Bovine trypanosomiasis in tsetse-free pastoral zone of the Far-North region, Cameroon

P.F. Suh¹, F. Njiokou², A. Mamoudou³, T.M. Ahmadou⁴, A. Mouhaman⁵ & R. Garabed⁶

¹-²Department of Animal Biology and Physiology, Faculty of Science, University of Yaoundé I; ³Department of Parasitology and Parasitological Diseases, School of Veterinary Medicine and Science, University of Ngaoundéré; ⁴Mission Spéciale d’eradication des glossines; ⁵The Higher Institute of the Sahel University of Maroua, Cameroon; ⁶College of Veterinary Medicine, Department of Veterinary Preventive Medicine, Ohio State University, USA

ABSTRACT

Background & objectives: The Far-North region of Cameroon has been considered free of tsetse and trypanosomiasis for the past three decades. But recent reports by pastoralists indicate its reappearance in the region. This study was aimed to confirm the existence of cattle trypanosomiasis and determine its prevalence, and to establish pastoralists knowledge and practice (KP) of the disease in Ndiyam Shinwa pastoral zone of Cameroon.

Methods: A total of 118 herds were surveyed for a descriptive, cross-sectional study in Ndiyam Shinwa pastoral zone from May to November 2014. Out of these, 110 herds were visited in the beginning of the rainy season, 22 of the 110 herds (suspect cattle) were revisited along with the remaining eight herds in the end of the season. The blood samples of 635 suspect cattle and 135 nonsuspect cattle were collected. Samples were subjected to two diagnostic tests: Buffy coat test (BCT) and packed cell volume (PCV) determination. A survey on pastoralist’s (n = 118) KP about trypanosomiasis was also undertaken.

Results: Parasitological analyses revealed six infections by Trypanosoma vivax: Four in suspect cattle against two in nonsuspect cattle, corresponding respectively to apparent prevalence of 0.63 and 1.46% and true prevalence of (0.79–3.15%) and (1.82–7.30%). The proportion of cattle found infected in the PCV as well as BCT tests was 33.26% for suspect cattle. More than 75% of followed-up suspects showed persisting symptoms nearly three months after initial examination. The most common diagnostic signs for pastoralists were ruffled hair, lacrimation, anorexia and emaciation.

Interpretation & conclusion: Cattle trypanosomiasis has reappeared in the Far-North region and seems to be in the inter-epizootic phase. Pastoralists have a good knowledge of the disease, but their perception of its importance seems to be influenced by the persistence of symptoms attributed to this disease in suspect cattle.

Key words Cameroon; cattle; Far-North region; pastoralists, trypanosomiasis

INTRODUCTION

With a cattle population of >2.1 million, the Far-North region of Cameroon is considered to be one of the major regions of the country for pastoral activities¹. It is also an important destination for pastoralists of neighbouring countries who come from as far as Niger on transhumance to exploit its seasonal pasture². However, the pastoral potential of this region is impeded, due to several factors including endemic animal diseases.

Animal African trypanosomiasis (AAT) is a vector-borne parasitic disease caused by Trypanosoma congoense, T. vivax and T. brucei brucei. The first two species are more virulent and responsible for majority of the bovine trypanosomiasis cases³. Trypanosomes are mostly transmitted cyclically by the tsetse fly (Diptera: Glossinidae); however, mechanical transmission of these parasites by tsetse fly or other haematophagous insects such as Tabanids has also been demonstrated⁴. This explains the occurrence of T. vivax outside the tsetse belt in Africa and even out of the continent⁵.

During the 1960’s this disease was reported as one of the most important constraints to animal husbandry in the Far-North region of Cameroon, precisely between the Logone River and two tributaries (Serbwell and Taffat) of the Chari River⁶. This zone was also known as an important human African trypanosomiasis (HAT) focus, reporting cases since 1907⁷. Both human and animal trypanosomiasises were successfully controlled in the middle of the 1970’s after the eradication of tsetse fly⁷-⁸. The last cases of these diseases were documented in the end of the seventies. Trypanosoma vivax was the only trypanosome species reported in the infected cattle of the canton of Serbwell, and mechanical transmission by Tabanids...
was also suspected to occur\(^9\). Since, then no investigation attempted to describe the epidemiological situation of this animal disease in the region. Recent surveys of pastoralists highlighted bovine trypanosomiasis, as one of the most important animal health issues encountered in the region\(^2,10-11\). Considering the importance of the disease, pastoralists have increased the use of trypanocides with the possible risk for the development of trypanosomal drug resistance (TDR), defined as the loss of sensitivity of a species of trypanosome to a compound (drug) which it had previously been susceptible. The pastoralists-reported disease prevalence, based solely on clinical signs, is widely used in veterinary epidemiologic studies\(^12\); but the validation of this simple and cheap method is absolutely necessary for its usefulness in control decisions. For veterinarians of poor countries, the diagnostic methods of choice for the validation of the reported cases on the field, depend heavily on the accessibility of the equipment and on their capacity of quick disease identification.

The buffy coat test (BCT) is a parasitological technique that concentrates trypanosomes in blood. It is particularly important when the parasite is undetectable in thin or thick smear microscopic examination\(^3\); but the detection threshold for this method remains low: 200–1000 trypanosomes/ml of blood\(^13\). BCT is nevertheless preferred over the serological anti-trypanosomal antibody detection tests which require laboratory facilities and do not differentiate infected animals from cured animals because of the persistence of antibodies\(^14\). Packed cell volume (PCV) determination is another accessible mean for the diagnosis of infected animals; it measures anaemia, a well-recognized and inevitable consequence of an infection with pathogenic trypanosomes, including \(T.\) congolense and \(T.\) vivax in livestock; and in the absence of other anaemia causing factors it stands as a reliable indicator for trypanosome infection in animals\(^15\). Moreover, PCV determination increases the sensitivity of BCT when used in combination\(^16\). Both methods can be used in field veterinary laboratory to assess animal trypanosomiasis prevalence.

This study was undertaken to ascertain the existence of trypanosomes in cattle in the Far-North region of Cameroon, decades after tsetse elimination, to determine the importance of bovine trypanosomiasis and to establish pastoralists’ knowledge and practice (KP) of the disease.

**MATERIAL & METHODS**

**Study area**

The Far-North region of Cameroon (9°40’N–13°05’N and 12°15’E–16°45’E) is a Sudano-Sahelian zone covered by savannah and steppes; it is characterized by three main seasons: Rainy season (June–October), cold dry season (November–February), and hot dry season (end of March–May). Pastoralists of the region can be grouped into two categories: The sedentary and the mobile pastoralists. For feeding cattle the first group relies on cotton seed cakes so as to overcome the lack of pasture during the dry season, whereas mobile pastoralists practice transhumance by taking their animals to rangelands. Mobile pastoralists belong to two general ethnic groups: Arab and FulBe. The FulBe are divided into transhumant and agro-pastoral groups; the transhumant pastoralists are permanently dependent on transhumance meanwhile the agro-pastoralists may go on transhumance and come back to the village once or twice a year for a few weeks where they cultivate crops\(^10\).

The Logone floodplain is one of the key resource areas in the region for livestock. In the dry season, it attracts thousands of pastoralists. Most of them then move north of the floodplain or south to the grazing lands that surround Lake Maga, also called Ndiyam Shinwa\(^2\) (Fig. 1), by the end of the dry season. At the start of the rains they...
Study design

**Sampling procedure and collection of data:** A descriptive, cross-sectional study was carried out in Ndiym Shinwa pastoral zone from May to November 2014. Mobile pastoralists were sampled in pasture and in five agro-pastoral villages: Manga, Gavra, Boukroy, Yanga and Barkaya of Kaikai sub-division. Sedentary pastoralists from the above villages were equally sampled.

The heads of Guirvidig, Kaikai and Manga Centres Zootechnique et de Contrôle de Santé Vétérinaire (CZV) were involved in the survey as facilitators to reach the maximum number of pastoralists and to construct a sample that reflected the composition of pastoralists in the zones under their sanitary authority.

**Ethics:** The study was carried out in compliance with the Regional Delegation of the Ministry of Fishery, Livestock and Animal Husbandry (MINEPIA) protocol for animal disease surveillance. Research authorization was obtained from the same delegation. Pastoralists were initially informed of the purpose of the study and those who voluntarily consented to participate were subjected to a questionnaire.

In total 118 herds were surveyed in the study: 110 were visited in the beginning of the rainy season (May–July); and eight in the end of the rainy season (October–November). An experienced veterinary technician clinically examined cattle suspected with trypanosomiasis. A total of 22 of the 110 herds sampled during May–July were re-visited in October to identify suspect cattle with persisting symptoms (old cases). Characteristics of individual animals such as breed, sex, age, and treatment history were recorded; and the size of each herd was estimated visually.

Additionally, 135 non-suspect cattle were examined and included in a trypanocide sensitivity survey. These cattle were sampled in the beginning of the rainy season from four of the herds in which suspect cattle were selected. Based on the methods of randomization for clinical trials as described by Pocock, each uninfected animal was attributed a random number generated from the table of random digits, then a random starting point was chosen, from which animals were either included into group one (treated) or group two (control). Group one included 75 animals, which received a preventive dose of Trypamidium (Trypamidium®, Merial, France) at 0.5 mg/kg. Group two contained 60 animals which received a placebo. The weight of each animal was measured with a Rondo® ribbon which associates weight with girth circumference. Animals were re-examined after 3.5 months. Pastoralists knew each of their animals by name on the basis of the color of animal’s coat, horn shape or on the basis of the name of the dam. A combination of four parameters was used as identifiers for each animal: The name given by pastoralists, the sex, the age and the colour of the coat. All confirmed cases of trypanosome infection were treated with Diaminazen (Veriben®, Ceva, France) at 7 mg/kg through intramuscular injection as recommended by the manufacturer and were re-examined two weeks later.

**Diagnosis of trypanosome infections**

Blood of cattle was collected from the jugular vein into an EDTA tube and used for parasitological (detection of trypanosomes by BCT) and paraclinical (PCV determination) analyses. Blood in each EDTA tube was transferred into capillary tubes which were centrifuged immediately in a micro-haematocrit centrifuge for 5 min at 9000 rpm. After centrifugation, the PCV was measured. Animals with PCV values <24% were considered anaemic and presumed infected. The buffy coat and the uppermost layers of red blood cells from each capillary tube were extruded onto a microscope slide, stained with Giemsa and examined under 100× oil immersion objective lens for the detection of trypanosomes.

**Data collection: Knowledge and practice questionnaire**

A standardized survey was employed to generate information on the participants’ KP on trypanosomiasis; it focused mainly on knowledge of clinical trypanosomiasis and treatment. Focus group discussions were conducted guided by a questionnaire containing open and close-ended questions on the etiology of trypanosomiasis and use of trypanocides. Participants included in the discussion were agro-pastoralists who were regrouped according to their quarter of origin in nine focus groups consulting 7–12 peoples.

**Statistical analysis**

Data were recorded in Microsoft Excel. The Z-test and chi-square ($\chi^2$) were used to compare proportions, and the $t$-test was used to compare means. All statistical tests were performed at a precision level of 5% in SPSS Statistics 17.0 software (SPSS Inc. Chicago, USA). Real BCT prevalence was estimated with the formula below.

$$\text{True prevalence} = \frac{\text{Apparent prevalence} + (\text{Specificity} - 1)}{\text{Specificity} + (\text{Sensitivity} - 1)}$$
RESULTS

**Parasitological tests results**

A total of 635 suspect cattle were identified in the study—496 in the beginning of the rainy season and 139 in the end of the rainy season. Out of the 139 suspect cattle, 73 were old cases (animals with persisting symptoms found among the revisited herds). They represented 75.26% of the total number of cattle followed-up; the others either recovered or were simply removed from the herds. The mean age of the study population was 8.01 yr (SD = 3.33); 48.50% (308/635) of selected cattle had attained the age of 10 yr.

Parasitological analyses revealed four trypanosome infections in suspect cattle. The apparent prevalence was 0.63% (4/635). The BCT sensitivity was assumed to be between 0.2 (lowest parasitaemia) and 0.8 (highest parasitaemia). Estimates of true prevalence ranged from 0.79 to 3.15%. *Trypanosoma vivax* was the only species identified. One of the animals infected with *T. vivax* and treated with diaminazen remained positive for two weeks after treatment.

Of the 135 non-suspect cattle included in isometamdium study, two cases were detected with *T. vivax* infection, corresponding to an apparent prevalence of 1.46% and an estimated true prevalence varying between 1.82 and 7.30%. A total of 101 animals were followed-up successfully. One positive case was detected within the control group (1.92%) and none in the treated group.

**Paraclinical results**

The mean PCV was 27.38 (SD = 6.91) in suspect cattle and 29 (SD = 7.38) in non-suspect cattle; the difference was statistically significant between these two categories (t = 2.368; p = 0.018). Suspect cattle whose clinical status remained unchanged over the survey period had PCV values of 27.86 (SD = 5.44) in the beginning of the study and 28.67 (SD = 5.38) in the end; the PCV values were not statistically different (t = 0.891; p = 0.376).

PCV values did not vary significantly between the control group (28.90; SD = 6.94) and the treated group (28.20; SD = 5.15) at the beginning of the study (t = 0.498; p = 0.620). But at the end of follow-up, a reduction in PCV was recorded in the control group (2.10; SD = 8.03), whereas a slight increase in PCV was observed in the treated group (0.57; SD = 6.59). The proportion of cases detected on combining BCT with PCV results was 33.26% (165/496) for suspect cattle against 25.92% (35/135) in non-suspect cattle.

*Pastoralists' knowledge and practice for trypanosomiasis*

A total of 118 pastoralists were interviewed in the study—60 agro-pastoralists, 39 transhumant pastoralists and 19 sedentary pastoralists. All of them knew about animal trypanosomiasis and reported it as an important health issue in herds. Ruffled hair, emaciation, lacrimation and anorexia were the most frequently reported signs (Table 1). Most pastoralists (66.10%; 78/118) used two clinical signs for trypanosomiasis diagnosis; 82.05% (64/78) of them used ruffled hair in combination with lacrimation, anorexia or emaciation (Fig. 2). About 22.03% of the pastoralists (26/118) used three signs. Similarly, 9.32 and 2.54% of the pastoralists used one and four clinical signs, respectively for diagnosing trypanosomiasis.

All interviewees used trypanocide and only 18 of them had their sick animals treated by a veterinarian. Most of them (100/118) treated their sick cattle themselves or by other pastoralists of the camp. The majority of pastoralists (98/102) who responded to the question on syringe utilization, declared using a single needle to treat all animals, and none of them knew about sterilizing needles before re-use. Of the 106 pastoralists who responded to treatment questions, almost all reported treating only

**Table 1. Frequently observed clinical signs of cattle trypanosomiasis by pastoralists for diagnosis**

<table>
<thead>
<tr>
<th>Clinical signs</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruffled hair (Rh)</td>
<td>86 (34.68)</td>
</tr>
<tr>
<td>Lacrimation (L)</td>
<td>57 (22.98)</td>
</tr>
<tr>
<td>Anorexia (An)</td>
<td>48 (19.36)</td>
</tr>
<tr>
<td>Progressive emaciation (Pa)</td>
<td>44 (17.74)</td>
</tr>
<tr>
<td>Coughing (C)</td>
<td>6 (2.42)</td>
</tr>
<tr>
<td>Diarrhoea (D)</td>
<td>4 (1.61)</td>
</tr>
<tr>
<td>Loss of hair (Lh)</td>
<td>2 (0.81)</td>
</tr>
<tr>
<td>Swelling of lymph node (Sl)</td>
<td>1 (0.40)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>248 (100)</strong></td>
</tr>
</tbody>
</table>

Figures in parentheses indicate number of percentages.

![Fig. 2: (a) The proportion of pastoralists who used two clinical signs as diagnosis pattern for trypanosomiasis against others (those who used one, three or four clinical signs); and (b) The most frequently used pairs of clinical signs for trypanosomiasis diagnosis by pastoralists; Rh—Ruffled hair; An—Anorexia; L—Lacrimation; Pa—Progressive emaciation.](image-url)
suspect cattle within their herd (100/106), whereas only 6 of 106 treated both suspect and the rest of the herd preventively at the start of the rainy and dry seasons.

Tsetse flies (Pechi) were cited as the first cause of the disease (100%; 9/9 focus groups), but none of the pastoralists in all nine quarters/groups were able to identify tsetse flies. Other causes of trypanosomiasis cited, included ticks (44.44%; 4/9) and dirty water (33.33%; 3/9). Tabanids also called Boubi in Fulfulde area were known and easily recognized by all quarters (9/9); they were pointed as an important nuisance by pastoralists of all quarters (100%; 9/9), but never as potential vector for trypanosomiasis. Pastoralists of all quarters use smoke to repel biting insects and/or grazed their cattle at night and/or kept the animals inside huts during the peak hours of insect biting activity; a few of them (11.11%; 1/9) use insecticides to repel biting insects.

The annual prevalence of trypanosomiasis estimated by pastoralists was 9.51% (646/6792). This prevalence was 5.95% (183/3076), 12.42% (373/3003) and 12.62% (100%; 9/9), but never as potential vector for trypanosomiasis. Pastoralists of all quarters use smoke to repel biting insects and/or grazed their cattle at night and/or kept the animals inside huts during the peak hours of insect biting activity; a few of them (11.11%; 1/9) use insecticides to repel biting insects.

The infection rate was twice as high in non-suspect cattle as in suspect cattle. This difference suggests that infected non-suspect cattle were suffering from early infections; which are more likely to be detected through parasitological diagnostic tools.

When PCV was used as a discriminating diagnostic tool along with BCT, one-third of suspect cattle were diagnosed infected; the accuracy of pastoralists-reported disease is higher with this approach. One quarter of non-suspect cattle were diagnosed with anaemia; which might be due to infections other than trypanosomes. This situation highlights the need for more sensitive diagnostic methods like molecular detection tool to confirm the infection status of cattle, otherwise the importance and accurate prevalence of the disease would be misleading.

In the present study, one case of repeated BCT positive results was observed in the same animal after treatment, indicating the possible presence of a resistant strain of T. vivax to diaminazen in the region. No evidence of resistance was observed with isometamidium in this small trial. Cattle treated with isometamidium had a slight increase in PCV contrary to control cattle where a decrease in PCV was observed. The apparent benefit of trypanocide in treated group implies that anaemia causing factors in cattle may include pathogens susceptible to this drug.

Pastoralists noticed eight different signs which they associated with trypanosomiasis. This number is fewer than that reported in Ethiopia. Nevertheless, the frequencies of the most frequently noticed signs are similar in both studies. The majority of the interviewed pastoralists administer drug to sick animals themselves; other
studies in West Africa reported similar observations. In the tsetse free area of northern Ethiopia, a different observation was reported; pastoralists of this area send their cattle to veterinary clinics or animal health post for trypanosomiasis cases. This difference may be due to a higher accessibility of pastoralists to veterinary services and/or a higher trust for veterinarians in this area. The fact that the majority of interviewees used a single needle for treating all suspect cattle suggests that there is an additional risk for mechanical transmission of trypanosomes and other pathogens among cattle through this mechanism. Moreover, maintaining animals for >10 yr within herds increases the risk for mechanical transmission of trypanosomes and other pathogens among cattle through this mechanism.

The presence of T. vivax in cattle of the Far North region, raises the alarm on the need for epidemiological surveillance particularly in its rangelands; where the high density of livestock, regular migration of animals from countries bordering the Lake Chad, and the abundance of Tabanids of the genus Tabanus and Atylotus (recognized as better mechanical vectors), increase the risk for epidemics.

CONCLUSION

Cattle trypanosomiasis is present in the Far-North region of Cameroon and seems to be in the inter-epizootic phase of its epidemiological cycle. The reappearance of this disease in the region calls for routine epidemiological surveillance in pastoral zones. Pastoralists have a good knowledge of animal trypanosomiasis but their perception of its importance is influenced by the persistence of symptoms in suspect cattle. More work is necessary to determine the etiology of the morbidity attributed to this disease in suspect cattle as well as to anaemia in non-suspect cattle.

Conflict of interest

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

This study was supported by the National Science Foundation through a grant (DEB-1) to the Disease Ecology and Computer Modeling Laboratory (DECMIL) at the Ohio State University (USA). The authors thank the Centre d’Appui à la Recherche et au Pastoralisme (CARPA) team for technical assistance, the Regional delegation of MINEPIA for their administrative support, and pastoralists who participated in the study.

REFERENCES


Correspondence to: Mr. Pierre Fongho Suh, Department of Animal Biology and Physiology, Faculty of Science, University of Yaoundé I, P.O. Box– 812, Cameroon.
E-mail: fongho_pierre@yahoo.fr

Received: 12 December 2016 Accepted in revised form: 26 June 2017