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Research Article

Prevalence of bovine tuberculosis in dairy cattle and the associated risk factors in Oromia, Ethiopia

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Abstract

A cross-sectional study was conducted in February 2013 by using Comparative Intra-dermal Tuberculin Test (CIDT) in order to determine the prevalence bovine TB and the associated risk factors in Tiyo, Agarfa districts and in Shashemene town of Oromia National Regional State. The study subjects included were crossbred dairy animals, kept under intensive e management systems. A standard questionnaire formats was used to collect information relevant to the age, body condition and the herd size of the animals. Five hundred forty two dairy animals were included in the study. The individual prevalence of BTB was 4.24% and 20.66% at ≥4 mm and ≥2mm cut off value respectively. The herd level prevalence of was found to be 48.9% (95%, CI: 34%-63%). The questionnaires survey results of this study indicated that, more than 85.1% of the households were consuming raw milk, whereas 14.8% were consuming heat-treated milk. 74.4% of the respondents were aware, that the transmission of bovine TB through consumption of raw milk, milk products and raw meat. The present study revealed that the overall low prevalence of bovine TB in the study area. Education and raising awareness of the animal owners about the health risks of contacting with infected animals, consumption habits of raw meat, unpasteurized milk, and milk products are very imperative. Moreover, appropriate diagnosis of the disease and provision of useful information for use by public health and agricultural officials is important in the control practices of bovine tuberculosis. This approach is highly appreciated and is a key to tackling zoonotic tuberculosis for the future.

Introduction

Bovine Tuberculosis (BTB) was widespread in many European countries and is a public health concern in some developing countries [1]. It is a chronic bacterial disease of animals, wildlife and humans and is caused by *Mycobacterium bovis (M.bovis)*, which belongs to a group of mycobacteria known as *Mycobacterium tuberculosis complex (MTBC)* [2-4]. *M. bovis* has one of the broadest host ranges of all known pathogens and has been diagnosed worldwide [5].

Bovine tuberculosis is usually characterized by formation of nodular granulomas known as tubercles and they are most frequently observed in several tissues, even though they are frequently seen in lymph nodes at head and neck, lung, intestines, liver and pleural cavity. Extreme emaciation and acute respiratory distress may occur during the terminal stages of the disease [6]. The Rates of *M.bovis* infection is higher among closely confined animals than animals in extensive farming systems [7]. This disease is one of the seven most neglected endemic diseases in the world, particularly in developing countries [8] and is a significant zoonosis that can spread to humans through aerosols, by the consumption of unpasteurized milk and dairy products and through meat from infected cows [7,9]. Veterinarians, farmers, and abattoir workers were most considered at the risk of this disease. The disease induces high animal morbidity and mortality that eventually reduces the financial capital and increases production costs [10]. As an OIE List B disease, it is one of the significant diseases, which affect the international trade of animals and animal products between countries [11].

Bovine Tb is widespread in many countries. During 2015 to 2016, 179 countries and territories reported their status concerning bovine TB to OIE. Of these, more than half reported the presence of the disease in livestock and wildlife, demonstrating its wide geographical spread. In 2016, there were almost 1.7million deaths from tuberculosis and

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10.4million new infections overall, according to the WHO's 2017 Global tuberculosis report [12]. The zoonotic transmission of M. bovis is responsible for 10%-15% of new human TB cases in developing countries [12]. This disease has been eradicated in most parts of the developed countries, but remains prevalent in many parts of sub-Saharan African countries. The studies in Ethiopia suggested that this disease is endemic and its prevalence varies depending on the animal husbandry systems. The prevalence ranges from 3.5%-50% was reported by many authors [13-20]. To our knowledge, information on bovine TB among dairy herds in the study area is limited.

Therefore, the current study was designed to investigate the epidemiology of bovine TB and to assess the animal level and herd level risk factors of BTB.

Materials and methods

Study area

The study was conducted in Tiyo and Agarfa districts and Shashemene town of Oromia National Regional State respectively. The area is located between 0380 46.17 to 0390 52.153 E and 070 18.814 to 070 56.911 N. The altitude ranges from 2108-2406 meters above sea level. The minimum and maximum temperature and the related humidity ranges from 8.4°c-22.6°c and 43% to 60% respectively. The average rainfall is 1600-2000smm. The study dairy herds were managed under intensive management system and they were kept indoors.

Study design, study population and Sample size determination

A cross-sectional study was conducted in February 2013 by using Comparative Intra-dermal Tuberculin Test (CIDT) in order to determine the prevalence bovine TB. The tuberculin test is the internationally accepted standard for detection of infection with *M. bovis*. This test was conducted according to the procedures described by [21]. The study subjects included crossbred dairy animals. Caves younger than six months of age, late pregnant cows and clinically sick animals were not included in the study. The late pregnancy of each cow was determined from the information from the owners and farm records. The herd size of the animals was categorized in to small size (less than seven animals), medium size (8-15 animals), and large size (above 16 animals). The sample size was determined according to formula given by Thrusfield [22], for simple random sampling methods using an expected prevalence of 50% at 95% level of confidence and 5% desired precision. However, the sample size was increased to 542 in order to increase the precision.

Questionnaire survey

The semi-structured questionnaire was used to collect information the general status of the farm, the management system and the raw milk consumption of the respondents were registered. The questionnaire was pre-tested before implementation at the field level.

Data collection and analyses

A standard questionnaire format was used to collect information relevant to the age of the animals, their body condition and the size of the herd. The ages of the animals were determined based on dentition formula according to [23]. The stage of pregnancy was determined based on information from owners and farm records. The body condition scoring was done according to the established guidelines of [24]. The data were stored in Microsoft Excel spread sheet and analyzed by using STATA version 12 [25]. The Chi-square test (X2) was used to evaluate the association between the risk factors and the tuberculin positive reactivity. 95 percent confidence interval (CI) was calculated and its statistical significance was assumed, if the confidence interval did not include one among its values. In all the analyses comparisons having the (P<0.05) were considered as statistically significant.

Results

The individual level prevalence based on comparative intradermal tuberculin test were 4.24% and 20.66% at ≥4mm and ≥2mm cut off value respectively. The herd level prevalence was 48.9% (Table 1). The result of this study revealed that, there is no statistically significant association between the tuberculin test positivity and the assessed risk factors such as towns, age, herd size and body condition (Table 2).

Table 1: The individual animal and herd level prevalence of tuberculin reactors.

Variable	Negative	Positive	Prevalence at ≥4mm cut off	Prevalence at ≥2mm cut off
Individual animal	542	23	4.24%	-
Individual animal	453	118	-	20.66%
Herd	47	23	48.9%	-

Table 2: The risk factors and their associations with the prevalence of tuberculin intra-dermal test.

Variable	Catagories	No tested	Positive	Prevalence	X^2	*P*-value
Town	Tiyo	243	9	3.7%		
	Agarfa	88	1	1.1%	3.166	0.205
	Shashemene	211	13	6.16%		
Total	Female	542	23	4.24%		
Age (Years)	< 2	150	5	3.33%		
	2-5	365	17	4.65%	0.278	0.870
	>5	27	1	3.7%		
Herd size	<7	111	5	4.5%	0.155	0.925
	8-15	190	8	4.21%		
	>16	241	10	4.14%		
BCS	Thin	101	2	1.98%	1.517	0.468
	Medium	387	18	4.65%		
	Good	54	3	5.5%		

Discussions

The study result revealed that the CIDT prevalence of 4.02% and 20.66% at ≥4mm and ≥2mm cut off value at individual animal level respectively and the herd level CIDT prevalence

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was 48.9% . This result is higher than the prevalence of 1% at the cutoff off value ≥4mm and 4.02% at the cut off value ≥2 in Ambo and Toke districts in Ethiopia [26]. The higher prevalence of tuberculin test positivity of 13.9% and 15.8% was also reported in Tigray and Arsi respectively [27,18].

In the present study, the highest prevalence was recorded in Shashemene town, which is 6.16% when compared to Tiyo 3.7% and Agarfa 1.1% districts. The highest prevalence of tuberculin positive reactivity was 4.65% in age group between 2-5 years as compared to the younger and older age group. The prevalence of small and medium herd size is similar, which is 4.25% and 4.21%, as compared to the large herd size, which is 4.14%. The animals with good body condition score have the highest prevalence 5.5% of tuberculin positive reactivity (Table 2).

The current study revealed the herd level CIDT prevalence was 48.9%. The result of the current study revealed that, there is no statistically significant associations between the tuberculin test positivity and the assessed risk factors such as towns, age, herd size and body condition (P>0.05).

The questionnaires result of this study indicated that, more than 85.1% of the households consumed raw milk, while 14.8% were consumed heat- treated milk. 74.4% of the respondents were aware that the bovine TB could be transmitted through consumption of raw milk, milk products and raw meat. The public health importance of *M. bovis* infection was reported mainly by consumption of infected milks [28-32]. Bovine Tuberculosis (BTB) is a public health concern in some developing countries and results in trade barriers, as well as posing a risk to food safety and human health [12].

Conclusions

The present study revealed overall low prevalence of bovine TB in the study area. In detail, information on molecular characteristics of M. bovis, strain affecting the cattle population in Ethiopia, is limited. Thus, it is suggested that, the isolation, identification and molecular diagnosis of different strains of M. bovis need to be further investigated in the study area in a way of multidisciplinary approach. Education and raising awareness of the animal owners about the health risks of contacting with infected animals, consumption habits of raw meat, unpasteurized milk, and milk products is very imperative.

Moreover, appropriate diagnosis of the disease and provision of useful information for use by public health and agricultural officials is important in the control practices of bovine tuberculosis. This approach is highly appreciated and is a key to tackling zoonotic tuberculosis for the future.

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