Short communication

Eimeria species in dairy goats in Brazil

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A B S T R A C T

The focus of this work is to determine the distribution and identify species of Eimeria parasites of dairy goats in the livestock of the National Goat and Sheep Research Center in Sobral, State of Ceará, Northeast Brazil. Results showed the presence of multiple species in 196 of 215 analyzed samples (91.2%). Fifty five out of these were from kids (28%) and 141 from adult goats (72%). Eight different Eimeria species were identified and their prevalence in the herd was: Eimeria alijevi Musaev, 1970 (26.7%), E. arloingi (Marotel, 1905) Martin, 1909 (20.6%), E. hirci Chevalier, 1966 (18%), E. ninakohlyakimovae Yakimoff & Rastegaieff, 1930 (16.2%), E. jochijevi Musaev, 1970 (8.7%), E. christensenii Levine, Ivens & Fritz, 1962 (6%), E. caprovina Lima, 1980 (2.8%) and E. caprina Lima, 1979 (1%). Moreover, E. ninakohlyakimovae showed higher prevalence in kids (97%), followed by E. arloingi and E. alijevi (88%). On the other hand, E. alijevi (77%) was more common in adult goats followed by E. hirci (74%) and E. ninakohlyakimovae (70%). The species E. caprina had low frequency in both kids (27%) and adult goats (13%). Data indicated that infection was relatively common among kids and adult goats. The implementation of a routine diagnostic strategy can be useful in maintaining Eimeria populations under monitoring and will enable the determination of its potential impact on dairy goat herds in Northeast Brazil.

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1. Introduction

The domestic goat (Capra hircus L., 1758) is phylogenetically more adapted to unfavorable conditions having ability to efficiently convert low-quality vegetable matter into energy-dense fat, muscle, and milk (Oltjen and Beckett, 1996). Additionally, the world population and its demand for food are growing rapidly so rearing small ruminants has become more interesting in recent years. Goat livestock in Brazil is the largest in South America and production numbers have been increasing as a result of changes in the food supply chain and market diversification. Management, nutritional and sanitary problems still plague the livestock business despite good production indicators. Coccidiosis is a widespread disease caused by protozoan parasites belonging to the Eimeria genus and which affect a variety of animal including small ruminants. Oocysts are the infective form eliminated in the feces and transmission happens directly by ingestion so infection is higher in specific conditions regarding environment, management and animal immunity. For example, goats of young age and under feedlot conditions (wet and unclean floor) are at higher risk of acquiring these parasites. Although goats can be parasitized by different Eimeria species, most of them do not cause clinical disease and economic losses so diagnosis must be accompanied by species identification.

The goals of this study were the characterization of the infection and identification of Eimeria species involved using traditional methods of diagnosis in dairy goat herds.

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2. Materials and methods

2.1. Animals

Studies were carried out at the National Goats and Sheep Research Center at Sobral in the State of Ceará, Northeast Brazil. The livestock has four distinct small ruminant herds distributed in 1.820 ha area 83 m high, placed at latitude 3° 42′S and longitudes 40° 21′W. The climate is tropical semi-arid and the rainy season lasts from January to May with 826 mm annual mean rainfall, 28 °C mean temperature and 69% relative humidity. Only dairy goats (n = 1075) were selected for study including pure Saanen, Alpine, Anglo Nubian and crossbred.

2.2. Samples

Fecal samples were collected directly from the rectum of 215 goats (20%) chosen for their suitability. All samples were placed into plastic bags and were classified in two categories: kids from 30 days to 8 months (n = 55) and adult pregnant or nursing goats (n = 160).

2.3. Sample processing and oocyst isolation

Fecal examination was performed using flotation in sucrose saturated solution. Positive samples were filtered through sieves covered with folded gauze and centrifuged at 250 × g for 10 min. Filtered material was placed into Petri dishes with 2.5% potassium dichromate solution (K₂Cr₂O₇) for sporulation at laboratory temperature. After seven days oocysts were recovered by centrifugation in sucrose saturated solution at 250 × g for 5 min followed by washing with distilled water. Concentration of sporulated oocysts was performed by centrifugation at 250 × g for 10 min, stored in potassium dichromate solution at 4 °C for subsequent study.

2.4. Morphology

For identification purposes, one hundred oocysts from each species found were measured using a binocular microscope (Carl Zeiss, Germany) and ocular micrometer (K-15X PZO, Poland). Parameters used for identification were measurements of oocyst and sporocyst walls (length, width and shape index) and observation of featured inner structures (Duszynski and Wilber, 1997).

3. Results

From 215 fecal samples examined 196 (91.2%) were positive for Eimeria oocysts. Fifty five were from kids (100% of kid’s samples) and 141 from adult goats (88.1%). Eight different Eimeria species were identified and their prevalence in the herd was: Eimeria alijevi Musaev, 1970 (26.7%), E. arloingi (Marotol, 1905) Martin, 1909 (20.6%), E. hirci Chevalier, 1966 (18%), E. ninakohlyakimovae Yakimoff & Rastegaieff, 1930 (16.2%), E. jolchiyei Musaev, 1970 (8.7%), E. christenseni Levine, Ivens & Fritz, 1962 (6%), E. caprovinia Lima, 1980 (2.8%) and E. caprina Lima, 1979 (1%). Moreover, E. ninakohlyakimovae showed higher prevalence in kids (97%), followed by E. arloingi and E. alijevi (88%). On the other hand, E. alijevi (77%) was more common in adult goats followed by E. hirci (74%) and E. ninakohlyakimovae (70%). The species E. caprina had low frequency in both kids (27%) and adult goats (13%).

4. Discussion

Reports of Eimeria infections date from the beginning of the last century and means for an appropriate species characterization method have been discussed ever since. Several parameters can be used and new methods have been developed (Morris and Gasser, 2006). However, traditional morphological classification is still useful. Duszynski and Wilber (1997) emphasized and encouraged precision in the identification of species and established basic characteristics for an appropriate description of the oocysts while Bondani and Duszynski (1988) already recommended accuracy and caution in these situations. When these recommendations are not accounted for identification problems arise because of similarities between oocysts structures, as seen with Eimeria of goats and sheep (Vieira, 2002). Furthermore, studies focusing on host specificity are also recommended to properly confirm the identification of the isolated pathogen (Lotze et al., 1961; McDougald, 1979). The present study used only goats with no contact with other ruminant cattle. The identification was performed by comparison with original descriptions of the parasites and even some variation in the oocysts size (length and width) could be found. This variation was considered a common issue by previous studies (Balicka-Ramisz, 1999; Hassum and Menezes, 2005). In addition, morphometric variations can be related to many factors such as host and parasite metabolism (Long and Joyner, 1984).

Here we demonstrate that Eimeria species are widespread in the studied herd. Many previous studies reported most of the species described here (Barbosa et al., 2003; Freitas et al., 2005; Hassum and Menezes, 2005; Kimbita et al., 2009). From thirteen Eimeria species known to occur in goats eleven were previously detected in Brazil but only eight were identified in samples from Sobral (Rebouças et al., 1992; Cardoso and Oliveira, 1993; Hassum and Menezes, 2005).

Infection frequency was lower in adults probably due to a more developed immunity when compared to kids. These results are in agreement with Balicka-Ramisz (1999) and Hassum and Menezes (2005). On the other hand, Kimbita et al. (2009) reported the majority of infected goats (35/52 or 67.3%) as adults, while 21.2% were growers (11/52) and only 11.5% (6/52) were weaners. Nevertheless, in both cases adult goats could be regarded as a source of infection for the kids.

In relation to the most pathogenic species, it is remarkable that some of them were quite frequent in the herd. In kids the most prevalent species was E. ninakohlyakimovae followed by E. arloingi and E. alijevi. Differently E. alijevi, E. arloingi and E. hirci were more common in adults. This is very worrisome since E. ninakohlyakimovae has been recognized to be more pathogenic to goats (Cavalcante et al., 2009; Dai et al., 2006) and E. arloingi was lethal to six
months old Angora kids in experimental infection using $10^3$ oocysts (Sayin et al., 1980). Experimental infections with *E. ninakohlyakimovae*, *E. arloingi* and *E. christenseni* produced bloody diarrhea and papilloma-like lesions within the intestine of young goats (Yvoré et al., 1980). According to most reports, healthy goats can resist *Eimeria* infections reasonably well without development of clinical signs but stressful situations can break the host–parasite balance leading to clinical coccidiosis or economic losses. Also, a positive correlation has been observed between parasites which is in tandem with the role of contamination in the acquisition as seen with coccidial and helminthes infections (Kanyari, 1993). These information indicates that constant monitoring of *Eimeria* incidence in dairy goats is necessary since it represents a potentially strong negative factor in the small ruminant livestock business if left unchecked.

**References**


