Prevalence of Trypanosome Infections in Cattle and Sheep in the Benin's West Atacora Agro-ecological Zone

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Summary

Trypanosomiasis remains one of the major constraints to ruminant livestock development in Benin. In order to determine the prevalence of trypanosome infections in the municipality of Ouake in the West Atacora agro-ecological zone, a parasitological study was conducted on 52 sheep (phenotype Djallonke) and 134 cattle phenotypes Somba (63), Borgou (21), Zebu (18) and crossbred Zebu x Somba (32). In order to determine prevalence rates, blood samples were checked for trypanosomes using microscopic techniques: 6.7% in cattle (n= 9) and 3.8% in sheep (n= 2). Two trypanosome species were encountered in cattle: Trypanosoma vivax *(33.3%) with n= 3 and* T. congolense *(44.5%) with n= 4. Some cases of co-infection by* T. vivax *and* T. congolense *(n= 2) were reported (22.2%). Only* T. congolense *was identified in sheep. Female calves were more infected (22.2%) than other cattle. The Somba phenotype had the lowest prevalence (1.6%) while the highest prevalence was recorded for crossbred Zebu x Somba (15.6%). These results suggest that the trypanosome infections control needs to be intensified, in order to improve cattle and sheep productivity in the municipality of Ouake.*

Résumé

Prévalence des infections trypanosomiennes des bovins et des ovins dans la zone agro-écologique ouest-Atacora au Bénin

La trypanosomose demeure l'une des contraintes majeures au développement de l'élevage des ruminants au Bénin. Dans le but de déterminer la prévalence des infections trypanosomiennes dans la Commune de Ouaké, en zone agro-écologique ouest Atacora, une étude parasitologique a été réalisée sur 52 ovins de phénotype Djallonké et 134 bovins de phénotypes Somba (63), Borgou (21), Zébus (18) et métis Zébu x Somba (32). La recherche de trypanosomes dans les prélèvements de sang par les techniques microscopiques a permis de déterminer des prévalences de 6,7% (n= 9) chez les bovins et 3,8% (n= 2) chez les ovins. Deux espèces de trypanosomes ont été rencontrées chez les bovins: Trypanosoma vivax *(33,3%) avec n= 3 et* T. congolense *(44,5%) avec n= 4. Les cas de co-infection à* T. vivax *et* T. congolense *(n= 2) représentent 22,2%. Seul* T. congolense *a été identifié chez les ovins. Les velles étaient plus infectées (22,2%) que les autres catégories de bovins. Le phénotype Somba avait la prévalence la plus faible (1,6%) alors que la prévalence la plus élevée a été enregistrée chez les métis Zébu x Somba (15,6%). Ces résultats suggèrent que la lutte contre les infections trypanosomiennes doit être renforcée pour améliorer la productivité des bovins et des ovins dans la Commune de Ouaké.*

Introduction

Animal trypanosomiasis represents a major constraint for the development of cattle and other ruminant farming in over 37 countries in Sub-Sahara Africa (7). In ruminants, these parasitic infections are caused by three species of trypanosomes (*T. vivax, T. congolense* and *T. brucei*), which are transmitted by tsetse flies and other blood-feeding insects (8).

The low productivity of indigenous cattle often makes it necessary to import more productive cattle breeds for the purpose of genetic improvement. However, these imported animals are more sensitive to trypanosomiasis than indigenous breeds. This represents an obstacle to genetic improvement programmes (13).

Benin is not unaffected by the continuous threat posed by animal trypanosomiasis. Various studies, focusing on the epidemiology of trypanosomiasis, trypanotolerance in cattle and the use of trypanocides, have been conducted on cattle and sheep – mainly in the agro-ecological zones of North Benin (cotton-growing), South Borgou (food crops) and Central Benin (cotton-growing) (4). In the agro-ecological zone of West Atacora, however, no epidemiological data exist on animal trypanosomiasis. Due to the presence of streams with gallery forests that can act as a refuge for tsetse flies, it is necessary to study the situation of this parasitic animal in this agro-ecological zone.

The objective of this study is to determine the

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prevalence of trypanosome infections in the municipality of Ouake in the agro-ecological zone of West Atacora, in which streams provide a source of water for farm ruminants.

Materials and methods

Area studied and sampling method

The study was conducted on farms in the Municipality of Ouake, which is located in the Donga region, between parallels 9° and 10° (north latitude) and meridians 1° and 2° (east longitude), in the agro-ecological zone of West Atacora.

In total, 134 cattle of different breeds (Somba, Borgou and Crossbred Somba x MBororo cattle) from 12 herds and 52 sheep from 5 flocks were examined. Their distribution, according to district, is shown in table 1. The animals to be sampled were selected at random.

Blood sampling and determining hematocrit values

The blood was sampled using sterile Vacutainer tubes, containing EDTA K3. The hematocrit tubes were filled directly by capillarity and centrifuged at 12,000 rpm for 3 minutes. The values obtained were divided into two groups: (i) hematocrit below 20%: anaemic animals (ii) hematocrit greater or equal to 25%: non-anaemic animals.

Identifying trypanosomes

A full blood test was conducted using the Woo method (14). The analysis was conducted 100X by examining the interface between the blood cells and plasma, using an OLYMPUS BH-2 photonic microscope. The positive samples were characterised by the swarming movement of trypanosomes in the tube. The content of the red blood cell - plasma interface collected on a degreased slide for each section of the hematocrit tube was analysed using 400X magnification. The trypanosomes were detected by means of their movements and shapes (11).

The positive samples in hematocrit tubes were used to prepare smears and thick films stained with Giemsa and examined using 1000X magnification. The trypanosomes were identified, with reference to the morphological characteristics of each species, as described by Itard (8).

Statistical analyses

The calculated prevalences were compared according to species, breed and animal category (age and sex),

Table 1
Distribution of ruminants sampled in the six zones studied

Farming areas	Farmers	Geographical coordinates of sites	Total cattle	Total sheep	Total cattle sampled	Total sheep sampled
Komde	1	N: 09°92.582 E: 001°21.738	117	15	18	10
	2	N: 09°40.243 E: 001°22.068	80	20	10	15
	3	N: 09°36.990 E: 001°23.301	40	12	11	8
	4	N: 09°38.398 E: 001°26.935	40	00	10	0
Central Ouake	5	N: 09°39.196 E: 001°27.646	60	10	9	7
	6	N: 09°39.747 E: 001°27.650	60	00	7	0
Badjoude	7	N: 09°36.543 E: 001°27.039	50	00	15	0
	8	N: 09°34.858 E: 001°27.039	60	00	15	0
	9	N: 09°41.526 E: 001°27.318	20	00	4	0
Tchalinga	10	N: 09°50.509 E: 001°22.509	100	00	25	0
Semere	11	N: 09°34.264 E: 001°24.127	20	18	2	12
	12	N: 09°34.366 E: 001°24.043	60	00	8	0
	Total		707	75	134	52

using the bilateral Z-test and STATISTICA software. The average hematocrits were compared using the T-test.

Results

Overall prevalence and hematocrits for cattle

The hematological examination of blood samples taken from 134 cattle revealed 9 cases of trypanosome infections and a prevalence of 6.7%. When the 5 localities are considered, in which samples were taken, the prevalence of trypanosome infection was significantly higher in Tchalinga than in Badjoude and Komde (Table 2). The average hematocrit values ranged from 2.1 ± 2.9 to 27.9 ± 5.9.

Total prevalence and hematocrits for sheep

For sheep, 2 cases of infection were detected out of the 52 sheep tested, which is equivalent to a prevalence of 3.8% (Table 2).

Hematocrit and prevalence variations according to age and sex

Prevalence of trypanosome infection in female calves (22.2%) was significantly higher than that obtained for cows (3.4%) ($p < 0.05$). However, no significant difference exists between prevalences of the infection in young bulls (8%), calves (7.7%) and bulls (0%), based on a threshold of 5% (Table 3).

The following hematocrit values varied between 21.3

Table 2
Average hematocrit values and prevalence throughout all the cattle and sheep farms sampled

Farming areas	Number of samples		Average hematocrit (%)		Trypanosoma			
					Number of cases		Prevalence (%)	
	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep
Badjoude	34	ND	27.9 ± 5.9	ND	1	ND	2.9[b]	ND
Komde	49	33	23.9 ± 6.5	22.1 ± 4.6	1	2	2.0[b]	5.9
Ouake	16	7	24 ± 2.8	19.5 ± 3.8	1	0	6.2[ab]	0
Semere	10	12	22.1 ± 2.9	18.6 ± 4.5	1	0	10.0[ab]	0
Tchalinga	25	ND	22.7 ± 4.7	ND	5	ND	20.0[a]	ND
Total	134	52	24.6 ± 6.0	21 ± 4.7	9	2	6.7	3.8

Prevalences in the same column, which bear the same letter, are not statistically different from the 5% threshold.
ND: No data available

Table 3
Average hematocrit values and prevalence of trypanosome infection according to age and breed in cattle

Category of cattle	Total number	Average hematocrit (%)	Number of trypanosome positive animals	Prevalence (%)
Cows	58	26.2 ± 4.5	2	3.4[b]
Heifers	14	26.4 ± 7.6	0	0.0a[b]
Female calves	18	22.9 ± 6.2	4	22.2[a]
Bulls	6	21.3 ± 4.8	0	0.0[ab]
Young bulls	25	23.1 ± 4.8	2	8.0[ab]
Male calves	13	22.9 ± 7.7	1	7.7[ab]
Total	134	24.6 ± 6.0	9	6.7
Somba	63	27 ± 6.3	1	1.6[b]
Borgou	21	23.9 ± 3.1	2	9.5[ab]
Zebus	18	20 ± 5.3	1	5.6[ab]
Crossbred	32	22.7 ± 4.5	5	15.6[a]
Total	134	24.2 ± 5.6	9	6.7

Prevalences in the same column, which bear the same letter, are not statistically different from the 5% threshold. Comparisons were made separately within the age/sex category (cow, heifer, female calves, bulls, young bulls, male calves) and in the breed category (Somba, Borgou, Zebus, Crossbreds). The totals are not included in the comparisons.

± 4.85 for bulls and 26.4 ± 7.6 for heifers. Analysis of these values made it possible to confirm that, in general, all categories of animal presented a good average hematocrit (above 20%).

Variation according to phenotypic characteristics

The prevalence of trypanosome infection was lower in the Somba (1.6%) than in the crossbred (15.6%), which showed the highest prevalence ($p< 0.05$) (Table 3). In terms of prevalence in Zebus (5.6%) and Borgou (9.5%), no significant difference was observed.

The average hematocrit values varied between 20 ± 5.3% for Zebus and 27 ± 6.3% for the Somba (Table 3). The Zebus presented the lowest average hematocrit (20 ± 5.3%), followed by the Metis (22.7 ± 4.5%). These Zebus showed more or less severe anaemia, which was not the case for the other breeds (Borgou, Somba).

Frequency of different trypanosome species

Two trypanosome species were identified during the microscopic examination of blood smears and thick blood films from the cattle: *Trypansoma vivax* and *T. congolense* in mono-infection with respective prevalences of 33.3% (n= 3) and 44.5% (n= 4). Mixed infections of *Trypansoma vivax* and *T. congolense* were also noted with a prevalence of 22.2% with n= 2 (Figure 1).

In the small ruminants, only *T. congolense* was detected.

Discussion

Cattle were more affected than sheep, with a prevalence of 6.7% for cattle compared to 3.8% for sheep. These results show that, when reared under the same conditions, cattle and sheep can be infected by trypanosomes. While less attention is given to trypanosomiasis in sheep, they could represent a reservoir for infection. According to some authors, small ruminants do not openly display clinical signs of trypanosomiasis, as they show a greater trypanotolerance than cattle (12). In addition, exposure to tsetse flies is lower for sheep, not only due to the eating habits of these parasites, but also the difficult task of taking blood from these animals, due to the density of their hair/wool and more nervous behaviour (12).

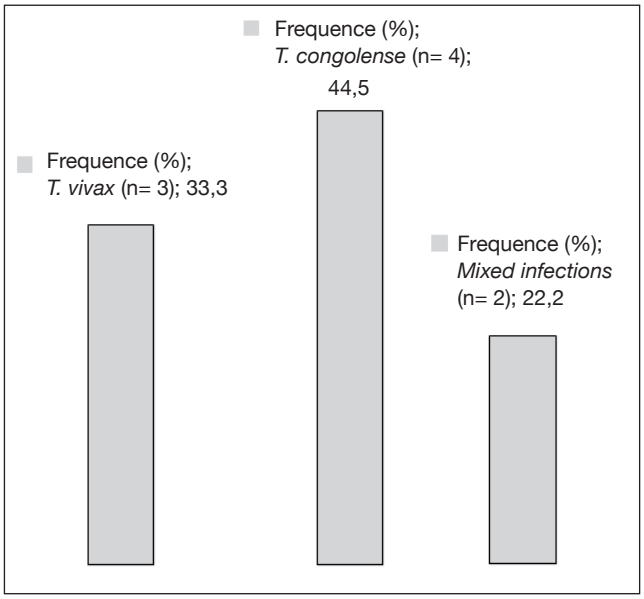

Figure 1: Frequency of trypanosome species detected in cattle.

In general terms, the prevalence of trypanosome infection measured in the cattle is similar to that reported by Kalu and Lawani (9) during the rainy season in the Kano region of Nigeria (7.6%). As part of a study on trypanosome infection in the Sudanese zone of Burkina Faso, Bengaly *et al*. (1) obtained an apparent prevalence of trypanosome infection of 7.6%. These results are no different from those of this study (6.7%).

In terms of sheep, our results show that they are slightly infected (3.8%). Similar results (3.8%) were reported by Dadah *et al*. (2) in Nigeria's Jos region. However, significantly higher results than ours have been reported: 13.1% in Kandi (Benin) (7); 38.16% in Nigeria (10).

With regard to sex, the females were more affected, while no positive cases were detected in the bulls and heifers. These differences can be explained by livestock management methods in the farming community, in which large numbers of males are removed and sold at any early age; the rest being used either for breeding or animal traction. As a result, the remaining males are more closely monitored than the females.

Female calves presented the highest prevalence of trypanosome infection (22.2%), while the heifers were less affected. Aceturate-based trypanocidal treatments (diminazene) administered by the farmers may explain these observations. Trypanocidal treatments are not generally administered to young animals before weaning. After being weaned, the young females are more closely monitored than males that are not selected for breeding or animal traction. Prevalence is also relatively higher in young bulls (8%) than heifers, in which no cases were identified. Sex did not impact significantly on the prevalence of the infection. Only the farmer's technical management can explain the differences observed, given that farmers do not apply trypanocidal treatments to all animals. When heifers and young bulls are compared, farmers are more interested in the females. When it comes to adult cattle, more importance is attached to breeding bulls.

However, the trypanosomiasis prevalence seems to fall as the animals get older. Age-acquired immunity could represent a key factor, bearing in mind that trypanocidal treatments are used more frequently on

adults. In addition, young animals are more vulnerable to bites from tsetse flies and other vectors, due to the fragility of their skin. Moreover, young animals are not yet able to drive insects away, when they graze in the same areas as the adults. The tsetse flies also frequently target weak animals as a source of food, in order to avoid being crushed by moving animals (1). However, as part of a study on the dynamics of trypanosome infections in Borgou cattle in Benin, Doko *et al.* (4) reported that male calves are less infected than the adults with cumulative serological prevalences of 30% and 80 - 95%, respectively.

In terms of the localities examined, prevalence of trypanosome infection was at its highest in Tchalinga. This variation in prevalence of the infection, depending on locality, can be explained by the fact that the farm sampled in Tchalinga consisted of untreated Metis cattle. Furthermore, the proximity of some gallery forests around the pasture zones and along the river Binao, which provide a source of water for the animals, also represents a positive factor for trypanosome infection in Tchalinga. As far as other farming areas are concerned, the results obtained can be explained by the fact that most of these locations consist of fields, leaving only abandoned arable land and a few areas along the streams, which provide pasture for the animals.

In terms of hematocrit, although this is due to multiple factors (trypanosomiasis, helminthiasis, babesiosis, anaplasmosis, nutritional status, etc.), the drastic fall in this value is traditionally considered a warning sign of the trypanosomiasis disease (3). The animals examined as part of this study were apparently healthy, but the pathological status characterised by low hematocrit values has generally been observed with the presence of detectable trypanosomes in some cases. The animals with low hematocrit values that were not infected by trypanosomes included those affected by other pathologies. In the same way, Farougou *et al.* (5) have described the role of gastrointestinal nematodoses and hemoparasites other than trypanosomes (*Babesia, Anaplasma* and *Theileria*) in triggering anaemia. The average hematocrit values ranged from 21.3 ± 4.3% for bulls and 26.2 ± 4.5% for cows. It must be noted that significantly higher values were obtained in similar studies: 36.5 ± 6.8% and 34.8 ± 8.4% are the values reported by Doko *et al*. (4) on the farm at Okpara. It should also be mentioned that animals of the Somba phenotype presented the highest average hematocrit values, but the presence of trypanosomes did not have a significant influence on their general condition. In addition, the Somba cattle raised in the same area may represent likely sources of infection for the most sensitive animals and especially transhumant zebus.

Though less affected by trypanosomiasis, sheep presented low hematocrit values (21 ± 4.7%) and a general change in terms of condition. Factors such as gastro-intestinal parasitism, malnutrition and over-exertion, caused by walking long distances in search of pasture, may explain this situation.

Conclusion

This study has enabled us to confirm the presence of trypanosome infection on cattle and sheep farms in the West Atacora agro-ecological zone. Its prevalence has been greater in zebus and crossbred than indigenous breeds (Somba bulls). Similarly, young animals were far more infected than adults on these traditional farms. This situation represents a constraint for the introduction of foreign breeds in this environment. It is therefore important, for successful farming, that combative measures are implemented, in order to improve sanitary conditions in these areas. A preventive treatment programme must also be introduced for young animals. In order to be more effective, these measures must be combined with steps aimed at vectors of the disease and gastro-intestinal parasitosis.

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