PREVALENCE OF AFRICAN ANIMAL TRYPANOSOMIASIS AND THE ASSOCIATED BLOOD PARAMETERS AMONG TRADE RUMINANTS AT OBOLLO-AFOR MARKET

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ABSTRACT

African trypanosomiasis is a haemoprotozoan disease of animals and humans. In animals particularly, the disease directly hinders production and therefore impedes socio-economic development of Sub-Saharan Africa. The prevalence of trypanosome infection was investigated in trade goats and sheep sold at Obollo-Afor market in Enugu State, Nigeria. Wet and thin films, haematocrit test (HCT) and buffy coat methods (BCT) were used to detect trypanosomes in jugular blood of the animals. The packed cell volume (PCV), red blood cell (RBC), and white blood cell (WBC) counts were also determined. A total of 200 goats and 100 sheep were examined within four months (October 2019 to January 2020). The prevalence rates of trypanosomes in the 200 goats and 100 sheep examined were 0(0.0 %) and 2(0.7 %) respectively. The RBC, WBC, and Hb of the two infected animals were significantly ($p<0.05$) lower than the uninfected. The average PCV of infected animals (20.65 ± 5.44%) was also lower than that of uninfected (34.17 ± 0.29%) although, it was not statistically significant ($p>0.05$).

Keywords: Trypanosomiasis, Prevalence, Haematology, Trade ruminants, Enugu State

INTRODUCTION

African animal trypanosomiasis (AAT) is a livestock disease caused by trypanosome species and frequently transmitted by the vector, tsetse flies. The representative species of the trypanosomes transmitted *en route* the infected saliva (salivaria group) of the vector, *Glossina* spp., in Sub-Saharan Africa are *Trypanosoma brucei, T. congolense and T. vivax* (Cayla *et al.,* 2019). *T. brucei* infection is zoonotic but because of preference of the vector, *Glossina* spp., to cattle for its blood meal, the infection is less in human than in the cattle (Liana *et al.,* 2020). In addition to cattle, sheep, goats and particularly pigs have been identified as reservoirs of human infective trypanosomiasis in Sub-Saharan Africa (Desquesnes *et al*., 2022).

The economic losses due to the infection are large and diverse. In Nigeria, there are several millions of cattle, goats, sheep, pigs, and thousands of camels and donkeys which are predisposed to trypanosome infections (Lawal-Adebowale, 2012).

Trypanosomiasis also infect livestock and wild animals in tropical and subtropical areas of the globe (Gutierrez *et al.,* 2006; Giordani *et al.,* 2016; Desquesnes *et al.,* 2022). Annual losses due to trypanosomiasis is put at 5 billion US dollars (Giordani *et al.,* 2016; Stijlemans *et al.,* 2018). In tsetse infested areas of Sub-Saharan Africa, vast number of these animals are predisposed to this disease which hinder their efficiency and lead to reduced quantity and quality of animal products, increased management cost and gross economic losses (Matovu *et al.,* 2020; Ngongolo *et al.,* 2020). The predisposition of these animals are influenced by myriads of factors including demographic, environmental, entomological, livestock management, among others, which in turn influence tsetse populations and eventual prevalence of trypanosome infections (Bouyer *et al.,* 2013; Kizza *et al.,* 2021).

The disease can be reduced, and eventually eliminated/eradicated with the proper control measures in place (Diall *et al.*, 2017; Isaac *et al.*, 2017). Concurrent measures targeting both the parasites and the vectors have been put forward (Liana *et al.,* 2020). Ultimately cost effective control of trypanosomiasis will lead to economic boom and render better health to both livestock and humans (Matovu *et al.,* 2020).

The aim of this study was to investigate the current prevalence status and intensity of trypanosomiasis of trade goats and sheep at Obollo-Afor market in Enugu State, Nigeria. In addition, haematological parameters were also evaluated to determine the health status of both the infected and uninfected animals.

MATERIALS AND METHODS

Study Area: This study was conducted in Obollo-Afor, the headquarters of Udenu Local Government Area (LGA) of Enugu State, South East, Nigeria (Figure 1). It has an area of 271.3 km^2 and a population of 256,500 persons as at 2022 (City Population, 2023). The animal market is located at latitude 6^0 54′ 56″ north and longitude 7^0 30′ 55″ east (Agina *et al.*, 2021).

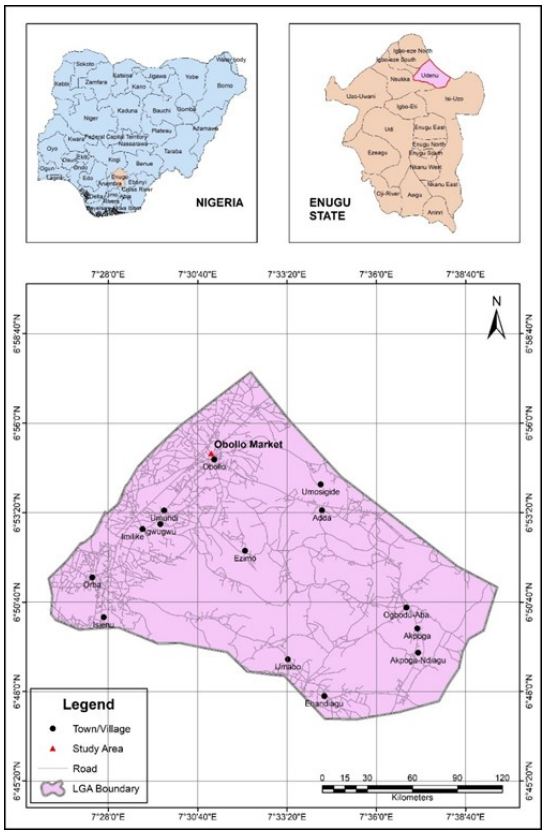

Figure 1: Map of Udenu Local Government Area showing the study area. ***Source:*** *Soil Survey Unit, Department of Soil Science, University of Nigeria, Nsukka*

Target Population: The target populations were trade goats and sheep transported from the Northern states of Nigeria to Obollo-Afor for sale. Two hundred (200) goats and one hundred (100) sheep were randomly selected for the study, between the months of October 2019 to January 2020).

Sample Collections: The animal market was visited twice every week during the four-month period of study for sample collection. Two mililitres (2 ml) of blood was collected from each animal by puncturing the jugular vein using 23-gauge needle attached to 2 ml. The collected blood sample was dispensed into a properly encrypted sodium ethylenediamine tetra-acetic acid (EDTA) bottle for subsequent transmission to the laboratory for determination of the haematological profile. The analyses were conducted at Parasitology Laboratory of the Department of Parasitology and Entomology, Faculty of Veterinary Medicine, University of Nigeria, Nsukka.

Examination of the Blood Samples for Parasites: Wet preparation, thin blood films and buffy coats were examined for the presence or absence of trypanosomes. To make a wet preparation, a drop of blood was placed on a clean glass slide and covered with 22 x 22 mm cover slip. The slides were examined using x40 objective lens of the microscope for the presence of trypanosomes. Thin blood smears were prepared, fixed in absolute methanol, Giemsa-stained and examined for trypanosomes using x100 objective of the light microscope (Gashururu *et al.,* 2021). The trypanosomes were detected and identified by searching transects of the stained blood smear. For buffy coat examination, heparinized capillary tubes were filled with blood and then closed at one end of each, using Cristaseal (Hawksley, Sussex, United Kingdom). The capillary tubes were centrifuged in a microhaematocrit centrifuge and the junction of the buffy coat layer and the plasma of each tube were examined for trypanosomes under a microscope using x10 objective lens. Trypanosomes were identified by both size and motility under the microscope. The tubes were rotated from time to time during the examination to ensure that all sides of the tube were examined (Woo, 1970).

Assay of Haematological Parameters: The blood samples were evaluated for packed cell volume (PCV), haemoglobin (Hb) status, and red blood cells (RBC) count. Standard methods were used to evaluate the haematological parameters (Schalm *et al.,* 1975; Thrall and Weiser, 2002; Higgins *et al.,* 2008).

Data Analysis: Data was analyzed using Statistical Packages for Social Sciences (SPSS) version 23.0 (IBM Corporation, Armonk, USA). Prevalence of infection was compared using Chi-square analysis. Heamatological indices were compared by student t-test. Level of significance was set at $p<0.05$.

RESULTS AND DISCUSSION

Prevalence of Trypanosomiasis: This study showed that trypanosome infection was present in trade ruminants sold at Obollo-Afor market in Enugu State, Nigeria. Only 2(2%) out of 100 sheep sampled were infected by trypanosomiasis. None of the 200 goats sampled was positive for the parasite (Table 1).

Table 1: Prevalence of trypanosomiasis in trade ruminants according to ruminant type

Ruminant Type	Number examined	Number infected (%)
Goat	200	0(0.0)
Sheep	100	2(2.0)
Total	300	2(0.7)

Overall, prevalence of trypanosomiasis in all the 300 ruminants sampled was 2 (0.7%). Infection of the sheep was significant compared to the goats ($\chi 2 = 4.027$, df = 1, $p = 0.045$). Of the two sheep infected, one was West African dwarf and the other the Yankasa breed (Table 2).

Table 2: Distribution of infection according to breed of sheep

Sheep type	Number examined	Number infected
West African dwarf sheep	33	1(3.0)
Yankasa	30	1(3.3)
Uda	37	0(0.0)
Total	100	2(2.0)

When compared to several prior reports of 6.9, 4.7 and 3.33% in sheep and 3.5, 4.7 and 1.2% in goats in some parts of Nigeria (Ameen *et al*., 2008; Ezebuiro *et al*., 2009; Ohaeri, 2010; Idehen *et al*., 2018), the results of trypanosome infections obtained for both the sheep (2%) and goats (0%) were quite low. According to Idehen *et al*. (2018), sheep in Plateau State had a lower prevalence of 1.1%. Reports from other regions of the world also indicated higher prevalence of trypanosome infections in sheep and goats than was seen in this study. Tadesse and Megerssa (2010) observed 2.76 and 1.70% among sheep and goats, respectively, in Guto Gidda district, East Wellega zone, western Ethiopia, and Coello-Peralta *et al*. (2022) recorded 20% in sheep in Ecuador. Also, Mossaad *et al.* (2020) reported 4% infections in the Sudanese states of Blue Nile and West Kordofan, while Maganga *et al*. (2020) recorded 19.2% and 7.8%

infections in sheep and goats, respectively, in South Gabon's Mongo County. Coello-Peralta *et al.* (2021) also reported 2% infection among 100 sheep in Ecuador just as obtained in this study. Several factors spanning through seasonal variations, number of samples assessed and environmental factors played rolls in the results obtained. Periods of study also varied. Among all the instances cited above, only Ezebuiro *et al*. (2009) worked on trade ruminants. While some of the studies were carried out either during the dry or rainy seasons, others were carried out all year round. The various reports obtained showed that trypanosomiasis is a tropical and subtropical animal infection.

There are myriads of other determinant factors for the level of prevalence of trypanosome infections in ruminants. These are embedded in biotic factors like the presence of the vector (*Glossina*) and their livestock preferences, species of trypanosomes, livestock size, treatment of the parasite, and tsetse control (Ohaeri, 2010; Liana *et al*., 2020; Kizza *et al.*, 2021). There have also been reports of trypanotolerance in sheep and goats (Gutierrez *et al*., 2006; Malatji, 2022), but the goats are said to be more trypanotolerant than the sheep (Gutierrez *et al*., 2006; Maganga *et al*., 2020). Ecological factors (rainfall, relative humidity, and temperature) and season also influence prevalence appreciably (Malatji, 2022). This study was carried out during the dry season (October to January) which was not a thriving period for the vector, *Glossina* spp. In the study, the trade animals arrived Obollo-Afor market, in Southeastern Nigeria, from the distant northern Nigeria. Environmental factors influences the transmission of parasitic diseases (Liang *et al.,* 2007). The few parasites diagnosed may possibly have been introduced from any cluster of sheep and goats in any endemic area of the north prior to transportation of the ruminants to Obollo-Afor market in the south. The short period of this study (4 months) and the small expanse of the study involved may have negatively influenced the result. Sample size and area covered determines whether endemic areas are included or excluded in the study (Ricciardi and Ndao, 2015). The prevalence of animal trypanosomiasis had, though, previously been reported among horses at Obollo-Afor (Agina *et al.,* 2021).

Haematological Status: The haematological profile of the infected and uninfected sheep is summarized in Table 3.

Table 3: Haematological profile of infected and uninfected trade sheep in the study area

Parameters	Infected	Uninfected	T	P
PCV (%)	20.65 ± 5.44	34.17 ± 0.29	- 3.508	0.176
RBC ($x10^{12}$)	7.58 ± 2.90	10.37 ± 1.85	- 1.359	0.267
Hb (g/dl)	7.60 ± 3.25	11.00 ± 1.71	- 1.593	0.209

The PCV, RBC and Hb values were lower in the infected sheep than the uninfected. The differences were however not significant statistically ($p>0.05$). Trypanosomiasis has been widely reported as a causative agent of anaemia in livestock (Kagira *et al*., 2008). Both significant and non-significant decreases of PCV, RBC, and Hb in trypanosome-infected livestock were previously reported (Ameen *et al.,* 2008; Kagira *et al.,* 2008; Tadesse and Megerssa, 2010; Fidelis Junior *et al.,* 2016; Agina *et al*., 2021). Stability or fluctuation in the haematological profile of trypanosome-infected livestock is influenced by various factors, including nutrition, species of trypanosome involved, intensity of parasitaemia, and host-parasite interaction in the bloodstream (Stijlemans *et al*., 2018; Kasozi *et al*., 2021; Lelisa and Meharenet, 2021).

Conclusion: Trypanosomiasis was diagnosed in trade sheep sold at Obollo-Afor, Enugu State. The study reports the danger of trans-boundary movement of trade ruminants as a potential means of spreading trypanosome infection as well as other zoonotic livestock diseases in the area. These trade ruminants should therefore be subjected to thorough examination to ensure that they do not pose as agents of the spread of this infection or cause the economic downturn commonly associated with the infection. Further studies involving larger samples of ruminants

and a longer duration of study are therefore proposed for more insight on the trypanosomiasis infection and blood parameters in trade ruminants in southeast Nigeria.

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