Prevalence and distribution of camel trypanosomosis in the semi-arid and arid Awash Valley of Ethiopia

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Abstract

A three-year study (from December 1998 to September 2001) was conducted on 1013 camels (Camelus dromedarius) for the prevalence and distribution of potential camel trypanosomosis and its vectors in two districts of the Awash valley, i.e., Fantalle in Oromia and Gowani in Afar Regional National States. Standard parasitological detection techniques (SPDT) and conventional entomological collection and identification procedures were applied in this investigation. Only *Trypanosoma evansi* was detected in this study with an overall mean prevalence rate of 5.20%. The two localities did not have significant difference in mean prevalence of surra (5.60% in Gowani, n=376 and 5.20% in Fantalle, n=637). Young stock (1-3 years of age) and males were found to be infected at higher rate than adults and females in the Gowani area ($p<0.05$), but there were no age and sex related differences in camels of the Fantalle area ($p>0.05$). Prevalence varied much between herds than within herds indicative, most likely, of ephemeral nature of disease transmission by mechanical vectors such as tabanids. Although not strong, prevalence appeared to be higher after rains (August to October) and at peak of the dry season (December to March) where the camel herds from different places congregate at watering points along permanent surface water bodies or bore holes. It is obvious that surra causes considerable socio-economic losses although it is difficult to make exact estimation. However, if Food and Agriculture Organization of the United Nations' static herd model estimate of annual losses from trypanosomiasis of US$10-20 per animal for cattle is also valid for camels it will be plausible to estimate annual losses of US$20-40 million from the population of about two million in Ethiopia. It is, therefore, recommended that management and appropriate treatment interventions could substantially reduce losses from surra in Ethiopia and elsewhere, where similar conditions prevail.

Keywords: Camel, prevalence, surra, vectors

Introduction

Camel (*Camelus dromedarius*) plays an important socio-economic role in the arid and semi-arid lowlands of eastern and southeastern Ethiopia, where nomadic and semi-nomadic pastoral and agro-pastoral production systems predominate. Camel is the major source of the highly valued milk supply and of transport energy in addition to its considerable contribution to meat supply for the human population in

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and out of their area of production. Moreover, the role of camel as cash income generator at producer as well at national levels is highly esteemed. Camel serves as an indicator of wealth and high social status, particularly in the society of pastoralists and agro-pastoralists of eastern and southeastern Ethiopia (Getahun and Belay, 2002). Camel is considered as the champion of domestic herbivores and conqueror of deserts, arid and semi-arid agro-ecological zones of Africa and Asia where it turns the scrub vegetation into valuable and useful products and byproducts for human consumption.

Despite all the above mentioned contribution and potential of camels to the betterment of human life, proportional respect and care are not given to these loyal and friendly animals considering animal husbandry and health care. Camels also have not attracted much attention from researchers and research organizations in view to improving their genetic potential and heath conditions for greater production and productivity.

In Ethiopia, human neglect and environmental vagaries, particularly of frequent recurrent droughts and feed shortages have aggravated the condition leading to unforgettable consequences of heavy mortalities on several occasions in recent past. Although camels are hardy animals to tolerate feed shortages and different infections than most other domestic animals in general, they do suffer from different parasites and diseases the severity of which usually depends on the animal's nutritional status as poorly nourished individuals suffer the most. The few reports on camel's health indicate that haemo-parasites, particularly surra, stands as the most important health problem of camels in many countries including Ethiopia (Richard, 1975; Olaho-Mukani *et al.*, 1992).

This study is attempting to fill the gap in knowledge in camel's trypanosomosis prevalence and distribution in the well-known camel rearing area of the Awash Valley. Hence, a three-year epidemiological study (December, 1998 - September, 2001) was conducted on camels/dromedaries using conventional parasitological and entomological techniques.

The main objectives of this study were to determine the etiology, prevalence and distribution of *T. evansi* infection in arid and semi-arid Awash Valley of Ethiopia with the view of assessing the economic impact and devising appropriate intervention strategy to alleviate the problem.

Materials and Methods

Study area

The study was conducted in Fantalle and Gowan districts, in Oromia and Afar regional states respectively, located in semi-arid and arid agro-ecological zones in the Awash Valley (Figure 1). The reason for the selection of the two sites was, the

little information available from these two sites than other camel rearing areas, but these areas are known for camel rearing in the eastern part of Ethiopia.

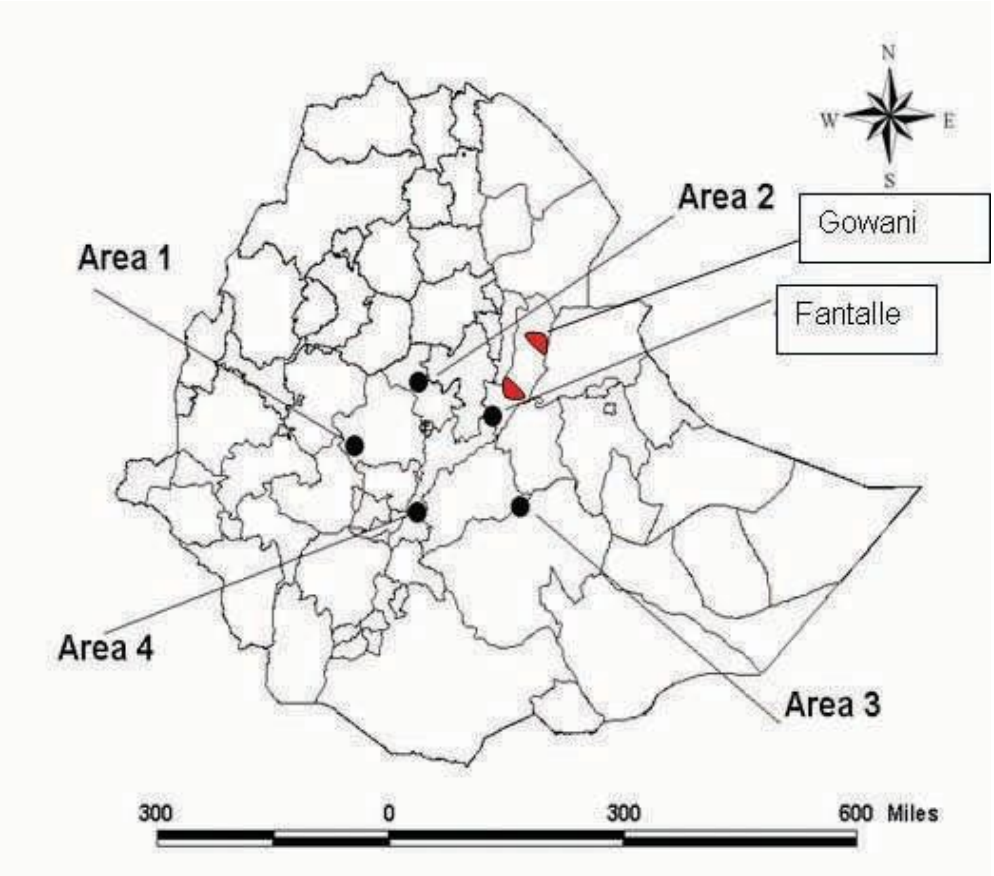

Figure 1. Surra study sites in Gowani and Fantalle areas. Area 1-4 not included for this study.

Sampling methods

Blood sampling: In each site, 50 animals of all age groups i.e. calf (6 to 12 months old), young (12 months to 3 years older), and adult (3 years and above) were randomly selected on each visit. Males and calves were generally fewer in number. It was tried to sample what was available and the analysis made into different age groups and sex was only to extract more information about the distribution of surra with what was made available.

Thick and thin blood smears were prepared from ear tip of each animal on clean and grease-free slides by deep puncture with sterile needle and allowed to dry thoroughly and then kept in dust-free slide boxes. Thin smears were fixed for three minutes with

absolute methyl alcohol on the same day they were prepared. Both thick and thin smears were stained with 10% Giemsa solution pH 7.2, for 35-40 minutes in the laboratory. Slides were then thoroughly washed of excess stain with tap water and allowed to drip-dry in an upright position before microscopic examination. Smears were examined under x40 and x100 oil immersion objectives and at least, 100 fields were scrutinized before a slide was considered negative. Identification of trypanosome parasites were based on morphology and measurement using standard identification keys (Soulsby, 1982; Morel, 1989). Blood samples were taken seasonally in heparinized micro-haematocrit capillary tubes from same animals that were subjected to blood smear sampling for packed cell volume (PCV) determination. PCV was determined within two hours after taking the blood samples. Buffy coat technique (BCT) could have been one of the sensitive methods to test surra, however, it was not employed because of the reason that the technique does not detect other haemo-parasites, such as Babesia, Theileria etc.

Vector sampling: Potential vectors were captured on and off the host using fine forceps and hand nets depending on feeding behavior of each vector. Traps were used to catch flies. Fine forceps were used in collecting ticks from their attachment sites on the host. Ticks were collected to identify them in order to determine their vector role for haemo-parasites which prefer their vector. Vector samples were collected in properly labeled specimen bottles, half-filled with 70% ethyl alcohol. Identification was carried out in the laboratory under stereomicroscope using standard identification keys (Soulsby, 1982; Morel, 1989). Data were analyzed using both descriptive statistics and the General Linear Model Procedures of SAS (SAS, 2002)

Results

A total of 1013 blood samples were collected from juvenile, young and adult camels of both sex groups in the two project areas of Fantalle and Gowani. A total of 637 animals were from Fantalle and 376 from Gowani. Only T. evansi was detected in herds of both areas with similar prevalence when animals of all age and sex groups were considered together. The mean prevalence in Fantalle was found to be 5% while that of Gowani was 5.6% indicating no significant differences ($P>0.05$). Animals of different age and sex groups in Gowani area manifested significantly different prevalence rates ($P<0.01$) by a Chi-square test, but 33% of the cells had expected values less than five. In Fantalle area no such difference was apparent (Table 1 and Figure 2). In Gowani area, the young stock, particularly the males appeared to be more frequently infected than the adults and the females, respectively. A study in Kenya (Olaho-Mukani et al., 1992) showed a high prevalence (85%, n=55) in males while all females were parasitologically negative (0%, n=83). The overall mean prevalence of the two areas was calculated at 5.2%, of which 32 out of 637 (5%) was from Fantalle and 21 out of 376 (5.6%) from Gowani.

Table 1.The prevalence rate (%) of surra in different age and sex groups of camels in the middle and lower Awash Valleys

Study area	AEC	Age group									Sex					
		Calf (1-12 months)			Young (12-36months)			Adult (> 36 months)			Male			Female		
		n	Inf	%	n	Inf	%	n	Inf	%	n	Inf	%	n	Inf	%
Gowani	Arid	50	8	16	78	5	6.4	248	8	3.2	58	6	10.3	318	15	4.7
Fantalle	Semi-arid	57	3	5.3	211	11	5.2	369	19	5.2	136	6	4.4	501	26	5.2
Total		107	11	10.28	289	16	5.54	617	27	4.38	194	12	6.19	819	41	5

n=number of camels examined, Inf = number of camels infected with surra

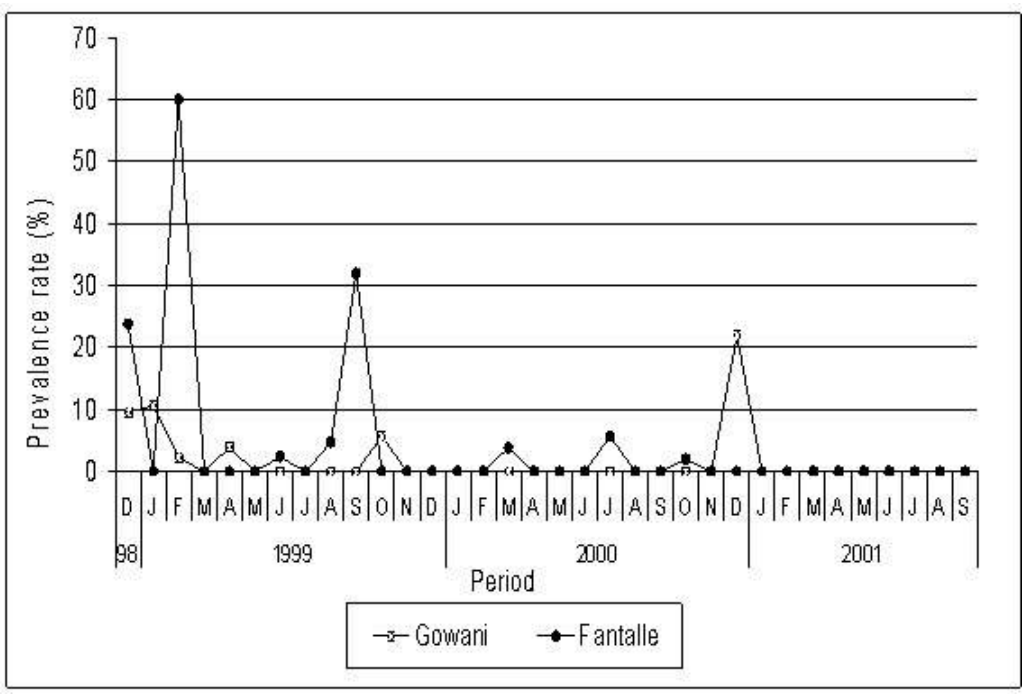

Figure 2. Prevalence of sura during the period Dec 1998-Sep 2001

Infection rates varied from place to place and from time to time and ranged from 0 to 60% (Figure 2). Although not consistent, infections appeared more common after rainy season between August and October, and during dry season between December and March when camel herds from different villages (encampments) meet at watering points far away from their camp-stead (Figure 2). Potential vectors identified in the study areas are depicted in Table 2 where *Tabanus* spp, *Stomoxys* spp *Lyperosia* spp and *Hippobosca* spp were dominant. *Tabanusspp* and *Stomoxys spp* were probably the chief culprits for surra transmission in the study area, although neither transmission trials nor dissections for infection rate analysis of the potential vectors were carried out in this study.

Table 2. Potential vectors identified in camels in the study areas

Study area	Agro-ecological climate	Animal species	Acarines	Insects
Gowani and Fantalle localities	Arid climate	Cameline*	Amblyomma cohaerens	Hippobosca spp
	Amblyomma gemma			Lucilia spp
	Amblyomma lepidum			Lyperosia spp
	Amblyomma variegatum			Musca spp
	Boophilus decoloratus			Stomoxys spp
	Hyalomma dromedarii			Tabanus spp
	Hyalomma marginatum rufipes Hyalomma truncatum Rhipicephalus evertsi evertsi Rhipicephalus pulchellus Rhipicephalus simus			

* the breeds are consisted of the Afar and Ogaden camels' breed and their crosses

Trypanocidal drugs were infrequently applied to camels for surra treatment according to the informal interviews made to selected elders from among camel breeders and veterinary personnel in the study area probably due to misdiagnosis or inability of diagnosis of the disease.

Affected herds showed high prevalence rates while there were many instances in same localities where camel herds not involved by the incident were encountered. This is believed to be due to ephemeral nature of surra mechanical transmission by biting flies in animals living in close contact. This phenomenon has produced an apparently low surra overall prevalence rate in the area of study. Although overall mean prevalence rate in Gowani was slightly higher than that of Fantalle, the highest prevalence rate in one visit was recorded in the latter in February 1999 (Figure 2).

The investigation team encountered three active cases, *i.e.*, two in Fantalle and one in Gowani localities, during the study period. In the one case of Fantalle area three adult female camels were found prostrate with typical symptoms of surra such as fever, debility, wasting, anaemia and lachrymation. The other two incidents, one around Gowani town and the other at Matahara veterinary clinic, involved mainly growing stock (1-3 years of age), which showed major symptoms of fever, coughing and lachrymation. Microscopic examination of blood smears taken from these animals revealed high parasitaemia of *T. evansi*. The PCV results were omitted because it did not give any additional information to separate infected and uninfected.

Discussion and Conclusion

This study has indicated that surra is a common disease of camels in the project area, although actual prevalence could have been higher had more sensitive techniques been employed in the study. Scott (1974) found a surra prevalence of 19% in camels in Negele area of southern Ethiopia through thin and thick blood smear examination whereas he obtained a prevalence of 37% from same animals by mouse inoculation test. The

overall 5.2% prevalence rate, which we obtained in camels of Gowani and Fantalle area would have provided a prevalence of not less than 10% had mouse inoculation technique been utilized in the study in analogy to the study conducted in Negele area (Pegram and Scott, 1976). Dirie *et al*. (1989) found similar results of 5.33% from 3000 blood samples analyzed in Somalia. Njiru *et al*. (2004) in Kenya also obtained similar results of 5.3% by microhaematocrit centrifugation technique (MHCT). However, they reported higher prevalence rates utilizing polymerase chain reaction-PCR (26.6%) and card agglutination test-CATT/*T.evansi* (45.9%) from randomly sampled 549 camels. Some other reports in southern Ethiopia (Scott, 1974; Pegram and Scott, 1976) put surra prevalence in camels at 15-19% by thin and thick smear method, 37% by mouse inoculation and 53% and 66% by mercuric chloride and formol gel test, respectively. Shank (2005) reports the prevalence of 15% in Shinile zone of Somali Regional National State of eastern Ethiopia.

The higher surra prevalence recorded in our study in growing stock and particularly in calves contradicts with some previous work elsewhere (Jaiquiet *et al.,* 1994) where it was stated that young calves below one year old seem to be free of *T. evansi* infection. Njiru *et al.,* (2004) also declared that an adult camel was 2.2 times more likely to be infected when compared to calves or young. However, our study has indicated, on several occasions, that infections are detected more frequently in growing stock than in adults. This is assumed to be due to newer infections in the young age that does not give much time for the parasite to go into chronicity where parasite detection becomes difficult through microscopic examination. Management differences amongst camel breeders could also be the factor responsible for the variation of surra prevalence in different age groups. Some breeders keep the calves around camp-stead while others allow the calves to follow the adults in most of the cases. Such practices will obviously produce variable levels or degrees of exposure to surra infection in the concerned stocks. Calves, which roam with the adults, will have greater risk of acquiring the infection than those kept most of the time around camp-stead/homestead.

As to camel surra prevalence variation in different herds, it appears that the suitability of the environment for multiplication of biting flies plays major role. Camels, which graze or stay for longer time along river courses with ample woody vegetation, would have more chances of being bitten by haematophagous flies (Table 2) than those grazing far away from river courses. The latter would be at risk only during watering times where they could meet other infected herds at the watering points. The risk could significantly be reduced, if mingling of uninfected with infected herds is avoided.

The assessment of the impact of surra in camels in the study area or in the whole country is not an easy task to undertake considering, *inter alia*, the lack of necessary information on camel production and productivity, on the one hand, and the actual number of animals affected by the disease at any one time on the other. However, there

should not be any doubt that surra in the affected animals produces morbidity and mortality losses of variable degrees depending on the challenge level, parasite strain, physical condition (plain of nutrition) of affected herds, environmental and man-made stresses to which the animals are subjected and a host of other circumstances that may prevail in the host or in the environment. All the camels in the area are at risk of acquiring surra infection at any one time as the parasite and its vectors are present in the area at variable frequency. If the Food and Agriculture Organization of the United Nations-FAO/UN (1991) static herd model estimate of annual loss from trypanosomiasis of US$10-20 per animal per year from cattle is applicable also to camels, the camel population in the study area could be multiplied by the annual loss per animal (US$10-20) to obtain annual loss from the population each year. Ethiopia with nearly two million camels all of which are at risk of acquiring surra could potentially lose US$20-40 million per annum according to the abovementioned estimate.

Losses from camel surra could be greatly reduced if appropriate intervention that is based on vector distribution and abundance and on camel management system is correctly applied. Strategic application of effective trypanocides (antrycide sulphate, cymelarsan, etc.) at the right dose rates during or just after rainy seasons, preferably to all animals in the affected herd, would effectively control the disease. Separation of different camel herds at watering points could assist in stopping transmission of the infections between herds. A tactical block application of trypanocides could also be given at any one time when more that 5% of the herd is found parasitologically positive to further enhance the reduction of losses. The control of biting flies such as *Tabanus, Stomoxys, Lyperosia* and *Hippobosca* species during peak fly seasons using appropriate insecticide formulations, preferably synthetic pyrethroid 'pour-ons', could significantly reduce surra prevalence and associated losses.

The standard parasitological detection technique (SPDT) employed in this study was not sensitive enough to capture all infected cases, and certainly, might have underestimated the magnitude of the problem. It is recommended that future studies need to employ more sensitive and specific techniques including animal inoculation, monoclonal antibody-based techniques such as the enzyme-linked immuno-sorbent assay (ELISA), card agglutination trypanosomiasis test (CATT) and recombinant DNA-based techniques in order to come up with reliable qualitative and quantitative analysis of surra and its impacts.

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