Observations on the epidemiology of ruminant trypanosomosis in Kano State, Nigeria

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Key words

Ruminant - Trypanosomosis - *Trypanosoma vivax* - *Glossina* - Epidemiology - Tabanidae - Vectorborne disease - Rainy season - Dry season - Nigeria.

Summary

The epidemiology of ruminant trypanosomosis was investigated during a two-year period in Kano State, Nigeria. Prevalence was 5.3 ± 1.3 % (mean ± confidence interval), 1.2 ± 1.6 % and 0.7 ± 1.3 % in cattle, sheep and goats, respectively. Prevalence of bovine trypanosomosis was higher during the second year (6.1 %) than in the first (4.8 %). Infections doubled during the rains (7.6 %) in comparison with an average of 3.8 % during the dry season. The northern guinea vegetational zone recorded a high infection rate (Tudun-Wada local government area (LGA), 16.7 %). It was the only area in which tsetse flies (*Glossina tachinoides*) were encountered. Nevertheless, haematophagous flies were common in the sudan savanna; tabanids were ubiquitous. *Trypanosoma vivax* infected 3.0 % of bovine herds and was responsible for 57.6 % of all diagnosable cases. It is suggested that vector control in Tudun-Wada LGA and chemoprophylaxis may break the transmission cycle of ruminant trypanosomosis in the area.

■ INTRODUCTION

Ruminant trypanosomosis is caused by three main pathogenic trypanosomes - *Trypanosoma vivax*, *T. congolense* and *T. brucei* - transmitted mostly by tsetse flies (genus: *Glossina*). The disease occurs wherever tsetse are prevalent but may also be transmitted mechanically by other haematophagous flies (27). Kano State is located mostly in the savanna vegetational zone and is crossed by the Hadeja River. Earlier reports indicate the area as being infected (8, 20) but there are accounts of successful efforts at tsetse control by hand spraying of insecticides along the rivers and the Kano-Katsina-Zaria (KKZ) axis (5, 20). Further efforts at vector control by aerial spraying and other methods between 1955 and 1975 in both Sudan and the contiguous northern guinea zone have also been described (10). In addition, Nigeria's map of the most current tsetse distribution (23) indicates that the area has been reclaimed from tsetse. However, recent reports show that *Glossina morsitans* and *palpalis* groups are prevalent in the state (13).

In Nigeria, knowledge of the epidemiology of trypanosomosis in livestock is based mainly on spot surveys, abattoir samples and occasional outbreaks involving cattle (1, 14, 15). Small ruminants are regarded as trypanotolerant and little responsible in the epidemiology of the disease because tsetse are supposed to only feed on them as an alternative source of blood meal (6). Although there is very limited evidence on the incidence of trypanosomosis among small ruminant farm populations, some recent findings in Northern Nigeria (2, 12, 13, 14, 15) contradict both the trypanotolerant and alternative source opinions.

Also there is dearth of information on animal trypanosomosis in Kano State not only for small ruminants but also for cattle, despite the fact that re-invasion from even distant tsetse foci is possible after vector control operations (10). This study was carried out to evaluate the prevalence of trypanosomosis among ruminants in Kano State and to elucidate aspects of the disease transmission in the area.

■ MATERIALS AND METHODS

Study area

The study was carried out in six randomly selected local government areas (LGAs) of Kano State, Nigeria (10°30'-13°00' North, 7°40'-10°38' East). The area lies within the sudan vegetational zone, has an annual temperature range of 20-31°C and is 250-300 m above sea level. Rainfall is unimodal (May to September), light to moderate, lasts 90-150 days and reaches a monthly (August) and annual maximum of 300 mm and 900 mm, respectively (16, 21). The northern extremity of the state (e.g. Hadeja LGA) is known to be free of tsetse flies (23).

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The herds

The herds surveyed were zebu (Bunaji) cattle of the White Fulani breed under semi-intensive and extensive (Fulani pastoralism) management. The sheep were Yankassa either grazing with the cattle or under intensive management for fattening purposes. Caprine hosts were peri-domestic Kano-Brown belonging to small holders and under semi-intensive management. The ruminant population in the state according to figures given by ODNRI (21) was 0.4 million cattle, 2.3 million goats and 0.5 million sheep, at the time of the study.

Sampling techniques/study visits

Herds in the LGAs selected for the study were sampled by simple randomization to obtain 95 % confidence limits (26, 28). For each visit, the same herds, but not necessarily the same animals, were bled. Herd history and clinical observations were recorded in standard formats (3) prior to bleeding. Two to 3 ml of blood were collected from the jugular vein of each animal into bottles (Sterilin, England) containing EDTA as anticoagulant.

Study visits to all six LGAs were undertaken on a seasonal basis (once during the rains and once during the dry season, October to April), giving a total of four visits per LGA for bovine herds. However, small ruminants were sampled twice only: during both seasons of the second year of study.

Diagnosis of trypanosomes and other haemoparasites

The concentration methods used for detection of trypanosome infections were the haematocrit centrifugation technique (HCT) (29) and buffy coat examination (19).

Examination of Giemsa stained thin films was used both in detection of other haemoparasites and for differentiation of trypanosome species using morphological descriptions of Schalm *et al.* (24) and Hoare (9), respectively.

Vector/transmission studies

The presence of tsetse and other biting flies was studied in four locations within the state using, at each sampling point, four unbaited biconical traps (4) and four prototypes of a cylindrical-shaped modification of the Challier trap called the NITSE trap (22). The traps were deployed in pairs, using one of each design as previously described (15). Structural differences described by Soulsby (25) were used in identifying haematophagous flies. *Glossina* species were identified, aged and their physiological status and infection with trypomastigotes established according to FAO recommended techniques (7).

■ RESULTS

Prevalence of trypanosome infection in cattle

Out of a total of 1106 samples from bovine herds, 59 were infected with trypanosomes giving a prevalence of 5.3 % with a confidence interval of ± 1.3 %. Prevalence rates were 4.9 ± 1.6 % and 6.1 ± 2.3 % for the first and second year, respectively. A mean prevalence of 7.6 ± 2.3 % and of 3.8 ± 1.5 % was recorded from 503 and 603 samples collected during the rainy and dry season, respectively.

Figure 1 shows the annual and seasonal variation in prevalence among the LGAs sampled.

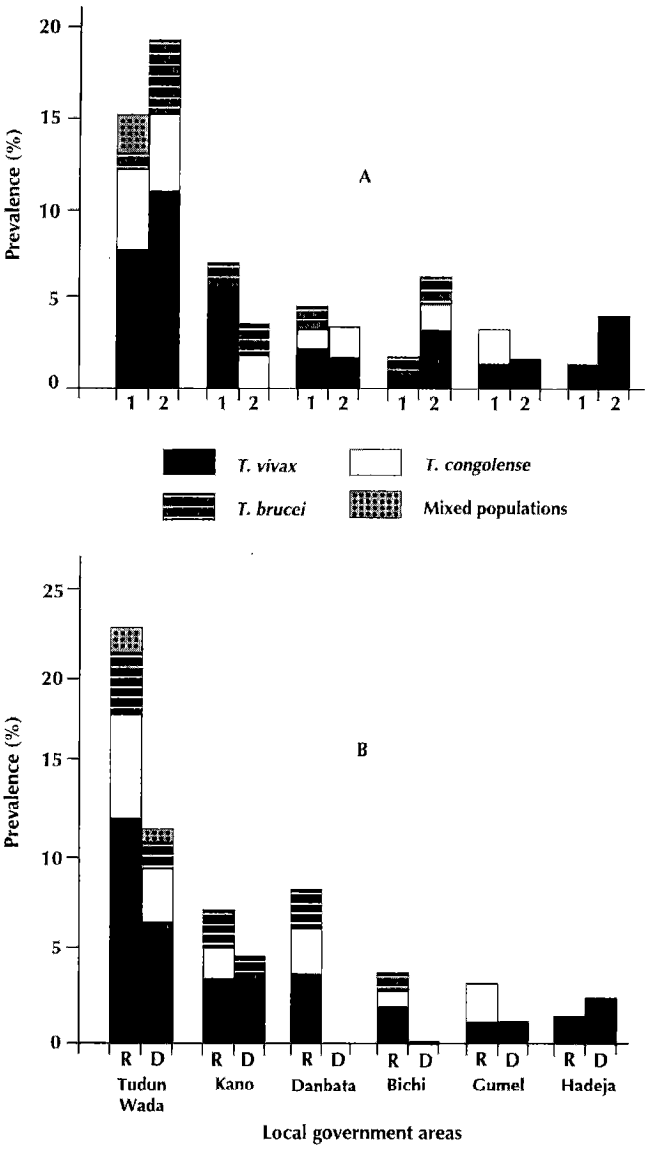

***Figure 1**: Contributions of different trypanosome species* T. vivax, T. congolense, T. brucei *subspecies and mixed population to (A) annual (1, first; 2, second) and (B) seasonal (R, rainy; D, dry) prevalence of bovine trypanosomosis in Kano State, Nigeria.*

Prevalence in the northern guinea savanna zone was much higher (16.7 ± 5.4 %) than in the sudan area (3.1 ± 1.1 %) of Kano State. Among the LGAs in the sudan zone, bovine trypanosomosis was highest in Kano (5.5 ± 3.3 %, figure 1), and least in Hadeja (2.1 ± 2.4 %, table I). *Trypanosoma vivax*, the predominant species in all ruminant herds and localities, was diagnosed in 3.1 % of the cattle population and responsible for 57.6 % of all infections (range 50-100 % within the LGAs).

Also, it was the only species encountered in Hadeja LGA outside the known northern limit of *Glossina* (figure 1). *T. congolense* was common but *T. brucei* subspecies were diagnosed only in the subhumid southern part of the state. Mixed trypanosome populations were not diagnosed outside the guinea zone (table I, figure 1).

Trypanosomosis in small ruminants

Three out of 318 small ruminants sampled were infected (prevalence 0.9 ± 1.0 %). Intraspecies infection rates were 1.2 ± 1.6 % among 166 sheep and 0.7 ± 1.3 % in 152 goats and was restricted to the rainy season (table II).

Table I

Distribution of trypanosomes among bovine herds in Kano State, Nigeria

	Sample size	Trypanosome infection and species						
		Nbr.	%	(CI[a]	Tv	Tc	Tb	Mix
Location								
Tudun-Wada	180	30	16.7	± 5	16	8	4	2
Bichi	239	6	2.5	± 2	3	1	2	0
Kano	183	10	5.5	± 3	7	1	2	0
Gumeil	189	4	2.1	± 2	2	2	0	0
Danbata	173	6	3.5	± 3	3	2	1	0
Hadeja	142	3	2.1	± 2	3	0	0	0
Vegetational zone								
Northern guinea	180	30	16.7	± 5	16 (53.3)	8 (26.7)	4 (13.3)	2 (6.7)
Sudan	926	29	3.1	± 1	18 (62.1)	6 (20.1)	5 (17.2)	0 (0.0)
Total	1106	59	5.3	± 1	34 (57.6)	14 (23.7)	9 (15.3)	2 (3.4)

Species: Tv = *T. vivax*; Tc = *T. congolense*; Tb = *T. brucei* subspecies.
CI[a] = Confidence interval calculated according to Thrusfield (1986).
( ) indicate percentage of the species out of total positive cases.

Table II

Prevalence of trypanosomes among small ruminants in Kano State, Nigeria

Season of year	Species	Sample size	Nbr. (%) infected	Trypanosome infection and species			
				Tv	Tc	Tb	Mix
Rainy	Sheep	79	2 (2.5)	1	0	1	0
	Goat	70	1 (1.4)	1	0	0	0
		149	3 (2.0)	2	0	1	0
Dry	Sheep	87	0 (0.0)	0	0	0	0
	Goat	82	0 (0.0)	0	0	0	0
		169	0 (0.0)	0	0	0	0
	Total	318	3 (0.9)	2	0	1	0

Species: Tv = *T. vivax*; Tc = *T. congolense*; Tb = *T. brucei* subspecies.
( ) indicate percentage of the species out of total positive cases.

Tsetse, other biting flies and domestic flies

Two *Glossina tachinoides* were caught in the Tudun-Wada area only. Both were hungry and trypanosome-negative following dissection. Other haematophagous flies caught totalled 542. They were composed of 521 *Tabanus*, 19 *Stomoxys* and 2 *Chrysops*. In addition, 580 *Musca domestica* were also caught. Although only 40 *Tabanus* were caught during the dry season, this genus was the

only one that was prevalent all year round and a high proportion (83.2 %) was encountered in the Hadeja area. Catches by the biconical and NITSE traps were similar for all flies during the dry months but the latter caught more mechanical transmitters (*Tabanus* and *Stomoxys*) of trypanosomes (94.4 %) during the rainy season.

■ DISCUSSION

The prevalence of bovine trypanosomosis reported for Kano State was less than the figures previously recorded in the contiguous vegetational zone of Plateau and Kaduna States (1) and so was that for small ruminants (11). Higher vector abundance (apparent density) and infection rates as reported by the former workers (1, 11) have been associated with higher prevalence of trypanosome infections in animal hosts (10). Besides, the *morsitans* group is known to have higher vectoral capacity than the riverine species encountered during this study (10, 18). However, association between hosts (man, animals) with the latter group (riverine tsetse) can be close and prolonged, resulting in high infection rates in livestock (10, 15, 20). In Kano State, such a situation is possible only in the Tudun-Wada area where a forest/game reserve provides the vectors with shelter, wild life and tresspassing pastoral ruminant hosts. This may, at least in part, explain the high trypanosome infection rates recorded there.

Differences in infection rates among the LGAs studied can be explained on the basis that tsetse are usually under stress on the edge of a fly belt (17). Management practices, nutritional status and reduced vector-host contact have also been reported to be responsible for differences in the prevalence of trypanosomosis among peridomestic goats and other ruminants under Fulani pastoralism (14, 15). Also, for goats in Kano, the low level of mechanical inoculators during the dry season makes peridomestic grazing safe for the species. Preponderance of other haematophagous flies with potentials as mechanical carriers of the parasite was responsible for the cases of *T. vivax* in Hadeja - an area outside the tsetse belt (10, 18, 23). Similar reports have been documented among semi-intensively reared cattle in the northern guinea zone (17).

The predominance of *T. vivax* among pathogenic trypanosomes in Kano supports similar findings in Nigeria and the subregion (1, 2, 11, 12, 14, 15, 17, 18). The parasites short life cycle in the vector (maximum of five days compared to nineteen for *T. congolense*) (9), its potential to be transmitted mechanically (27) and the pathogenicity of all *T. vivax* stocks for ruminants (2, 9) make 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 (19, 29), used in this study. Considering the low prevalence of trypanosome infection and the preponderance of *vivax* group trypanosomes in Kano, it is suggested that a combination of insecticidal control of the vector in the Tudun-Wada area, drug treatment and a two-year prophylactic regimen may break the transmission cycle.

■ CONCLUSION

This study shows a low mean prevalence (5.3 %) in cattle and lower figures for sheep and goats (1.3 % and 0.7 %, respectively). Infections were due to tsetse flies of the riverine species in the south while the variety of other haematophagous flies (*Stomoxys*, tabanids) and their numbers suggest mechanical transmission of *T. vivax* in the northern parts. Also, considering the high sensitivity of the predominant species (*T. vivax*) to trypanocides, the localization of the vector in one southern area where it is maintained by a forest reserve and the low transmission potential of mechanical inoculators found in the rest of the state, it is suggested that eradication of the disease in livestock may be easier in Kano than in other parts of the Federation.

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Résumé

Kalu A.U., Lawani F.A. Observations sur l'épidémiologie de la trypanosomose des ruminants dans l'Etat de Kano, Nigeria

L'épidémiologie de la trypanosomose des ruminants a été étudiée, pendant une période de deux années, dans l'Etat de Kano, Nigeria. La prévalence était de 5,3 ± 1,3 p. 100 (moyenne ± intervalle de confiance), 1,2 ± 1,6 p. 100 et 0,7 ± 1,3 p. 100 chez, respectivement, les bovins, les moutons et les chèvres. La fréquence de la trypanosomose des ruminants était plus élevée pendant la seconde année (6,1 p. 100) que pendant la première (4,8 p. 100). Les infections ont doublé pendant la saison des pluies (7,55 p. 100) par rapport à la moyenne de 3,8 p. 100 pendant la saison sèche. La zone de végétation nord guinéenne a enregistré un taux d'infection élevé (région du gouvernement local de Tudun-Wala (LGA), 16,7 p. 100) et était la seule zone où les mouches tsé-tsé (*Glossina tachinoides*) ont été rencontrées, alors que des mouches hématophages étaient également présentes dans la savane soudanienne ; les tabanidés se trouvaient partout. Trois pour cent des troupeaux bovins étaient infectés par *Trypanosoma vivax* qui était responsable de 57,6 p. 100 de tous les cas qui pouvaient être diagnostiqués. Il est suggéré que le contrôle vectoriel dans la LGA et la chimioprévention pourraient briser le cycle de transmission de la trypanosomose chez les ruminants dans cette région.

Mots-clés : Ruminant - Trypanosomose - *Trypanosoma vivax* - *Glossina* - Epidémiologie - Tabanidae - Maladie transmise par vecteur - Saison humide - Saison sèche - Nigeria.

Resumen

Kalu A.U., Lawani F.A. Observaciones sobre la epidemiología de la tripanosomosis en los rumiantes en el estado de Kano, Nigeria

Se estudio la epidemiología de la tripanosomosis de los rumiantes durante un período de dos años, en el estado de Kano, Nigeria. La prevalencia fue de 5,3 ± 1,3 p. 100 (promedio ± intervalo de confianza),1,2 ± 1,6 y de 0,7 ± 1,3 en ganado, ovejas y cabras respectivamente. La prevalendia de la tripanosomosis bovina fue mas elevada durante el segundo año (6,1 p. 100) que durante el primero (4,8 p. 100). Las infecciones se duplicaron durante las lluvias (7,6 p. 100), si se compara con el promedio de 3,8 p. 100 durante la estación seca. La zona vegetal de guinea del norte mostró una alta tasa de infección (zona local del gobierno de Tudun-Wada (LGA), 16,7 p. 100). Fue la única área en la que se encontraron moscas tse tse (*Glossina tachinoides*). Sin embargo, moscas hematófagas fueron comunes en la savana de sudan; tábanos fueron omnipresentes. *Trypanosoma vivax* infectó 3,0 p. 100 de los hatos bovinos y fue responsable de 57,6 p. 100 de todos los casos diagnosticados. Se sugiere que el control de los vectores en la LGA Tudun-Wada y la quimioprofiláxis puede romper el ciclo de transmisión de la tripanosomosis bovina en el área.

Palabras clave : Rumiante - Trypanosomosis - *Trypanosoma vivax* - *Glossina* - Epidemiología - Tabanidae - Enfermedad transmitida vector - Estación lluviosa - Estación seca - Nigeria.