

An outbreak of *Trypanosoma vivax* infection in a dairy herd in the Pantanal, Brazil

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Key words

Dairy cattle - *Trypanosoma vivax* - Blood - Biochemistry - Pantanal - Brazil.

Summary

In this study is reported for the first time an outbreak of trypanosomosis due to *Trypanosoma vivax* in dairy cattle from the Pantanal of Nabileque, Brazil. Animals presented pale mucosae, ophthalmitis, progressive weakness, loss of condition, inappetence and abortions during the third trimester of pregnancy. Among the most important hematological and blood chemistry findings were leukopenia, macrocytic hypochromic anemia and high total lipid serum levels.

INTRODUCTION

Trypanosomosis is one of the most devastating diseases of animals and man in sub-Saharan Africa and has a profound effect on rural development over vast areas (10). Non-tsetse transmitted trypanosomosis, caused by *Trypanosoma evansi* and *T. vivax*, occurs in various forms in South America, Africa and Asia (including China), and is a potential risk for 500 million cattle, 100 million buffaloes and 12 million camels (20). In South America, four species of trypanosomes have social or economic importance. They are *Trypanosoma cruzi*, the cause of Chagas' disease in humans, *T. equiperdum* causing a chronic sexually transmitted disease of horses, *T. evansi* causing Mal de Caderas in horses and other mammals and *T. vivax* causing disease in bovines (27, 30). *T. vivax* is found throughout the tsetse belt in Africa. It has, however, spread to other parts of Africa, Central America,

South America, the West Indies and Mauritius (16). *T. vivax* was reported in the New World for the first time in French Guyana (15) and later in others parts of South America, Central America, and some Caribbean islands (17). In Brazil, Shaw and Lainson reported the first occurrence of *T. vivax* (25). The parasite was observed in a water buffalo (*Bubalis bubalis*) from the vicinity of the city of Belém, Pará, Brazil. Twenty-three years later, *T. vivax* was recorded in the North of the Pantanal (26). In the following year, *T. vivax* outbreaks were reported in the lowlands of Bolivia (28). The purpose of the present study was to characterize the hematological and some blood chemistry changes as well as clinical observations of the natural infection in dairy cattle from the Pantanal.

MATERIALS AND METHODS

Study area

The Pantanal is one of the most important beef cattle breeding regions of Brazil. Extensive cattle ranches varying from 10,000 to 200,000 ha occupy most of this wetland. It is populated by 3,996,000 beef cattle, 4966 buffaloes and 49,000 horses (3, 24, 26). Milk production is economically insignificant and usually consumed by poor people. The Pantanal is divided into 11 subregions (figure 1). This study was carried out in the Pantanal of Nabileque subregion. It is a high flooding plain with abundant water bodies surrounded by mountains forested mainly by species from the Paraguayan Chaco.

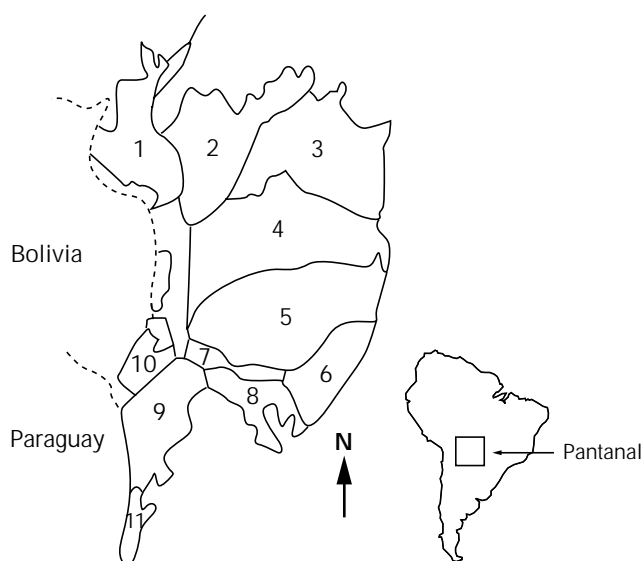
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Pantanal subregions

1. Pantanal of Cáceres
2. Pantanal of Poconé
3. Pantanal of Barão de Melgaço
4. Pantanal of Paiaguás
5. Pantanal of Nhecolândia
6. Pantanal of Aquidauana
7. Pantanal of Abobral
8. Pantanal of Miranda
9. Pantanal of Nabileque
10. Pantanal of Paraguay
11. Pantanal of Porto Murtinho

Figure 1: Location of the Pantanal and its subregions.

Animals

In August 1997, an outbreak of bovine trypanosomosis occurred in a dairy-cattle ranch of 40 crossbred cows (Holstein Friesian x White Nelore) with three cows dead, five abortions and seven placenta retentions.

Blood sampling

All animals were blood sampled. Refrigerated blood and serum samples were submitted to EMBRAPA-Centro de Pesquisa Agropecuária do Pantanal for analysis.

Diagnosis

The diagnosis of trypanosomosis was done using the hematocrit centrifuge technique (31) and Giemsa-stained smears. Following the diagnosis a study was carried out on hematological changes in all 17 *T. vivax* infected animals.

Hematological determinations

Hematological examinations were performed on EDTA-treated blood samples collected into evacuated tubes by jugular venipuncture. The packed red cell volume (PCV) was measured using the standard microhematocrit method, and the red cell count (RBC) and total white cell count (WBC) were obtained using a Neubauer chamber. The hemoglobin (Hb) concentration was determined colorimetrically (Micronal digital spectrophotometer, B 34212, São Paulo, SP, Brazil) after its conversion to cyanomethemoglobin.

Blood chemistry determinations

Serum concentrations of total protein, total lipids and blood urea nitrogen were determined by spectrophotometric methods (Labtest Sistemas Diagnosticos, São Paulo, SP, Brazil).

RESULTS

The prevalence for *T. vivax* was 42.5% (17/40). The trypanosomes were identified based on morphological and biometrical data according to Hoare (9).

The clinical signs observed were pale mucosae, ophthalmitis, progressive weakness, loss of condition, inappetence and abortion in the third trimester of pregnancy. The main hematological changes produced by *T. vivax* infections were anemia and severe leukopenia. The cattle presented macrocytic hypochromic anemia (table I). The leukocyte changes were characterized by a decrease in the leukocyte count (table II). Increased values of total serum lipids were observed. No change in serum total protein and blood urea nitrogen values was observed (table III). The animals were treated with diminazene aceturate and survived.

DISCUSSION

T. vivax has been reported to cause natural and experimental diseases in South America and other countries of the world. Bovine trypanosomosis due to *T. vivax* affects the health and productivity of cattle in Colombia (29) and Venezuela (17). The parasite was recorded in Colombia in 1932, when an epidemic with high associated mortality occurred on the Atlantic coast, allegedly following the importation of infected cattle from Venezuela. In 1932 in Colombia, Virviescas found outbreaks of *T. vivax* severe enough for a butter factory and a cheese factory to shut down in El Piñon due to lack of milk (29). According to Desquesnes and Gardiner, despite the absence of clinical signs during a two to three years' epidemiological survey in French Guyana, the antigen and/or antibody seroprevalences of *T. vivax* showed a stable infection in the country (7). Natural pathogenicity of Guyanan *T. vivax* should be confirmed; very low parasitemia or extravascular foci might explain the apparent absence of bloodstream forms between two outbreaks. However, severe trypanosomosis is reported here and the findings of this study agree with those of Camus and Martenchar (4). These authors found that experimental infections of Brahman zebu with a strain of *T. vivax* isolated in Guyana resulted in moderate, transient fever, a decrease in packed cell volume and a rapid, severe weight loss, diarrhea, swollen glands in the neck, lacrimation, weakness and death (4). Otte *et al.* observed decreased milk production and loss of weight in bovines of endemic regions of Colombia (19). In Nigeria, Kalu reported on anemia, abortion and death caused by *T. vivax* in Friesian dairy cows (13). According to Ogwu and Njoku non-pregnant heifers and heifers in the third trimester of pregnancy, when infected with *T. vivax*, developed a more severe form of the disease than pregnant heifers in the first and second trimesters of pregnancy (18). Anemia is one of the most consistent findings in trypanosomosis. The nature of the anemia has not been completely elucidated (2). Leukopenia has been reported in trypanosomosis and is attributed to reduced myelopoiesis (12). The anemia due to a *T. vivax* infection is described as normocytic normochromic with a tendency to being macrocytic normochromic (22). The main hematological changes were macrocytic hypochromic anemia and a severe leukopenia. This kind of anemia can be found in acute processes. Severe leukopenia could cause

Table I

Red blood cell values of *Trypanosoma vivax* infected dairy cattle of Pantanal (mean \pm SD)

	Infected dairy cattle	Normal values* Zebu Gobra	Normal values* Zebu Maure	Normal values** (average)
Erythrocytes (x 10 ⁶ /μl)	3.11 \pm 1.12	8.07 \pm 0.32	8.06 \pm 0.71	5.0-10.0 (7.0)
Hemoglobin (g/dl)	7.74 \pm 1.41	11.80 \pm 0.50	11.60 \pm 0.90	8.0-15.0 (11.0)
PCV (%)	29.60 \pm 4.43	37.80 \pm 1.30	36.80 \pm 2.60	24.0-46.0 (35.0)
MCV (fl)	98.07 \pm 26.60	46.80	44.90	40.0-60.0 (52.0)
MCH (pg)	27.04 \pm 7.23	-	-	11.0-17.0 (14.0)
MCHC (g/dl)	27.36 \pm 3.22	31.20	30.40	30.0-36.0 (32.7)

PCV: packed cell volume; MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration

* Cuq *et al.*, 1977, *Revue Elev. Méd. vét. Pays trop.*

** Jain N.C., 1986, Lea and Febinger

Table II

White blood cell values of *Trypanosoma vivax* infected dairy cattle of Pantanal (mean \pm SD)

Leucocytes (%)	Infected cattle	Normal values*
Neutrophils	35.62 \pm 10.44	15-45
Lymphocytes	44.43 \pm 10.85	48-75
Monocytes	11.87 \pm 4.61	2-7
Eosinophils	7.5 \pm 4.58	2-15
Basophils	0.56 \pm 1.50	0-2
Total leucocytes (x 10 ³ /μl)	1.54 \pm 0.81	4-12

* Coles E.H., 1984, Editora Manole

Table III

Serum blood chemistry of *Trypanosoma vivax* infected dairy cattle from the Pantanal (mean \pm SD)

	Infected cattle	Normal values
Total proteins (g/dl)	7.84 \pm 1.24	7.56 \pm 0.5* 7 (6-8)**
Blood urea nitrogen (mg/dl)	23.40 \pm 8.73	6-27* 25 (10-40)***
Total lipids (mg/dl)	136 \pm 86.12	34.8** 30 (15-45)***

* Coles E.H., 1984, Editora Manole; ** Kolb E., 1976, Editorial Acribia

*** Rosenberg G., 1983, Guanabara-Koogan

immunosuppression. Ilemobade *et al.* studied groups of cattle vaccinated against contagious bovine pleuropneumonia (CBPP) and experimentally infected singly with *T. vivax* or *T. congolense* or a combination of *T. vivax* and *T. congolense* (11). The results of this experiment suggest that the protective immunity to CBPP engendered by vaccination is impaired during an infection with African trypanosomes. High total lipid serum levels found in this investigation could represent endocrine dysfunction. Diehl and Risby reported increases in the lipid concentration of the serum from *T. gambiense* infected rabbits suggesting altered lipid metabolism (8). According to Seed and Hall, in addition to the changes observed in the glycogen, lipid, and protein metabolism in African trypanosome infections, there are strong indications of endocrine dysfunction (23). Abebe and Eley (1) found a significant reduction of total plasma thyroxine during the acute stage of a trypanosome infection in cattle, indicating the presence of hypothyroidism possibly caused by dysfunction of the hypothalamic-pituitary-thyroid axis. Because severe leukopenia could cause immunosuppression the importance of trypanosomosis control in ensuring success of vaccination campaigns against the foot and the mouth disease in the Pantanal could be considered. Although evidence of pathophysiological changes in the hematology and lipid metabolism of infected bovines is presented here, further studies should be carried out to increase our knowledge of the disease in South America.

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Résumé

Silva R.A.M.S., Ramirez L., Souza S.S., Ortiz A.G., Pereira S.R., Dávila A.M.R. Foyer d'infection à *Trypanosoma vivax* chez un troupeau de bovins laitiers dans le Pantanal, au Brésil

Dans cette étude est rapporté pour la première fois un foyer de trypanosomose dû à *Trypanosoma vivax* chez des bovins laitiers au Pantanal de Nabileque, Brésil. Les animaux ont présenté des muqueuses pâles, de l'ophtalmie, un affaiblissement progressif, une nette dégradation de l'état général, ainsi que de l'inappétence et une tendance à l'avortement au cours des trois derniers mois de gravidité. Les résultats les plus importants des analyses hématologiques et biochimiques du sang ont été : une leucopénie, une anémie hypochrome macrocytaire et un niveau élevé des lipides totaux dans le sérum.

Mots-clés : Bovin laitier - *Trypanosoma vivax* - Sang - Biochimie - Pantanal - Brésil.

Resumen

Silva R.A.M.S., Ramirez L., Souza S.S., Ortiz A.G., Pereira S.R., Dávila A.M.R. Una epidemia de infecciones por *Trypanosoma vivax* en un hato lechero en Pantanal, Brasil

En el presente estudio se reporta, por primera vez, una epidemia de tripanosomosis provocada por *Trypanosoma vivax*, en un hato lechero de Pantanal de Nabileque, Brasil. Los animales presentaron mucosas pálidas, oftalmítis, debilidad progresiva, pérdida de condición, falta de apetito y abortos durante el tercer trimestre de preñez. Entre los hallazgos hematológicos y de química sanguínea más importantes se encuentran leucopenia, anemia hipocrómica macrocítica y altos niveles séricos de lípidos totales.

Palabras clave: Ganado de leche - *Trypanosoma vivax* - Sangre - Bioquímica - Pantanal - Brasil.