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Prevalence of Bovine Trypanosomosis in Morogoro, Tanzania

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Abstract: The prevalence study of bovine trypanosomosis was conducted in 43 smallholder farms which were randomly selected from 350 cattle farms and seven medium scale farms purposively selected in Morogoro, Tanzania. A total of 509 and 102 cross breed and local cattle, respectively aged six months and above were used in the study. The selected animals were examined for clinical signs of trypanosomosis and thereafter screened for haemoparasites using direct blood smears and micro-centrifugation methods. The overall prevalence of trypanosomosis in cattle was 2.3% (95% CI: 1.4-3.8, n = 691). Infected animals (n = 16) had the mean rectal temperature of 39.1°C±1.03. The mean number of parasites and PCV was 8.6±13.6 and 24.8%±7.9, respectively. Specific infection rates based on trypanosomas species were 0.4%, 0.6%, and 1.3% for *T. congolense*, *T. brucei* and *T. vivax* respectively. A highly significant ($P < 0.05$) infection rate was found in cattle on farms located in northeastern part of Morogoro town (4.0%, n = 303) than those in the southwest (1.0%, n = 388, RR = 3.84, 95% CI = 1.18 - 16.98). Sex, breed, grazing system, farm size, acaricide application and chemoprophylaxis were not the risk factors for the trypanosomosis infection. It was concluded that, despite a continuous uses of chemoprophylaxis, synthetic pyrethroids, bush clearing and many other methods against tsetse flies, trypanosomosis is still prevalent in cattle in Morogoro. Animals in the livestock-wildlife interphase are at higher risk of infection. It was recommended that trypanosomosis losses due to cattle mortalities, reduced production and reproduction performance, continuous disease treatment and control costs need to be quantified. Knowing the associated losses may call for strengthening the disease surveillance, treatment and control strategies which are aimed at reduction or total elimination of the tsetse flies.

Key words: Cattle, morogoro, infection, trypanosomosis, tsetse flies

Introduction

Bovine trypanosomosis is a major animal disease constraint to livestock production in sub-Saharan Africa. It is estimated that some 46 million cattle are at risk of contracting African animal trypanosomosis in sub-Saharan Africa (Kristjanson *et al*., 1999; FAO, 2000). Tsetse flies, through the cyclical transmission of trypanosomosis to both humans and their animals, greatly influence food production, natural-resource utilization and the pattern of human settlement throughout much of sub-Saharan Africa (SSA). It is estimated that the annual direct production losses in cattle alone amount to between US $6000 million and $12000 million, while animal deaths may reach 3 million in SSA (FAO, 2000). It is estimated that over one million tonnes of meat in SSA equivalent per year and 1.26 million tonnes of milk per year valued at US dollar 5 billion are being lost due to trypanosomosis infection (Jahnke *et al*., 1988). In Tanzania, tsetse-borne diseases, and in particular bovine trypanosomosis is one of the two most important diseases that are responsible for reduced livestock productivity and together with tick-borne diseases they are responsible for 75% of the morbidities and mortalities in cattle (Jahnke *et al*., 1988).

Trypanosomosis, which takes the form of an acute or chronic status, is normally characterized by fever, anaemia and loss of productivity; with cattle being the most susceptible domestic animal to *Trypanosoma congolense*, *Trypanosoma vivax* and *Trypanosoma brucei* infections (Blood and Radostitis, 2007). Tsetse flies are the most common vector for the trypanosomas and they occupy up to ten million square kilometers of Africa. In Tanzania, there different species of tsetse flies (*Glossina spp*) and occupy up to two thirds of the land. The species include *Glossina morsitans*, *Glossina pallidipes*, *Glossina swynnertoni* and *Glossina austeni* occupying the savannah areas, *Glossina fuscipes* occupying riverine and lake areas, around Lakes Victoria and Tanganyika and *Glossina longipennis* and *G. brevipalpis* occupying fringe forests areas (Connor and Halliwell, 1987; Ministry of Agriculture and Co-operatives, 1998).

Trypanosomosis continues to be a menace in the livestock industry in Tanzania despite the age long attempts to control the disease. The tsetse flies eradication efforts should be strengthened in view of the fact that the disease transmitted by tsetse not only affects livestock but also humans. Because of the importance of the disease in the livestock industry, it is

necessary to have a regular surveillance and ascertain the status of the disease. The purpose of this study was to establish the prevalence of trypanosomosis in cattle in selected farms around Morogoro town.

Materials and Methods

Study areas, farms and animals: This study was conducted in the urban and peri-urban areas of Morogoro municipality. A total of 43 smallholder farms were randomly selected from a sampling frame comprising of 350 farms. In addition, seven medium scale farms (Kingolwira, Lutheran Junior Seminary, Shem, Mwilunga, ARU Otitis, Nasar and Ole) were purposefully selected for convenient of shipping samples to the laboratory and willingness of the farmers to participate in the study. After selection of the study farms, all the animals with the six months of age in the selected farms were screened for trypanosomosis.

The field study was conducted in both urban and periurban areas in Morogoro. Morogoro municipality is situated at the latitude 5.7-10°S and longitude 35.6-39.5°E, with an elevation of 1200m above sea level and is about 200km west of Dar es salaam, the capital city of Tanzania. Annual average rainfall ranges between 500 and 1800mm and ambient temperature ranges between 18-28°C. The municipality areas have a bimodal rain pattern, with about 83% of the rain falling between late February and end of May and short rains between November and January. The vegetation cover of the area ranging from northeastern to southwestern parts of Morogoro town is extremely variable. It ranges from drier lowland coastal forest habitats, to transitional rainforests, to sub-montane, montane and upper montane forest types.

The study area was arbitrary divided into two parts; the northeastern and southwestern parts of Morogoro town. The northeastern areas are located towards Dar es salaam. Up to 30 km away from the town center, the area is more occupied for human settlement and has active agricultural activities. On the other hand, the southwestern areas have pronounced dry seasons. To the eastern parts, the area is boarded to Mikumi national park. This area is less populated with minimal agricultural activities but more occupied by pastoralist herds of cattle. Twenty one small holder and three medium scale farms were located in the northeastern area while 22 small holder and four medium scale farms were from southwestern areas of the town.

The cattle screened were mainly were crossbreeds of Friesian, Ayrshire and Jersey. Two farms medium and some small scale farms had local breeds of cattle namely Borans and Tanzania shorthorn zebu. The animals were managed under a semi-intensive management system whereby the animals were sent out for grazing and supplemented with some cut grasses and concentrates when animals are back-home. However, other small scale farms had their animals under total confinement being stall fed. The use of acaricides against ticks and flies is common and in some farms chemoprophylaxis against trypanosomosis and helminths are routinely used. The traditional herds of cattle were managed under pastoral system and no disease preventive measures were given.

Screening of animals for trypanosomosis: During the farm visits to the selected farms, herd and animal information were recorded. These included number of the animals in the farm, breed, sex, age, use of chemoprophylaxis and acaricides; grazing systems and the area where the farm located. General health status of the animals was assessed and all the animals showing signs of ill health were recorded. Thereafter, blood smears were collected from the ear veins; air-dried, fixed with absolute ethanol and well packed in slide racks before shipment to the laboratory. In addition, some blood samples were collected in the heparinized capillary tubes and properly sealed for blood packed volume (PCV) analysis.

In the laboratory the blood samples were screened for trypanosomas using Standard Trypanosome Detection Methods (STDM) thin smear examination as well as the microhaematocrit centrifugation buffy-coat examination as described by Sewell and Brocklesby (1990). Briefly, the dried and fixed smears were stained with 10% Giemsa solution for 30 minutes, washed with tap water and air-dried then examined under the microscope at magnification of x100 under oil immersion. Ten random fields in each smear were examined in order to establish whether the smear was negative or positive. For the positive smears, the trypanosomas were identified to species level using morphological appearances and quantification of the number of parasites (parasitemia level) was done by physical counting of the parasites (Murray *et al.*, 1983). PCV and Buffy coat examination was carried out as described by (Paris *et al.*, 1982).

Results

General results: Up to 56% of all the farms were located in the southeastern part of the Morogoro town. Both smallholder and medium scale farms, were dominated with crosses of local with exotic breeds of cattle accounting up to 85.2% (n = 589) and the local breeds were 14.5% (n = 102). Of the screened animals, 78% were female animals and 22% were males. All the small scale and 74% of the medium scale farms screened were using acaricides routinely. Ninety percent of all farms were grazing their animals outside in the field. Most of the farms (87%) under study were using isometamedium chloride as a control of trypanosomosis at the interval of three months.

Trypanosome screening results: The overall prevalence of trypanosomosis in cattle was 2.3% (95% CI: 1.4-3.8, n = 691). The infected animals (n = 16) had the mean rectal temperature of 39.1°C±1.03, with the mean number of parasite and PCV being 8.6±13.6 and 24.8% ±7.92, respectively. Interestingly, one animal had parasitaemia level of up to 58 trypanosomas in 10 fields and the PCV was 16%. Results on prevalence and risk factors of trypanosomosis in cattle are summarized in Table 1. Specific infections rates based on trypanosomas species were 0.4, 0.6 and 1.3% for *T. congolense*, *T. brucei* and *T. vivax* respectively (Table 1). Of the 16 trypanosome isolated identified, 56.25% (n = 9), 25.0% (n = 4) and 18.75% (n = 3) were *T. vivax*, *T. brucei* and *T. congolense* respectively. A highly significant ($P < 0.05$) infection rate was found in cattle of farms located in northeastern part of Morogoro town 4.0% (n = 303) than those in the southwest 1.0% (n = 388, RR = 3.84, 95% CI = 1.18-16.98). The northeastern part of Morogoro is known to have high tsetse fly challenge since it is towards Mikumi national park. Cattle sex, breed, grazing system, farm size, acaricide applications and chemoprophylaxis were not associated with trypanosomosis.

Discussion

This study has demonstrated that trypanosomosis is prevalent in cattle in Morogoro and is among the limiting factors to cattle production industry. The species isolated in the survey were *T. congolense* (18.75%), *T. brucei* (25.0%) and *T. vivax* (56.25%) being the most prevalent spp in cattle of Morogoro. Such findings are in line with other studies by Msolla (2001), Mbwambo *et al.*, (1988), Eisler *et al.* (1999) and Peregrine *et al.* (1988). However the prevalence of trypanosomosis recorded in this study is low compared to that reported by Connor and Halliwell (1987) who reported the prevalence of 16% in southern Tanzania.

The lower prevalence might be attributed by regular use of trypanosome chemoprophylaxis as most farmers (86%) were using isometamedium chloride since were aware of the disease and its control. Moreover, the weekly use of pyrethroids acaricides against ticks probably has contributed to the reduction of tsetse fly density. For instance, in the study conducted by Msolla (2001), a 93% reduction of tsetse flies in Melela was reported following the use of alpha-cypermethrin 10% preparation. Dipping animals in synthetic pyrethroids appeared to have inadvertent positive effect of also controlling tsetse flies at Kambala area in Morogoro (Mbilu *et al.*, 2007). Increased urbanization, villagelization and clearing of bushes in preparation of land for agriculture and settlements may have significantly contributed in the reduction of tsetse flies density and consequently the reduced prevalence of trypanosomosis as was also reported by Reid *et al.*, (2000) and Thornton *et al.* (2006). However, the low prevalence rate could also be due to the use of less sensitive diagnostic tools (blood smears and micro-centrifugation) in this study.

The effect of trypanosome on these animals range from anaemia, immunosuppression, retarded growth, low milk production and weight loss as well as infertility, abortion, stillbirth and depressed reproductive performance (Elhassan *et al.*, 1994; Losos and Ikede, 1972). With the current prevalence, the disease still causes losses by poor meat and milk production, increased costs for treatment and control which all lead to losses to farmers. The importance of cattle industry in the economy of the Tanzania cannot be over emphasized as it contributes up to 24% of the agricultural Gross Domestic Product (GDP). Therefore with existence of trypanosomosis despite the age long attempts to control the disease, more efforts and targeted strategies are needed to rescue the industry. Continuous intensified surveillance, treatment and control of trypanosomosis and its vectors can make the disease remain as a history. The expected spin-off effects from tsetse-trypanosomosis control on the socio-economy of the livestock keepers' communities are increased production and reproduction performance of their animals and hence improved likelihood of the rural poor. Indeed, it is argued that the tsetse-trypanosomosis problem has been contributing significantly to increased poverty among the pastoral and agropastoral communities in Tanzania.

The establishment of trypanosomosis at higher infection rates in cattle which belong to the farms located in the northeastern part of the Morogoro town suggests high tsetse challenge. These areas are towards Mikumi national park whereby there many tsetse flies in the wild animals which are the potential reservoirs for trypanosomosis. Moreover, the northeastern part of the town has much vegetation cover dominated by acacia and combretum species. Such kinds of vegetation give a favourable habitat for the tsetse flies.

Most animals which were trypanosome positive were clinically normal with the mean rectal temperature, number of parasite and PCV being 39.1°C±1.03, 8.6±13.6 and 24.8%±7.92, respectively. The normal clinical parameters in infected cattle may suggest that the animals probably were affected by the chronic form of the disease. Such animals look clinically normal which is contributed by the balance established between the parasite and the host and such animals remain carrier for longer periods. However, for the infected animals to develop clinical manifestation, sometimes depends on the dose of trypanosome inoculated, strain of the pathogen and the host. Indeed, the severity of the disease varies with species and age of the animal infected. Surprisingly, one animal had parasitaemia level of up to 58 trypanosomas in 10 fields, rectal

Table 1: Prevalence and risk factors for trypanosomosis in cattle

Risk factors	Category	Sample (n)	Prevalence (%)	RR	95%CI
Sex	Female	539	2.8	4.23	0.65-4.32
	Male	152	0.7		
Breed	Crosses	589	2.2	1.21	0.27-11.20
	Local	102	2.9		
Grazing system	Field grazing	625	2.6	-	-
	Zero grazing	66	0.0		
Farm size	Medium	375	2.9	1.85	0.59-6.97
	Small	316	1.6		
Acaricide use	Not use	100	3.0	1.41	0.26-5.31
	Use	591	2.2		
Chemoprophylaxis use	Not use	100	3.0	1.41	0.26-5.31
	Use	591	2.0		
Location	Northeast	303	4.0	3.84	1.18-16.98
	Southwest	388	1.0		

Table 1: Continue

Risk factors	Category	p-value	Isolates (n)	*T. brucei* (%)	*T. vivax* (%)	*T. congolense* (%)
Sex	Female	0.124	15	0.6	1.7	0.6
	Male		1	0.7	0.0	0.0
Breed	Crosses	0.797	14	0.7	1.5	0.2
	Local		2	0.0	0.0	2.0
Grazing system	Field grazing	0.189	16	0.6	1.6	0.5
	Zero grazing		0	0.0	0.0	0.6
Farm size	Medium	0.239	11	0.8	1.6	0.5
	Small		5	0.3	0.9	0.3
Acaricide use	Not use	0.585	3	0.0	1.0	2.0
	Use		13	0.7	1.4	0.2
Chemoprophylaxis use	Not use	0.585	3	0.0	1.0	2.0
	Use		13	0.7	1.4	0.2
Location	Northeast	0.011*	12	1.3	1.7	1.0
	Southwest		4	0.0	1.0	0.0

* Significantly different $p<0.05$

temperature of 40^{0}C and the PCV was 16%. The animal died two days post diminazene treatment. Normally anaemic animal in poor condition in an endemic area suggests trypanosomosis as was the case for this animal. Comparatively, the local cattle are said to be more resistant to many infections including exotic ones and their crosses. This explains also the fact that of the 100 indigenous cattle screened in this study which were neither dipped in acaricide nor given chemoprophylaxis while were kept only 20km to Mikumi national park where there is high tsetse challenge had only one animal being trypanosome positive.

The dominance of *T. vivax* in cattle affected by trypanosomosis recorded in this study is a further confirmation of the earlier findings (Mbwambo *et al.*, 1988; Silayo and Mkoma, 1988; Msolla, 2001) in different parts of Tanzania. However, the current findings are different from those of Connor and Halliwell (1987) who reported a specific species infection rate of 56% for *T. congolense* in cattle, 17% and 2.2% due to *T. vivax* and *T. brucei* respectively. *Trypanosoma vivax* is the most dominant species of trypanosome in east Africa. Jordan (1974) reported that trypanosoma infection rates in tsetse flies vary greatly from species to species, with *T. vivax* ranking the highest and *T. brucei* species ranking the lowest. Indeed, *T. vivax* higher infection rate may partly be contributed by its means of transmission since it can be transmitted mechanically by biting flies like *Tabanus spp.* and the pathogen can even occur in absence of tsetse flies. In general, infection rates of the trypanosomas in cattle determined by the number and parasite in place, the host susceptibility, availability of the vector and the environment.

In conclusion, despite a continuous use of chemoprophylaxis, synthetic pyrethroids, bush clearing and many other methods against tsetse flies trypanosomosis is still prevalent in cattle population in Morogoro. The farms located in the northeastern part of the Morogoro town are more affected by the disease meaning that the increased tsetse challenges in the livestock-wildlife interphase have an inadvertent positive effect on trypanosomosis in domestic animals. In addition, the losses due to cattle mortalities, reduced production and reproduction performance, continuous disease treatment and control costs are yet to be quantified. In the absence of a vaccine for trypanosomosis and with the looming threat of trypanocidal drug resistance, the only means of

controlling the disease is through controlling the vector population. Although complete eradication of the vector is impossible, the most successful attempts at controlling tsetse flies should aim at a significant reduction of tsetse flies density and their contacts with cattle.

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