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Caseous lymphadenitis in goats from Borena Range Land South Ethiopia slaughtered at Luna Export Abattoir

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A study was conducted on 400 goats in Luna Export Abattoir originated from district area of Borena Range land (that is Yabello and Negella) from November, 2008 to April, 2009 to estimate the prevalence of caseous lymphadenitis (CLA) in goats. Detail post mortem examination and bacteriology were applied to undertake this study. On the bases of post mortem and bacteriological results, the prevalence of caseous lymphadenitis was 15% (60/400), out of which 42 (70%), 13 (21.7%) and 5 (8.3%) were cutaneous form, visceral form and generalized form, respectively. There is statistical significance difference (P < 0.05) among the three age groups. The study revealed that as age increases the prevalence also increases. Statistical significant difference was also recorded between goats having poor and good body condition score (P < 0.05). Moreover, goats with poor body condition score seem to be more infected (24.7%) than those goats with good body condition (12.5%). In conclusion, this study has indicated the occurrence of CLA in high frequency in goats of Borena range land. Therefore, further extensive research should be conducted over all the country to determine prevalence and economic significance of the disease.

Key words: Goats, Borena range land, Luna Export Abattoir, caseous lymphadenitis, post mortem examination, bacteriology, prevalence.

INTRODUCTION

Caseous lymphadenitis (CLA) is a chronic, recurring and highly contagious bacterial infection caused by *Corynbacterium pseudotuberculosis* which can manifest itself as cutaneous or visceral disease of sheep and goat. *Corynbacterium pseudotuberculosis* (*C. pseudotuberculosis*) produces an exotoxin, phosphlipase D, which is leukotoxic and damages endothelial cells, propagating the spread of the organisms from the site of infection to the regional lymph nodes and visceral organs/ structures. The cell wall of the bacterium is characterized by a high lipid content helping it to resist destruction by phagocytes and allowing for continued chronic infection (Nicastro, 2004).CLA is an endemic infection in regions with large sheep and goats' population (East, 1998). CLA also cause suppurativeorchitis in rams and sporadic disease in horses and cows (ulcerative lymphangitis), water buffalo, wild ruminants, primates, pigs and fowl (Merck, 1997).

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In majority of infected animals, there was no overt clinical disease or impairment of health other than visible abscessation but the disease is of considerable economic importance to sheep and goat industries (Radostits et al., 1994). Economic losses result from reduced weight gain, reproductive efficiency and wool and milk production, as well as from condemnation of carcass and devaluation of hides/skins and also from culling of infected animals (Merck, 2005). The bacterium is spread when the infected lymph nodes of a diseased animal rupture and drain, infecting naive animals that come in contact with the purulent infectious exudates. The draining exudates or pus, containing bacteria, enter through superficial skin cuts, abrasions or via mucus membranes (ingestion). Shearing, castration, docking, head butting and licking of another animal's draining abscess increase the chance of infection (Nicastro, 2004). Environmental contamination happens when the draining lymph nodes contaminate the hay, straw, shavings and/or soil. The bacteria can survive over 24 h in dips and for months in moist dark conditions, such as a shearing shed (Augustine and Renshaw, 1986).

Shearing is a risk factor for the disease in sheep as it creates skin wound but in goats, shearing is not a risk factor, other than with Angeras. The difference in abscess distribution in goats compared to sheep, with a predominance in the head, neck and sternum in goats, suggests that fomites and trauma form browse and use of common neck collars are probable risk factors (Radostits et al., 1994).

Diagnosis is based mainly on clinical signs for cutaneous form (that is, enlarged lymph nodes). Confirmation of diagnosis is through aspirates of enlarged nodes with cytology, gram stain and culture. Culture is definitive when supported by biochemical characterization of bacteria (Lloyd, 1998). Radiographs and Ultrasound may also be useful demonstrating abscesses within organ and internal lymph nodes. Internal abscess are often recognized during postmortem or slaughter (Matthews, 1999) and can be a cause of carcass condemnation (Lloyd, 1998). Serology is available for CLA. The enzyme linked immunosorbent assay (ELISA) test followed with an immunoblot analysis which is considered more sensitive and specific in goats (Laak et al., 1992).

Treatment for CLA is not curative. Once an abscess has drained, it will tend to recur. *C. pseudotuberculosis* is susceptible to penicillin; however, these antibiotics cannot penetrate the wall of abscesses. The best way to control this infection in a flock is not to treat individuals but to cull those showing clinical signs with confirmed diagnosis (East, 1998). Decreasing transmission of disease from infected to susceptible animals on farm and working to eliminate the disease from the environment are the two main goals in preventive control program. CLA is not only economically important disease but has also zoonotic importance. The disease in human is rare but well documented and it causes a suppurative glaucomatous lymphadenitis (Nicastro, 2004).

As the environment and management system in which the animal is kept plays an enormous role in the occurrence and severity of CLA infection (Radostits et al., 1994), goats in Borena area are reared largely in the hand of nomadic pastoralists where the management system is traditional (Tamrat and Asfaw, 2003). The disease is highly contagious and the causative agent can survive in feces, straw, hay and wood for several weeks (Radostits et al., 1994). On the other hand, the common behavior habit amongst goats of frequent licking, as well as of rubbing their heads and necks against fence posts and sheds, allows the rapid spread of CLA.

Recent epidemiological surveys have examined the prevalence of CLA in different countries (Al-Rawashdeh and al-Qudah, 2000; Ben et al., 2002; Connor et al., 2000). Among flocks surveyed in Australia, the average prevalence of CLA in adult sheep was 26% (Paton et al., 2003). Forty-five percent of the farmers interviewed in a study in the United Kingdom had seen abscesses in their sheep; however, this could be an overestimation of CLA prevalence since few farmers had investigated the causes of the abscesses (Binns et al., 2002). Twenty-one percent of 485 culled sheep examined in Canadian slaughterhouses had CLA (Arsenault et al., 2003). This disease remains an important subject of veterinary concern throughout the world. But, there was no study conducted on the prevalence of the disease in goats in Ethiopia. Hence, for an effective goat disease control program, it is pertinent to have a record of common diseases prevalent in an area. Slaughter houses provide excellent opportunities for detecting diseases of both economic and public health importance. Accordingly, the study was designed to determine the prevalence and occurrence of CLA in Borena goats in Luna export abattoir thereby determining lesion distribution and to generate base line data for future studies in Ethiopian goat population.

MATERIALS AND METHODS

Study area and abattoir

The study was conducted in goats slaughtered at Luna Export Abattoir. The abattoir is found at Modjo town, Lume district, East Shoa Zone of Oromia Regional State, Central Ethiopia at a distance of 70 km South East of Addis Ababa. The origin of goats slaughtered at the abattoir was from Borena pastoral area/range land in Borena zone of Oromia Regional State, South Ethiopia. Borena is found in the southern part of the country at about 570 km from Addis Ababa.

Study animals and study population

Goats originated from different districts of Borena area were sampled at Luna Export slaughter house. As there is no previous study on CLA in Ethiopia, expected prevalence (50%), precision (5%) and confidence level (95%) was used to calculate the sample size so as to determine the prevalence of the disease in the study area and the formula described by Thrusfield (2005) was used. Although, the required sample size was 384, by adding a few more

Table 1. Distribution of CLA lesions in different tissue of slaughtered goats.

Anatomical site	Number of CLA lesions	Percentage (%)
Parotid lymph nodes	20	23.2
Submandicbular lymph nodes	7	8.2
Retropharyngeal lymph nodes	7	8.2
Prescapular lymph nodes	12	13.9
Prefemoral lymph nodes	8	9.3
Inguinal lymph nodes	2	2.3
Popliteal lymph nodes	1	1.2
Lung	8	9.3
Bronchial lymph nodes	4	4.6
Mediastenal lymph nodes	7	8.2
Sternal area (Carcass)	2	2.3
Liver	1	1.2
Hepatic lymph nodes	3	3.5
Mesentric lymph nodes	4	4.6
Total	86	100

animals, a total of 400 goats were examined to increase precision.

Study design

Abattoir inspection

A cross sectional study was conducted in goats admitted to Luna Export Abattoir from Borena pastoral area. Goats were selected randomly and selected goat was first identified (given identification) using tag body condition, age and at the same time ante mortem examination was carried out. Immediately after the animal was killed, detail post mortem inspection of every organ, carcass and lymph nodes was carried out by visualization, palpation and incision.

Sample collection

Pus, several milliliters by scraping from the wall of abscess was collected aseptically using screw caps that are clearly marked with the tissue enclosed, with animal identification and the date of collection, and refrigerated at 4°C until transported to Alklilu Lemma Institute of Pathobiology. Sample collection was carried out according to the techniques recommended by Quinn et al. (2004).

Bacteriological examination

Pus from 60 infected goats was processed for laboratory isolation of the causative agent (*C. pseudotuberculosis*) and the result interpreted in accordance with Quinn et al. (2004). The pus was subjected to culture on blood agar. The cultures were then incubated at 37°C for 24 to 48 h. The colonies were differentiated based on their shape, size, color and presence of hemolysis. Pure culture was then made from these colonies using gram stain CAMP test and biochemical test (catalase test and sugar fermentation (O-F test)), the isolated bacteria were finally identified.

Data analysis

Data entry was made in Microsoft Excel Spreadsheet. Descriptive statistics was used to summarize the generated data on the prevalence. The effect of age on the occurrence of diseases was assessed by chi-square (x^2) test. A confidence level of 95% and $P < 0.05$ was set to interpret the statistical association.

RESULTS

Post mortem findings

In this study, a total of 400 goats were examined out of which, 60 (15%) suspicious CLA lesions were detected at post mortem examination. Of these, 42 (70%), 13 (21.7%) and 5 (8%) had cutaneous, visceral and generalized forms of the diseases, respectively. Macroscopically, the most common lesions seen in the affected lymph nodes and to lesser extent in internal organs were caseous abscess filled with greenish yellow pus. When palpated they were soft and pasty but in some findings, the pus was firm and dry on cross sectional cutting. The pus has a characteristic of laminates or “onion ring” appearance. The range and frequency of anatomical sites affected with CLA (cheesy gland lesion) is displayed in Table 1.

Overall, superficial lymph nodes were affected more frequently than visceral ones. Parotid lymph node was most affected followed by pre scapular lymph nodes. From a total of 400 goats examined, 15% (n = 60) were found to have CLA. The prevalence was 12.2% in Yabello and 17.8% in Negele districts. But there was no statistically significant difference in occurrence of CLA between the two study districts. Similarly no statistical significant difference was observed among different forms of the disease between the study areas. Table 2 presents the results of postmortem finding in goats from the two study areas.

Statistical significant difference was recorded among

Table 2. Prevalence of CLA in Goats from Yabello and Negelle districts.

Site	Number of animal inspected	Positive (%)	Cutaneous form (%)	Visceral form (%)	Generalized form (%)
Yabello	198	24 (12.2)	18 (9)	4 (2)	2 (1)
Negelle	202	36 (17.8)	24 (11.9)	9 (4.5)	3 (1.5)
Total	400	60 (15)	42 (10.5)	13 (3.3)	5 (1.3)
Chi-square (X^2)		2.548	0.544	1.886	0.183
P value		0.110	0.451	0.170	0.669

Table 3. Summary of CLA cases by age, and body condition.

Parameter	Number of animal examined	Positive	Negative	Positive (%)	X^2	P value
Total	400	60	340	15	-	-
Age						
<1 year (young)	149	7	142	4.7		
1 ½ -2 ½ years (yearling)	135	19	116	14.1	31.125	0.000
≥2 ½ years (adult)	116	34	82	29.3		
BCS						
Poor	81	20	61	5	7.482	0.006
Good	319	40	279	10		

different age groups, the highest being in adult (29.5%) followed by yearling (14.1%) and young 4.7% ($P < 0.05$). The study has also revealed a statistically significant difference in cutaneous form of the disease, the highest being in adult (22.4%) followed by yearling (9.6%) and young (2.7%). But no statistical significant association was recorded ($P > 0.05$) for visceral and generalized forms of the diseases. The highest being in adult (29.5%) followed by yearling (14.1%) and young 4.7% ($P < 0.05$). Statistical significant difference was also recorded between goats having poor and good body condition score ($P < 0.05$). In this study, goats with poor body condition score seems to be more infected (24.7%) than that of animals with good body condition (12.5%) (Table 3).

Bacteriological analysis

All 86 samples collected with CLA lesions were subjected to culture in blood agar and all culture yielding bacteria. The vast majority of colonies was small, white, dry and surrounded with narrow zone of hemolysis. Few of the colonies were from medium sized to large white mucoid. The gram stained smears from pure culture colonies have shown pleomorphic gram positive rods. Smear from the pus revealed that the rod was arranged at sharp angles to each other which look like “Chinese letters”. Zones of hemolysis interacting with the Beta hemolysis of *Staphylococcus auerous* were observed on all of the samples by CAMP test. The bacteria were grown only on the inoculated straight line which revealed that the organisms were non-motile. Upon catalase test, immediate effervescence was observed on all of the isolates which indicate the bacteria were catalase positive. During oxidation fermentation test all of the isolates utilized carbohydrate both aerobically and anaerobically which indicate that the isolated organisms were facultative anaerobes. The results of bacteriological analysis are depicted in Table 4.

DISSCUSSION

In the present study, the post mortem findings and bacteriological analysis performed have shown that the caseous lesion in the lymph nodes and other organs affected were due to CLA. 15% prevalence of caseous lymphadenitis is recorded in this study in Luna Export Slaughter house based on post mortem examination and bacteriology. This result indicates a high infection rate of CLA in goat population in Borana rangeland. This might be due to the environment and management system in which the animals are kept together which plays an enormous role in the occurrence and severity of CLA infection. The disease is highly contagious and the causative agent can survive in feces, straw, hay and wood

Table 4. Summary of Bacteriological findings.

Test conducted	Result
Colony characteristics	Small, white, dry, surrounded with narrow zone of hemolysis
Gram staining	From pure culture colonies have shown pleomorphic gram positive rods. Pus revealed that the rod arranged at sharp angles to each other which look like “Chinese letters”
CAMP test	Beta hemolysis
Catalase test	Positive
O-F test	Facultative anaerobes

for several weeks (Radostitis et al., 2007). Goats in Borana area are reared largely by nomadic pastoralists where the management system is traditional (Tamrat and Asfaw 2003). These pastoral area are featured by thorny bush encroachment which frequently cause cutaneous trauma that favor entrance of the bacteria. On the other hand, the common behavioral habit amongst goats of frequent licking as well as rubbing their heads and necks against bushes and sheds, allows the rapid spread of CLA.

Caseous lymphadenitis (CL) is characterized by abscess development in subcutaneous tissues, lymph nodes and internal organs. An American study found that 42% of culled mature sheep had abscesses compatible with CL and the most-frequently affected site (both for abscesses and CL) was the thoracic cavity (Stoops et al., 1984). In the present study, lesions were most frequently observed in superficial lymph node (66.3%) followed by lung and associated lymph nodes (22.4%). To a lesser extent, lesions were found in liver, hepatic lymph nodes, mesenteric lymph nodes and carcass on sternal area. This indicates that most CLA infections are acquired by skin abrasion and much greater proportion of affected goats having lesions in the head, related to possibly a high rate of superficial injury during browsing. The possible contribution of such browsing behavior in the thorny bushes to occurrence of CLA was previously described (Radostitis et al., 2007).

The study has shown that the cutaneous formed the diseases found in 42 (10.5%) goats which is much greater than visceral form 13 (3.3%). Out of 60 carcass of positive goats for CLA infection; 5 (1.3%) were infected with generalized form of the disease and were totally condemned. The visceral form was prevalent in respiratory tract (22.4%). This may be due to the fact that the organism could be acquired via inhalation of droplets from infected animals. Besides, the cutaneous form of CLA may spread through hemotogenous or lymphatic route which produces visceral form of the diseases (Radostitis et al., 2007).

The study revealed that no statistically significant difference ($P > 0.05$) exist between the study area. This may be due to pastoral way of keeping goat in the area which result in constant moving and mixing of goat between the two sites. However, a statistical significant association of age with caprine caseous lymphademitis infection ($P < 0.05$) was observed. Especially the cutaneous form of the diseases was significantly associated ($P < 0.05$) with age. As age increased, the prevalence of CLA was increased. This increase in prevalence of the diseases with age is due to the increasing probability of head butting, trauma from broloses, use of common collar and exposure to infected fomites (Radostitis et al., 2007). There is no statistical significant association ($P > 0.05$) of age with visceral and generalized form of CLA. There is also statistically significant difference between the goats with poor and good body condition ($P < 0.05$) in which goats with poor body condition are more infected by the disease condition than the ones with good body condition.

CONCLUSION AND RECOMMENDATION

Prevalence of CLA recorded in this study was based on post mortem examination and bacteriology. The result has indicated the presence of high infection (prevalence) of CLA in the animal/goats population of Borena range land. Most of the CLA lesions were detected in lymph node head, shoulder and thigh area that signify cutaneous route of transmission. Detection of CLA by bacteriologic examination was successfully conducted. Therefore, caseous lymphademitis should be considered as serious diseases because of its impact on the economy and health of goat and sheep.

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Conflict of Interest

The authors declare that they have no conflict of interests.

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