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# Preliminary Study on Public Health Implication of Bovine Tuberculosis in Jimma Town, South Western Ethiopia

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**Abstract:** A cross-sectional study was conducted from October 2007 to April 2008 on 384 dairy cattle and 35 dairy farm owners in Jimma Town. The objective of the study was to generate preliminary data on public health implication of bovine tuberculosis. Simple random sampling, comparative intradermal tuberculin (CIDT) test, mycobacteriological and questionnaire survey were carried out. On the basis of CIDT test, herd prevalence of BTB was found to be 51.4% (95% CI=34.8, 68.0). Mycobacteria were able to be grown from 12.5% of milk samples obtained from CIDT test positive cows. Among the interviewed households, 22.9% (8/35) had at least one case of human tuberculosis in their family. From these families, 62.5% (5/8) owned reactor cattle in their dairy herd. Significant association ($\chi^2$ = 10.80; P = 0.001) was obtained between reactor cattle and human tuberculosis cases in households. 85.7% of the respondents used either raw (31.4%) or non-treated soured (54.3%) milk, while 94.3% of the respondents used to consume mixed (raw and cooked) meat. 37.1% of them knew that cattle have tuberculosis among which only 25.7% of them recognized BTB is zoonotic. Analysis of secondary data on human TB obtained from Jimma University specialized hospital revealed significant level of TB cases. In conclusion, the results of the present study indicated the prevailing occurrence of bovine TB in the studied area and thus, its potential risk to the public health was important based on food consumption habits and lack of understanding about its transmission from cattle to humans.

**Key words:** Bovine tuberculosis · Risk to human health · Awareness · Feeding habits

## INTRODUCTION

In humans, tuberculosis is still a major cause of death worldwide in general and high-burden regions in particular [1, 2]. Even though, *M. tuberculosis* is mainly responsible, some mortalities and morbidities due to tuberculosis are caused by bovine tuberculosis (BTB) [3]. BTB is an infectious disease of cattle caused by *Mycobacterium bovis* (*M. bovis*) that seriously affects the productivity of the livestock industry in the developing countries jointly with other diseases [4]. It is a zoonotic disease transmitted to human by erogenous route and /or through consumption of infected milk and other cattle products [5].

Human population in Ethiopia is growing causing increased demands on animal products such as milk and meat. This in turn caused and is causing intensification of animal production integrated with genetic improvement [6]. BTB is a disease of intensification and exotic/their cross breeds that have high potential of milk production. This could put the people most probably those who drink raw milk potentially infected with *M. bovis* under risk of BTB infection [7].

The global prevalence of human TB due to *M. bovis* has been estimated at 3.1% of all human TB cases, accounting for respectively 2.1% and 9.4% of pulmonary and extra-pulmonary TB cases [5]. Human TB due to *M. bovis* in developing countries today is analogous to conditions in the 1930s and 1940s in Europe, where more than 50% of the cervical lymphadenitis cases in children were caused by *M. bovis* infection [8]. In countries where BTB in cattle is still highly prevalent, pasteurization of milk is not widely practiced and/or milk hygiene is insufficient, usually an estimated 10% to 15% proportion of human tuberculosis is considered to be caused by BTB [9].

In Ethiopia, *M. bovis* infection is prevalent in cattle especially in exotic and cross breed dairy cattle. The prevalence of BTB in Ethiopia range from 3.4% in smallholder production systems to 50% in intensive dairy

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production system [10-12]. Moreover, a prevalence of 5.15% of BTB was reported in animals slaughtered in Nazareth municipality abattoir of central Ethiopia [13]. Previous works in Ethiopia also reported isolates of *M. bovis* from milk samples and tuberculous lesions collected from tuberculin positive cattle and sputum sampled from persons working in tuberculin positive herds [14, 15]. However, the base line information of the public health implication of BTB in Jimma town and its surroundings is lacking. Therefore, the objective of this study was continue to undertake preliminary investigation on public health implication of bovine tuberculosis in Jimma town.

## MATERIALS AND METHODS

**Study Design and Sampling Method:** A cross-sectional study was conducted on 384 dairy cattle from 35 small holder dairy farms and 35 households that own dairy farms in Jimma town. Consent of all the dairy farm owners included in the questionnaire survey and permission from Jimma University Specialized hospital (to use secondary data on tuberculosis) were obtained.

**Study Methodology**

**Intradermal Tuberculin Test:** Single intradermal tuberculin (SIDT) test was performed in cattle of both sex and above 6 months of age excluding those in late pregnancy and recently calved cows/heifers. After the result of SIDT was read, positive and doubtful reactors were subjected to comparative intradermal tuberculin (CIDT) test two months latter after the firs test and interpretation of the result on the infection status of the animal was made [16]. Animals were classified as TB positive after the screened animals confirmed positive for comparative intradermal tuberculin test.

**Specimen Collection and Processing:** About 30 ml of the last few streams of milk from the 4 quarters of 24 CIDT test positive cows were collected into a sterile universal bottle aseptically. The samples were kept in a cool box and transported to laboratory. The milk samples were centrifuged at 3000 rpm for 15 min and the supernatant discarded. The sediments were suspended in 2ml of sterile physiological saline solution and decontaminated with equal volume of sterilized 4% NaOH solution. The suspension of the decontaminated milk sample was concentrated with HCl using phenol red as indicator. Neutralization was achieved when the suspension color changed from purple to yellow. The neutralized suspension from each sample was spread on 2 slants of Lowenstein-Jensen (L-J) media (one enriched with sodium pyruvate and the other enriched with glycerol). The cultures were incubated aerobically at 37°C for 12 weeks in appropriate positions with weekly observation for growth of colonies [13, 17].

**Identification/Isolation of Mycobacterium Bovis:** A direct smear was prepared and Ziehl-Neelsen staining was performed to confirm the presence of acid-fast bacilli whenever visible colonies observed from cultured milk samples [17]. Niacin production and nitrate reduction tests were conducted on 3 strains of mycobacteria that grown on pyruvate enriched L-J media. The tests were conducted as described earlier [16, 17].

**Data Collection:** CIDT test and mycobacteriological results were recorded. The public health aspects of BTB were investigated by using questionnaire survey. A pre designed questionnaire was administered to farm owners/ head of households whose cattle were tested. The questions were focused on information inline with the awareness of the respondents about BTB, habit of milk

Table 1: Occurrence and relative prevalence of human tuberculosis recorded in Jimma University Specialized Hospital (2001 to 2007)

| Year | PTB cases | EPTB cases | Total | %PTB | %EPTB |
|---|---|---|---|---|---|
| 2001 | 1055 | 366 | 1421 | 74.24 | 25.76 |
| 2002 | 403 | 446 | 849 | 47.47 | 52.53 |
| 2003 | 424 | 435 | 859 | 49.36 | 50.64 |
| 2004 | 656 | 603 | 1259 | 52.10 | 47.90 |
| 2005 | 681 | 886 | 1567 | 43.46 | 56.54 |
| 2006 | 598 | 600 | 1198 | 49.90 | 50.10 |
| 2007 | 392 | 617 | 1009 | 38.85 | 61.15 |
| Total | 4209 | 3953 | 8162 | 51.56% | 48.43% |

PTB: Pulmonary Tuberculosis

EPTB: Extra pulmonary Tuberculosis

Table 2: Prevalence of BTB in dairy cattle, confirmed TB case in households and awareness of dairy farm owners about BTB in Jimma Town

| Variable | Number and percent | 95% CI |
|---|---|---|
| BTB at dairy herd/farm level (N =35) | 18 (51.4%) | 34.8-68.0 |
| Confirmed human TB in households (N=35) | 8 (22.9%) | 9.4-36.4 |
| Awareness of farm owners on BTB (N =35) | | |
| Know cattle have BTB | 13 (37.1%) | 21.1-53.1 |
| Do not know that cattle have BTB | 22 (62.9%) | 46.4-78.9 |
| Awareness of farm owners that BTB is zoonotic (N = 35) | | |
| Know BTB is zoonotic | 9 (25.7%) | 11.2-40.2 |
| Do not know BTB is zoonotic | 26 (74.3%) | 59.8-88.8 |

CI = Confidence Interval

and meat consumption and recent history of tuberculosis in their families. The owners were also interviewed about the purpose of dairy operation and condition of milk they sell. In addition, 7-years data on human TB was collected from Jimma University Specialized Hospital to look into the frequency and form/type of tuberculosis in humans (Table 1).

**Data Analysis:** Individual animal prevalence was defined as the number of positive reactors per 100 animals tested (CIDT). Pearson Chi- Square ($\chi^2$) test was used to determine the association between reactor cattle in dairy herd for CIDT and confirmed human TB in household using SPSS version 13.0.

## RESULTS

Summary of prevalence of BTB in dairy farms in Jimma Town and indicators of awareness level of dairy farm owners about BTB is presented in Table 2. Out of 24 milk samples from CIDT test positive cows cultured and processed, *M. bovis* was isolated and confirmed from 3 (12.5%) samples on the basis of culture characteristics, staining and niacin and nitrate tests..

Results of the interview conducted on 35 households who owned smallholder dairy farms revealed that 22.9% (8/35) had at least one confirmed case of tuberculosis in their family (Table 2). 62.5% (5/8) of the households that had TB patients in their family owned reactor cattle in their dairy herd. Significant association ($\chi^2$ = 10.80; P = 0.001) was obtained between the households with TB patient and reactor cattle in their dairy farm.

Inline to their feeding habit, 85.7% of the respondents used either raw (31.4%) or non-treated soured (54.3%) milk, while only 14.3% of them did not use milk and milk products without heat treatment. Regarding to meat consumption, 94.3% and 5.7% of the respondents used to consume mixed (raw and cooked) and only cooked meat, respectively. Of the interviewed individuals, 5.7% used milk and milk products for home consumption. 40% and 60% of the owners sold fresh milk for local consumers and cafeterias and hotels in Jimma town, respectively.

Assessment of the awareness of the respondents about BTB showed that 37.1% of them know that cattle have tuberculosis among which only 25.7% recognized that BTB is zoonotic (Table 2).

According to the results of the 7 years data obtained from Jimma University Specialized Hospital on human tuberculosis due to different agents, about 8,162 TB cases (pulmonary and extra pulmonary forms) were recorded (Table 1).

## DISCUSSION

The proportion of which BTB contributes to the total tuberculosis cases in humans depends on the prevalence of the disease in cattle, consumer habits, socio-economic conditions, level of food hygiene [9] and medical prophylaxis measures in practice. The high dairy herd level prevalence (51.4%) of BTB and detection of causal agents of BTB from raw milk (12.5%) in the current study combined with the milk and milk products consumption habit of the interviewed households indicated existing potential risk of BTB infection in humans.

According to the results of the current study, 85.7% of the interviewed households in Jimma town used either raw or non-treated soured milk. Similarly, high proportion of cattle raising families was reported to have the habit of drinking raw milk and milk products by studies conducted in selected sites of Ethiopia [11, 12, 18]. Consumption of unpasteurized fresh and soured milk potentially infected with *M. bovis* was found to cause milk-borne infection with BTB. Such risk was reported to be the main

cause of non-pulmonary TB and is high in areas where bovine TB is common and uncontrolled [7]. Although the number of *M. bovis* positive samples was low, the habit of pooling milk may still pose a public health danger to those consumers of unpasteurized milk as one cow with tuberculous mastitis can excretes enough viable tuberculosis bacilli to contaminate milk and milk products [19].

The association of human tuberculosis in the households and reactor cattle in their dairy herd obtained in the current study was significant ($\chi^2 = 10.80$; $P = 0.001$). Similarly, different studies conducted on the assessment of public health implication of BTB in different parts of Ethiopia revealed statistically significant association between reactor cattle and confirmed TB patients among family members of cattle owners [11, 12, 20, 21]. The presence of both human TB patients and reactor cattle in a household could suggest that either of them could be a source of infection for the other as the disease may be cyclical (cow-to man and man-to cow) [5].

The poor understanding of the cattle owners about BTB observed in this study could also magnify the public health implication of BTB. Only 25.7% of the cattle owners interviewed understood that BTB is zoonotic, while 62.9% of the respondents did not know as cattle could have TB. According to a study performed in Adama Town (central Ethiopia), only 35% of the respondents knew about bovine TB, while 32% of them were aware that it could be transmitted from cattle to humans [21]. According to the result of this study, in Jimma, consuming raw meat is a well come tradition that 94.3% of the respondents used to consume mixed (raw and cooked) meat, while only about 5.7% used to consume only cooked meat. Thus, meat may also be the other potential threat to be a source of BTB infection in Jimma and its surroundings.

The result of 7 years data (2001 to 2007) obtained from Jimma University Specialized hospital on human tuberculosis showed that an average of 1166 TB patients was found to visit the Hospital in one year. Out of the 8,162 TB cases registered during the 7 years, 48.4% (3,953) of them were extra-pulmonary, while 51.6% (4,209) of the cases were found to be pulmonary form. A study conducted in selected sites of east Showa, Ethiopia on epidemiology and zoonotic significance of BTB demonstrated that, out of 7,138 human patients with tuberculosis, 38.4% were found to have extra-pulmonary tuberculosis and the proportion of patients with extra-pulmonary tuberculosis was significant in patients who have close contact with cattle and in those who frequently used to drink raw milk in particular [22].

In conclusion, tuberculosis was found to occur widely in both cattle and humans in Jimma and its surroundings. The knowledge of the cattle raising family about BTB was poor and their milk consumption habit could favor transmission of the infection from animals to humans. Thus, this study underlined the potential risk of BTB to humans in Jimma and its surroundings.

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## REFERENCES

1. WHO, 2007. Global tuberculosis control: surveillance, planning and financing, (WHO Report. Geneva, World Health Organization), pp: 376.
2. Marcotty, T., F. Matthys, J. Godfroid, L. Rigouts, G. Ameni, N. Gey van Pittlus, R. Kazwala, J. Muma, P. Van Helden, K. Walravens, C. De Geoghegan, D. Mbotha, M. Otte, K. Amenu, N. Samra, C. Botha, M. Ekron, A. Jenkins, F. Jori, N. Kriek, C. McCrindle, A. Michel, D. Morar, F. Roger, E. Thys and P. vanden Bossche, 2009. Zoonotic tuberculosis and brucellosis in Africa: neglected zoonoses or minor public-health issues? The outcomes of a multi-disciplinary workshop. Annals of Tropical Medicine and Parasitol., 103: 401-411.
3. Theshome, Y., 1995. Status of bovine tuberculosis in Ethiopia. In: *Mycobacterium bovis* infection in Animals and Humans, Eds., thoen, C.O. and J.H. Steele. Lowa State University press, Ames, Lowa, USA, pp: 273-279.
4. Ameni, G., S. Bekele and T. Tolosa, 2010. Preliminary study on the impact of bovine tuberculosis on the reproductive efficiency and productivity of Holstein dairy cows in central Ethiopia. Bulletin of Animal Health and Production in Africa, 58: 223-228.

5. Cosivi, O., J.M. Grange, C.J. Dabora, M.C. Ravighone, T. Fujikura, D. Cousins, R.A. Robinson, H.F. Huchzermeyer, I. de Kantor and F.X. Meslin, 1998. Zonootic tuberculosis due to *M. bovis* in developing countries. Emerging Infectious Diseases, 4(1): 1-14.
6. FAO, 1993. Dairy development and breeding. Livestock sector Development project preparation report. Food and Agricultural Organization of United Nation, 2(24): 1-7.
7. Lee, K. and A. Mills, 2000. Strengthening governance for global health research-the countries that most need health research should decide what should be funded. British Medical J., 321: 775-776.
8. Cosivi, O., F.X. Meslin, C.J. Daborn and J.M. Grange, 1995. The epidemiology of Mycobacterium bovis infections in animals and humans, with particular reference to Africa. Review Science and Technology Office of International Epizootics, 14: 733-746.
9. Ashford, D.A., E. Whitney, P. Raghunathan and O. Cosivi, 2001. Epidemiology of selected mycobacteria that infect humans and other animals. Review Science and Technology Office of International Epizootics, 20: 325-337.
10. Assegid, B., A. Lubke-Beeke, E. Lemma, K. Tadele and S. Britton, 2000. Bovine tuberculosis: A cross –sectional and epidemiological study in and around Addis Ababa. Bulletin of Animal Health and Production for Africa, 48: 71-80.
11. Ameni, G., K. Tesfu, R. Alemayehu and Z. Enderias, 2000. Pilot Study on bovine tuberculosis in cattle and its implication in man in selected site of Ethiopia. Ethiopian Veterinary Association Proceeding of 14$^{th}$conference, Addis Ababa, Ethiopia, pp: 28-37.
12. Ameni, G., A. Ragassa, T. Kassa and G. Medhin, 2001. Survey on bovine tuberculosis and its public health implications to cattle raising families in Wolaita-Soddo, Southern Ethiopia. Ethiopian Society of Animal Production, 1: 55-62.
13. Ameni, G. and A. Wudie, 2003. Preliminary study on bovine tuberculosis in Nazareth municipality abattoir of central Ethiopia. Bulletin of animal Health and Production for Africa, 51: 125-132.
14. Ameni, G., 1996. Bovine Tuberculosis: Evaluation of diagnostic tests, prevalence and zoonotic importance. DVM thesis, Facility of Veterinary Medicine, Addis Ababa University, Debre-zeit, Ethiopia.
15. Assegid, B., Z. Woldesenbet, E. Timer and E. Lemma, 2004. Evaluation of abattoir inspection for the diagnosis of *M. bovis* infection in cattle slaughtered at Addis Ababa abattoir. Tropical Animal Health and Production, 36: 537-546.
16. Office of International Epizootics (OIE), 2000. Bovine Tuberculosis. Manual of Standard Diagnostic Tests; and vaccines.
17. Quinn, P.J., M.E. Carter, B. Markey and G.R. Carters, 2002. Clinical Veterinary Microbiology. Harcourt publishers, Virginia, pp: 156-169.
18. Ameni, G., K. Amenu and M. Tibbo, 2003a. Bovine tuberculosis: prevalence and risk factors assessment in cattle and cattle owners in Wuchale-Jida district, Central Ethiopia. International J. Appl. Research in Vet. Med., 1: 17-25.
19. Kleeberg, H.H., 1984. Human Tuberculosis of Bovine Origin in Relation to Public Health. Review Science and Technology Office of International Epizootics, 3: 11-32.
20. Cook, A.J.C., L.M. Tuchill and A. Buve, 1996. Across-sectional study on human and bovine tuberculosis in the Monze District of Zambia. British Vet. J., 152: 37-46.
21. Ameni, G. and A. Erkihun, 2007. Bovine Tuberculosis and Farmers Awareness on Small- Scale Dairy Farm in Adama Town. Review Science and Technology Office of International Epizootics, 26(3).
22. Kiros, T., 1998. Epidemiological and Zonootic Importance of Bovine Tuberculosis in Selected Sites of East Showa, Ethiopia. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre Ziet, Ethiopia.