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The Complementary Roles of Biting Flies and Reservoirs of Infection: In the Resurgent of African Animal Trypanosomosis in Keffi Local Government Area of Nassarawa State, Nigeria

[1]S.M. Samdi, [2]J.N. Abenga, [1]B. Wayo, [3]W.P. Mshelia, [1]D. Musa, [1]M.K. Haruna, [1]B.U. Musa, [1]I. Bala and [1]K. Adeyemi

[1]Nigerian Institute for Trypanosomiasis Research, Kaduna, Nigeria
[2]Department of Veterinary Pathology and Microbiology, University of Agriculture, P.M.B. 2373, Makurdi, Nigeria
[3]Department of Veterinary Surgery and Medicine, Faculty of Veterinary Medicine, Ahmadu, Bello University, Zaria, Nigeria

Corresponding Author: S.M. Samdi, Nigerian Institute for Trypanosomiasis Research, P.M.B. 2077, Kaduna, Nigeria

ABSTRACT

The aim of this study is to investigate the prevalence of trypanosomosis in a semi sedentry herd on a farm in Angwan Ninzom Keffin local government area of Nassarawa state. The complicating role of mechanical transmitters and reservoirs of infection in the epidemiology of trypanosomosis was reviewed. A total of sixty eight blood samples collected at random and examined using the parasitological method and concentration method Haematocrit Centrifugation Technique (HCT) and Buffy Coat Method (BCM) and Giemsa stained thin films made after BCM examination. The overall infection rate of 5.5% was recorded in the herd while infection rate of 10% occured in the bulls and 5.2% was observed in cows. The average Packed Cell Volume (PCV) of infected animal appeared lower (26±1.7) than the average Packed Cell Volume (PCV) of non infected (control) (35±0.6) and these values were statistically significant at ($p<0.05$). Half of the herd showed Lacrimation, Pallour of the mucous membranes, dry muzzle and pyrexia, progressive emaciation despite normal appetite, the above mentioned clinical signs were in variation. However, emaciation was observed in 26 (38.3%) of herd along with a normal appetite and all the infected animal appeared emaciated. The trypanosome encounted were *T. vivax* (75%) and *T. brucie* (25%). The presence of biting flies (*Tabanus* sp., *Stomoxy* sp. etc.) on the farm were noted.

Key words: Mechanical transmitters, reservoirs of infection, resurgent, trypanosomosis, *T. vivax*, *T. brucie*

INTRODUCTION

African animal trypanosomiasis a complex debilitating Protozoan disease of animals ranked among the top 10 cattle diseases (Perry *et al.*, 2002). It is a major obstacle to food security in Nigeria (Samdi *et al.*, 2008, 2010b). The disease is found in many regions of the world, but mainly between latitude 14°N and 29'S in sub-Saharan Africa. Despite the age long attempt to control the disease through vector control and chemotherapy/ chemoprophylaxis the present resurgence of the disease presents a major constraint in the development of the African continent (Perry *et al.*, 2002; Abenga and Lawal, 2005; Samdi *et al.*, 2010a). The parasite was introduced into Latin America that is tsetse free through cattle imported from Africa, possibly in the late 19th century. However the parasite has now spread to ten of the 13 countries of the South American continent (Tudor and Alberto, 2001).

It is currently estimated that about 48 million cattle (Kristjanson *et al.*, 1999) are at risk of contracting African trypanosomiasis which stretches across over 40 countries within and outside the tsetse belt. African trypanosomiasis is responsible for 3 million livestock deaths annually and the losses in livestock production and mixed agriculture alone is valued at 5 billion US dollars yearly in Africa (PATTEC, 2000). The most important species of trypanosome causing disease in livestock in Nigeria are *Trypanosoma brucei brucei, T. congolense, T. vivax, T. simiae, T. evansi* (NAERLS, 2002).

Many species of Heamatophagous dipterans are responsible for the spread of diseases however the are categorized as those transmitting cyclically (Molyneaux an Ashford, 1983) mechanically (Dirie *et al.*, 1989) or by regurgitation (Colemen and Gerhardt, 1988). The mechanical transmission of trypanosomes in sub-Saharan Africa has been argumentative, therefore control measures were mainly targeted on tsetse with little attention on other bitingflies. The role of mechanical transmitters on the epidemiology of trypanosomes in tsetse infested Africa has been described as negligible (Taylor, 1930). However, Abenga and Lawal (2005), Desquesnes and Dia (2003, 2004) and Sinshaw *et al.* (2006) reported the relevance of mechanical transmitters in the epidemiology of trypanosomes in sub-Saharan Africa. The genera of bitingflies Tabanus, Heamatopota, Chrysops and Stomoxys and their possible presumed transmission capabilities has been reported in Ethiopia (Sinshaw *et al.*, 2006), Nigeria (Roeder *et al.*, 1984; Ahmed *et al.*, 2005) and Sudan (Rahman, 2005). Mechanical transmission of trypanosome by other vectors other than *Glossina* has been identified as a factor responsible for spread of the parasite to many parts of the world and maintenance of transmission in the presence of tsetse control (Tudor and Alberto, 2001; Sinshaw *et al.*, 2006).

Reservoir hosts harbour the parasites without showing symptoms of the disease serving as a source of infection. Destruction of reservoir hosts is difficult because of the large range of animals serving that purpose especially where several species of tsetse flies are involved in disease transmission. Hunters bring home wild game to domesticate and they contribute in no small way in the epidemiology of the disease. Animal reservoir hosts are believed to have contributed in the current resurgence of human sleeping sickness (Abenga and Lawal, 2005).

Mechanical transmission: Mechanical transmitters are important haematophagous vectors of other diseases (Rickettsia and Viruses) that weaken the defense mechanism and reduce feed intake of the host (Ahmed *et al.*, 2005). Their population is abundant through out the year and contributes to the presence of trypanosomiasis in places like Borno and Delta states where high densities of these flies occur with little or no tsetse activity (Onyiah, 1997). Mechanical transmitters are good flyers with high biotic potential (Seifert, 1996).

Transmission of trypanosomiasis has been reported by members of the genera Tabanid in Kenya (Wilson and Stevenson, 1989) as well as in the pastoral zone of Sideradougou, Burkina Faso (Mattuash, 1990). Similarly, the flies are responsible for the transmission of *Trypanosoma evansi* Steel, Balbiani among herds of camels in Mauritania (Diall *et al.*, 1987; Dial *et al.*, 1988). Transmission of trypanosomiasis in the complete absence of tsetse was also observed among camels in Somalia (Dirie *et al.*, 1989). *Tabanus taeniola* has been found capable of harbouring *Trypanosoma congolense* infections in Burkina faso (Solano and Amsler-Delafose, 1995), however Dirie *et al.* (1990) found trypanosomes in disected *Tabanuus bromius* Linneaus and *Heamatopota pluvialis* in Somalia. Evuti *et al.* (2004) reported the presence of infected biting flies (*Stomoxy* sp., *Tabanus* sp. and *Heamatobia* sp.) on a farm in Keffi local government area.

Experimentally the African tabanid *Atylotus* mechanically transmitted *Trypanosoma vivax* and *T. congolense* (Desquesnes and Dia, 2003, 2004). Experimentally stomoxy has the ability to transmit Trypanosoma brucei, *T. vivax*, *T. evansi* and *T. congolense* to mice within 3 min of interrupted feeding on highly parasitaemic blood. *T. brucei* was the easiest parasite to transmit with an 11.5% success rate, followed by *T. vivax* at 3.4% and *T. evansi* at 0.9%. *T. congolense* was not transmitted in 129 attempts. *Stomoxys niger* sp. and four unstudied species (*S. varipes*, *S. taeniatus*, *S. pallidus*, *Haematobosca squalida*) were capable of transmitting trypanosomes mechanically (Mihok *et al*., 1995). Microscopy and subinoculation of triturated flies into uninfected mice demonstrated the survival of *T. congolense* in Stomoxys for up to 210 min and *T. evansi* for up to 480 min. Parasites survived for much longer periods in the digestive tract than inside or on the mouthparts (Sumba *et al*., 1998). Epimastigote stages of trypanosome were isolated from Chrysops in Congo (Caubere *et al*., 1990).

Reservoirs of infection: When disease-causing organism establishes itselves in an animal, it attacks certain tissues, multiply and set up a disease process. The infected animal may eliminate the infective agent or carries an infective agent within its body without showing evidence of illness acting as a source of infection to other animals; or the carrier animal itself through some adverse condition may develop a frank attack of the disease (Schoening *et al*., 1956). In wild animals, trypanosomes cause relatively mild infections while in domestic animals they cause a severe, often fatal disease. The long coexistence of both tsetse flies and game animals may explain why most African wildlife species are tolerant of trypanosomiasis they become infected by the parasite but show no ill effects, therefore they become reservoirs of infection, but clinical trypanosomosis only manifests when these animals are stressed (Penzhorn *et al*., 1994; Steverding, 2008). In areas where the fauna of ungulates is very rich and coexists with domestic animals these animals could serve as important reservoirs of infection (Roberto *et al*., 1998). Trypanotolerant animals and their crosses are able to eliminate the parasite or carry the parasite within its body without showing clinical signs acting as a source of infection to other animals (Onditi *et al*., 2007).

Problem statement: A veterinary surgeon in charge of a cattle farm located at Angwan Ninzom, Keffi LGA Nassarawa State reported to Nigerian Institute for Trypanosmiasis Research Kaduna that his animals are showing the following signs; normal appetite, loss of condition, emaciation and death. He requested that they be examined and screened for blood parasites:

MATERIALS AND METHODS

On 27th /May/2008 a team of Research Officers from the Institute went to the farm in Angwan Ninzom, Keffi LGA Nassarawa State to carry out investigation. A total of 68 cattle were bled and examined. The following clinical signs were observed: Lacrimation, Pallour of the mucous membranes, dry muzzle and pyrexia, progressive emaciation despite normal appetite, recumbency, presence of ticks and biting flies were also noted. Using a 5 mL syringes blood samples was collected from the jugular vein of 68 animals selected at random than stored in 5 mL hepatrinised blood containers and were kept cool by placing them in cold boxes containing ice packs after collection. Parasitological examination was done in the Laboratory using the haematocrit centrifugation technique, HCT (Woo, 1971), Buffy Coat Method (BCM) (Murray *et al*., 1977) and Giemsa stained thin films made after BCM examination. The Packed Cell Volume (PCV) of each animal was also determined while trypanosome species were identified based on their motility using the BCM and morphological features from Giemsa stained films. The physical condition of the animals was also examined.

Table 1: Trypanosome infection rates in cattle on a farm in Keffi local government area of Nassarawa State Nigeria

Breeds and sex	No. examined	No. positive	Infection (%)	*T. vivax*	*T. congolense*	*T. brucei*	Mixed infection	Overall infection rate (%)
W/fulani bull	7	1	0.02	1	0	0	0	10.0
S/gudali bull	3	0	0	0	0	0	0	0.0
W/fulani cow	39	2	0.03	2	0	0	0	5.2
S/gudali cow	19	1	0.02	0	0	1	0	5.1
Total	68	4	0.07	3	0	1	0	5.5

*(S)Sokoto *(W)White

RESULTS

The prevalence of trypanosome and the specie of trypanosome are shown the Table 1. Out of the 68 animals sampled at random 4 animals were infected with trypanosme. The overall infection rate of 5.5% was recorded in the herd while an infection rate of 10% occured in the bulls, 5.2% was observed in cows. The infection rate in the herd due to *T. vivax* (75%) appeared higher than the infection rate infection rate due to *T. brucie* (25%). The average Packed Cell Volume (PCV) of infected animal appeared lower (26±1.7) than the average Packed Cell Volume (PCV) of non infected (35±0.6) and these values were statistically significant at ($p<0.05$). Half of the herd showed the above mentioned clinical signs in variation. However, emaciation was observed in 26(38.3%) of herd along with a normal appetite and all the infected animal appeared emaciated. The biting flies observed were *Tabanus* sp. and *Stomoxy* sp. All the animal were treated with diaminazene diaceturate and topical fly repellant (cypermethrine).

DISCUSSION

Surveys conducted between 1989 and 1991 in Northern Nigeria, where two thirds of Nigeria's livestock resources are concentrated showed a prevalence rate of 4.3% in cattle. A higher prevalence rate of 10.0% was obtained in a wider survey of all agro ecological zones between 1993 and 1996 (EEC Mid-term Report, 1992; NITR/NARP External Review, 1996; Onyiah, 1997). The overall infection rate 5.5% appeared higher compared to earlier reported infection rates of 1.88% in Gouta (Yanan *et al.*, 2007) but lower than 47.9% in Gouta and 98% in keffi and Adua (Evuti *et al.*, 2004). This study is in agreement with the findings of other researchers (Evuti *et al.*, 2004; Yanan *et al.*, 2007). That *T. vivax* is the predominant species confirming the economic importance of these specie infection to livestock industry in Nigeria giving the complementary roles played by other haematophaguos flies in epidemiology and mechanical transmission of *T. vivax* in the absence of tsetse or in the presence of tsetse control.

CONCLUSION

Mechanical transmitters and reservoirs of Infection play a significant role in the epidemiology and spread of *T. vivax* to other parts of the world were tsetse are absent or are being control. The extreme temperature and other hash enviromental condition in keffi LGC at the time of the study is unfevourable for tsetse infestation and survival. Trypanosomiasis control measures should include biting flies, surviellance of domestic animal resevoirs of infection along side treated, enlightment of animal health works along side herdsmen.

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