

Pig trypanosomosis: prevalence and significance in the endemic Middle Belt zone of Southern Nigeria

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OMEKE (B.C.O.). La trypanosomose porcine. Prévalence et incidence dans la zone endémique du Middle Belt au Sud-Nigeria. *Revue Élev. Méd. vét. Pays trop.*, 1994, 47 (4) : 381-386

Des enquêtes sur la trypanosomose porcine menées aux abattoirs et sur les marchés de brousse ont concerné 1 954 porcs croisés, âgés de 6 à 30 mois et élevés dans la zone du Middle Belt au Sud-Nigeria. Elles ont révélé un taux de 26,8 p. 100 d'infection. Parmi les animaux infectés, 66,5 p. 100 l'étaient par *Trypanosoma brucei* et *T. congolense* (infection mixte), 23,9 p. 100 par *T. brucei* et 8,2 p. 100 par *T. congolense*. Dans 1,5 p. 100 des cas, l'agent causal n'a pu être identifié et aucune preuve n'a été apportée de l'existence de *T. simiae*. Pour les deux sexes, le taux d'infection était significativement plus élevé ($p < 0,05$) chez les porcs provenant des abattoirs (37,8 p. 100) que chez ceux des fermiers (21,8 p. 100). Un pic a été noté chez les animaux âgés de 11 à 15 mois, de même qu'à la fin de la saison des pluies et au commencement de la saison sèche (de septembre à décembre). Des tests complémentaires d'inoculation sur souris ont révélé 83 cas à l'état subclinique ou latent. L'auteur les recommande comme technique de confirmation du diagnostic. La maladie crée des problèmes aux éleveurs et la coopération des chercheurs est essentielle.

Mots clés : Porcin - Trypanosomose - *Trypanosoma brucei* - *Trypanosoma congolense* - Prévalence - Saison - Nigeria.

INTRODUCTION

It is no longer a matter for debate that trypanosomosis constitutes a disease constraint to pig production in the tropics. Evidence abounds (1, 2, 4, 12, 18) confirming this disease to be an important livestock problem. It is noteworthy that outbreaks in pigs due to virulent strains of trypanosomes other than *Trypanosoma simiae* have been reported (1, 9, 15) in the Middle Belt zone of Southern Nigeria and elsewhere. OMEKE and ONUORA (19) recently documented the pathogenesis of *T. brucei* and *T. congolense* in experimentally infected boars. There is scarce information to ascertain the prevalence and hence significance of these pathogens in this endemic zone which supports all the Nigerian potential for pig production. KILLICK-KENDRICK and GODFREY (10) carried out a pilot survey of the pathogens among slaughter pigs in a native market near Nsukka in Eastern Nigeria, but they were not definite in their conclusion. MALLY (15) highlighted the importance of the disease in the zone. MADUBUNYI (12) and MAGAJI (13) confirmed that prevalent tsetse and other biting flies in the zone transmit *T. brucei* and *T. congolense*. The present studies were car-

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ried out to determine the prevalence of trypanosome species pathogenic to pigs and the significance of pig trypanosomosis in the Middle Belt zone of Southern Nigeria.

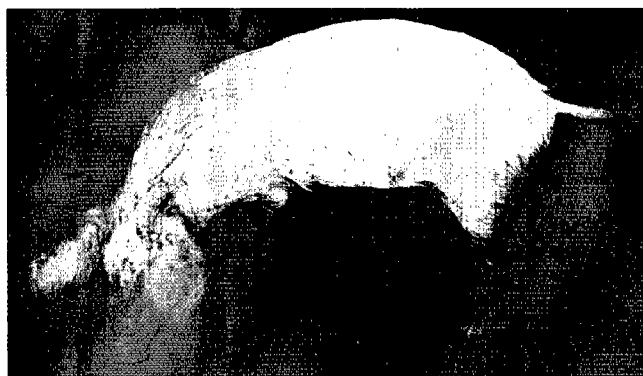


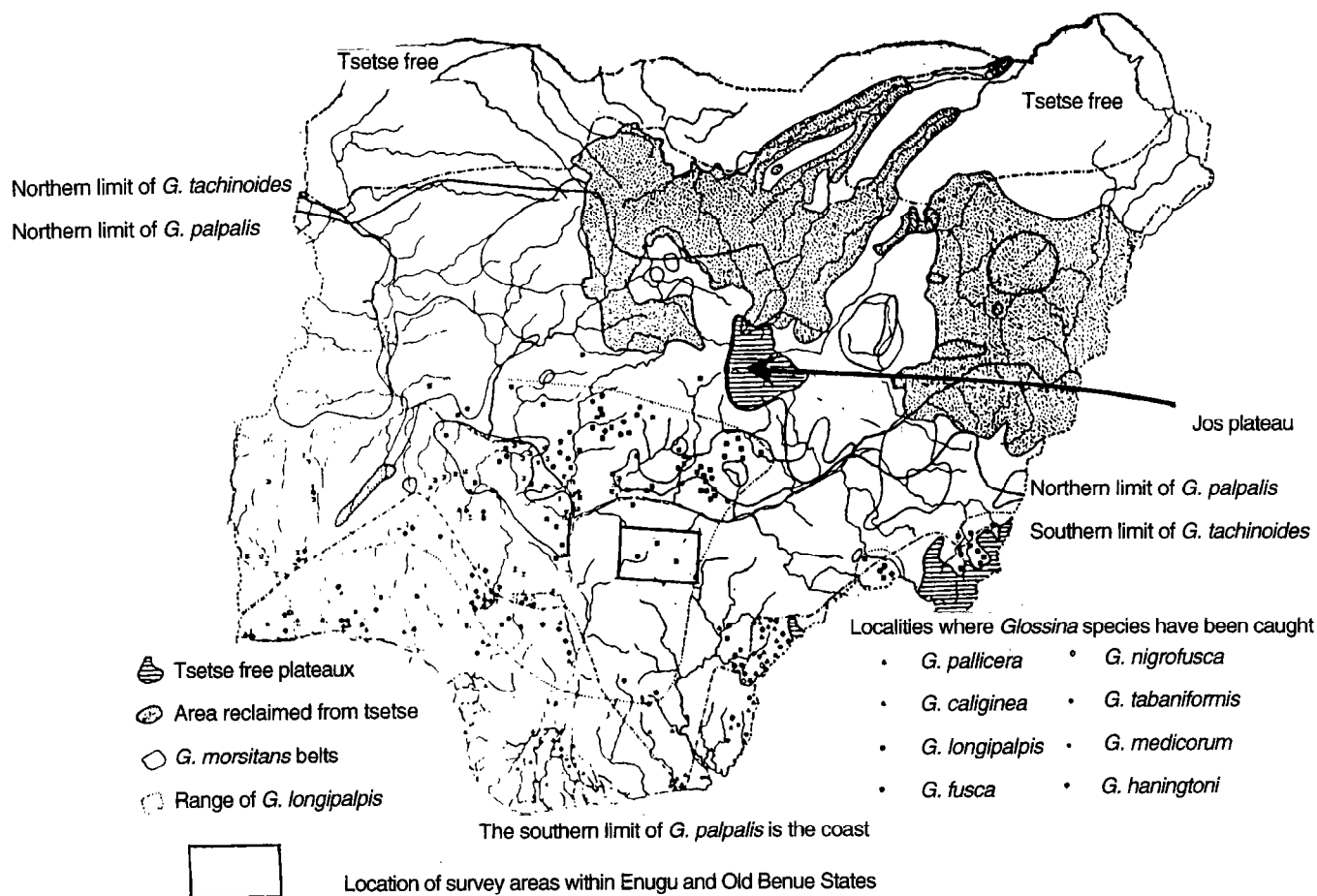
Photo 1 : Pigs infected with trypanosomes: poor demeanour, emaciation shown.



Photo 2 : Pigs infected with trypanosomes: scrotal oedema and petechiation shown.

MATERIALS AND METHODS

Twenty three medium sized piggery farms and five rural market abattoirs (Orie Orba, Afor Opi, Nkwo Ibagwa in Anambra State and Orie Akpanya, Orie Ogugu in Benue State) randomly spread within the Middle Belt zone of Southern Nigeria (maps 1, 2) were selected and tested between January 1990 and December 1992. The climate of the zone



Map 1 : Tsetse distribution in Nigeria.

is rather humid with relatively equal dry (November-April) and rainy (May-October) seasons. The vegetation consists of open savanna woodland infested all the year round with tsetse and other biting flies. There is a shift at present from keeping indigenous scavenger pigs to closed farm-yard pigs, most of which are exotic breeds or their crossed offspring. A total of 1,954 pigs, 614 of which were at the slaughter house, were used in the study.

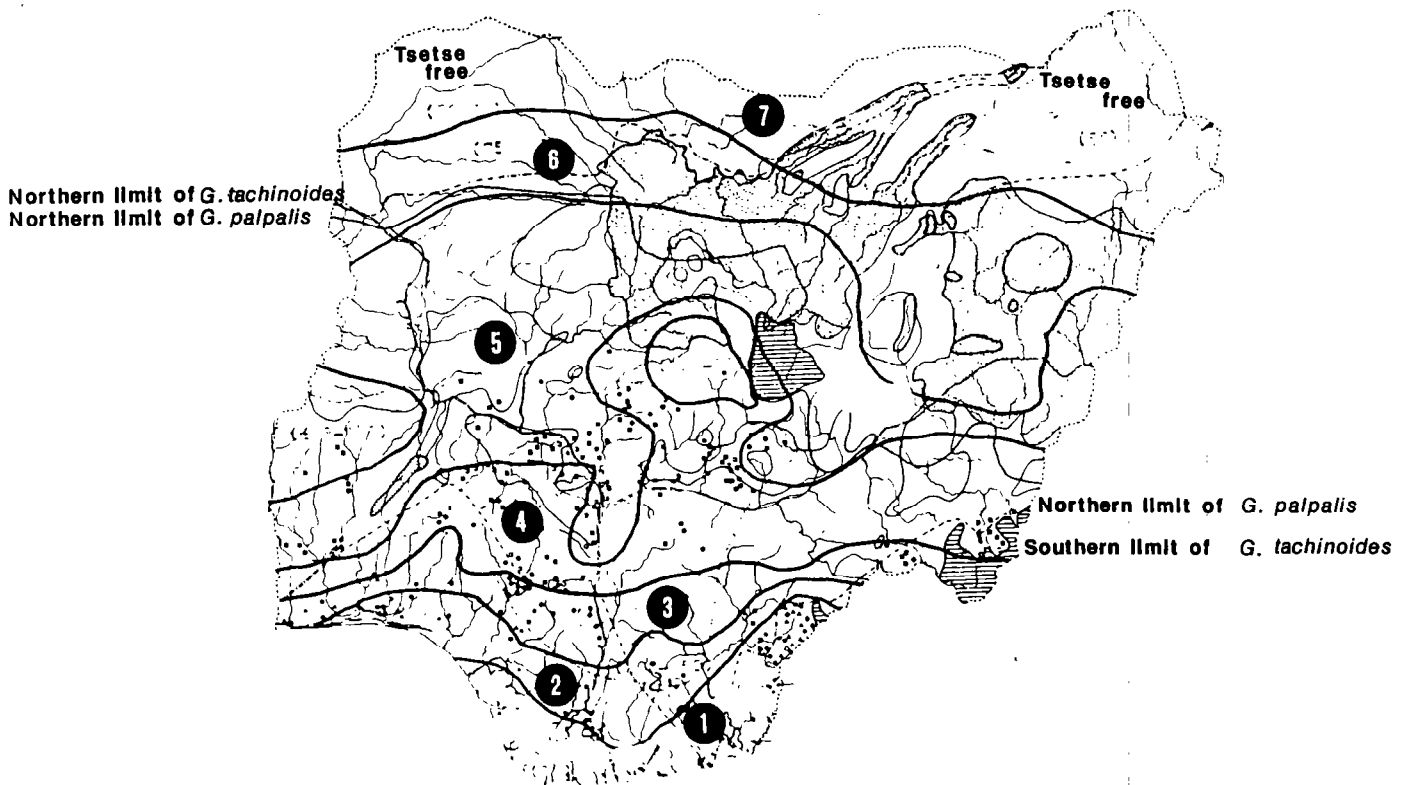
Experimental pigs

Farm pigs aged between 6 and 30 months were screened or examined at 6 month intervals to ascertain the likelihood of "self cure". Twenty pigs were marked and examined from each farm. Management procedures, differed slightly between farms. However, pigs were generally fed on concentrates (14-18 % crude protein) supplemented with kitchen left-overs and leguminous leaves. Water was adequately provided. Usually pigs were kept in open ventilated houses and were not protected or treated against trypanosome infection.

Experimental procedure

Each pig was examined physically for appearance, behaviour and body conditions including weight, where possible. The rectal temperature was taken and about 5 ml blood was aspirated from the ear vein (in the case of farm pigs) or collected from the bleeding jugular vein at slaughter, into a clean bijoux bottle containing ethylene diamine tetra-acetic acid (EDTA) as a coagulant. Samples were kept in a large flask containing ice cubes, and taken to the University of Nigeria's diagnosis laboratories for haematological examinations, isolation and identification of pathogens, if any.

To do this, thin and thick Giemsa-stained blood smears were prepared from each sample and were examined in a phase contrast microscope according to methods described by COLE (4) and MACLENNAN (11). Trypanosome strains were identified accordingly. Packed Cell Volume (PCV) was measured in microhaematocrit tubes. The capillary tubes were cut just below the buffy coat to include the uppermost layer between the red blood cells and the plasma. The contents of the tubes



Map 2 : Tsetse species and vegetation distribution in Nigeria.

1: swamp forest ; 2: rain forest (B&W) ; 3: derived savanna ; 4: southern Guinea savanna ; 5: northern Guinea savanna ; 6: Sudan Savanna ; 7: Sahel.

were expressed on clean slides, mixed and covered with clean coverslips (22"x18"). Each slide was examined with a phase-contrast microscope using x10 eyepieces in combination with a x25 objective which gave optimum viewing and large visual fields. The incidence and level of parasitaemia were determined and trypanosomes were identified by their morphology according to the method applied by HOARE (7) and MURRAY *et al.* (17).

As well as the application of the Standard Trypanosome Detection (STDM) and the buffy-coat diagnostic methods, for every sample not immediately diagnosed approximately 0.1 ml of the sample blood was inoculated intra-peritoneally into each of four healthy mice. Mice tail blood was smeared on clean slides and examined daily for 12 days, starting from the third day after inoculation. In this way subpatent (or prepatent) trypanosome infections in the donor pigs were diagnosed. Pigs at the abattoir or those that died on the farms within the study period were examined for pathology, including organ size and texture. Pre-slaughter and carcass weights were recorded.

Statistical analyses

Where possible, data collected was subjected to the simple linear and second order polynomial regression

analyses as described by STEEL and TORRIE (22). The lowest level of statistical significance from the t-test for each coefficient of regression is presented below.

RESULTS

Of the 1,954 pigs, 524 (26.8 %) were positive for trypanosome infections (table I), 348 (66.5 %) of which had a mixed *T. brucei* and *T. congolense* burden, while 125 (23.9 %) and 43 (8.2 %) others had single *T. brucei* and *T. congolense* infections respectively. Only 8 (1.5 %) of the infections were not identified, although they were confirmed not to be *T. simiae* by their positive test for *T. brucei* and *T. congolense* and Blood Incubation Infectivity Test (BIIT). The infection rate was significantly higher ($p < 0.05$) among the abattoir pigs than among the farm (21.8 %) pigs, especially for those aged 11 to 15 months (table II). The acute course of the disease peaked among pubertal pigs while chronic and or subclinical cases were prevalent among older pigs. Sex and seasons did not influence disease prevalence, except that it peaked towards the end of the rainy season to the beginning of the dry season (September to December). There was no "self-cure" observed. Characteristic symptoms of trypanosomosis were evident, including lowering of PCV to between 27.6 and 26.1 %.

TABLE I Observed prevalence and sex related rate of trypanosome infections in abattoir and on-farm pigs in Southern Nigeria, 1990-1991.

Description	Abattoir pigs			On-farm pigs			Total
	Males	Females	Both	Males	Females	Both	
No. examined	348	266	614	616	724	1,340	1,954
No. infected	128	104	232	108	184	292	524
Infection rate (%)	36.8 ^a	39.1 ^a	37.8 ^a	17.5 ^c	25.4 ^b	21.8 ^b	26.8
Differential <i>T. brucei</i> and <i>T. congolense</i> infections							
Mixed (% of infection)	61 (47.7) ^a	52 (50.0) ^a	113 (48.7) ^a	83 (76.8) ^b	152 (82.6) ^b	235 (80.5) ^b	348 (66.5)
<i>T. brucei</i> only (% of infection)	46 (35.9) ^a	38 (36.5) ^a	84 (36.2) ^a	18 (16.7) ^b	23 (12.5) ^b	41 (14.0) ^b	125 (23.9)
<i>T. congolense</i> only (% of infection)	20 (15.6) ^a	12 (11.5) ^a	32 (13.8) ^a	5 (4.6) ^b	6 (3.3) ^b	11 (3.7) ^b	43 (8.2)
Unidentified (% of infection)	1 (0.8) ^a	2 (1.9) ^a	3 (1.3) ^a	2 (1.0) ^a	3 (1.6) ^a	5 (1.7) ^a	16 (1.5)

^{ab}: $p < 0.05$. ; ^{bc}: $p < 0.01$; Values in the same horizontal rows followed by the same superscripts are not significantly different.

Parasitaemia was higher in mice than in pigs; the former usually died within three weeks of infection. Thus 83 infections were diagnosed following mice inoculation as described. Single (particularly *T. brucei*) infection was more lethal to mice. Preslaughter and carcass weights of infected pigs were significantly lower than those of uninfected pigs (table III). At necropsy, splenomegaly, enlarged liver, opaque hydropericardium, regional adhesions and ballooned gastrointestinal tracts were frequently observed.

DISCUSSION

The results lend credence to recent observations (14, 16, 18, 19) in which debilitating effects of strains of trypanosomes other than *T. simiae* on pigs, particularly in the Middle Belt zone of Southern Nigeria, were highlighted. The situation is also influenced by the tendency of farmers in the zone to keep exotic pigs (18) which are highly susceptible to trypanosomosis. They do so to meet the preferential demand of consumers. It was evident from the studies that trypanosomosis was more severe in pigs with single rather than mixed trypanosome infections. Similar observations previously recorded (5, 10, 13) support the fact that multiple pathogen infections tend to lower their individual impact on their hosts. This is also in agreement with the postulation made by SCOTT (21) that closely related trypanosome strains naturally coexist in the same hosts. This may explain the usual chronic course and lower mortality in infected hosts. The mechanisms responsible for this phenomenon are a subject for further investigations.

The clinical symptoms observed were characteristic of animal trypanosomosis (8, 10, 13). In their observations, KILLICK-KENDRICK and GODFREY (10) reported that

T. congolense is more virulent in pigs than *T. brucei*. The reverse was the case in the present studies. A low level of parasitaemia was also observed. Periodic aparasitaemia or low levels of parasitaemia often present diagnostic problems. Several authors (6, 10, 19) have consequently advocated the use of laboratory animal inoculation to reveal subpatent conditions in pigs. In the present studies, mice inoculation tests revealed 83 supplementary subpatent and or prepatent infections.

Trypanosomes were properly identified in the studies made. However, the possibility of the 1.5% unidentified infections being due to low virulent *T. simiae* is very slight. So far, *T. simiae* has not been identified from pigs in the zone. The problem of porcine trypanosomosis is complicated by its usual subclinical but chronic course, often not noticed or ignored by the less experienced farmers until serious debilitation sets in. Evidently the disease hinders pig productivity in this high-potential zone of Nigeria. The cooperation of animal scientists, particularly veterinarians, is needed. Farmers should be encouraged to keep upgraded pigs which apparently are less susceptible to trypanosomosis. This is in addition to improved husbandry techniques, including construction of fly-proof houses.

CONCLUSION

Trypanosoma brucei brucei and *T. congolense* are endemic in the Middle Belt zone of Southern Nigeria, a large potential area for pig production. These pathogens cause disease and consequently hinder production by their chronic course. Infection is more reliably diagnosed by mice inoculation and this test is strongly recommended. Farmers need the cooperation of livestock experts in the control of the disease through improved husbandry techniques.

TABLE II Observed age-related course of infection, packed cell volume and mortality due to trypanosomosis of pigs in Southern Nigeria, 1990-1991.

Variables	Age range (months)					Total
	6-10	11-15	16-20	21-25	26-30	
No. of pigs examined	394	398	528	384	250	1,954
No. infected As % of examined	98 24.8 ^b	134 33.7 ^a	169 32.0 ^a	86 22.4 ^b	47 18.8 ^c	524 26.8
Course of infection						
Acute	39	28	18	8	—	93
Subclinical/mild	48	92	87	36	17	280
Chronic	11	18	64	28	30	151
Mean PCV (\pm SEM) (%)						
Infected pigs	31.1 \pm 1.4 ^a	30.0 \pm 1.0 ^a	27.6 \pm 2.3 ^b	26.9 \pm 1.9 ^b	26.1 \pm 2.4 ^b	29.1 \pm 1.7
Uninfected pigs	33.8 \pm 1.0 ^a	34.0 \pm 0.8 ^a	34.1 \pm 0.8 ^a	33.9 \pm 0.7 ^a	33.8 \pm 0.7 ^a	33.9 \pm 0.8
¹Mortality/Abortion (No.)						
Abortion	—	3	6	4	5	18
Culled	6	10	6	6	4	32
Mortality	4	5	3	2	3	17

¹ On-farm pigs only.

SEM : Standard Error of the Mean.

^a : $p < 0.05$; ^b : $p < 0.01$. Values in the same horizontal rows followed by the same superscripts are not significantly different.**TABLE III** Diagnostic features and percentage carcass weight at slaughter or death of pigs due to trypanosomosis.

Variables	Type of infection				Controls (group E)
	Mixed (group A)	<i>T. brucei</i> (group B)	<i>T. congolense</i> (group C)	Unidentified (group D)	
Diagnosis					
No. diagnosed by STDM*	280	106	31	6	NA
No. diagnosed by buffy coat	283	123	37	8	NA
No. diagnosed by mice inoculation	348	145	43	8	NA
Average No. of days to death of infected mice	30.8	25.2	26.4	31.1	NA
No. dead/slaughtered** pigs weighed	30	30	30	5	30
Average carcass as % body weight	64.2 ^b	61.8 ^b	62.3 ^b	63.4 ^b	71.6 ^a

* STDM = Standard Trypanosome Detection Method.

** Random numbers selected for each group.

^a : $p < 0.05$. Values in the same horizontal rows followed by the same superscripts are not significantly different.

NA = not analysed.

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- Abattoir and field/market surveys of 1,954 crossbred pigs aged 6 to 30 months, for trypanosomiasis in the Middle Belt zone of Southern Nigeria, revealed a 26.8 % infection rate. Of those infected, 66.5, 23.9 and 8.2 % were due to mixed, single *Trypanosoma brucei* and *T. congolense* infections respectively. Although 1.5 % of the infections were unidentified, there was no evidence of *T. simiae*. The infection rate was significantly higher ($p < 0.05$) among the abattoir pigs (37.8 %) than among the farm pigs (21.8 %) in both sexes. Peak infection was noted among pigs aged 11 to 15 months and during the end of the rainy season and the beginning of the dry season (September to December). Complementary mice inoculation tests revealed 83 subpatent and prepatent cases and are being recommended as a confirmatory diagnostic technique. The disease poses problems for pig productivity and the cooperation of scientists is essential.**
- Key words:* Swine - Trypanosomiasis - *Trypanosoma brucei* - *Trypanosoma congolense* - Prevalence - Season - Nigeria.
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- Se llevaron a cabo seguimientos para la tripanosomiasis, en matadero y en campo/mercado de 1954 cerdos cruzados, de 6 a 30 meses de edad, en la faja media del sur de Nigeria. La tasa de infección fue de 26,8 p. 100. De animales infectados, 66,5 p. 100 lo fueron por ambos tripanosomas, *T. brucei* y *T. congolense*, 23,9 por *Trypanosoma brucei* y 8,2 p. 100 por *T. congolense*. Aunque 1,5 p. 100 de los agentes causales de las infecciones no fueron identificados, no existe evidencia de infección por *T. simiae*. Para ambos sexos, la tasa de infección fue significativamente más alta ($p < 0.05$) en los cerdos de matadero (37,8 p. 100) que en las fincas (21,8 p. 100). El pico de infección se presentó en los cerdos de 11 a 15 meses de edad y durante el final de la época de lluvias y el inicio de la estación seca (septiembre a diciembre). La inoculación complementaria de ratones mostró 83 casos subpatentes y prepatentes y es recomendada como técnica de confirmación diagnóstica. La enfermedad representa un problema para la productividad porcina y la cooperación de agrónomos y profesionales en el campo es esencial.**
- Palabras clave :* Cerdo - Tripanosomiasis - *Trypanosoma brucei* - *Trypanosoma congolense* - Prevalencia - Estación - Nigeria.