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Prevalence of Bovine Tuberculosis in Kombolcha Industrial Abattoir

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Abstract: A cross sectional study on bovine tuberculosis (BTB) was conducted to determine its prevalence in cattle in Kombolcha industrial abattoir in the period from September, 2018 to January 2019. Routine and detailed meat inspection methods were used to detect lesions. A total of 720 cattle were inspected; their body condition scores and ages were recorded before slaughtering. Of the total animals, 5.83% (42/720) had lesions of tuberculosis. Out of these, routine abattoir inspection detected only 0.28% (2/720) with visible lesions and there was poor agreement (kappa=0.09) between routine and detailed inspection methods. The proportion of lesions found in the lung and associated lymph nodes, head, mesenteric and hepatic lymph nodes were 69.78, 18.75, 9.38 and 2.08%, respectively. The prevalence of the disease was significantly ($P < 0.05$) varying with body condition scores but it didn't significantly ($P > 0.05$) vary with age groups of the animals. This study demonstrated the prevalence of BTB in cattle slaughtered in Kombolcha industrial abattoir and low sensitivity of routine abattoir inspection. So the carcass must be examined well to reduce the chance of messing lesions of tuberculosis.
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INTRODUCTION

Bovine tuberculosis (BTB) is a chronic infectious disease of animals characterised by the formation of granulomas in tissues and organs, more significantly in the lungs, lymph nodes, intestine and kidney including others. BTB is caused by slowly growing non-photochromogenic bacilli members of the Mycobacterium tuberculosis complex: M.bovis and M. caprae species. However, M.bovis is the most universal pathogen among mycobacteria and affects many vertebrate animals of all age groups including humans although, cattle, goats and pigs are found to be most susceptible, while sheep and horses are showing a high natural resistance (23). BTB has been significantly widely distributed throughout the world and it has been a cause for great economic loss in animal production. zoonotic BTB is present in most developing countries where surveillance and control activities are often inadequate or unavailable bovine tuberculosis (TB) is a disease characterised by the progressive development of specific granulomatous lesions or tubercles in the lung tissues, lymph nodes or other organs and the disease caused by Mycobacterium bovis (27). M bovis the causative agent of bovine TB, is a member of the Mycobacterium tuberculosis complex (MTBC), a group that includes M.tuberculosis, M.bovis, Mycobacterium africanum, Mycobacterium canetti Mycobacterium pinnipedi, Mycobacterium caprae and Mycobacterium microti (25). These species cause similar pathologies in various mammalian hosts. M.tuberculosis is specifically adapted to human beings, although it is occasionally isolated from other mammals. Similarly, M.bovis is most frequently isolated from cattle, but it has also been isolated from other bovids and other mammals (25).

MATERIALS AND METHODS

Study area

The study was conducted from September 2018 to January 2019 in Kombolcha Industrial abattoirs. Kombolcha is located in North Eastern part of Ethiopia, at 11o4' 37"N and 39 o44'42"E at a distance of about 375km from Addis Ababa. The area has an altitude range of 1500-1840 meter above sea level. The region is marked by numerous mountains, hilly, and sloppy areas, plateaus, rivers, and streams with three topographic categories 14% high altitude-Dega, 34% mid high land weina-dega, and 52% of low altitude-kola. The vegetation in the area changes with the altitude ranging from scattered trees and bushes to dense shrubs and bushes. The soil is mainly verity soil, which is deep clay

soil. The area experiences a bimodal rainfall with a minimum annual rain fall of 750-950 mm and a relative humidity from 23.9-79%. The average monthly-recorded minimum and maximum temperature is 11.7o and 23.9o respectively (26). Livestock population of the area comprises 100,386 cattle, 12,975 sheep, 31,041 goats, 2,540 horses, 634 mules, 7758 donkeys, 1,865 camels, 119,347 poultry (26).

Study Animals:

The study subjects were local breed cattle. The origins of these animals were from local market and local place like Ancharo, Gedera, Chefew, Thomas, and Tebissa kebeles. Some animals are from distance market like Bati. A total of 720 local breed animals (Bos indicus) were randomly selected and examined.

Study Design:

A cross-sectional study was conducted to determine the prevalence of BTB. The efficiency of routine abattoir meat inspection to diagnose TB lesions was also evaluated. A systematic random sampling procedure was used to choose animals in the study. In general, 720 cattle and their carcasses were carefully examined.

Ante-Mortem Inspection:

Those cattle selected for the study were examined physically before slaughtering; age and body condition score (BCS) were recorded. The body condition of each of the study animals were scored using guideline established by Nicholson and lymph nodes were the presence of circumscribed Butterworth (1986) during ante-mortem examination. In the mean time, the age of the study animals were also determined according to De-Lahunta and Habel [12]. The age was categorised as young less than 2 years old, young adult between two to six years old and adult greater than six years old [13]. All animals slaughtered during the study period were greater than two years old so they were categorized as young adult and adult.

Postmortem examination

Postmortem examination was performed following the procedure described by Corner (1994). Mandibular, retropharyngeal, left and right bronchial, cranial and caudal mediastinal, and mesenteric lymph nodes, and organs including the lungs, liver and kidneys, were subjected to a detailed postmortem examination. The seven lobes of the two lungs were inspected externally and then palpated. Each lobe was then sectioned into approximately 2 cm thick slices to facilitate the detection of lesions. Similarly, lymph nodes were sliced into sections of a similar thickness and inspected for the presence of visible lesions.

Routine Abattoir Inspection:

Routine inspection for tuberculosis at the abattoir was conducted according to the method developed by the meat inspector and the quarantine division of the Ministry of Agriculture,
Ethiopia [14, 15]. The method involves palpation and incision of the bronchial, mediastinal and prescapular lymph nodes, as well as visual inspection and incision of the lungs, liver, kidneys, udder and lymph nodes around these organs.

Detailed Post-Mortem Examination:

Detailed post-mortem examination was performed in such a way that the lungs and lymph nodes were removed for the investigation of tuberculous lesions, the seven lobes of the two lungs, including the left apical, left cardiac, left diaphragmatic, right apical, right cardiac, right diaphragmatic, and right accessory lobes, were inspected externally and palpated, each lobe was then sectioned into about two centimeter thick slices to facilitate the detection of lesions. Similarly, lymph nodes, namely, the mandibular, medial retro pharyngeal cranial and caudal mediastinal, left and right bronchial, hepatic and mesenteric lymph nodes, were sliced into thin sections (23 millimetre thick) and inspected for the presence of lesions [9, 16].

Data Analysis:

The raw data was fed into Microsoft Excel and the prevalence of bovine tuberculosis was calculated in percentage. The variation between different factors was assessed by using Chi-square (X) and all statistical analyses were conducted by SPSS statistical software routine abattoir meat inspection to diagnose TB version 17 [17]. A p-value less than 0.05 were considered to be statistically significant.

RESULTS

Prevalence of the disease; The overall prevalence of bovine tuberculosis in cattle slaughtered in Kombolcha Industrial abattoir during the study period was 5.83% (42/720) based on detailed post-mortem examination. Macroscopically, the most common changes seen in the affected organs and/or lymph nodes were the presence of circumscribed yellowish white lesions of various sizes and numbers. However, only 0.27% (2/720) head of cattle were found to have detectable tuberculous lesions by the routine abattoir inspection (Table 1). Thus, the proportion of lesion detected by detailed

examination to that of routine abattoir inspection procedure was in the ratio of 21:1. The results of this study indicated that the probability of missing an animal with tuberculosis during.

Table 1: Comparison of the results of routine and detailed meat inspection

	Detailed meat Inspection		
Routine meat Inspections	Positive	Negative	Total
Positive	20	0	2
Negative	40	678	718
Total	42	678	720

Sensitivity = 0.04 Kappa = 0.09

Table 2: Distribution of TB lesions in organs of cattle slaughtered

Organ	Number	Percent
Lung	28	3.89
Bronchial lymph node	14	1.94
Mediastinal lymph node	25	3.47
Retropharyngeal lymph node	12	1.67
Mandibular lymph node	6	0.83
Mesenteric lymph node	9	1.25
Liver and hepatic lymph nod	2	0.28
Total	96	

Table 3: Pooled TB lesions distribution

Anatomic site	lesion	Percent from all*	Organ proportion**
Lymph nodes around Head	18	2.5	18.75
Lung and lymph nodes around it	67	9.31	69.79
Mesenteric lymph nodes	9	1.25	9.38
Liver and hepatic lymph nodes	2	0.28	2.08
Total	96		

*Percent from all=lesion divided by/number of animal examined (720) multiplied by 100
**Organ proportion=lesion in the region divided by overall lesions (96) multiplied by 100

Table 4 Bovine tuberculosis with respect to age and body condition score

Variables	No of animals examined	Positive	%	X^2cal	P-Value
Age					
Young	308	18	5.84	0.00	0.99
adult	412	24	5.82		
BCS					
Good	560	8	1.42	89.01	0.00
Medium	160	34	21.25		

BCS= body condition score; % = percent, X = Chi square

routine abattoir inspection was 95.24%. Thus, a poor agreement (Kappa =0.09) was recorded between these two procedures.

Distribution of Tuberculous Lesions:

The distribution of tuberculous lesions in different tissues of cattle was presented in Table 2. Seven organs and/or lymph nodes were containing tuberculous lesions. About 69.79% of the lesions were observed in the lung and associated lymph nodes. The lung region contributes a higher percentage of tubercle lesions than the head and the gastrointestinal area (Table 3). The prevalence of tuberculosis in Kombolcha Industrial abattoir slaughter cattle in relation with age and body condition score was presented in Table 4. There was no statistically significant ($P > 0.05$) difference between age groups. However, there was a variation in occurrence of tuberculous lesions across body condition scores (medium and good), with considerable higher prevalence recorded in medium scored cattle.

DISCUSSION

This study has documented the prevalence and distribution of lesions of BTB in cattle slaughtered in Kombolcha Industrial abattoir. The findings of overall prevalence of 5.83% tuberculosis reported in detailed post-mortem examination and 0.27% in routine abattoir inspection are in agreement with the results reported by Demelash et al. [16] and Teklu et al. [9] in Yabello municipal abattoir 4.2% and Hosanna 4.5%, respectively. On the other hand, the present results are less than those of previous reports from Butajira municipality abattoir
11.50% [18], Addis Ababa and Adama 10.10% [16], Adama municipal abattoir 24.70% [20] and 19.8% record from cattle slaughter in rural Tanzania [19]. This could indicate the endemicity of the disease and high infection rate prevailing in the general population of slaughter cattle in Ethiopia. This study revealed that the probability of missing an animal with TB lesion during routine abattoir inspection is 95.24%. Previous studies have also indicated probability of 84.85% [20], 84% [21] and 70.59% [9]. Therefore, detailed post-mortem examination can be considered as a better procedure to detect tuberculous lesion. This study also revealed a much low sensitivity (0.04%) of routine meat inspection to detect carcasses with tuberculous lesion, implying that large proportion (95.24%) of tuberculosis infected carcasses pass undetected and the meat is approved for human consumption. The most probable explanation for the failure of standard meat inspection to correctly detect tuberculosis infection could be the manner of examination [21]. It was noticed that in standard meat inspection procedure only few sites (organs) are often inspected at a glance due to heavy duty of inspecting large number of animals each day. Corner [21] argued that in abattoir smaller lesion could be missed due to limited time available for the examination of each tissue. Furthermore a lack of competence in meat inspection training could be another reason for inefficiency of the service as most of the personnel lack adequate training in the area of meat inspection.
In the present study, gross tuberculosis lesions were found most frequently in the lymph nodes of lung and lung (69.79%), lymph nodes of the head (18.75%) followed by mesenteric lymph node (9.38%) and hepatic lymph node (2.08%). This finding is consistent with previous studies done by Firdissa [22], Abdurohama [18] and Tefera [20] who reported 67.7, 70 and 70.7% tuberculosis lesions in lungs and associated lymph nodes, respectively. However, Corner [21] has reported that up to 95% of cattle with visible TB lesions could be identified by examination of the lung and associated lymph nodes. This finding indicated that inhalation might be the principal route of TB infection in cattle. Therefore, during post-mortem examination, focus should be given on lungs and associated lymph nodes. The presence of lesions in mesenteric lymph nodes indicated that the infection occurs through ingestion [23].
The prevalence of the diseases was statistically insignificant in age categories which agree with previous reports [9, 24]. This might be due to type of animals slaughtered in the abattoir in which both were greater than two years of age which is enough to develop the lesions once infected. On the other hand, there was a statistically significant difference ($P < 0.05$) in the prevalence of the disease between body condition scores (BCS), the prevalence being higher in medium (21.25%) than good (1.42%) body conditioned animals. The present result is consistent with previous reports which indicated that animals with good BCS have relatively strong immunological response to the infectious agent than animals with medium BCS and the result could also indicate the wasting nature of the disease [23].

In conclusion, BTB is prevalent in cattle slaughtered in Kombolcha industrial abattoir in which lesions were better detected using detailed meat inspection. This should be practiced giving more attention to the lungs and associated lymph nodes. Further studies are needed to characterize the organism by culturing and molecular techniques.

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