

## Bovine Tuberculosis Prevalence in Slaughtered Cattle at Akaki Municipal Abattoir, Based on Meat Inspection Methods

<sup>1</sup>Lackech Ewnetu, <sup>1</sup>Achene Melaku and <sup>1,2</sup>Ayalew Birhanu

<sup>1</sup>Basic veterinary science Unit, Faculty of Veterinary Medicine,  
University of Gondar, P.O. Box 196, Gondar, Ethiopia  
<sup>2</sup>Veterinary Paraclinical Studies Unit, Faculty of Veterinary Medicine,  
University of Gondar, P.O. Box 196, Gondar, Ethiopia

**Abstract:** A cross sectional study on bovine tuberculosis (BTB) was conducted to determine its prevalence in cattle at Akaki municipal abattoir in the period from October 2010 to March 2011. 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 at Akaki municipal abattoir and low sensitivity of routine abattoir inspection. So the carcass must be examined well to reduce the chance of missing lesions of tuberculosis.

**Key words:** Akaki · Bovine Tuberculosis · Detail Meat Inspection · Prevalence · Routine Meat Inspection

### INTRODUCTION

Tuberculosis is a chronic granulomatous disease caused by *Mycobacterium* that has been a major health risk to man and animals for more than a century. It is widely distributed throughout the world affecting all age groups. In human, it is being responsible for more deaths than any other bacterial disease ever today [1]. Bovine tuberculosis (BTB) is characterized by the formation of nodules called tubercles whose location depends largely on the route of infection. In calves, it is usually transmitted by ingestion and lesions involve the mesenteric lymph nodes with possible spread to other organs. In older cattle, infection is usually transmitted by the respiratory tract with lesions in the lung and dependent lymph nodes [2].

Recently, there have been increasing reports of human cases due to *M. bovis* especially in patients with HIV [3]. Thus, a greater degree of transmission of infection with bacteria to human being and domestic farm animals could occur [4]. In industrialized countries, animal tuberculosis control and elimination program, together with milk pasteurization, have drastically reduce the incidence of the disease caused by *M. bovis* in both cattle and human. In developing countries however, animal tuberculosis is widely distributed, control measures are not applied or are applied sporadically and pasteurization is rarely practiced.

In Ethiopia, animals are kept in the same dwelling with their owners and use of cow dung for plastering wall, floor and as a source of energy for cooking, do exacerbate chance of spread of tuberculosis to human [5]. Thus, BTB is endemic and has been reported from different regions

of the country [6-9]. The disease in the country is associated with decreased productive efficiency and carcass or organ condemnation in abattoir [10]. The nationwide distribution of the disease and the economic loss associated with it has not been fully determined due to lack of good diagnostic facilities [6]. Hence, having the knowledge of distribution, prevalence and risk factors of the disease are fundamental so as to look for effective control strategy. Therefore, the objectives of this study were to determine the prevalence of bovine tuberculosis at Akaki municipal abattoir, Addis Ababa and to evaluate the efficiency of abattoir inspection for the diagnosis of *M. bovis* infection as well as to assess the distribution of tuberculous lesion in slaughtered animals.

## MATERIALS AND METHODS

**Study Area:** The study was conducted from October 2010 to March 2011 in Akaki municipal abattoir, Addis Ababa.

**Study Animals:** Animals used for the study were those which were ready to be slaughtered at Akaki municipal abattoir, came from surrounding areas and all of them were local breed (*Bos indicus*) and male. Most of the cattle were kept in fattening for variable period of time, so their body condition was almost medium or good [11].

**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 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 was scored using guideline established by Nicholson and 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.

**Routine Abattoir Inspection:** Routine inspection for tuberculosis at the abattoir was conducted according to the method developed by the meat inspector and 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 centimetre thick slices to facilitate the detection of lesions. Similarly, lymph nodes, namely, the mandibular, medial retropharyngeal, 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 ( $X^2_{cal}$ ) and all statistical analyses were conducted by SPSS statistical software version 17 [17]. A *p-value* less than 0.05 was considered to be statistically significant.

## RESULTS

**Prevalence of the Disease:** The overall prevalence of BTB in cattle slaughtered at Akaki municipal 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

Routine meat Inspection	Detailed Meat Inspection		Total
	Positive	Negative	
Positive	2	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	Postmortem	
	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 node	2	0.28
Total	96	

Table 3: Pooled TB lesions distribution

Anatomic site	Lesion	Percent from all*	Organ proportion**
Lymph nodes around Head	18	2.50	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: Prevalence of bovine tuberculosis with respect to age and body condition score

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

BCS= body condition score; % = percent, X<sup>2</sup><sub>cal</sub>= 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 Akaki municipality 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 at Akaki municipal 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], Abdurhama [18] and Tefera [20] who reported 67.7, 70 and 70.7% TB 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 Akaki municipal 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.

## REFERENCES

1. Bhatia, R. and R. Ichpujanti, 1994. Mycobacterium. In: Essentials of medical Microbiology, 1<sup>st</sup> ed., New -Delhi, pp: 285-292.
2. Carter, G.R. and D.J. Wise, 2004. Essentials of Veterinary Bacteriology and Mycology, 6<sup>th</sup> ed. Iowa State Press, A Blackwell Publishing Company, pp: 207-213.
3. Rusell, D.J., 2003. Highlighting the parallels between human and bovine tuberculosis. Journal of veterinary Medicine Education, 30: 140-142.
4. Taracha, E.L., R. Bishop, A.J. Musoke, A.V.S. Hill and S.C. Gilbert, 2003. Hetrologous priming boosting immunization of cattle with mycobacterium tuberculosis 85aindces antigen specificis T-cell response. Infection and Immunity, 71: 6906-6914.
5. Asseged, B., 1999. Bovine tuberculosis a cross-sectional and epidemiological study in and around Addis Ababa, MSc thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
6. Asseged, B., A. Lubke-Beeker, E. Lemma, K. Tadele and S. Britton, 2000. Bovine TB: A cross-sectional and epidemiological study in and around Addis Ababa. Bultentin of Animal Health and production in Africa, 67: 71-80.
7. Regassa, F., 2001. Herd prevalence of Contagious Bovine Pleuropneumonia, Bovine TB and Dictyocoulrosis in Boji woreda, west Wollega, Ethiopia. Faculty of Veterinary Medicine, Addis Ababa University, DVM thesis. Debre-Zeit. Ethiopian.
8. Asseged, B., Z. Woldesenbet, E. Yimer 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.
9. Teklu, A., B. Asseged, E. Yimer, M. Gebeyehu and Z. Woldesenbet, 2004. Tuberculous lesions not detected by routine abattoir inspection: the experience of the Hossana municipal abattoir, Southern Ethiopia. Revue Scientifique et Technique OIE, 23: 957-964.
10. Shitaye, J.E., B.G etahun, T. Alemayehu, M. Skoric, F. Tremel, P. Fictum, V. Vrbas and I. Pavlik, 2006. A prevalence study of bovine tuberculosis by using abattoir meat inspection and tuberculin skin testing data histopathological and IS6110 PCR examination of tissues with tuberculous lesions in cattle in Ethiopia. Veterinarni Medicina, 51: 512-522.
11. Nicholson, M.J. and M.H. Butterworth, 1986. A guide to condition scoring of zebu cattle. ILRI/FAO, Addis Ababa, Ethiopia.

12. De-Lahunta, A. and R.E. Habel, 1986. Teeth. Applied veterinary Anatomy. USA. W. B. Saunders Company, pp: 4-16.
13. Pace, J.E. and D.L. Wakeman, 2003. Determining the age of cattle by their teeth. Animal science Department, Institute of Food and Agricultural Sciences, University of Florida USA.
14. MOA, 1973. Ministry of Agriculture, Meat Inspection Regulation. Legal Notice Number 428 Nega Vit Gozete. Addis Ababa, Ethiopia.
15. Solomon, H., 1975. A brief analysis of the activities of the Meat Inspection and Quarantine Division. Ministry of Agriculture, Addis Ababa, pp: 57.
16. Demelash, B., F. Inangolet, I. Oloya, B. Asseged, M. Badaso, A. Yilakal and E. Skjerue, 2009. Prevalence of bovine tuberculosis in Ethiopia slaughter cattle based on post-mortem examination. Tropical Animal Health and Production, 41: 755-765.
17. SPSS, 2007. Statistical Package for the Social Sciences (SPSS) 17.0 User's Guide. USA: SPSS Inc.
18. Abdurohman, M., 2009. Cross-sectional study of bovine tuberculosis in Butajira municipal abattoir. DVM Thesis, University of Gonder, Faculty of veterinary medicine, Gondar, Ethiopia.
19. Cleaveland, S., D.J. Shaw, S.G. Mfinanga, G. Shirima, R.R. Kazwala, E. Eblate and M. Sharpe, 2007. Mycobacterium bovis in rural Tanzania: risk factor for infection in cattle and human populations. Tuberculosis, 87: 30-43.
20. Tefera, D., 2009. A cross-sectional study of bovine tuberculosis in Adama municipal abattoir. Central Ethiopia, DVM Thesis, Gondar University, Faculty of veterinary medicine, Gondar, Ethiopia.
21. Corner, L.A., 1994. Post-mortem diagnosis of M. bovis infection in cattle. Veterinary Microbiology, 1(40): 53-63.
22. Firdissa, R., 2006. Preliminary study on bovine tuberculosis in and around Sululta town, North shoa zone of Oromia, Ethiopia. DVM thesis. Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
23. Radostits, O.M., C.C. Gay, W.H. Kenneth and P.D. Constable, 2007. Veterinary Medicine. A textbook of the disease of cattle, horses, sheep, pigs and goats. 10<sup>th</sup> ed., Londen, Ballier Tindals, pp: 1007-1021.
24. Bekele, B. and I. Belay, 2011. Evaluation of Routine Meat Inspection Procedure to Detect Bovine Tuberculosis Suggestive Lesions in Jimma Municipal Abattoir, South West Ethiopia. Global Veterinaria, 6: 172-179.