



## **Animal Trypanosomosis in Kaura Local Government Area, Kaduna State, Nigeria**

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### **Authors' contributions**

This work was carried out in collaboration between all authors. Author AJD designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AJD, EII, GA, PMD and ACI managed the analyses of the study. Authors AJD, EII and SOO managed the literature searches. All authors read and approved the final manuscript.

### **Article Information**

DOI: 10.9734/MRJI/2017/35438

Editor(s):

(1) Lachhman Das Singla, Department of Veterinary Parasitology, College of Veterinary Science, Guru Angad Dev Veterinary and Animal Sciences University, India.

Reviewers:

(1) Robert H. Barker, USA.

(2) Abdul Razzaq, Pakistan.

Complete Peer review History: <http://www.sciencedomain.org/review-history/21725>

**Original Research Article**

**Received 13<sup>th</sup> July 2017**  
**Accepted 12<sup>th</sup> September 2017**  
**Published 3<sup>rd</sup> November 2017**

### **ABSTRACT**

A survey of animal trypanosomosis in Kaura LGA of Kaduna State was undertaken. Blood samples were collected from 635 animals in five Districts of the LGA. The blood samples collected from different species comprising of 424 cattle, 131 sheep and 80 goats. The samples were examined by wet film (WF), haematocrit centrifugation technique (HCT), buffy coat method (BCM) and thick film (ThF). An overall prevalence rate of 9.4% was recorded in the study. Of this, *T. vivax* accounted for 7.9% while *T. congolense* accounted for 1.5%. No *T. brucei* species was encountered. A number of other haemoparasites were also encountered in the study. These include *Babesia* 8(1.5%), *Anaplasma* 8(1.5%) and microfilaria of *Onchocerca* 42(7.9%). The prevalence rates recorded in this study has made it imperative to recommend that Government and

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policy makers should attach more importance to the problem of animal trypanosomosis. Furthermore, herd owners and villagers should be educated on the importance of cooperation with Veterinary or Livestock Officers in the control of animal trypanosomosis in their communities.

**Keywords:** *Trypanosomosis; Yankasa sheep; West African dwarf goats; Babesia; Anaplasma.*

## 1. INTRODUCTION

African trypanosomosis (sleeping sickness), which affects people and livestock, lies at the heart of Africa's struggle against poverty. The disease, transmitted mainly by tsetse flies, is prevalent in 37 countries among the poorest of the world [1]. Probably more than any other disease affecting both livestock and people, trypanosomosis not only threatens human and livestock health but also damage agricultural production, and, thereby, leads to declined rural development and poverty alleviation [2].

Trypanosomosis is a collective term for a group of diseases brought about by one or more of the pathogenic trypanosome species. Typically, trypanosomosis is a wasting disease in which there is a slow progressive loss of condition accompanied by increasing anaemia (the main sign of the disease) and weakness to the point of extreme emaciation, collapse and death often due to heart failure. It is generally recognised as the greatest single impediment to the development of the livestock industry in Tropical Africa, as well as the only disease that has profoundly affected the settlement and economic development of a major part of the continent of Africa [3,4]. The trypanosomes of economic importance are *Trypanosoma vivax*, *T.congolense* and *T.brucei brucei*, for livestock and *T. b. gambiense* for man. The disease is most often cyclically transmitted by tsetse flies of the genus *Glossina*.

The importance of livestock in Nigeria cannot be overemphasized. Livestock provide majority of the meat supply of the country as well as employment for a good part of the populace [5]. The effects of trypanosomosis on livestock range from anaemia to immuno suppression, retarded growth, low milk yield and weight loss in conjunction with infertility, abortion, stillbirth and depressed reproductive performance. These damaging effects and the man and material resources committed to the disease were said to result to more than \$23.8 million annually in Nigeria [6]. The presence of other haemoparasites in the blood of livestock during

trypanosomosis further aggravates the effects of the disease in them.

Previous spot and comprehensive surveys of the country for animal trypanosomosis showed an overall prevalence in cattle, sheep and goats of 10.0%, 8.6% and 8.1% respectively [7]. These prevalence rates though high but fail to reveal the enormous scourge of trypanosomosis in different high density livestock producing localities in Nigeria.

## 2. STUDY AREA

Kaura LGA is situated in the southern part of Kaduna State. The LGA lies between Latitude 9° and 9° 49" North and Longitude 8° and 8° 40" East within the Sudan and Guinea savannah region. The rainy season in the area is 6 months (April to September) with a mean annual rainfall of 2000-10000 mm, temperature of 24-27°C and relative humidity of 40-60% in January and 60-80% in July. The survey covered a total of ten villages in the five districts of the LGA. The study area is bounded on the North by Zangon Kataf LGA, on the West by Jema'a LGA, all in Kaduna state. On the East, the area is bounded by Bassa and Riyom LGAs of Plateau state which is on the low land. It harbours many Fulani herdsmen in several settlements, some of who have been there for more than forty years. The suitable vegetation, availability of pasture all year round, water from the perennial Biniki river as well as the friendly disposition of the Moroa people, make the area conducive for livestock husbandry.

The animals screened were white Fulani Zebu cattle and their crosses as well as the Yankasa breed of sheep and the West African Dwarf goats. Majority of the herds sampled were sedentary with a few semi-nomadic. The goats were from local indigene farmers, kept as domestic or peridomestic animals. A total of 635 animals, comprising of 424 cattle, 131 sheep and 80 goats were randomly selected during the study. The study period was of seven (7) months consisted of two different sessions from September to November and March to June.

## 2.1 Study Sites / Population

The study sites included Fulani settlements in the case of cattle and sheep. They were sampled very early each day, while still tied together in twos in the paddocks, before they were released for grazing. Goats on the other hand, were sampled from homes within the study villages.

## 2.2 Blood Collection

Approximately 2 mls of blood was collected from each animal by jugular venipuncture, using 18 gauge needles and syringe. It was dispensed in bijoux bottles containing Ethylene Diamine Tetracetate (EDTA) as anticoagulant for parasitological examination.

## 2.3 Field / Laboratory Diagnosis

Three diagnostic techniques, viz wet film (WF), haematocrit centrifugation technique (HCT) and buffy coat method (BCM) were employed for trypanosome detection in the field. Identification of trypanosome species in the laboratory was done using morphological differentiation of parasites on Giemsa-stained films. The Packed Cell Volume (PCV) of each animal sampled was estimated using a haematocrit reader.

## 2.4 Packed Cell Volume (PCV)

The packed cell volume of each animal sampled was estimated, to assess the level of anaemia, using a haematocrit reader. This method is simple and reliable and quick to perform one of its main advantage.

## 3. RESULTS

The result of the study (Table 1) of the prevalence of animal trypanosomosis and other haemoparasites in the five districts of Kaura LGA of Kaduna State shows that in Manchok district, 119 animals were sampled. Out of that number, 5(0.8 %) were positive for trypanosomes while 3(0.6%) were infected with *Microfilaria* and 1(0.2%) with *Babesia*. From Zankan district, 127 were sampled, out of which 13(2.0%) were infected with trypanosomes, 6(1.1%) with microfilaria and 2 (0.4%) with *Anaplasma*. 148 were sampled in Addu district out of which 23 (3.6%) were positive for trypanosomes, 30(5.6%) for microfilaria, 3(0.6%) for *Anaplasma* and 4(0.7%) for *Babesia*. In Kagoro district, 131 animals were sampled from which 14(2.2%)

positive for trypanosomes, 1(0.2%) for *Anaplasma* and 2(0.4%) for *Babesia*. Out of the 110 animals sampled from Kukum Daji, 5(0.8%) were infected with trypanosomes while 3(0.6%) were positive for microfilaria, 2(0.4%) for *Anaplasma* and 1(0.2%) for *Babesia*. An overall trypanosome prevalence rate of 9.4% was encountered in the study.

In relation to breeds of animals sampled (Table 2), the prevalence of the disease in the 5 districts shows that out of 424 cattle (Zebu) examined, 53 (8.3%) were found to be infected with trypanosomes. From the 53 (8.3%) positive cases, 45(7.0%) were due to *T. vivax* and 8(1.3%) to *T. congolense*. From the 131 sheep (Yankasa) examined, 7(1.1%) were infected with trypanosomes, out of this number, 6(0.9%) were due to *T. vivax* and 1(0.2%) to *T. congolense*. From the 80 goats (West African Dwarf) sampled, none was infected. On the whole, *T. vivax* accounted for 84% of all positive cases while *T. congolense* accounted for the remaining 16% of the positive cases.

The prevalence of trypanosomosis in relation to the ages of the sampled livestock shows that out of the 424 cattle sampled 41 were less than 1 year old. Out of this number, 6(0.9%) were positive for trypanosomes. 45 were within the 1-2 years age group. 6 (0.9%) of this number were infected with trypanosomes. Within the 3 - 4 years age group, 160 were sampled, out of which 18 (2.8%) were positive for trypanosomes. Those within the 5-6 years age group were 104, out of which 12 (1.9) were positive. The rest 74 were above 6 years and 11(1.7%) of the number were infected with trypanosomes.

In the case of the sheep, out of 131 sampled, 12 were less than 1 year old and none of them was found infected. 17 were between 1 and 2 years and none was infected. In the 3 - 4 years group, 25 were sampled out of which 2(0.3%) were positive for trypanosomes. Those in the 5 to 6 years age group were 32, out of which 4(0.6) were infected. The remaining 46 were above 6 years of age and only 1(0.2%) was infected with trypanosomes.

Out of the 80 goats sampled, none was found to be infected with trypanosomes. The breakdown of the ages of the sampled animals, show that 10 were less than 1 year old, 12 were within the 1 - 2 years age bracket, 24 were in the 3 - 4 years group, 22 were in the 5 to 6 years group while the remaining 12 were above 6 years.

**Table 1. Prevalence of animal trypanosomosis and other haemoparasites in five districts of Kaura LGA, Kaduna State**

District	No. sampled	No (%) +ve for tryps	No. positive for other haemoparasites		
			Microfilariae	Anaplasma	Babesia
Kaura	119	5 (0.8)	3 (0.6)	- (0)	1 (0.2)
Zankan	127	13 (2.0)	6 (1.1)	2 (0.4)	- (0)
Bondon	148	23 (3.6)	30 (5.6)	3 (0.6)	4 (0.7)
Fada Kagoro	131	14 (2.2)	0 (0)	1 (0.2)	2 (0.4)
Kukum	110	5 (0.8)	3 (0.6)	2 (0.4)	1 (0.2)
Total	635	60 (9.4)	42 (7.9)	8 (1.5)	8 (1.5)

**Table 2. Prevalence of trypanosomosis in breeds of livestock sampled in five districts of Kaura LGA of Kaduna State**

Breed of animals	No. sampled	No. (%) +ve	Species of trypanosomes		
			<i>T. vivax</i>	<i>T. congolense</i>	<i>T. brucei</i>
Cattle (Zebu)	424	53(8.2)	45(7.0)	8(1.3)	-
Sheep (Yankasa)	131	7(1.1)	6(0.9)	1(0.2)	-
Goats (WAD)	80	-	-	-	-
Total	635	60 (9.4)	51 (7.9)	9 (1.5)	-

#### 4. DISCUSSION

The findings of this study show that trypanosomosis - *T. vivax* and *T. congolense*, are prevalent among livestock in all the districts in the study area, occurring naturally in domestic cattle and sheep. The cattle and sheep sampled in the study grazed side by side under nomadic conditions. This exposes them to bites by tsetse and other biting flies. The goats on the other hand were grazing within the home or fed with grass by the owners, away from the reach of the tsetse vectors. They only occasionally strayed away from the home environment to nearby bushes but not far enough to establish contact with the vectors. More animals were sampled in Addu District than from the other regions. The location of the district near the Biniki River as well as a nearby perennial stream made the Fulani herds men to prefer to settle there for the purpose of water and pasture. The animals in this area looked a lot better fed compared with those in the other districts. Despite their good looks, however, many of them were found to carry the infection. Furthermore, a number of tsetse flies were caught along the stream, indicating the possibility of transmission of the disease between them and the animals.

This finding indicates that even in the face of heavy tsetse challenge, animals with high nutritional status, can survive and still do well. Zankan and Fada districts also had a comparatively high number of livestock, the vegetation of the area also possibly explains why

a few flies were caught there and the number of animals infected. Manchok and Kukum Daji districts had the least number of Fulani settlements as well as animals sampled. Kaura is the Headquarters of the LGA and is a semi urban town. The activities in the area make it uncondusive for host-vector activity. The only contact between the animals and vectors occur when the animals graze beyond the district into neighbouring districts where the flies are available. Kukum Daji on the other hand, lies along the ever busy Kagoro - Kafanchan highway, with less vegetation for host-fly contact. Surprisingly however, the presence of other biting flies such as *Tabanus* and *Stomoxys* species was highest in the Kukum district. Beside other biting flies, ticks, the vectors of *Anaplasma* and *Babesia* species, were also noticed on the skin of the animals, explaining the presence of these haemoparasites in the study. A higher prevalence rate was observed in cattle than in sheep. This could be as result of the larger size of the cattle. It has been established that tsetse flies identify their target by sight. It follows therefore that the larger the size of the object, the faster it is identified [8,5].

Furthermore, [9] reported that tsetse prefer the blood of cattle to that of sheep, given the option. The smooth skins of the cattle make penetration of the flies' proboscis easier than the dense coat of the sheep. Also, due to their small size, sheep tend to be more mobile than cattle, thus making it very difficult for the flies to feed on them comfortably. None of the goats sampled was

found infected. It has been reported that goats are less fed upon by tsetse flies compared to sheep and cattle. However, they are naturally and experimentally infected by trypanosomes. As a matter of fact, they have been found to be excellent laboratory models for experimental infection, especially with *T. vivax* and *T. congolense*. The goats sampled in this study were maintained at domestic and peridomestic levels. This fact reduces the amount of contact between the animals and the vectors. The predominance of *T. vivax* in the study supports the fact that *T. vivax* is the most important trypanosome species infecting ruminants in Nigeria and the sub region. The parasites short life cycle in the tsetse flies vector (maximum of 5 days compared to 19 days for *T. congolense*), its potential to be transmitted mechanically as well as its pathogenicity to all ruminants makes this finding possible. Furthermore, the relative motility and size of the species (*T. vivax*) compared to other salivarian trypanosomes facilitate its detection in a fresh state with tools such as haematocrit centrifugation and buffy coat techniques, used in this study.

The low PCV observed in infected animals, as compared with the healthy ones, agree with previous findings that trypanosomiasis is accompanied by anaemia [10]. The nutritional status of the infected animals could have affected the level of anaemia during the course of the disease [5].

The occurrence of other haemoparasites in the blood of the animals could be additionally responsible for the low PCV of infected animals which may further worsen the health status of the animals infected. Babesiosis ranks among the most debilitating protozoan diseases of livestock in Africa and is also characterised by anaemia (low PCV) in infected animals. Anaplasmosis on its part is almost as much a problem of livestock as Babesiosis, Theileriosis and East Coast Fever [11]. The presence of Microfilariae in the blood of animals sampled, however, does not have any direct effect on the level of PCV, as the microfilaria are only developmental stages of other parasites.

Age of the animals sampled did not significantly influence the prevalence of trypanosomosis in the study area. However, on the whole, those below one (1) year old tended to be slightly more infected due to weak immunological status. In spite of this, their PCV remained high. On contrary to this, [12] reported that calves

between age of 0 to 6 months possess maternal immunity against trypanosomosis and are able to self-cure after infection. The immunity, however, does not last indefinitely. Calves below 6 months of age hardly embark on large scale grazing. From 6 months, they begin to undertake long distance grazing expeditions. This exposes them to tsetse bites and subsequent infection but they are still able to survive and cope. This group is followed by those in the one (1) to two (2) year bracket, then those above (3) to four (4) year group. After six (6) years, the prevalence was observed to be on the decrease. The general practice of the herd owners is to sell off animals above this age, whose productivity in terms of calving rate, milk yield or in the case of bulls, mating, was on the decline. Hence the fewer number of such animals for sampling. Also, at their age, their skin becomes tough making it very difficult for the flies to feed on them than on the young ones.

The prevalence pattern among sheep is similar to that in cattle i.e., the infection in the older ones (above 6 years) is less, compared with the younger ones. The possible reason could be that the coat gets denser with age thus making penetration of the vector's proboscis during feeding very difficult.

This study shows a high prevalence of trypanosomosis in cattle (12.5%) and in sheep (5.3%). Infections were due to tsetse flies of the riverine species while the variety of other haematophagous flies (*Tabanus*, *Stomoxys* and *Chrysops* species) and their numbers suggest mechanical transmission of *T. vivax*. Trypanosomosis in livestock in the study area could be more common and severe than has been discovered in this study. This prevalence rate of infection in livestock in this area is no doubt a matter of concern as well as a serious threat to the livestock industry and animal production.

Furthermore, the study shows that Yankasa Sheep and WAD Goats are highly susceptible to experimental *T. vivax* infection. However, sheep were better able to survive the infection - clinically and haematologically.

## 5. CONCLUSION

Prevalence rate of the infection in small ruminants was relatively less than that of cattle. Further studies could be carried out to determine the susceptibility of these small ruminants to experimental infection with *T. vivax*. This is with a

view to encouraging small ruminant production, for the purpose of supplementing beef and for the fact that keeping them is less capital intensive. Government and policy makers need to attach more importance to the problem of Animal trypanosomosis, in view of the prevalence rate recorded in this study. The herd owners and villagers should be educated on the importance of cooperation with Entomologists as well as Veterinary / Livestock Officers in the control of tsetse and trypanosomosis in the area in particular and the country in general.

### ETHICAL APPROVAL

As per international standard or university standard ethical approval has been collected and preserved by the authors.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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