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Prevalence and Risk Factors of Human and Bovine Tuberculosis at Mymensingh District in Bangladesh

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Keywords: human, bovine, tuberculosis, prevalence, risk factor, Bangladesh.

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Prevalence and Risk Factors of Human and Bovine Tuberculosis at Mymensingh District in Bangladesh

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Abstract- Tuberculosis (TB) is a major global health problem and economically important zoonotic diseases worldwide. This study was conducted to determine the prevalence of tuberculosis and risk factor in human and cattle at Mymensingh district in Bangladesh. In this study, 3085 human and 649 cattle were examined during January 2009 to December 2011 at Dhobaura upazila of Mymensingh district. The overall prevalence of tuberculosis in human and animal was 9.7% and 2.34%, respectively ($p<0.01$). The difference in the prevalence of tuberculosis in human and cattle is statistically significant ($p<0.001$). Statistically significant higher prevalence was found in the age group of 20 ≤29 years and 30≤39 years than 40≤49 years, 50≤59 years and ≥60 years age group of human ($p<0.001$). The relationship among the prevalence in different age group of cattle was statistically insignificant ($p=0.129$). In human, statistically significant higher prevalence was recorded in female (11.2%) than in male (8.6%) ($p=0.02$). But in cattle, statistically insignificant slightly higher prevalence was recorded in male (2.4%) than in female (2.1%) ($p=0.777$). In human, highest prevalence was found in the April month (15%) and lowest in the July month (5.7%) ($p=0.012$). In cattle, highest prevalence was found in the April and October month (3.8%) and no positive cases were recorded in the July month.

Keywords: human, bovine, tuberculosis, prevalence, risk factor, bangladesh.

I. Introduction

Tuberculosis (TB) remains is a major global health problem (Cosivi *et al.*, 1998; Schiller *et al.*, 2010). Tuberculosis plays a central role in public health and animal health because of its severe disease in humans and significant economic losses to cattle producers related to affected herds (Rodriguez *et al.*, 1999; Ayele, *et al.*, 2004; Zinsstag *et al.*, 2006; Samad, 2008; OIE, 2009). *Mycobacterium tuberculosis, M. bovis* causing disease in humans ((Dankner *et al.*, 1993). *M. bovis* is the most universal pathogen among mycobacteria and affects many vertebrate animals of all age groups although, cattle, goats and pigs are found to be most susceptible, while sheep and horses are showing a high natural resistance. *M. tuberculosis* and *M. bovis* are genetically and antigenically very similar and cause identical clinical disease in humans. ((Radostis *et al.*, 2000; Zinsstag *et al.*, 2006). Transmissions of tuberculosis in humans are mainly by inhalation and ingestion of raw milk or unpasteurized dairy products or meat from an infected animal ((Srivastava *et al.*, 2008). Aerosol exposure to *M. bovis* is considered to be the most frequent route of infection of cattle, but infection by ingestion of a contaminated material also occurs ((Biet *et al.*, 2005). Fever, night sweats, weight loss, poor appetite, weakness, chest pain, swollen glands and breathing problems, a general sick feeling are the general symptom in human. In cattle, the early stages of TB, clinical signs are not visible. In later stages, clinical signs may include: emaciation, lethargy, weakness, anorexia, low-grade fever, and pneumonia with a chronic, moist cough. Lymph node enlargement may also be present ((Radostis *et al.*, 2000). The most common method for diagnosing TB in human worldwide is sputum smear microscopy (developed more than 100 years ago). Chest x-ray also a common method for TB diagnosis in human. In countries with more developed laboratory capacity, cases of TB are also diagnosed via culture methods. TB in Bangladesh is commonly diagnosed by suggestive clinical symptoms and signs coupled with a suggestive chest x-ray and sputum sample (Matin *et al.*, 2011). Bovine TB is difficult to diagnose with clinical signs alone. Many methods are available for diagnosis of tuberculosis in infected animals but the single comparative intradermal tuberculin test (SCITT) is most widely used for diagnosis and eradication of Bovine tuberculosis (OIE, 2009). In Bangladesh, so far the single intradermal (SID) skin test with purified protein derivative (PPD) has been used to detect the prevalence of bovine TB (BTB) ((Pharo *et al.*, 1981; Samad and Rahman, 1986; Islam *et al.*, 2007). Sero-diagnostic tests, ICGA as Antigen Rapid Bovine TB Ab Test Kit was

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used to detect Bovine TB and its effect on milk production in lactating cows in Bangladesh ((Rahman and Samad, 2008).

Tuberculosis causes ill-health among millions of people each year and ranks as the second leading cause of death from an infectious disease worldwide. The latest estimates included that there were almost 9 million new cases in 2011 and 1.4 million TB deaths worldwide. About 89% of the world's TB cases are account for 96 countries. Bangladesh ranks 5th Globally (WHO, 2006). In Bangladesh mortality rate in human varies from 19 to 82 (average 45), Prevalence varies from 199 to 698 (average 411), incidence varies from 185 to 268 (average 225) per 100 000 population (WHO, 2012). There is little literature available on the prevalence of tuberculosis in human and animal in Bangladesh. Therefore, the study was conducted to determine the prevalence and risk factors associated with human and bovine tuberculosis.

II. Methodology

This was a prospective, cross-sectional, observational study conducted among the human and animal population simultaneously. The study was conducted for the period of three years starting from January 2009 to December 2011 to determine the prevalence and risk factors associated with human and bovine tuberculosis.

a) Selection of study population

In this study, 3085 patients who were admitted in Dhobaura Health Complex and 649 cattle registered in Dhobarua Upazila Veterinary Hospital were selected. A detailed history, age, sex were recorded in a questionnaire from disease register maintained by the Upazila Tuberculosis and Leprosy Control Unit, Health Complex, Veterinary Hospital, human residence and animals owners houses of Dhobaura upazila in Mymensingh.

b) Diagnoses of cases

The diagnosis of human tuberculosis was based on history, clinical examination, BCG test and X-ray, Sputum examination, tuberculin test, lymph node biopsy and histological or cytological examination at Dhobaura Health Complex, Mymensingh; Mymensingh Medical college Hospital, Mymensingh; Department of Medicine, Bangladseh Agriculturl University, Mymensingh, Bangladesh. Acid fast bacilli were demonstrated in the section of chemical and mediastinal lymphnodes by acid fast staining. Bovine tuberculosis was diagnosed based on history, clinical findings, complete physical examination, Caudal fold tuberculin (CFT) test at Dhobarua Upazila Veterinary Hospital, Mymensingh and Department of Medicine, Bangladseh Agriculturl University, Mymensingh, Bangladesh. To determine the seasonal influence on the clinical prevalence of tuberculosis in human and animals, the data were collected in different months of the year.

c) Caudal fold tuberculin (CFT) test

This is the primary screening test to identify animal potentially infected with bovine TB. The test measures the immune response to *Mycobacterium bovis,* the causative agent of bovine TB. The test was performed by intradermal injection of 0.1 ml bPPD with a hypodermic syringe in the skin of the caudal fold (the fold of skin at the base of the tail). If the animal was exposed to mycobacteria, the immune system responded with inflammatory cells at the injection site to cause swelling and/or discoloration of the skin. After 72 hours, inspection and palpation of the injection site was done to evaluate for a response. Marked edematous swelling, reddening at the injection site classified the animal as a responder. If no response was noted, the animal was classified as CFT test-negative. Responder animals were further tested with CCT test for confirmation.

d) Statistical analysis

The collected data was compiled, tabulated and analyzed in accordance with the objectives of the study. The approximate percentage was calculated for each parameter. The questionnaire-based data was processed in Microsoft Excel and analyzed in SPSS. The z-test for proportions was done to find out the relationship of different factors on the occurrence of tuberculosis in human and cattle. Where Significance was determined in terms of age, sex, year and month of occurrence at 5% level.

III. Results

a) Overall prevalence of tuberculosis in human and cattle

In this study, 3085 human and 649 cattle of different sexes and ages were examined to determine the prevalence and risk factors associated with human and bovine tuberculosis. Out of 3085 human, 300 were shown positive reaction to human tuberculosis and out of 649 cattle, 15 were shown positive reaction to bovine tuberculosis. So the overall prevalence was 9.7% in human and 2.34% in cattle (Table 1). The difference in the overall prevalence of tuberculosis in human and cattle is statistically significant ($p<0.001$).

Table 1: Comparison between prevalence of human and bovine tuberculosis in Mymensingh District

Species	Total selected	TB positive	Percentage (%)	95% CI (%)	P Value	Level of significance
Human	3085	300	9.7	8.7-10.7	<0.001	S
Cattle	649	15	2.3	1.1-3.5		

S=significant at 1% level of significance

b) Prevalence in human

Age-wise prevalence of tuberculosis in human revealed that the prevalence was 19.4%, 15.5%, 10.1%, 3.7% and 1.7% in 20≤29 years, 30≤39 years, 40≤49 years, 50≤59 years and ≥60 years age group, respectively. Highest prevalence (19.4%) was found in age group 20≤29 years old human. Prevalence was gradually decreasing with higher age group and lowest prevalence was recorded in the ≥60 years age group. Statistically significant higher prevalence was found in the age group of 20≤29 years and 30≤39 years than 40≤49 years, 50≤59 years and ≥60 years age group (p<0.001). Also statistically higher prevalence was found in the age group of ≤40 years than 50≤59 years and ≥60 years age group (p<0.001). (Table 2).

Table 2 : Prevalence of tuberculosis based on different risk factors in human at Dhobaura upazila in Mymensingh

Age group (years)	Selected human	TB positive	Percentage (%)	95% CI (%)	P Value	Level of significance
20≤29	371	72	19.4	15.4-23.4		
30≤39	504	78	15.5	12.3-18.7		
40≤49	1130	114	10.1	8.3-11.9	<0.001	S[a]
50≤59	900	33	3.7	2.5-4.9		
≥60	180	3	1.7	-0.2-3.6		
Sex						
Male	2085	201	8.6	7.4-9.8	0.02	S[b]
Female	1000	99	11.2	9.2-13.2		
Year						
2009	959	100	10.4	8.5-12.3		
2010	1165	101	8.7	7.1-10.3	0.304	NS
2011	961	99	10.3	8.4-12.2		

NS= Not significant at 5% level of significance,

[a]= significant at 1% level of significance

[b]= significant at 5% level of significance

Sex-wise prevalence of tuberculosis in human showed that higher prevalence was recorded in female (11.2%) than in male (8.6%) which is statistically significant (p=0.02) (Table 2). Over the three study years slightly similar prevalence was found in the year 2009 (10.4%) and 2011 (10.3%). Lower prevalence was found in the year 2010 (8.7%) than 2009 and 2011. The difference in the prevalence of three years is not statistically significant (p=0.304) (Table 2).

Monthly distribution of tuberculosis in human is shown in the Figure 1. The distribution revealed that highest prevalence was found in the April month (15%) and lowest prevalence was found in the July month (5.7%). The difference in the prevalence of tuberculosis in April and July months is statistically significant (p=0.012). The difference among the prevalence of tuberculosis in the other months of the year is statistically insignificant (p>0.05).

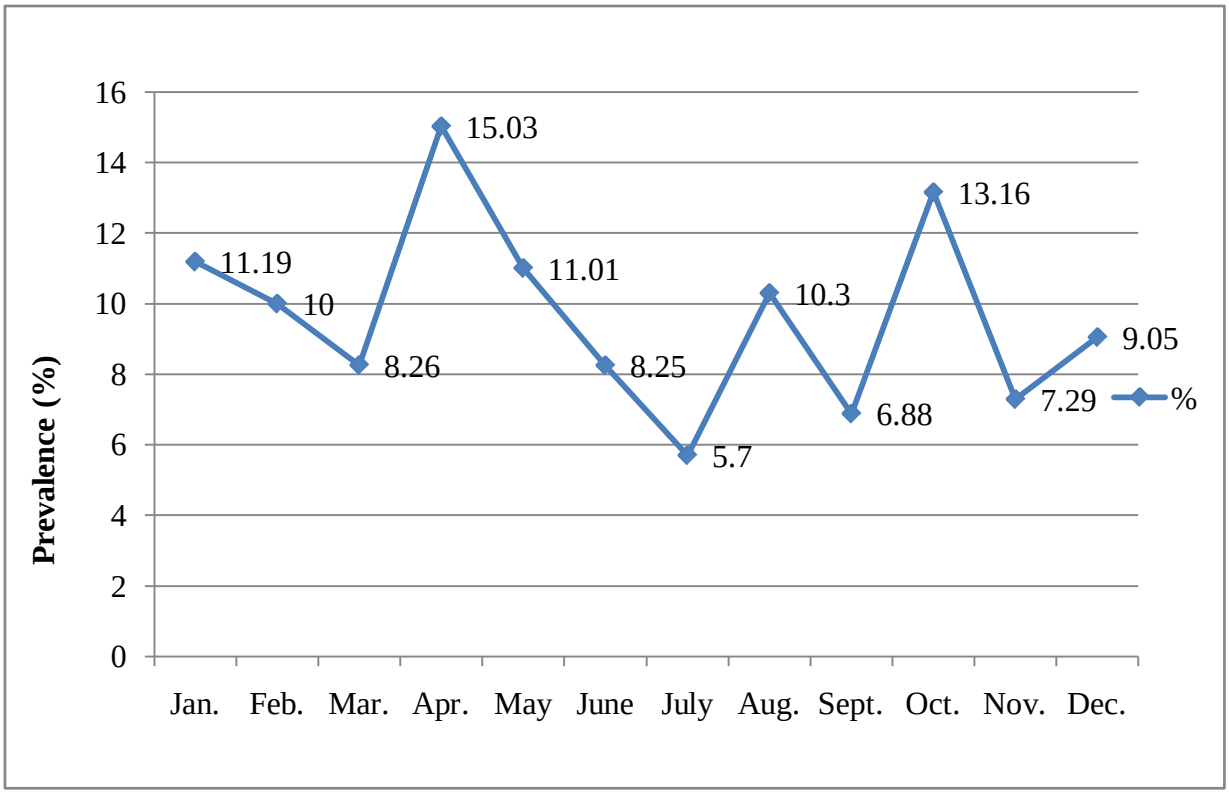

Figure 1 : Monthly distribution of tuberculosis in human

c) Prevalence in animal

Age-wise prevalence of tuberculosis in cattle revealed that the prevalence was 0%, 1.8%, 3.0% and 4.0% in ≤4 years, 4.1≤5 years, 5.1≤6 years and 6.1≤10 years age group, respectively. Highest prevalence (4%) was found in age group 6.1≤10 years old cattle. Prevalence was gradually decreasing with lower age group and no tuberculosis cases were recorded in the ≤4 years age group. The relationship among the prevalence in different age group is statistically insignificant (p=0.129) and ≤4 years age group is not included in the statistical comparison as its proportion is zero (Table 3). Sex-wise prevalence of tuberculosis in cattle showed that slightly higher prevalence was recorded in male (2.4%) than in female (2.1%) but not statistically significant (p=0.777) (Table 3). Over the three study years same prevalence was found in the year 2009 (2.2%) and 2011 (2.2%). Slightly higher prevalence was found in the year 2010 (2.5%) than 2009 and 2011. The difference in the prevalence of three years is not statistically significant (p=0.97) (Table3).

Table 3 : Prevalence of tuberculosis based on different risk factors in cattle at Dhobaura upazila in Mymensingh

Age group (years)	Selected cattle	TB positive	Percentage (%)	95% CI (%)	P value	Level of significance
2≤4	135	0	0	0		
4.1≤5	165	3	1.8	-0.2-3.8	0.129	NS
5.1≤6	198	6	3.0	0.6-5.4		
6.1≤10	151	6	4.0	0.9- 7.1		
Sex						
Male	410	10	2.4	0.9-3.9	0.777	NS
Female	239	5	2.1	0.3-3.9		
Year						
2009	230	5	2.2	0.3-4.1		
2010	240	6	2.5	0.5-4.5	0.97	NS
2011	179	4	2.2	0.1-4.3		

NS= Not significant at 5% level of significance

Monthly distribution of tuberculosis in cattle is shown in the Figure 2. The distribution revealed that highest prevalence was found in the April and October month (3.8%) and no positive cases were recorded in the July

month. July month was not included in the statistical comparison as its proportion is zero. The difference among the prevalence of tuberculosis in the other months of the year is statistically insignificant (p=0.985).

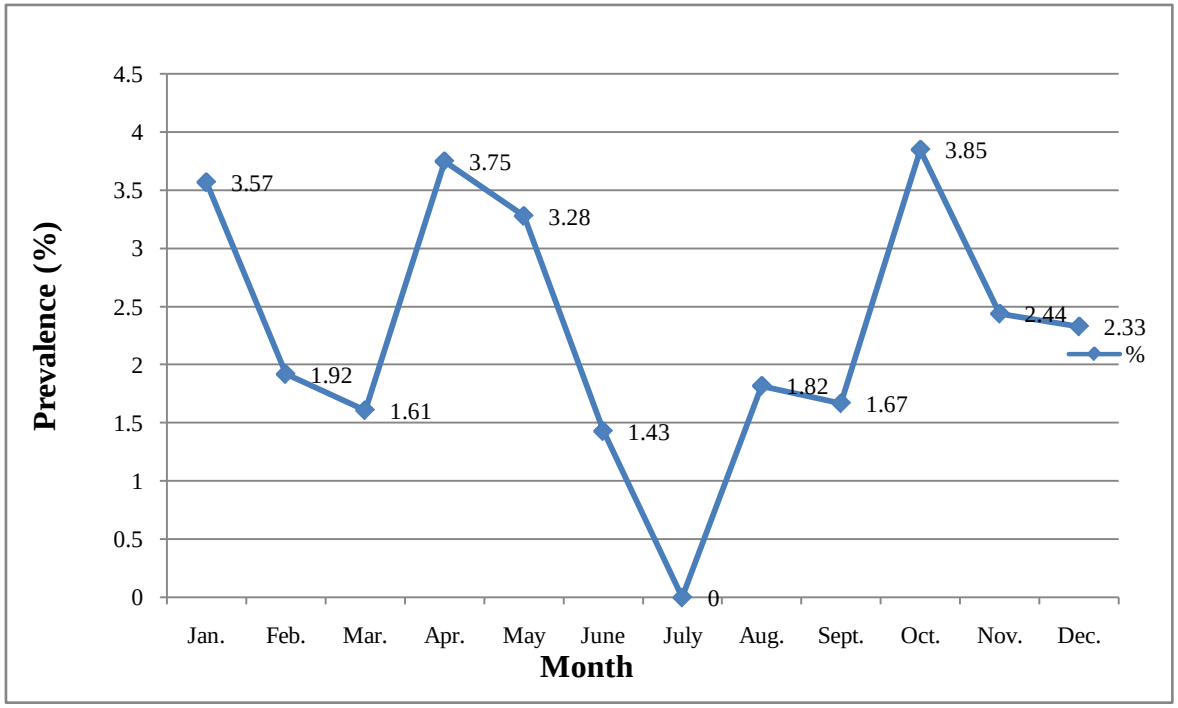

Figure 2 : Monthly distribution of tuberculosis in cattle

d) Comparison between human and bovine tuberculosis

Higher prevalence of tuberculosis was reported in human (9.7%) compared to cattle (2.34%) (Table 1). The difference in the prevalence of tuberculosis in human and cattle is statistically significant (p<0.001). Prevalence was gradually decreasing from comparatively lower age group (20≤29) towards higher age group ≥(60) of human. Where prevalence was gradually increasing from comparatively lower age group (2≤4) towards higher age group (6.1≤10) of cattle. In human, prevalence was higher in female (11.2%) than in male (8.6%) but in cattle, prevalence was higher in male (2.4%) than in female (2.1%). Monthly distribution of tuberculosis revealed that similar strand was found both in human and cattle. Prevalence was gradually decreased from January to March and then peak at April followed by lowest prevalence at July. Prevalence was fluctuating in the rest of the year with an increase prevalence at October in both cases.

IV. Discussion

The Tuberculosis is of paramount importance and public health authorities because of its economic and zoonotic implications (Hermandez and Baca, 1998). It is quite prevalent in Bangladsh (Rahman and Samad, 2008; Samad and Rahman, 1986; Pharo et al., 1981). It is now estimated that every year 300 000 people in Bangladesh develop active tuberculosis (Karim et al., 2012). The paucity of literature on the prevalence of tuberculosis in human and animal in Bangladesh encouraged the authors to report findings. Therefore the study was conducted to determine the prevalence and risk factors associated with the occurrence of tuberculosis in human and animal.

In this study, significant difference was found on the overall prevalence of TB in human (9.7%) and in cattle (2.34%). Where, Ibrahim et al. (2012) found no statistically significant association between reactor cattle (2%) and human TB cases (5%) in the households. This could be due to difference in agro-ecological zones and management system. Age-wise prevalence of tuberculosis in human revealed that highest prevalence (19.4%) was found in age group≤2920 years old human. Prevalence was gradually decreasing with higher age group and lowest prevalence was recorded in the≥60 years age group. The present study corresponds to the study of Biswas et al. (1999) who found more prevalence in young than old. But does not corresponds to the study of Zaman et al. (2012) who reported highest prevalence in the 55-64 years age group and lowest in 15-24 years age group. The present study reveals that the prevalence of female patient (11.2%) is more than that of male patient (8.6%) which are in disagreement with the observation of Baker et al. (1996) and Zaman et al. (2012) who reported more prevalence in male than in female. Weiss et al. (2008) studied on cultural epidemiology of TB with reference to gender in Bangladesh, India and Malawi. They found

that female patients reported more diverse symptoms and men more frequently focused on financial concerns. Men emphasized smoking and drinking alcohol as causes of TB, and women in Malawi reported sexual causes associated with HIV/AIDS. Over the three study years, slightly similar prevalence was found in the year 2009 (10.4%) and 2011 (10.3%). Lower prevalence was found in the year 2010 (8.7%). Monthly distribution of tuberculosis in human revealed that highest prevalence was found in the April month (15%) and lowest prevalence was found in the July month (5.7%). There is no report available in literature to compare on monthly distribution of TB in human.

In this study the overall prevalence was 2.34% in cattle by caudal fold tuberculin test. The prevalence is slightly higher than the earlier reports of prevalence in indigenous cattle (2.10%) but lower than the prevalence in cross-bred cattle (7.80%) detected with a caudal fold tuberculin test in Bangladesh reported by Samad and Rahman, (1986) and however, these increased prevalence rate of bTB in RCC might be due to differences of the sensitivity of the test used, increased infection rate and different breed tested (Samad and Rahman, 1986). The prevalence is also slightly higher than the prevalence (2.0%) reported in southeast Ethiopia by Gumi et al., (2012). Age-wise prevalence of tuberculosis in cattle revealed that highest prevalence (4%) was found in age group 6≤10 years old cattle and gradually decreasing with lower age group. The present findings support the finding of Chauhan et al., (1974) who reported the incidence of bovine tuberculosis in India was higher in adult (3.599%) against in young stock (0.30%). The finding is also similar with the finding of Kazwala et al., (2001) who found that older cattle were more affected by the disease than yearlings and calves. Sex-wise prevalence of tuberculosis in cattle showed that slightly higher prevalence was recorded in male (2.4%) than in female (2.1%). This finding support the finding of Shehu et al., (1988) who reported that male animal had a higher chance of being positive than female animal in the tuberculin tests. This may be due to the usage of the male cattle in agriculture. Male cattle are mostly used as oxen and therefore are kept in the herd for long thereby having more chances of being exposed to infection than female cattle. Similarly, female cattle have less frequent contact with other cattle except at grazing and watering point (Shehu, 1988). Kazwala et al. (2001) also found significant differences in the prevalence of tuberculosis between male and female cattle. Over the three study years same prevalence was found in the year 2009 (2.2%) and 2011 (2.2%) and slightly higher prevalence was found in the year 2010 (2.5%). Monthly distribution of tuberculosis in cattle revealed that highest prevalence was found in the April and October month (3.8%) and no positive cases were recorded in the July month. There is no report available in literature to compare on monthly distribution of TB in cattle. High prevalence in April and October month may be due more usage of cattle in agriculture in these two months and therefore, more chance of exposure to infection.

a) The zoonotic importance of tuberculosis

Most of the human patients having tuberculosis in this study are poor, having malnutrition. Most of them live with animals in the same damp and overcrowded houses. Most of the time of day they are in close contact with animals. They share the same materials used for animls and man. They did not take proper hygienic measures during milking and processing of milk. They drink unpasteurized milk and eat infected meat with tuberculosis. All these factors help in spread of the disease from animal to human. So people should not eat infected meat, improvement of socioeconomic and housing condition can help to limit spread of disease.

V. Conclusions

Tuberculosis is a zoonotic and economically important disease in Bangladesh. In this study prevalence and risk factors were determined in both human and bovine. The result represents the present status of tuberculosis in Bangladesh. This study will help to take necessary action to control and eradicate tuberculosis in Bangladesh. It is necessary to carry out a routine program of tuberculin testing, for confirmation, combined with interventions to reduce the risk of nosocomial transmission in the workplace. It might be suggested that a well coordination in activities should be taken among the public health and Veterinary public health organelles for complete eradication of the disease from the country.

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