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Full Length Research Paper

Studies on major respiratory diseases of Camel (*Camelus dromedarius*) in Northeastern Ethiopia

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A comparative serological test was carried out to identify the primary causative agent involved in the camel respiratory disease outbreak that occurred in Ethiopia. The samples were collected during and post outbreak time and analyzed for parainfulenza-3 and pasteurellosis. According to the result, parainfulenza-3 was found as a primary causative agent as 70.5% in outbreak and 6.8% in surveyed areas and there is a statistical significant variation observed between the outbreak and survey sera samples (P < 0.01). *Manhaemiya hemolytica* was involved as secondary bacterial complications. The association of parainfulenza-3 and pasteurellosis was also assessed and has shown that *M. haemolytica* A2 was a dominant serotype over others which account 50% in higher antibody titration ranging from 1:80 - 1:320 in outbreak samples. Camel respiratory diseases are still flaring up in various parts of the country and reports are coming year after year urging for an intervention measures. Further studies have been recommended on the epidemiology of the disease and the identification of the responsible pathogens and its serotypes to be involved for the development of vaccines.

Key words: Ethiopia, camel respiratory diseases, *Manhaemiya hemolytica*, parainfulenza-3, serotyping.

INTRODUCTION

Camel (C*amelus domedarius*) is an important domestic animal species uniquely adapted to the hot and arid environment. The camel is an important animal in Ethiopia because of its adaptation to adverse climatic conditions and shortage of forage and water. It is also an indicator of social prestige and wealth (Bekele, 1999). Camels are an important source of milk, meat, draught power and transportation service for the pastoralists in Eastern and Southern Ethiopia (Bekele, 1999; Schwartz and Doli, 1992). About 11.5 million of camels are living in the eastern part of Africa (Djibouti, Eritrea, Ethiopia, Somalia and Sudan) representing over 80% of the African and two thirds of the world population (Bekele, 1999). In Ethiopia alone estimated 1.7 million camels, which are mainly distributed in arid and semi arid areas of the country (CSA, 2007). Camel respiratory problem has received little consideration, even though it is an emerging disease in Ethiopia causing considerable loss of production and deaths (Rufael, 1996; Bekele, 1999). In 1995 camel respiratory disease outbreak in Ethiopia has occurred and characterized by a highly contagious nature with high rate of morbidity (over 90%) and a variable rate of mortality (Roger et al., 2001). Despite all efforts have been done so far for the identification of the real possible causes of the disease there was no substantial result obtained from the investigation of the disease. More investigative effort still in need for the identification of the true cause of the problem.

A definitive etiology of most respiratory diseases of camels has not yet been determined as a variety of viruses, fungi, bacteriae and parasites are to be the possible causes of respiratory outbreaks among camels (Schwartz and Dioli, 1992). Schwartz and Dioli (1992) indicated that the most important predisposing factors are sudden climatic changes, poor management practices, exposure to various diseases, over traveling and low-grade nutrition (Schwartz and Dioli, 1992). Despite the versatile uses in the pastoralists' areas, camel has been largely neglected by international agencies and local governments as regards to improvement in its health and productivity (Bekele, 1999). Therefore, this paper presents the findings of the collected sera samples and isolation of the possible pathogens for the unusual epidemics of respiratory disease in camels that have occurred in most districts of the northeastern zones of Ethiopia. This paper presents evidence of the possible

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pathogens responsible for recent respiratory outbreak of camels in some districts of Afar region of Ethiopia.

MATERIALS AND METHODS

The study was carried out mainly in Afar region, Ethiopia. The area is fully located within the Northeast rift valley. The climate ranges between sub- humid, and semi-arid to arid. The mean annual maximum and minimum temperature is 30 and 16°C, respectively. The study area is indicated in Figure 1.

Study animals and protocol

Sampling strategy

Cluster sampling strategy was used. Villages and camel herds were taken as a cluster. Samplings were performed at grazing areas and watering points.

Sample types and size

Survey sample: The number of sera sample was determined based on 95% confidence interval with a 5% estimated sero-prevalence of the disease. Camels were sampled at grazing area and watering points representing the sample unit of the district.

Outbreak sample: 217 outbreak sera samples (samples collected during the occurrence of the respiratory problem) were also assayed for comparison with the survey sample.

Active disease search: Active disease search for outbreak cases of respiratory disease in camels were carried out in Kobo district veterinary clinics, North Wollo. Nasal swabs from clinically diseased camels were collected for bacteriological examination.

Laboratory analysis

A total of 762 sera samples, 545 surveys and 217 outbreaks, were tested for parainfulenza-3 using haemagglutination inhibition test (OIE, 2004). 369 sera samples (166 surveys and 203 outbreaks) were tested for *Pasteurella* serotyping using the indirect haemagglutination technique (OIE, 2004). 23 nasal swabs from cases of respiratory disease were also analyzed for *Pasteurella* isolation (OIE, 2004).

RESULTS

The outbreak and survey sera samples were tested for the different diseases which have a significant role in camel respiratory disease complex.

Parainfulenza- 3

217 outbreak and 545 survey sera samples were subjected for haemagglutination inhibition test (HI) and the parainfulenza-3 antibody was evaluated by serial dilution (Table 1). From the total outbreak sera samples 153 (70.5%) were found positive within the range of 1/40-1/1280. As indicated in (Table 1), 72% (110) of the positive reactors found within the range of 1/80 - 1/1280 antibody titration (Table 2). The prevalence rate of the disease was recorded at 6.8% and 36 (97.3%) of the positive sera samples have given a reaction at 1/40 titration (Table 2). There is a statistical significant variation observed between the outbreak and survey sera samples ($P < 0.01$).

Pasteurellosis

From the total positive serotypes A2 (51.6%), T3 (48.4%), A13 (45.3%) and A1 (35.9%) were found as the highest prevalent strains. However A2 was found the most predominant strain in higher titration range of between 1:80 - 1:320. One serum sample might give response for multiple serotypes (Tables 3 and 4).

Active disease search

During active disease searching activity there was no respiratory disease outbreak report in the study areas. However some mild respiratory cases were investigated at Kobo veterinary clinic, North Wollo and nasal samples were collected from the suspected clinical cases with the history of coughing and nasal discharge. According to the findings, 13 (56.5%) of the cases were positive for *Manhaemiya hemolytica* T and 2 (8.7%) for *M. haemolytica* A from 23 tested samples.

DISCUSSION

A number of microbial agents are involved as a primary or secondary infection of camel respiratory disease. Since the disease has multi etiological agents, this study gave special focus to the diseases having high spreading and contagious nature. So that, parainfluenza-3 and pasteurellosis were taken as a priority diseases and analysis were made by comparing the outbreak and survey samples. In general, literature about camel pneumonia is scarce; however, some works having relevance with this paper were included for the discussion.

In this comparative study, the real causes of the camel respiratory disease occurred in Ethiopa were determined from sera samples analysis. According to the result, parainfluenza-3 was found as primary responsible agent of the camel respiratory disease outbreak. Serum antibody titrations used as a comparative evidence for and have shown a significant difference between the survey and outbreak samples ($P < 0.05$). This finding is in agreement with Schwartz (1992) that the prevalence of parainfluenza 1, 2 and 3 are common and widely distri-buted in most camel rearing areas. Camel respiratory

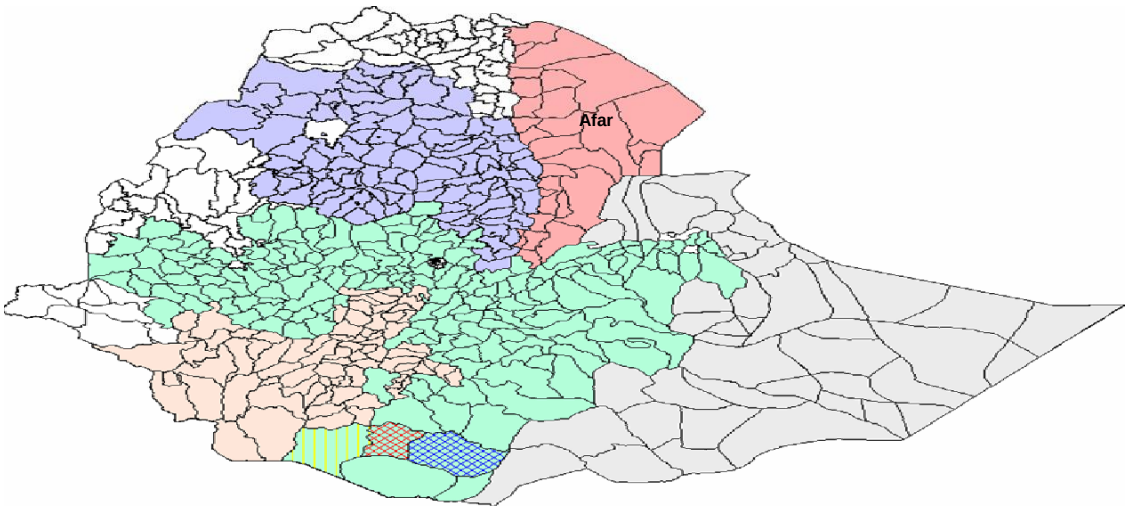

Figure 1. Study area (Afar Region).

Table 1. Hemagglutination Inhibition result of the outbreak sera samples.

Location	No. of sample	No. of positive (Titer)						Positive no. (%)
		1/40	1/80	1/160	1/320	1/640	1/1280	
Cluster 1	40	2	13	2	2	1	1	21 (52.5)
Cluster 2	40	7	9	11	3	0	0	30 (75)
Cluster 3	40	-	-	1	3	12	21	37 (92.5)
Cluster 4	24	1	-	5	12	2	4	24 (100)
Cluster 5	33	4	4	3	3	-	-	14 (42.4)
Cluster 6	40	-	4	3	9	8	3	27 (67.5)
Total	217	9	9	14	30	25	32	153 (70.5)

Cluster 1: Merti, Fentale, Nuraere and Nazareth; Cluster 2: Gewane, Hurso and Arbebodebe; Cluster 3: Ji and Mermersa; Cluster 4: Gero and Babile; Cluster 5 and 6: Unkown.

Table 2. Hemagglutination Inhibition result of the survey sera samples.

Area	No. of sample	No. of positive						Positive no. (%)
		1/40	1/80	1/160	1/320	1/640	1/1280	
Zone 1	130	5	-	-	-	-	-	5 (3.8)
Zone 2	207	11	1	-	-	-	-	12 (5.8)
Zone 3	208	20	-	-	-	-	-	20 (9.6)
Total	545	36	1	-	-	-	-	37 (6.8)

disease investigation in Northeastern Nigeria indicated that 22.3% complement fixing antibody for parainfluenza-1, 18.5% for parainfulenza-3 virus and 12.7% for influenza virus B from 150 sera samples (Olaleye et al., 1989). The prevalence of parainfluenza-*3* in Afar region was found within the range of 3.6 - 9.6% and this finding was in agreement with the report of Olaleye et al. (1989).

Camel pasteurellosis, due to *M. haemolytica* was reported by Kombolcha regional veterinary laboratory from clinically sick individuals during outbreak time. Similar finding was also reported from lung and whole blood of febrile camels in Shinnelle zone of Somali National Regional State (Bekele, 1999). Since pasteurellosis usually related with various debilitating factors, it was appeared as a secondary bacterial complication following parainfluenza exposure. The association of parainfluenza with pasteurellosis causes serious respiratory disease complication and even death in camels,

Table 3. Sero-reactors for different *Pasteurella* serotypes in the 887 outbreak sera samples.

Titration	*Pasteurella* serotypes with number of sera														
	A1 (64)*	A2 (64)	A5 (61)	A6 (61)	A7 (61)	A8 (64)	A9 (64)	A11 (64)	A12 (64)	A13 (64)	A14 (64)	T3 (64)	T10 (64)	T15 (64)	Total (887) no. (%)
1/40	14	1	9	1	4	6	9	3	8	7	7	19	6	9	96 (10.8)
1/80	6	7	6	1	-	4	5	1	8	16	2	7	-	2	64(7.2)
1/160	2	16	-	-	1	-	-	-	2	6	-	5	-	-	33(3.7)
1/320	1	9	-	-	-	-	-	-	-	-	-	-	-	-	10(1.1)
Total no. (%)	23(35.9)	33(51.6)	15(24.6)	2(3.3)	4(6.6)	10(15.6)	14(21.9)	4(6.3)	18(28.1)	29(45.3)	9 (8.3)	31(48.4)	6 (9.4)	11(17.2)	203(22.9)

* Number of tested sera samples.

Table 4. Sero reactors for *Pasteurella* serotypes in the 109 cross-sectional survey sera samples.

Titration	*Pasteurella* serotypes														
	A1	A2	A5	A6	A7	A8	A9	A11	A12	A13	A14	T3	T10	T15	Total
1/40	28	12	2	1	21	14	7	10	-	5	7	9	2	13	131(8.6)
1/80	6	6	-	-	2	8	1	6	-	-	2	-	2	1	34(2.2)
1/160	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1(0.1)
1/320	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total no. (%)	34(31.2)	18(16.5)	2(1.8)	1(0.9)	23(21.1)	22(20.2)	8(7.3)	17(15.6)	-	5 (4.6)	9 (8.3)	9 (8.3)	4 (3.7)	14 (12.8)	166 (10.9)

The predominant serotypes identified were A1 (31.2%), A7 (21.1%), A8 (20.2%) and A2 (16.5%). 78.9% of the positive reactors were found at 1/40 and 20.5% at 1/80 antibody titration.

which were not treated in early time of infection. A number of studies proved that different bacterial agents were isolated from lung tissue samples.

According to the findings of Al-Rawashdeh et al. (2000) indicated that 10% of slaughtered camels had bacterial pneumonia among which *P. haemolytica* was found the most isolates (56%) from lung tissue, whereas 6.66% was reported by Al-Tarazi (2001). Similar study in Egypt indicated that the prevalence of *P. haemolytica* was found 1.17% from abattoir samples (Seddek et al., 2002). In Ethiopia few works have been done on camel respiratory diseases and all of them were focused on pathological and bacteriological examination in abattoir samples and that is why the isolates of *M. haemolytica* in the lung tissue seems to be low in number (Samuel, 2008). However, in most active respiratory disease problem *M. haemolytica* is the predominant isolates as it was seen in this finding.

Shemsedin (2002) reported that 8.7% of the total bacterial isolates from lung tissue were *P. haemolytica*. Numerous bacterial spp. were isolated and reported by different authors. The most common and dominant isolates from abattoir samples were *Staphylococcus aureus*, *Klebsella*, *Escherichia coli, Pasteurella* and *M. haemolytica*. *Streptococcus equi* sub-species *equi* was isolated from a sick female camel in Ethiopia during the outbreak time as stated by Yigezu et al. (1997).

The antibody profile of each serotype was determined by comparing the highest antibody titration of the survey and outbreak samples. According to this finding *M. haemolytica* A2 was identified as the predominant serotype by comparing the antibody titration ranging 1:80 - 1:320. The number of reactors to *M. haemolytica* A2 was found higher from other serotypes in the outbreak samples whereas in the survey samples

the number of reactors in higher titration was dropped. So, this picture proved that the animals were recently exposed to this specific serotype which involved as secondary bacterial complication in disease process. There was a significant variation between the survey and outbreak samples ($P < 0.05$).

Conclusion

This result will have equal importance to the areas where camels are dominantly rear in Ethiopia. As indicated in this paper and other country finding camels' respiratory disease is the major problem, which can be caused by various microbial organisms including parainfulenza and *M. haemolytica*. Although, the works done in this area is very little, the available research documents give valuable information in this regard. However, there is a need of more works in relation to identification of other diseases which might have serious consequence in camels' health status and productivity since the role of camels in pastoralist areas is un-replaceable by other livestock species.

Thus, as it is shown in this document parainfulenza-3 was found as a primary causative agent with the association of *M. haemolytica* serotype A2 serologically and indicated as evidence for the camel respiratory disease outbreak occurred. Therefore, it is recommended to develop a vaccine containing the responsible pathogens in order to protect this unique animal species from such kind of unpredictable disastrous diseases.

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