address TB in livestock species including buffaloes in order to improve the health of livestock and to safeguard the human population from this menace. Therefore, the present study were undertaken to investigate the prevalence of bovine tuberculosis based on age, sex and breed (local and crossbred).

2. Materials and Methods

2.1. Place and Period

The present study was conducted at several dairy farms in Rangpur division of Bangladesh during the period of July to December, 2012.

2.2. Samples and Grouping of Animals

In this study a total of 150 cattle of different dairy farms were subjected to caudal fold tuberculin test. To determine the prevalence and risk factors associated with bovine tuberculosis infection in 150 cattle kept at several dairy farms of Rangpur division of Bangladesh were selected based on age, sex and breed (local and crossbred) using CFT test. 0ut of the 150 cattle, 49 were male, 101 were female, among these calves, are grouped into two subgroups: as group-1 (6-12 months) and group-2 (5-7 years). Date of birth, age, breed and other managemental information were recorded.

2.3. Reagent

Caudal fold tuberculin test is done by using bovine purified protein derivatives (bPPD).Out of 150 cattle 49 were male (local and crossbred) and 101 were female. Bovine PPD was injected at the lower site of tail and the upper site of neck region. The difference in skin thickness was measured after 72 hours of inoculation by slide calipers. The results were recorded and analyzed to determine the prevalence of bTB. In addition, the predisposing factors associated with the occurrence of tuberculosis in cattle were evaluated. In the CFT test, bPPD was used for determination of *M. bovis* in cattle. The PPD was obtained from a licensed laboratory in Italy (*Instituto Zooprofilattico sperimentale dell'Umbria e delle Marche, Perugia)*.The tuberculin vials were kept in a refrigerator for maintaining the potency and quality as for instruction of the manufacturer. For the purpose of cleaning and disinfection of the inoculation site, sterilized cotton and 70% ethyl alcohol were employed. For inoculation, 1 ml tuberculin syringe of 100 graduations, fitted with a short hypodermic needle was used.

2.4. Caudal Fold Tuberculin Test (CFT)

This is the primary screening test to detect animals potentially infected with bovine TB. The test grossly measures the immune response to *Mycobacterium bovis*, the causative agent of bTB. According to the test intradermal injection of 0.1 ml bPPD was given with a hypodermic syringe in the skin of the caudal fold (the fold of skin at the base of the tail). If the animal has been exposed to Mycobacteria, the immune system responds with inflammatory cells at the injection site to cause swelling and/or discoloration of the skin. After 72 hours the injection site is inspected and palpated to evaluate for a response. Marked edematous swelling, reddening at the injection site classifies the animal as a responder. If no response is noted, the animal is classified as CFT test-negative. The results were interpreted according to OIE [8]:

a. If the reaction is ≥ 4.0 mm, then the test is considered reactor.
b. If the reaction is between 3.0 and <4.0 mm, then the test is considered suspicious.
c. If the reaction is <3.0 mm, then the test is considered negative.

3. Results

In this study 150 cattle of different age, sex and breeds in several Dairy Farms in Rangpur division of Bangladesh were examined to determine the potential infection of tuberculosis by CFT test. The results of tuberculin test on the basis of age and breed are shown in Table 1. Among 150 cattle of different age and breed those were subjected to initial CFT test, highest percentage 20 where 0.9% crossbred and 19.17% local breed and 2.4% in 6-12 months age group where 0.1% crossbred and 2.34% local bred.

The results of CFT test using bPPD on the basis of age and sex are summarized in Table 2. In this study out of 150 cattle 7 cattles (6-12 months age) and 30 cattle (5-7 years age) were positive for *Mycobacterium bovis*. The prevalence of bovine tuberculosis was 30.37% where 3.43% were recorded in male and 30.30 in female.

The results of CFT on the basis of breed and sex are presented in Table 3. Among 150 cattle under study, 7 cattle positive with a percentage of 3.43 and 30 cows with a percentage of 30.30 were confirmed for CFT test. On the other hand, out of 150 cattle, 7 cattle local (6 -12 months age) and 30 cattle local (5-7 years age) were positive to bovine tuberculosis. Moreover, the results of CFT test after 72 hours of inoculation by slide calipers are shown in Table 4.

Table-1. Results of tuberculin test on the basis of age and breed.

Age	Breed	No. of cattle	No. of positive case	Percentage of positive case	Total percentage of positive case
6-12 months	Cross	10	1	0.10%	2.44%
	Local	39	6	2.34%	
5-7 years	Cross	30	3	0.90%	20.07%
	Local	71	27	19.17%	

Table-2. Results of CFT test using bPPD on the basis of age and sex.

Test	Study area	Herd size	No. of test cattle		Male	Female	Positive case	Percentages
CFT	Munshi dairy farm,Rangpur (crossbred)	322	Male =	3	49 (6-12 Months Age) Group 1	101 (5-7 Years Age) Group 2	7 (local) Out of 49	3.43%
			Female =	27				
	Janu dairy, Saidpur (local bred)	212	Male =	13				
			Female =	17				
	Sumon dairy farm, Chirirbondor (local bred)	271	Male =	13			30 (local) Out of 101	30.30%
			Female =	17				
	Desh dairy , Takurgaon (local bred)	467	Male =	12				
			Female =	18				
	Ryiad dairy farm, Rangpur(cross bred)	228	Male =	8				
			Female =	22				
Total		1500	150		150		37 (local) Out of 150 cattle	33.73%

Table-3. Results of CFT on the basis of breed and sex.

Test	Sex	Number of cattle	Positive cases	Percentages (%)
CFT	Male	49	7 (local)	3.43
	Female	101	30 (local)	30.30

Table-4. Results of CFT test after 72 hours of inoculation by slide calipers.

Breed	Age	Sex	Measurement of skin thickness			Positive cases	Percentages (%)
			Before inoculation	After inoculation			
				Positive	Negative		
Local	6-12 months	Male	1.7	4.2	2.1	37	33.73
Cross	6-12 months	Female	1.7	4.4	2.1		
Local	5-7 years	Female	2.3	4.4	2.3		
Cross	5-7 years	Female	2.1	4.7	2.4		

4. Discussion

Tuberculosis is an important disease in animals. This disease is widely distributed in the world in domestic and wild animals throughout the world. To start a control or eradication program, knowledge about its prevalence in each country and the associated risk factors is mandatory. We carried out studies to investigate bovine tuberculosis in local and cross breed animal at Rangpur division in Bangladesh. For this study we have to know the prevalence and risk factors associated with the prevalence of tuberculosis in animals. The prevalence of tuberculosis varied from 0% to 18.8%. Greater than 10% prevalence of tuberculosis in animals is a serious issue. In the present study, five out of seven farms had higher than 10% prevalence. The only farm with 0% prevalence had only 12 bulls. If we remove that farm out of the herd-based analysis then 50% farms had infected animals and the prevalence in 33.73% of the farms was greater than 10%. The prevalence is on the increase from previous. The prevalence is higher at old large farms. The frequency results revealed increase in prevalence in present study with the increase in age, sex and breed. Female and local cattle are most susceptible to tuberculosis. It has been reported that susceptibility to *M. bovis* infection in cattle increases with age and the prevalence is higher in adult cattle than heifers and bulls or calves. It suggests that as the animal becomes older, the chance of it becoming infected increases. As the animals live for a longer period on the farm, they might have a greater possibility of contact with the infectious agent.

The method of tuberculin testing as described by Grooms and Molesworth [9] was followed in both the caudal fold tuberculin (CFT) test and comparative cervical tuberculin (CCT) test in this study. In the caudal fold tuberculin test 33.73% reactions in cattle were evident from a clear inflammatory whorl like swelling. This results obtained were found in accordance with the findings of Grooms and Molesworth [9] that marked that the response to CFT test may be caused by infection with *Mycobacterium bovis* and *Mycobacterium paratuberculosis*.

In accordance with findings of Ameni, et al. [10], present showed that as the herd size increased, there was a corresponding rise in the prevalence of bovine TB. This could be due to the fact that overcrowding creates conducive condition to the transmission of the *Bacillus*. Animals with zero grazing are at a high risk of infection than those kept on free grazing and mixed grazing. As herd size increased, so did the risk of cattle within the herd showing a positive reaction arise from the fact that risk of an individual animal introducing tuberculosis infection in to a negative herd may increase with herd size.

In the present study, high prevalence of bovine TB was recorded in cows compared to bull and calves. Majority of previous reports [11, 12] supported the idea that Europeans breeds more susceptible to bovine TB due to the predisposing factors related to environment, management, and also production stress that reduce the body defense. In this research work one type of test has been done. That is most of the female cattle show positive results 30.30% and 3.43% was young (6-12 months age) cattle to caudal fold tuberculin test (CFT).

The results showed that 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 swelling was either soft and edematous or somewhat hard in nature. The swelling was felt and estimated by palpation at the site of inoculation, while the animal expressed the sign of pain. In CFT test two injections were made intradermally; bPPD at upper site and lower site at neck & tail region. Reading was taken after 72 hours and measured with slide calipers.

The percentages of reactors to CFT test in female cattle were 30.30%. Debnath, et al. [13] reported that a retrospective study of calf losses on the Central Dairy Cattle Breeding Station in Bangladesh was carried out between January 1980 and July 1992. Tuberculosis was responsible for 11.3% of the calves' mortality. Calf mortality rate was significantly higher in male calves and in calves having exotic breeding and lower birth weight. Our findings were more or less similar with the findings of other researchers for the prevalence of tuberculosis in calves however it is impracticable to draw exact conclusion as a whole on the prevalence of tuberculosis in calves. Prevalence of bovine tuberculosis is influenced by many factors such as geographical situation of a country, and its temperature, hygienic status of humans and animals and enforced regulatory laws in Public Health and Veterinary Public Health sectors that also affect the prevalence percentage. In the CFT test, the reactor percentage of local cattle is 2.44% (age 6-12 months) and female cattle is 20.07% (age 5-7 years) respectively in relation to age. In our study we also found 3.43% male cattle show positive result and 30.73% female cattle show to CFT test in relation to sex.

It has previously been reported that the animals older than 10 years were within high risk of infection [14]. Similarly, Cleaveland, et al. [15] and Phillips, et al. [16] suggested that older animals are more susceptible to tuberculosis. The present findings indicated that the overall percentage of tuberculin test reactor animals in cattle were 49 and 101 for the age group-1(6-12 months age) and group-2 (5-7 year age) respectively.

It might be suggested that for obviously complete eradication of tuberculosis from the country, there should be very well coordination in activities among the public health and veterinary public health personnel.

5. Acknowledgements

This study was supported by Department of Microbiology, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh. The authors wish to express their heartfelt thanks to Professor Dr. M. Mufizur Rahman, Department of Microbiology and Hygiene, Bangladesh Agricultural University, Mymensingh, Bangladesh for critical reading of this manuscript. This study was performed in partial fulfillment of the requirements of a M.S. thesis for A.S.M. Tahmid Uddin from the Department of Microbiology, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh.

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