Hematological and blood chemistry alterations in coatis (Nasua nasua) naturally infected by Trypanosoma evansi in the Pantanal, Brazil

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Key words
Nasua nasua - Trypanosoma evansi - Blood - Biochemistry - Pantanal - Brazil.

Summary
During a study on the wildlife reservoir of Trypanosoma evansi, 40 coatis (Nasua nasua) were caught in the Pantanal of Nhecolândia subregion, Brazil. The values observed in infected coatis (16/40) were 4.21 x 10⁶/mm³ for red blood cell count, 12.68 x 10³/mm³ for white blood cell count, 28.19% for hematocrit, 9.51 mg/dl for hemoglobin, 73.60 mg/dl for glucose and 1.18 g/dl for albumin. The infected coatis presented anemia, hypoglycemia and low albumin values. These data are indications of the importance of coatis as a wild reservoir and of T. evansi as a disease-causing parasite in coatis. The nature of the blood and chemistry alterations needs to be elucidated. This is the first report of a disease caused by T. evansi in coatis.

INTRODUCTION

The Pantanal is a seasonal floodplain of about 140,000 km², located in the center of South America, between 16° and 21° S and 55° and 58° W (figure 1). The Pantanal is divided into 11 subregions differing in terms of watercourses, soil types and historical occupation (17, 19). The Pantanal has the greatest fauna density of the Americas. There are 235 fish species, 650 bird species, 50 reptile species and 80 mammal species. Man has introduced some animals in the Pantanal, including cattle, mules, donkeys, horses, pigs and dogs (10). Extensive cattle ranches varying from 10,000 to 200,000 ha occupy most of this wetland. It is populated by 3,996,000 cattle, 4966 buffaloes, and 49,000 horses (2, 14). The Pantanal is considered one of the most important livestock regions of Brazil.

Coatis are found mainly in wooded areas. They forage in trees, as well as on the ground, using the tail as balancing and as a semi-prehensile organ. While moving along the ground, these animals usually carry the tail erect except for the curled tip. Adult males are often active at night, but coatis are primarily diurnal. They move about 1500 to 2000 m a day in search of food, and usually sleep at night (7). Coatis are highly opportunistic omnivores (5). Trypanosoma evansi has the widest distribution of all trypanosome species and the greatest range of mammalian hosts. This parasite has a broad geographical distribution in a wide variety of mammals (10). A trypanosome survey carried out on domestic and wild animals in the Pantanal by Nunes and Oshiro (8) identified T. evansi in dogs, coatis (Nasua nasua) and capybaras (Hydrochaeris hydrochaeris). The role of wild mammals as reservoirs in the Pantanal is still unknown. The goal of this study was to evaluate the hematological and some blood chemistry parameters of infected animals.

MATERIALS AND METHODS

Animals

This study was conducted from September to December 1994. Forty coatis (Nasua nasua) were caught in the Pantanal of Nhecolândia subregion, Brazil. The coatis were physically restrained and injected intramuscularly with 0.01 ml/kg of acepromazine (Acepran 1%, Univet SA, São Paulo, Brazil).

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Blood sample collection

The coatis were bled by cardiac puncture for determination of hematological data using a vacuum system (Vacuum II, Labnew, Campinas, Brazil) in tubes containing ethylenediaminetetraacetic acid as anticoagulant. The packed red cell volume (PCV) was measured using the standard microhematocrit method, and the red blood cell count (RBC) and total white blood cell count (WBC) were obtained using the Neubauer chamber. Differential leukocyte count was made using thin film blood smears and stained with Wright-Giemsa stain. The hemoglobin (Hb) concentration was determined colorimetrically (Micronal digital spectrophotometer, São Paulo, SP, Brazil) after its conversion to cyanomethemoglobin.

Blood chemistry

The serum concentrations of glucose and albumin were determined by spectrophotometric methods (Labtest sistemas para diagnósticos, São Paulo, SP, Brazil).

Trypanosome diagnosis

The diagnosis of trypanosomosis was done using the hematocrit centrifuge technique, inoculation in rats and mice, and Giemsa-stained smears. Blood from each sample and the concentrated parasites in the buffy coat of microhematocrit tubes were also used to prepare thin smears. The isolates were identified based on morphological and biometrical data (table I).

RESULTS

Infected coatis (16/40) presented anemia, hypoglycemia and low albumin values. One of the infected animals presented a parasitemia as high as 106.35 x 106 parasites/ml. The same animal had anemia characterized by low erythrocyte count (2.75 x 106/ml) and decreased hematocrit (22%). The hematological and blood chemistry values of the infected coatis are presented in table II.

Table I

Measurements of *T. evansi* isolates of coatis (*Nasua nasua*) from the Pantanal, Brazil; means ± SD (µm) (n=100)

<table>
<thead>
<tr>
<th>PK</th>
<th>KN</th>
<th>PN</th>
<th>NA</th>
<th>F</th>
<th>T</th>
<th>PN/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>9.19 ± 2.21</td>
<td>7.48 ± 1.82</td>
<td>8.01 ± 2.30</td>
<td>24.69 ± 3.64</td>
<td>1.29 ± 0.45</td>
</tr>
</tbody>
</table>

PK: distance from posterior end to kinetoplast; KN: from kinetoplast to middle of nucleus; PN: from posterior end to middle of nucleus; NA: from nucleus to anterior end; F: free flagellum length; T: total length including free flagellum

Table II

Hematological and blood chemistry values of coatis (*Nasua nasua*) naturally infected by *Trypanosoma evansi* in the Pantanal, Brazil, and non-infected coatis

<table>
<thead>
<tr>
<th></th>
<th>RBC count x 10⁶/mm³</th>
<th>WBC count x 10³/mm³</th>
<th>Ht (%)</th>
<th>Hb (mg/dl)</th>
<th>Glucose (mg/dl)</th>
<th>Albumin (g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infected coatis</td>
<td>4.21 ± 1.13 a</td>
<td>12.68 ± 4.68 a</td>
<td>28.19 ± 5.27 a</td>
<td>9.51 ± 1.290 a</td>
<td>73.60 ± 44.53 a</td>
<td>1.18 ± 0.80 a</td>
</tr>
<tr>
<td>Captive coatis*</td>
<td>7.50 ± 2.00 b</td>
<td>13.40 ± 4.50 a</td>
<td>40.90 ± 6.2 b</td>
<td>12.20 ± 3.30 a</td>
<td>176.20 ± 38.4 b</td>
<td>4.50 ± 1.20 bc</td>
</tr>
</tbody>
</table>

RBC: red blood cell; WBC: white blood cell; Ht: hematocrit; Hb: hemoglobin; * according to Pimentel, ABRAVAS, 1994

a, b, c: Values on the same row with different letters are significantly different (P < 0.0005)
Equine trypanosomosis caused by *Trypanosoma evansi* is known in the Pantanal and subtropical areas of Argentina as “Mal de Caderas” (6). Spanish settlers probably introduced it in South America during the sixteenth century (3, 12). Apparently, the disease entered in the Pantanal region in the 1850s (19). Since 1894, Mal de Caderas has been reported in horses in the Nhecolândia subregion of Pantanal (1). The most serious epidemics followed extensive flooding and this disease became a significant barrier to the expansion of cattle industry in the Pantanal (19). Outbreaks in horses are related to the vector season. Studies showed that the vector season occurs in the first half of the rainy season, from September/October to December/January. This study was conducted during the high vector season. Outbreaks of horse trypanosomosis have been reported that year (1994) as well (15, 16, 17). This season represents the period of major risk of trypanosome transmission to horses by vector insects due to their abundance and the population peak of species with high vector potential, notably *Tabanus importunus* (16). After this season no cases are observed in horses. Nothing is known about *T. evansi* transmission from horses to wild mammals and between wild animals.

This study demonstrated that coatis presented anemia as reported in other mammal species infected by salivarian trypanosomes (17, 18). The lower values of albumin and glucose in *T. evansi* infected coatis have also been reported in other animal species infected by trypanosomes (4, 11, 13).

**CONCLUSION**

These data are indications of the importance of coatis as a wild reservoir and of *T. evansi* as a disease-causing parasite in coatis. The nature of the blood and chemistry alteration needs to be elucidated and mechanisms proposed. This is the first report of *T. evansi* causing diseases in coatis. More studies will be necessary to clarify whether there is a relationship between outbreaks of equine trypanosomosis and the infection of coatis.

**REFERENCES**


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Lors d’une étude sur le reservoir animal sauvage de Trypanosoma evansi, 40 coatis (Nasua nasua) ont été capturés dans le Pantanal, district de Nhecolândia, Brésil. Les valeurs observées chez les coatis infectés (16/40) étaient de 4,21 x 10^6/mm³ pour les globules rouges, de 12,68 x 10^3/mm³ pour les globules blancs, de 28,19% pour l’hémacrit, de 9,51 mg/dl pour l’hémoglobine, de 73,60 mg/dl pour le glucose et de 1,18 g/dl pour l’albumine. Les coatis infectés ont présenté de l’anémie, de l’hypoglycémie et de faibles valeurs d’albumine. Ces données signalent l’importance du coati en tant qu’animal réservoir de T. evansi, ainsi que du pouvoir pathogène de ce parasite chez le coati. La nature des modifications sanguines et chimiques doit être éclaircie. Cette communication met en évidence, pour la première fois, T. evansi comme cause de maladie chez le coati.


Durante un estudio del reservorio silvestre de Trypanosoma evansi, se capturaron 40 coatis (Nasua nasua) en Pantanal, subregión de Nhecolândia, Brasil. Los valores observados en los coatis infectados (16/40) fueron de 4,21 x 10^6/mm³ para el conteo de glóbulos rojos, 12,68 x 10^3/mm³ para el conteo de glóbulos blancos, 28,19% para el hematocrito, 9,51 mg/dl para la hemoglobina, 73,60 mg/dl para la glucosa y 1,18 g/dl para la albúmina. Los coatis infectados presentaron anemia, hipoglucemia y bajos niveles de albúmina. Estos datos indican la importancia de los coatis como reservorios silvestres, así como la importancia de este parásito como causa de enfermedad en los coatis. Debe elucidarse la naturaleza de las alteraciones químicas y sanguíneas. Este es el primer reporte de enfermedad en coatis causada por T. evansi.

Palabras clave: Nasua nasua - Trypanosoma evansi - Sangre - Bioquímica - Pantanal - Brasil.