Prevalence of Bovine Tuberculosis in Dairy Farm
(Study in Debre Tabor Town)

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Abstract: Cross sectional study was conducted in Debre Tabor town from September 2018 to December, 2018 to the prevalence of bovine tuberculosis in dairy farm. The objective of this study is to assess bovine tuberculosis (BTB) status using two diagnostic, tests, to estimate the prevalence of BTB in dairy farms using tuberculin skin test, to enumerate the economical impacts of bovine tuberculosis, to identify risk factors and display spatial distribution of BTB and to asses BTB zoonotic awareness among smallholder dairy farm owners. In Debre Tabor town, 68 smallholder dairy herds of five kebeles were included. A total of 251 cattle were tested using single intradermal tuberculin test. At the caudal fold, the injection site was cleaned. The skin fold thickness was measured using caliper and recorded before injection. Then after, 2000 IU dose or 0.1ml of bovine tuberculin was injected. Pea like small nodule was palpated on injection site. After 72 hours the thickness of the skin at the injection site was measured. In Debre Tabor town, individual animal level prevalence in small holder dairy farms was 10.4% that is 11/106 individuals were positive and have lower prevalence than that of medium scale dairy farms which has 25/145 positive animals with 17.2% prevalence. The herd level prevalence in smallholder dairy farms, 7/25 was positive herds with prevalence of 28% and in medium scale dairy farms the herd prevalence was 54.5%, which have 6/11 positive dairy herds. The prevalence is higher than the smallholder dairy farms herd prevalence.

Keywords: Debre Tabor, Bovine Tuberculosis, South Gondar & Dairy Farm.

1. INTRODUCTION

Ethiopia is among the nation that possesses the largest livestock population in the Africa continent with the total cattle population for the country is estimated to be about 56.71 million [1]. The major biological and socio-economic factors attributing to the low productivity include: the low genetic potential and performance, poor nutrition (in quality and quantity terms), the prevailing of different diseases, traditional way of husbandry systems and inadequate skilled manpower. Ethiopia is one of the African countries where BTB is considered as a major disease burden in animals. BTB is one of the endemic
infectious diseases that have long been recorded in Ethiopia. In Ethiopia, BTB is considered to be a prevalent disease in cattle populations where tuberculin skin test survey indicates that the prevalence ranges from 0.8% in extensive rural farming systems that keep Zebu cattle to 50% in intensive husbandry systems [2].

Bovine tuberculosis (BTB) is found throughout the world and the disease is more prevalent in most of Africa, parts of Asia and of the Americas [3]. BTB is a chronic disease of animals caused by bacteria called Mycobacterium bovis, which is closely related to the bacteria that cause human. This disease can affect practically all mammals, causing a general state of illness, coughing and eventual death. The name TB comes from the nodules, called ‘tubercles’, which form in the lymph nodes of affected animals. Until the 1920s when control measures began in developed countries, it was one of the major diseases of domestic animals throughout the world [4].

Bovine tuberculosis has been significantly widely distributed throughout the world and has been a cause for great economic loss in animal production and the most frequent cause of zoonotic TB in man [5]. Ethiopian milk consumers generally prefer raw milk (as compared to pasteurized milk) because of its taste, availability and lower price. The zoonotic risk of BTB is often associated with consumption (ingestion) of unpasteurized milk and other dairy products infected with M. bovis. Also, aerosol transmission from cattle-to-human (or vice versa) should be considered as a potential risk factor [6].

Bovine Tuberculosis is endemic in cattle population of Ethiopia [2] and is prevalent in North Gondar smallholder dairy farms [7, 8]. The economic losses due to the disease is said to be enormous, where infected animal loses 10 to 25% of its productive efficiency. Direct losses due to the infection become evident by decrease in 10 to 18% milk and 15% reduction in meat production [9].

The disease is contagious and spread by contact with infected domestic and wild animals. The usual route of infection is by inhaling infected droplets which are expelled from the lungs by coughing. Calves and humans can also become infected by ingesting raw milk from infected cows. Because the course of disease is slow, taking months or years to kill an infected animal, an animal can spread the disease to many other herd mates before it begins to manifest clinical signs. Therefore, movement of undetected infected domestic animals and contact with infected wild animals are the major ways of spreading the disease [3]. Diagnosis of bovine tuberculosis is based on TST and culture which can take 3 days and 6 weeks respectively [3] that makes the diagnosis of BTB economical as well as epidemiological costly. So that, TB rapid tests at small dairy farm level are needed. Apart from lower awareness of most of the communities of our country regarding zoonotic diseases, particularly TB, Bovine TB is a known zoonotic disease causing in most of the cases extra pulmonary TB in humans. However, the extent of its contribution to human TB is not assessed very well. The tradition of raw milk consumption and the life style of farmers in South Gondar kebeles where sharing shelter during the night time is practiced may increase zoonotic importance of BTB through ingestion and inhalation of M.bovis [7]. This in turn might alter the dynamics of human tuberculosis. Therefore, knowing the status of the disease and its possible economic implications in the stipulated study area will contribute its share for the efforts made to prevent and control human tuberculosis. Therefore, this study had the following objectives.

a. To assess bovine tuberculosis (BTB) status using two diagnostic tests.
b. To estimate the prevalence of BTB in dairy farms using tuberculin skin test.
c. To enumerate the economical impacts of bovine tuberculosis.
d. To identify risk factors and display spatial distribution of BTB and
e. To asses BTB zoonotic awareness among smallholder dairy farm owners.

2. MATERIAL AND METHODS
2.1 Study area description
Cross sectional study was conducted from September 2018 to December, 2018 in Debre Tabor town and its location in South Gondar zone Amhara Regional State, Debre Tabor is a town and a Wereda in North Central Ethiopia, located in the south Gondar zone of the Amhara Region of Ethiopia, about 100 km southeast of Gondar town and 50 km east of lake Tana. This historic town has a latitude and longitude of...
11°51'N 38°1'E 11.850°N 38.017°E with an elevation of 2,706 meters (8,878 ft) above sea level. The presence of at least 48 springs in the area contributed to the developments of Debre Tabor. Debre Tabor is served by airports. Based on 2007 national census conducted by the Central statistical agency of Ethiopia, this town has a total population of 55,596 of whom 27,644 are men and 27,952 women. The climate is warm and temperate. In winter there is much less rainfall than in summer. The average annual temperature is 15°C. The average rainfall is 1497 mm. The livestock population in the area comprises of cattle (8,202), goat (22,590), sheep (2,695), horse (1,065) and donkey (9,001) [10].

2.2 Study population

The source population was those small holder dairy herds in Debre Tabor town. Five kebeles of Debre Tabor town were involved in the study, namely; Ajibar, Weybla Mariam, Abaregagn, Melo, Asfaw Grar, and Sibseba Meda. A total of 68 smallholder dairy farm herds were used as the study population. A total of 251 eligible heads of cattle were tested using the two antigens.

For the purpose of this study, smallholder dairy farms were defined as dairy farms that hold <10 dairy animals. Medium scale dairy farms are farms that hold >10 and < 50 dairy animals.

2.3 Sampling method

All smallholder dairy farmers found in both study sites were registered. Study herds were selected randomly based on the registry. On the sampling frame, in the randomly selected herds, all eligible animals were sampled except aggressive animals; those less than 6 months of age, pregnant cattle near to term, recently delivered cows or added to the herd were excluded from the test. Some of these are justifiable in that animals lose sensitivity to tuberculin shortly before and after calving [11]. Data regarding age using dentition, [11] body condition (using body score method; poor, fair, good), parity, milk yield per day by lit., breed, feed type, source, (using data sheet by asking owners) of the tested animal within the herd, as well as other related variables were taken while testing the cattle and the study follow up.

2.4 Data collection methods

The materials used for this study were digital vernier caliper, insulin syringe, blades and scalpel handle, detergents, Determine LAM Ag strip, sample bottle, dropper, alcohol, cotton, gloves and rope and bovine (M.bovis, strain AN-5 25,000 IU/ml & avian PPDs (M. avium, strain D4 ER 25,000 IU/ml).

2.4.1 Single Intradermal Tuberculin Test (SITT)

In Debre Tabor town, 56 smallholder dairy herds of five kebeles were included. A total of 179 cattle were tested using single intradermal tuberculin test. At the caudal fold, the injection site was cleaned. The skin fold thickness was measured using caliper and recorded before injection. Then after, 2000 IU dose or 0.1ml of bovine tuberculin was injected. Pea like small nodule was palpated on injection site. After 72 hours the thickness of the skin at the injection site was measured. To avoid errors, the same person who measured the skin before injection measured 72 hours after injection. The result was interpreted as <2mm = negative, >2mm and <4mm = doubtful and >4mm = positive [3].

2.4.2. Comparative Intradermal tuberculin Test (CIDT)

In two kebeles of Debre Tabor town, CIDT injection was given for 12 smallholder dairy cattle. A total of 72 cattle were tested using Comparative Intradermal tuberculin Test (CIDT). Prior to injection, the two injection sites around the middle neck region were cleaned and shaved. A fold of skin thickness within shaved area was measured with calipers and recorded [12]. A 0.1 ml needle, graduated syringe charged with tuberculin was inserted obliquely into the deeper layers of the skin. The dose of tuberculin injected was 2000 International Units (IU) or 0.1 ml of bovine and avian tuberculin on two different sites on one animal. The distance between the two injections was approximately 12 cm apart. Correct injection was checked by palpating a pea like small nodule on the injection site. The skin-fold thickness of each injection site was remeasured. To avoid errors, the same person who measured the skin before injection measured
72 hours after injection. The result was interpreted as Negative <2mm, >2mm and <4mm as doubtful and >4mm as positive [12].

3. RESULT
In Debre Tabor town, individual animal level prevalence in small holder dairy farms was 10.4% that is 11/106 individuals were positive and have lower prevalence than that of medium scale dairy farms which has 25/145 positive animals with 17.2% prevalence. The herd level prevalence in smallholder dairy farms, 7/25 was positive herds with prevalence of 28% and in medium scale dairy farms the herd prevalence was 54.5%, which have 6/11 positive dairy herds. The prevalence is higher than the smallholder dairy farms herd prevalence. See table 1 below.

Table1. Individual animal and herd level prevalence of BTB in Debre Tabor town.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total no. examined</th>
<th>No. (%) of positive</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Animal prevalence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herd size&lt;10</td>
<td>106</td>
<td>11</td>
<td>10.4%</td>
</tr>
<tr>
<td>Herd size&gt;10</td>
<td>145</td>
<td>25</td>
<td>17.2%</td>
</tr>
<tr>
<td><strong>Herd prevalence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herd size&lt;10</td>
<td>25</td>
<td>7</td>
<td>28%</td>
</tr>
<tr>
<td>Herd size&gt;10</td>
<td>11</td>
<td>6</td>
<td>54.5%</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1&lt;4</td>
<td>123</td>
<td>29</td>
<td>23.6%</td>
</tr>
<tr>
<td>&gt;4&lt;7</td>
<td>97</td>
<td>19</td>
<td>19.6%</td>
</tr>
<tr>
<td>&gt;7</td>
<td>31</td>
<td>9</td>
<td>29%</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Female</td>
<td>235</td>
<td>45</td>
<td>19.1%</td>
</tr>
<tr>
<td><strong>Breed</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross</td>
<td>241</td>
<td>39</td>
<td>16.2%</td>
</tr>
<tr>
<td>Local</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Body condition</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>117</td>
<td>25</td>
<td>21.4%</td>
</tr>
<tr>
<td>Fair</td>
<td>125</td>
<td>37</td>
<td>29.6%</td>
</tr>
<tr>
<td>Good</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>219</td>
<td>31</td>
<td>14.2%</td>
</tr>
<tr>
<td>Purchased</td>
<td>32</td>
<td>5</td>
<td>15.6%</td>
</tr>
</tbody>
</table>

4. DISCUSSION
The individual animal level prevalence in small holder dairy farms in Debre Tabor town was 10.4%. This finding was higher than the studies of Mohammed in Gondar town [12] reported a prevalence of 7.2%. Contrary to this it was lower compared to that of the medium scale dairy farms 14.5%. This might be justified by differences in herd size and possibly the breed composition and feeding/grazing practices. Higher individual animal bovine tuberculosis prevalence was reported in dairy herd size having >10 and those medium herds had an increased risk to be tested positive compared to the smaller ones [13, 14].

A herd prevalence of 28% in Debre Tabor town were reported in the current study. Mengistu and colleagues reported similar herd prevalence (28.6%) of bovine tuberculosis [15]. But the prevalence is higher than Marshet finding (10%), in Ambagiorgis [8]. The variation with the findings made from Ambagiorgis might be due to the herd composition, where much more crossed cattle involved in the current study. This could be strengthened by the findings of Debre Tabor town herd prevalence (Almost all
are crosses), which accounted higher compared to Gondar town. This breed difference in susceptibility is reasoned out by different research findings [2].

The present study showed that females are in higher risk than male cattle in the dairy farm. This is in disagreement with findings of Birr and Zeru [16, 13]. This might be attributed to the fact that male animals might be given less attention than females since the motto of the majority is to produce milk in the dairy farms.

At the herd level risk factor Semi intensive production system has protective factor than intensive production system this result support that BTB is a disease of intensification [2]. The dairy farm owners that have heard about BTB likely to better have BTB infection than the respondents who never heard about. But the variation might be due to the higher prevalence of crossbreeds in Debre Tabor town where the dairy farm owners are mostly aware about BTB.

Spatial distribution showed that bovine tuberculosis in Debre Tabor town has dispersed almost through the dairy herds in different kebeles. Dispersed occurrence of BTB has epidemiological importance in the transmission of the disease with the neighboring herds through different ways. The dispersion of BTB positive herds are confined mostly in two kebeles that are semi urban areas following the main road of Debre Tabor town. Spatially confined infected herds have low probability to transmit to BTB free dairy herds than the dispersed ones in Debre Tabor town.

Source of the animal, sex and breed were found to be individual animal level risk factor whereas, Feed type and the dairy farm owner familiarity to BTB found to be herd level risk factors. Debre Tabor town has higher dispersal of BTB infected herds in different kebeles. The zoonotic awareness among both Debre Tabor kebeles dairy farm owners has low awareness as well as they consume raw milk. Based on the above conclusion the following recommendations are indicated:

a. Crossbreds should have better management since they are more exposed to BTB infection.
b. In medium scale dairy farms appropriate stocking of herd size and hygiene should be followed.
c. In dairy farms male animals should have better management.
d. Dairy cattle feed is better to be stored appropriately to avoid contamination.
e. It is better to cull BTB infected animal with organized compensation plan as it has economical as well as epidemiological impact on the dairy production.
f. Introduction of new animal should be tested before mixing to the herd.

5. REFERENCES


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