

Demodex and Sarcoptes Mites of Cattle: An Extravagance for Leather Industry

¹Tewodros Fentahun, ¹Mekash Alemayehu and ²Mersha Chanie

¹University of Gondar, Faculty of Veterinary Medicine,
Unit of Basic Veterinary Sciences, P.O. Box: 196, Gondar, Ethiopia

²University of Gondar, Faculty of Veterinary Medicine,
Unit of Veterinary Paraclinical Studies, P.O. Box: 196, Gondar, Ethiopia

Abstract: A cross sectional study was conducted on 59 randomly selected dairy farms and small-scale owners in Gondar town commencing October 2010 to March 2011, to determine the prevalence of mange mite on cattle and associated risk factors. The study involved the application of skin scrape. Among the farms examined, 38 (64.4%) contained at list one positive cattle. There was statistically insignificant ($\chi^2=6.457$; $p > 0.05$) difference observed among the three herd size categories though management system had statistically significant ($\chi^2=15.625$; $p < 0.05$) effect on herd level prevalence. The overall prevalence of 13.79% was recorded out of 435 cattle examined in the study period. There was no statistically significant variations observed among various age ($\chi^2=1.23$; $p > 0.05$), sex ($\chi^2=0.091$; $p > 0.05$), breed ($\chi^2=0.30$; $p > 0.05$) categories and different management systems ($\chi^2=1.198$, $p > 0.05$), but statistically significant ($\chi^2= 413.00$; $p < 0.05$) variations observed among sites of lesions. The most preferable site of lesions was shoulder (35%) while ventral area was the lowest (8.34%). Among the total of 60 positive cattle for mange mite, 41 (68.3%) *Demodex* and 19 (31.7%) *Sarcoptes* types of mange mites were identified. In conclusion, the prevalence recorded in this study was found higher than those reported previously in other study area. Therefore, for the impending of such a high prevalence, measures must be undertaken on management system, sufficient veterinary service and creation of awareness for the owners about the disease.

Key words: Cattle • Gondar • Mange mite • Dairy farms • Occurrence

INTRODUCTION

Ruminants represent an important segment of the Ethiopian livestock system. The national ruminant's population of Ethiopia is the largest in Africa and is estimated to be 47,570,675 for cattle, 26,117,272 for sheep and 21,709,428 for goats [1]. Although large numbers of ruminants are slaughtered per annum, the production of quality skins remains very low. The Ethiopian tanning industry has long complained about the poor quality of processed skins [2]. Hides and skins account for 12-16% of the total value of exports from Ethiopia. The current utilization of hide and skins in Ethiopia is estimated to be 48% for cattle, 75% for goat and 97% for sheep with the expected off take rate of 33, 35 and 7% for sheep goats and cattle, respectively. Though hides and skins are important source of export income, its contribution to the

national economy may be far below the expected potential. This is because the quality of hides and skins has deteriorated due to pre and post-slaughter defects [3]. This has created a serious problem for competition in international markets through the export of semi-processed and processed skin. Despite this, the country has earned 405 to 590 million USD in the years 1998 to 2004 by exporting semi- processed and processed skins to the world market [4].

Hides and skin problems are caused by lice, keds and ticks and mange mites are among the major pre-slaughter defects that cause downgrading and rejection of hides and skin [3]. From these ectoparasites, mange mites are responsible for significant losses. Therefore, the major objective of this study was to determine the prevalence of mange mites on cattle in and around Gondar town.

MATERIALS AND METHODS

Study Area: Gondar town, the capital city of North Gondar Administrative Zone, is located in Amhara National Regional State, which is 750 km North of Addis Ababa at latitude, longitude and altitude of 12.3-13.8 °N, 35.3 - 35.7 °E and 2, 200 ma.s.l, respectively. The annual mean minimum and maximum temperature of the area vary between 12.3 - 17.7°C and 22 - 30°C, respectively. The livestock population of the Zone is estimated to be 1,936,514 cattle (exotic, cross and local), 524,083 sheep, 682,264 goats, 36,828 horses, 12,473 mules, 223,116 donkey and 3,165,068 poultry [5]. The region receives a bimodal rainfall; the average annual precipitation rate being 1000 mm that comes from the long and short rainy seasons. The short rainy season occur during the months of March, April and May while the long ones extend from June through September [6].

Study Design: A cross-sectional study was conducted on cattle in order to assess the prevalence of mange mite in and around Gondar town.

Sample Size Determination: Simple random sampling was used to select study animals and the sample size was determined by the formula given by Thursfield [7]. Since there was no similar study done previously on the study area, the expected prevalence was taken as 50% with the confidence interval of 95%. By substituting the value in the above stated formula, the required sample size was determined as $n = 384$, but for the current study, the required sample size is allowed to be 435 which were higher than the determined sample size to increase the precision of the result.

Study Animals and Sampling Protocol: The study was conducted on 435 cattle of both local and cross breeds which were found in and around Gondar town from different dairy farms and small-scale owners. Cattle were categorized on the basis of age as < 2 years old, 2-5 years old and > 5 years old; and on the two breeds of cattle which were local and cross and on the bases of production systems; they were categorized in intensive, semi intensive and extensive.

The animals were inspected visually and by palpation for any skin lesion and samples were collected by skin scraping from animals showing sign of scales, nodules, itching and alopecia for further laboratorial examinations by applying the following procedures. A drop of mineral

oil was put on clean glass slide, Clean scalpel blade was dipped in to the mineral oil and then the edge of affected area was scraped until capillary blood oozes and then the sample was transferred to another clean microscopic slide, treated with 10% potassium hydroxide solution and examined under light microscope. In cases where nodular skin lesion suspected for Demodectic mange, the content (white cream pus) were collected and direct smear was made for microscopic examination. Identification of mange mite species was done based on the morphological characteristics described by Wall and Shearer [8].

Data Analysis: The data were first entered and managed in to Microsoft Excel worksheet and analyzed using Statistical Package for Social Sciences (SPSS) software version 19. The prevalence rate of mange mite was calculated for different risk factors as the number of mange mite positive cattle examined dividing by the total number of cattle investigated at the particular time. The significant difference between the prevalence of mange mite was determined using Descriptive statistics; Chi-Square test (χ^2 values) and $P < 0.05$ was considered as statistically significant.

RESULTS

Individual Animal Level Prevalence: Out of the total 435 cattle examined, 60 (13.792%) were found positive for mange mites. Of these, 41 (9.425 %) were local breed and 19 (4.367 %) were cross breed; 7 (1.609%) were less than two years old, 49 (11.264%) were 2 to 5 years old and 4 (0.919%) were greater than 5 years old; 22 (5.037 %) were male and 38 (8.735 %) were female; 45 (10.344%) were from extensive, 13 (2.98%) from semi-intensive and 2 (0.46%) from intensive management systems.

There was no statistically significant difference observed ($\chi^2=1.233$; $p > 0.05$) among the three categories of ages although the highest prevalence was recorded in cattle of 2 - 5 years old, 49 (11.264%) while the lowest in cattle of greater than 5 years old, 4 (0.919%). The higher prevalence was recorded in female cattle, 38 (8.735%) than male, 22(5.03%) even if there was statistically insignificant difference observed between the two sexes ($\chi^2 = 0.91$; $p > 0.05$). The higher prevalence was recorded in local breed cattle, 41(14.137%) than cross breed cattle, 19 (13.38%) even if there was statistically insignificant difference observed ($\chi^2=0.30$; $p > 0.05$) between the two breeds (Table 1). The prevalence of mange mite in different management systems was 10.344%, 2.988% and

Table 1: Prevalence of mange mite among different categories of cattle

Risk factors	No of cattle examined	Positive for <i>Demodex</i>	Positive for <i>Sarcoptes</i>	Total positive Cattle	Total prevalence	χ^2	p-value
Age							
< 2 years	35	4(11.428%)	3(8.57%)	7(20%)	1.609%	1.233	> 0.05
2-5 years	370	36(9.729%)	13(3.51%)	49(13.24%)	11.264%		
> 5 years	30	1(3.3%)	3(8.57%)	4(13.3%)	0.919%		
Sex							
Male	152	15(9.868%)	7(4.605%)	22(14.47%)	5.037%	0.91	> 0.05
Female	283	26(9.187%)	12(4.24%)	38(13.427%)	8.735%		
Breed							
Local	293	29(9.897%)	12(4.095%)	41(14.137%)	9.425%	0.30	0.05
Cross	142	12(8.45%)	7(4.929%)	19(13.38%)	4.367%		
Management System							
Intensive	301	30(9.966%)	15(4.98%)	45(14.95%)	10.344%	1.198	> 0.05
Semi-intensive	112	9(8.035%)	4(3.57%)	13(11.607%)	2.988%		
Extensive	22	2(9.09%)	0(0%)	2(9.09%)	0.46%		
Total	435	41(9.425%)	19(4.367%)	60	13.792%		

Table 2: Prevalence of mange mites based on site of infestation.

Site of lesion	No of cattle examined	No of positive cattle	Prevalence (%)	χ^2	p-value
Neck	8	8	13.34	415	0.05
Shoulder	21	21	35.00		
Ventral area	5	5	8.34		
Shoulder, neck, back	19	19	31.67		
Whole body	7	7	11.67		
No lesion	355	0			
Total	435	60	13.79		

Table 3: Herd level prevalence of mange mite on cattle.

No of cattle in a herd	No of herds examined	No of positive herds	Prevalence	χ^2	p-value
< 10	27	13	22.03%	6.457	< 0.05
11-30	23	19	32.2%		
> 31	9	6	10.16%		
Total	59	38	64.4%		

Table 4: Herd level prevalence of mange mites in different management systems.

Management systems	No of herds examined	No of positive herds	Prevalence	χ^2	p-value
Intensive	20	6	30 %	15.625	< 0.05
Semi-intensive	28	23	82.14%		
Extensive	11	9	81.8%		
Total	59	38	64.4%		

0.46% in extensive, semi-intensive and intensive systems, respectively (Table 1). There was no statistically significant difference observed ($\chi^2= 1.198$; $p>0.05$) among these three different management systems. However, mange mite was more prevalent in extensive management system than the other two management systems.

There was statistically significant differences ($\chi^2=415$; $p<0.05$) observed among the various sites of

infestation. Furthermore, the highest prevalence rate was recorded on shoulder (35%) while the lowest on ventral area (8.34%).

Herd Level Prevalence: From the total of 59 herds examined, 38(64.4%) were positive for mange mite. The difference among the different herd sizes and management system categories were statistically significant ($p<0.05$).

There was no statistically significant difference ($\chi^2= 6.457$, $p < 0.05$) observed among the herds size categories (Table 3). Herds, which have 11- 30 heads of cattle, were more prevalently infested with mange mite (32.2%).

There was statistically significant variation detected ($\chi^2= 15.625$; $p < 0.05$) among the three management systems. Furthermore, relatively higher prevalence was observed on cattle from semi-intensive 23 (82.14%) while the lowest from intensive 6 (30%) management system (Table 4).

DISCUSSIONS

In the current study, the overall prevalence of mange mite on cattle in the study area was 13.79%. It's slightly higher than the previous studies of Ashenafi and Tibbo [1] who reported 11.78% in central zone of Tigray and 3.54% in Womberta. From the 60 (13.792%) cases of mange mite infested cattle observed, the two mange genera, *Demodex* (*D. bovis*) and *Sarcoptes* (*S. scabies*) were detected. From these, *Demodex bovis* was more prevalent in the study area and accounts, 41 (68.3%) from the total 60 positive animals for mange and 9.425% from the total animals examined (435). This is higher than the previous study of Yakob *et al.* [9] in Adama (1.88%) and Ashenafi and Tibbo [1] in central zone of Tigray (4.19%).

The second common mange mites observed in the study area was *Sarcoptes* (*S. scabies*) with the prevalence of 19 (31.66 %) of the total 60 positive cattle for mange mites and 4.367% of the total cattle (435) examined. This is higher than the previous reports of Baker and Fisher [3, 10] who reported 1.4% in the Southern rangelands and Matthes and Bukva [5] who reported 3.94% in Eastern Shoa district and also lower than the report of Ashenafi and Tibbo [1] who reported 7.69% in central zone of Tigray. Such a higher prevalence of mange might be attributed due to high air temperature and prolonged sunlight, extensive poor traditional cattle management system and poor awareness of the owners to visit veterinary clinics which can exacerbate the disease condition.

The prevalence of mange mites in different age categories were not found statistically significant even though young cattle (<2 years) were more prevalent than the other two age categories and it accounts 7 (20%) from the total positives (60) and 1.6% from total cattle examined (435). This difference might come due to poorly developed immune system of young cattle than the rest age categories.

In the current study, the prevalence rate of mange in different breeds of cattle showed (14.1375%) and (13.38%) in local and cross breeds respectively. This can indicate that there was slight difference in susceptibility of different breeds of cattle and then, local breeds are highly affected than cross breeds. It is in agreement with the previous work of Yakob *et al.* [9, 11, 12] who reported a higher prevalence in local breed (8.8%) than cross breeds (2.2%) cattle in and around Mekelle. It might be due to the fact that the populations of local breeds were higher than cross breeds in poor management systems of rural areas that can lead to confinement of cattle in narrow space housing that can facilitate the transmission of the mite.

There was insignificant variation observed between the two sexes of cattle though it was more prevalent in females (8.735%) than males (5.037%). This result agrees with the study of Matthes and Bukva [5] who reported 2.32% in females and 1.22% in male animals. It might be due to factors like pregnancy and lactation that can decrease the immunity of females than male that can lead to the greater susceptibility of females for mange mites. The prevalence of mange was not significantly different among the three management systems. Of these, in extensive management system, the occurrence of the disease was higher (10.34%) than semi-intensive (2.98%) and intensive (0.46%) management systems. This might be attributed due to better management and sanitation that allows the development of a thicker skin and greater body surface volume; rendering more resistance to infection by mange mites in cattle that were kept under an intensive and even semi-intensive management system than extensive system. The lesions of mange were observed in different parts of the body. From these, shoulder, neck and back area were the most preferable sites for mange mites. In the case of demodectic mange, non-pruritic creamy pus containing nodules were observed with extensive skin damage and in the case of Sarcoptic mange; lesions were characterized by itching, thickening of skin, pruritus and hair loss.

The herd level prevalence of mange mite in the current study was 38 (64.4%) out of the total (59) herds examined and there were also statistically significant difference observed among the three categories of herd sizes and their management systems. The highest prevalence (32.2%) was recorded in herds that had 11-30 heads of cattle and the lowest (10%) in herd containing less than 10 heads of cattle. The highest prevalence rate was recorded in extensive management system (82.14%) while the lowest (30%) in intensive management system. This might be herds that have 10- 30 heads of cattle were

found in poor sanitation, management and had inadequate veterinary service since most of these herds that were found under this herd size category were managed under poor traditional extensive and even in semi intensive management systems.

CONCLUSIONS AND RECOMMENDATIONS

Prevalence of mange mite increases together with increasing of herd size, especially in extensive management system. It has been associated with overcrowding and poor husbandry system that can facilitate the spread of the disease. This study magnifies the higher herd level prevalence of mange mite (64.4%) on cattle in the study area. The increasing prevalence of mange mite in the country should call for strong collaboration of researchers and animal health professionals to assess and evaluate the magnitude of the problem at national level. Better cattle management practices should be implemented to minimize transmission of the disease and to increase the productivity of cattle. Further researches on mange mite of cattle should be initiated and encouraged especially to identify the risk factors, epidemiology and regarding with zoonotic importance of the disease. The government, private sectors and veterinarians should create awareness of the cattle owners regarding the effects of mange mite on hide and skin quality, animal health and production and they should work together to decrease the effect of mange mite on livestock production.

ACKNOWLEDGEMENTS

We would like to thank the faculty of Veterinary Medicine, University of Gondar for funding this research. We also like to extend our thanks to the technical staff members for their valuable and incalculable supports throughout our work.

REFERENCES

1. Ashenafi, H. and M. Tibbo, 2003. Major skin diseases of cattle in the Central Zone of Tigray region Northern Ethiopia. *AE J. Agri. Envir. Sci.*, 7: 1-8.

2. Ayele, S., W. Assegid, M. Ahmed, M. and M. Belachew, 2000. Livestock marketing in Ethiopia: A review of structure, performance and development initiative. *Global Veterinaria*, 5: 35-36.
3. Baker, D.W. and W.F. Fisher, 1991. The Incidence of Demodectic Mites in eyelids of various mammalian hosts. *Econ. Entomol.*, 62: 942.
4. Belachew, H., 2004. Livestock marketing and animal health in Ethiopia. A paper presented at the 18th annual conference of Ethiopian Veterinary Association 2004, Addis Ababa, Ethiopia, pp: 36-45.
5. Matthes, H.F. and V. Bukva, 1993. Features of Bovine Demodecticosis in Mongolia. Germany. Preliminary Observations. *Folia Parasitologica*, 40: 154-155.
6. MoA, 2003. Ministry of Agriculture; Budgeting and planning report, Summary for North Gondar Zone, during 1987-88, 2003 report, Addis Ababa, Ethiopia.
7. Thursfield, M., 2005. *Veterinary Epidemiology*. 3rd ed. UK: Blackwell Publishing, pp: 213-124.
8. Wall, R. and D. Shearer, 2001. *Veterinary Ectoparasites; Biology, Pathology and Control*. Second ed. UK: Black Science.
9. Yacob, H.T., B. Netsanet and A. Dinka, 2008. Prevalence of Major Skin Diseases in Cattle, Sheep and Goats at Adama Veterinary Clinic, Oromia Regional State, Ethiopia. *Ethiopian Veterinary Journal*, 3: 12-14.
10. Sertse, T. and A. Wossene, 2007. Effect of ectoparasites on quality of pickled skins and their impact on the tanning industries in Amhara regional state, Ethiopia. *World Appl. Sci. J.*, 6: 55-61.
11. Rahmeto, A., T. Makelesh, M. Bekele and S. Desie, 2011. Prevalence of Small Ruminant Ectoparasites and Associated Risk Factors in Selected Districts of Tigray Region, Ethiopia, *Global Veterinaria*, 7(5): 433-437.
12. Belew, T. and A. Mekonnen, 2011. Distribution of Ixodid Ticks on Cattle in and Around Holeta Town, Ethiopia. *Global Veterinaria*, 7(6): 527-531.