

Frequency of species of the Genus *Eimeria* in naturally infected cattle in Southern Bahia, Northeast Brazil

Frequência de espécies do gênero *Eimeria* em bovinos naturalmente infectados no Sudeste da Bahia, Nordeste do Brasil

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Abstract

The aim of this study was to determine the presence of species of the genus *Eimeria* species in naturally infected bovines in Southern Bahia, Northeast Brazil. The study population comprised 117 Zebu crossbred cattle that belonged to 10 dairy herds with extensive or semi-extensive production systems. The modified Gordon and Whitlock technique was used to determine positive samples and number of oocysts per gram of feces. Statistical analyses were performed using the chi-square test with Yates correction and a 95% confidence interval. Thirty-nine cattle (33.33%) were positive, and ten different species were identified in infected animals: *E. bovis* (24.79%); *E. canadensis* (8.55%); *E. zuernii* (6.83%); *E. ellipsoidalis* (5.99%); *E. cylindrica* (3.42%); *E. auburnensis* (3.42%); *E. brasiliensis* (2.56%); *E. bukidnonensis* (1.71%); *E. alabamensis* (0.85%), and *E. subspherica* (0.85%). Higher parasitism was observed in animals up to one year of age ($p = 0.005$), but no animal presented clinical signs of the disease. As the presence of clinical eimeriosis was not evidenced and all animals were Zebu crossbred cattle from extensive or semi-extensive production systems, further studies should be conducted to investigate the effects of these factors on disease development.

Keywords: Coccidian, dairy cattle, age group, frequency.

Resumo

O objetivo deste estudo foi determinar a presença de espécies do gênero *Eimeria* em bovinos naturalmente infectados, na região Sudeste da Bahia, Nordeste do Brasil. A população do estudo incluiu 117 bovinos mestiços de raças Zebuínas que pertenciam a 10 fazendas leiteiras com sistemas de produção extensivo ou semiextensivo. A técnica de Gordon e Whitlock modificada foi utilizada para determinar as amostras positivas e o número de oocistos por grama de fezes. A análise estatística foi realizada utilizando o teste do qui-quadrado com correção de Yates e intervalo de confiança de 95%. Trinta e nove animais (33,33%) foram positivos, e dez diferentes espécies foram identificadas nos animais infectados: *E. bovis* (24,79%), *E. canadensis* (8,55%), *E. zuernii* (6,83%), *E. ellipsoidalis* (5,99%), *E. cylindrica* (3,42%), *E. auburnensis* (3,42%), *E. brasiliensis* (2,56%), *E. bukidnonensis* (1,71%), *E. alabamensis* (0,85%) e *E. subspherica* (0,85%). Maior parasitismo foi observado em animais com até um ano de idade ($p = 0,005$), mas nenhum animal apresentou sinais clínicos que fossem compatíveis com a parasitose. Como não foi observado presença de eimeriose clínica e como todos os animais eram mestiços zebuínos e pertencentes ao sistema de criação extensivo ou semiextensivo, novos estudos devem ser conduzidos para comprovar a influência desses fatores no surgimento da doença.

Palavras-chave: Coccídio, gado leiteiro, faixa etária, frequência.

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Introduction

Bovine eimeriosis is an intestinal illness caused by protozoan parasites from the genus *Eimeria*. Adult animals are usually asymptomatic carriers that often serve as a source of infection for juvenile animals, which are more susceptible to parasitosis (COURTNEY; ERNST; BENZ, 1976; CHIBUNDA et al., 1997; MATJILA; PENZHORN, 2002; DAUGSCHIES; NAJDROWSKI, 2005).

During its biological cycle, the coccidian destroys the host's enterocytes causing loss of blood, water, albumin and electrolytes from the intestinal lumen. The disease's clinical manifestations, such as diarrhea, anorexia and prostration can cause significant production losses (FITZGERALD, 1980; DAUGSCHIES et al., 2004).

Several *Eimeria* spp. have been shown to be pathogenic in cattle, causing several clinical symptoms (SAMSON-HIMMELSTJERNA et al., 2006; SÁNCHEZ; ROMERO; FOUNROGE, 2008). *Eimeria alabamensis* has been reported to induce clinical coccidiosis (SVENSSON; UGGLA; PEHRSON, 1994; MARSHALL et al., 1998; SAMSON-HIMMELSTJERNA et al., 2006) and *E. auburnensis* and *E. ellipsoidalis* have been occasionally associated with diarrhea in bovines (MIELKE; RUDNICK; HIEPE, 1993). However, the two most pathogenic species are *E. bovis* and *E. zuernii* (STOCKDALE et al., 1981; CHIBUNDA et al., 1997).

Although the prevalence of *Eimeria* species generally reaches 100% in calves of a herd (CORNELISSEN et al., 1995; SAMSON-HIMMELSTJERNA et al., 2006), it varies according to location, climatic conditions, the host's age (DAUGSCHIES; NAJDROWSKI, 2005), nutritional status and immunity, amount of ingested oocysts and population density (WARUIRU et al., 2000).

Despite the fact that climate and environmental characteristics in the state of Bahia, northeastern Brazil, are extremely favorable to oocyst sporulation and the development of *Eimeria*, there are few known reports on the presence of this protozoan in bovines in this area. The present study aimed to determine the presence of *Eimeria* spp. in naturally infected bovines.

Material and Methods

1. Study area and selection of participants

The study was carried out in the municipalities of Ilhéus (14° 47' S and 39° 02' W) and Uruçuca (14° 36' S and 39° 17' W), located in the Southern part of the State of Bahia, Northeastern Brazil, between March and July 2007. The cattle population from these cities comprise 18,293 animals out of 11,099,880 in Bahia (IBGE, 2008). Cattle were selected from 10 different dairy herds with extensive or semi-extensive production systems, with at least 10% of each herd taking part in the study. Dairy herds were selected from a list of the Agricultural Protection Agency of the State of Bahia (ADAB) and animals milking at the time of the visit were sampled by convenience, minimum age of five days and no selection criteria were applied. The study population included a total of 117 Zebu crossbred animals that were divided into two age groups: up to one year old; more than one year old. The study farms and animals were both selected using a non-random method.

2. Sample collection and coproparasitologic test

Fecal samples were directly removed from the rectal ampoule of each animal. The samples were collected in plastic bags, labeled and stored in a cool environment until processing.

The modified Gordon and Whitlock technique, as described by Ueno and Gonçalves (1998), was used to determine positive samples and number of oocysts per gram of feces (OoPG), with the use of the McMaster camera.

3. Oocyst sporulation and species identification

For sporulation, positive samples were placed in Petri dishes, conditioned with a solution of 2.5% potassium dichromate at room temperature and aired daily for up to two weeks.

The centrifugal flotation technique was used (MENEZES; LOPES, 1995) to concentrate sporulated oocysts from each sample. Their counts were determined with the aid of a reticulum and an Olympus™ (USA) micrometric ruler. Species identification was performed based on their morphological characteristics according to Daugschies and Najdrowski (2005). There were morphologically characterized at least 10 oocysts of each species for identification.

4. Statistical analysis

Statistical analyses were performed using the chi-square test with Yates correction (SAMPALIO, 1998). The odds ratio of the bivariate analysis was calculated with association measures and a 95% confidence interval.

Results

A total of 39 (33.33%) animals were positive for *Eimeria* spp., with at least one representative animal from each farm (Table 1). Ten different species were identified in isolated or mixed infections, and their occurrence is presented in Table 2. *Eimeria bovis* was the most prevalent species found in 90% of the farms studied. In addition, this species infected 24.79% of all animals and was present in 84.6% of the positively infected cattle (Table 1 and 2).

Only two (5.1%) of the positive animals (one young and one adult) had OoPG over 800. Higher parasitism was seen in young (51.22%) compared to adult animals (23.68%) ($p = 0.005$; Table 3).

On examination none of the animals had clinical signs of eimeriosis. Even cattle infected by *E. bovis* and *E. zuernii*, which are the most pathogenic species in bovines (STOCKDALE et al., 1981) were asymptomatic.

Discussion

This study is the first documentation of bovine eimeriosis in the municipalities of Ilhéus and Uruçuca in the State of Bahia, which has the largest contingent of bovines in Northeast Brazil. The prevalence of *Eimeria* spp. was similar to that reported in studies by Kasim and Al-Shawa (1985), Chibunda et al. (1997) and Gül, Çiçek and Kiliç (2008) but different from that (>40%) found by Munyua and Ngotho (1990), Rebouças, Grasso and Spósito Filha (1994) and Sánchez, Romero and Founroge (2008).

Table 1. Number of positive animals, identification of *Eimeria* species and number of oocysts per gram of feces in herds naturally infected by *Eimeria* spp. Southern Bahia, Northeastern Brazil.

Farm	Total number of positive animals (%)	<i>Eimeria</i> spp.	OoPG (Min-Max)
1	10/4 (40%)	<i>E. bovis</i> ; <i>E. canadensis</i> ; <i>E. ellipsoidalis</i> ; <i>E. alabamensis</i> ; <i>E. cylindrica</i> ; <i>E. subspherica</i>	100-700
2	10/4 (40%)	<i>E. bovis</i> ; <i>E. zuernii</i> ; <i>E. ellipsoidalis</i> ; <i>E. cylindrica</i>	100-10,900
3	12/9 (75%)	<i>E. bovis</i> ; <i>E. zuernii</i> ; <i>E. brasiliensis</i> ; <i>E. auburnensis</i> ; <i>E. canadensis</i>	50-400
4	14/6 (43%)	<i>E. bovis</i> ; <i>E. auburnensis</i> ; <i>E. zuernii</i> ; <i>E. ellipsoidalis</i> ; <i>E. canadensis</i>	50-800
5	10/3 (30%)	<i>E. bovis</i> ; <i>E. bukidnonensis</i> ; <i>E. ellipsoidalis</i> ; <i>E. cylindrica</i> ; <i>E. zuernii</i>	300-4350
6	10/2 (20%)	<i>E. bovis</i> ; <i>E. ellipsoidalis</i> ; <i>E. brasiliensis</i>	100-200
7	19/6 (32%)	<i>E. bovis</i> ; <i>E. zuernii</i> ; <i>E. bukidnonensis</i> ; <i>E. canadensis</i> ; <i>E. auburnensis</i>	50-200
8	09/1 (11%)	<i>E. canadensis</i>	400
9	10/1 (10%)	<i>E. bovis</i> ; <i>E. canadensis</i>	50
10	13/3 (23%)	<i>E. bovis</i> ; <i>E. zuernii</i> ; <i>E. canadensis</i>	100-800

Table 2. Percentage of positive farms and infected animals and number of oocysts per gram of feces by each *Eimeria* spp. in naturally infected cattle. Southern Bahia, Northeastern Brazil.

Species	Infection rate (%)		OoPG (Min-Max)
	Farms	Animals	
<i>E. bovis</i>	90	24.79	33-5450
<i>E. canadensis</i>	60	8.55	17-700
<i>E. zuernii</i>	50	6.83	5-3374
<i>E. ellipsoidalis</i>	50	5.99	14-1557
<i>E. cylindrica</i>	30	3.42	29-519
<i>E. auburnensis</i>	30	3.42	11-150
<i>E. brasiliensis</i>	20	2.56	50-100
<i>E. bukidnonensis</i>	20	1.71	75-150
<i>E. subspherica</i>	10	0.85	29-29
<i>E. alabamensis</i>	10	0.85	29-29

Table 3. Presence of *Eimeria* spp. in two different age groups of naturally infected cattle. Southern Bahia, Northeastern Brazil.

Age group	<i>Eimeria</i> spp.		Total (%)
	Positive (%)	Negative (%)	
< 1 year-old	21 (51.22)	20 (48.78)	41 (35.04)
> 1 year-old	18 (23.68)	58 (76.32)	76 (64.96)
Total (%)	39 (33.33)	78 (66.67)	117 (100)

$p = 0.005$ $\chi^2 7.89$ OR: 3.38 1.4 < OR < 8.26

Among the species identified in this study, *E. bovis*, *E. zuernii*, *E. canadensis* and *E. ellipsoidalis* were also the most prevalent in other Brazilian studies (FIGUEIREDO; FREIRE; GRISI, 1984, 1985; CARNEIRO et al., 1988; REBOUÇAS et al., 1988; CERQUEIRA; LIMA; FACURY FILHO, 1989; REBOUÇAS et al., 1994). Except for *E. canadensis*, these species are commonly identified in other countries (KASIM; AL-SHAWA, 1985; MUNYUA; NGOTHO, 1990; CHIBUNDA et al., 1997; MATJILA; PENZHORN, 2002; SÁNCHEZ; ROMERO; FOUNROGE, 2008), evidencing their wide geographical distribution. In fact, *E. bovis* is often the most prevalent species found in infected animals in various parts of the world (FIGUEIREDO; FREIRE; GRISI, 1984, 1985; KASIM; AL-SHAWA, 1985; CERQUEIRA; LIMA; FACURY FILHO, 1989; MUNYUA; NGOTHO, 1990; REBOUÇAS; GRASSO;

SPÓSITO FILHA, 1994; CHIBUNDA et al., 1997; MATJILA; PENZHORN, 2002; SAMSON-HIMMELSTJERNA et al., 2006; SÁNCHEZ; ROMERO; FOUNROGE, 2008), which corroborates our study findings.

High parasitism in calves is corroborated by the observations of Rebouças, Grasso and Spósito Filha (1994). They found that 55.8% of animals up to 18 months of age and only 30.8% of those over 31 months of age were positive. These data support the hypothesis that young animals have more susceptible to infection by this parasite (COURTNEY; ERNST; BENZ, 1976). Some studies have reported the presence of *Eimeria* oocysts in 70% (MATJILA; PENZHORN, 2002) and 100% of samples from young animals (SAMSON-HIMMELSTJERNA et al., 2006). A potential explanation for these findings is that coccidiosis develops as a result of immunosuppression that naturally occurs during an animal's weaning (PARKER et al., 1984), which is followed by a gradual decline in the number of eliminated oocysts as they age (FIGUEIREDO; FREIRE; GRISI, 1985).

Previous cross-sectional studies of *Eimeria* spp. in Brazil have not identified any cases of clinical eimeriosis in infected bovines, which is probably due to the low amount of oocysts that are eliminated by cattle (FIGUEIREDO; FREIRE; GRISI, 1985; REBOUÇAS; GRASSO; SPÓSITO FILHA, 1994). Although clinical symptoms are common mainly in calves, especially those between 20 and 35 days old (SÁNCHEZ; ROMERO; FOUNROGE, 2008), with excretion of large numbers of oocysts (CHIBUNDA et al., 1997; SAMSON-HIMMELSTJERNA et al., 2006), only one calf (10,900 OoPG) and one adult cow (4,350 OoPG) without clinical symptoms eliminated moderate amounts of oocysts in the present study. These results contrast with those found in intensive production systems in animals of European origin (SAMSON-HIMMELSTJERNA et al., 2006; SÁNCHEZ; ROMERO; FOUNROGE, 2008).

This study evidenced the presence of *Eimeria* infection in herds in Bahia, with a higher frequency in young animals. As the presence of clinical eimeriosis was not evidenced and all animals were Zebu crossbred cattle from extensive or semi-extensive production systems, further studies should be conducted to investigate the effects of these factors on disease development as infected cattle eliminate a small number of oocysts in their feces and, consequently, are asymptomatic.

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