Acute coccidiosis in an organic dairy farm in tropical region, Brazil*

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ABSTRACT. Florião M.M., Lopes B. do B., Berto B.P. & Lopes C.W.G. **Acute coccidiosis in an organic dairy farm in tropical region, Brazil.** [Coccidiose aguda em uma fazenda de gado leiteiro orgânico na região tropical, Brasil.] *Revista Brasileira de Medicina Veterinária, 37(Supl.1):6-12, 2015*. Curso de Pós-Graduação em Ciência, Tecnologia e Inovação em Agropecuária, Universidade Federal Rural do Rio de Janeiro, BR 465, Km 7, *Campus* Seropédica, RJ 23897-970, Brasil. E-mail: monicafloriao@hotmail.com

Coccidiosis or bovine eimeriosis is an intestinal disease caused by species of the genus *Eimeria* Schneider, 1875. It is responsible for gastrointestinal disorders and in some cases, animals died, especially the young animals. The proposed organic management for the system was relevant in establishing the health of the studied herd. Only some of the animals had clinical signs of acute eimeriosis. In nursing calves clinical signs appeared at 30 days old, during the first period of the study (2013-2014), occurring shortly after abrupt change in management, when the amount of milk supplied to animals of this extract was reduced. The other two cases occurred during the second period of the study (2014-2015), after fire in the area of pastures, causing the batch of weaned calves come into pasture destined to cows, with such abrupt change in management developed clinical signs of acute eimeriosis. The most frequent species was *E. zuernii* in both extracts, followed by *E. cylindrica* in nursing calves, and *E. bovis* and *E. bukidnonensis* in the weaned calves. The recovery of the animals was performed with the return to the proposed organic management associated with use of homeopathic medication. In addition, the animals recovered their body weight gains established for Gir breed (zebu dairy cattle) and its cross breeds.

KEY WORDS. Organic dairy farm, clinical coccidiosis, tropical region, Holstein-Zebu crossbred, Rio de Janeiro.

RESUMO. A coccidiose ou eimeriose bovina, doença intestinal causada por espécies do gênero *Eimeria* Schneider, 1875 é responsável por alterações gastrintestinais e, em alguns casos, os animais vêm a óbito, principalmente os mais jovens. O manejo orgânico proposto para o sistema foi competente no estabelecimento da saúde do rebanho estudado. Somente alguns dos animais tiveram sinais clínicos de eimeriose aguda. Nas bezerras do aleitamento os sinais clínicos apareceram aos 30 dias de vida, durante o primeiro período de estudo (2014-2015), ocorrendo logo após mudança brusca no manejo, quando foi reduzida a quantidade de leite fornecida aos animais desse extrato. Os outros dois casos observados ocorreram durante o segundo período do estudo (2014-2015), após incêndio na área das

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pastagens, fazendo com que o lote de bezerras desmamadas entrasse em pastagem destinada as vacas, com tal alteração brusca no manejo desenvolveram sinais clínicos de eimeriose aguda. As espécies mais frequentes foram *E. zuernii* em ambos os extratos, seguida por *E. cylindrica* nos animais em aleitamento e, *E. bovis* e *E. bukidnonensis* no extrato desmame. A recuperação dos animais foi feita com o retorno ao manejo proposto anteriormente e com o uso de medicação homeopática. Além disso, a recuperação do ganho de peso vivo desses animais esteve dentro doa parâmetros estabelecido para a raça Gir e seus mestiços.

PALAVRAS-CHAVE. Criação de gado leiteiro orgânico, coccidiose clínica, região tropical, mestiços holando-zebu, Rio de Janeiro.

INTRODUCTION

Coccidiosis or bovine eimeriosis is an intestinal disease caused by species of the genus *Eimeria* Schneider, 1875. It is responsible for gastrointestinal disorders and in some cases, the animals have died. Adults are usually asymptomatic carriers, which often serve as a source of infection for young animals, more susceptible to the disease (Chibunda et al. 1997, Matjila & Penzhorn 2002, Daugschies & Najdrowski, 2005). Among the various species involved, especially *Eimeria zuernii* (Rivolta, 1878) and *Eimeria bovis* (Züblin, 1908) are responsible for severe clinical signals, characterized by bloody diarrhea, with evolution, sometimes fatal (Daugschies & Najdrowski 2005).

Clinical eimeriosis is aggregated to fecal contamination and stressful situations, especially in animals under one year old (Fayer 1980, Sánchez et al. 2008). Any stressor as high temperature, sudden temperature change, nutritional deficiency, reunification of the animals, early weaning and other intercurrent diseases can cause sudden onset of clinical coccidiosis (Rebhun 2000, Noronha Junior & Buzetti 2002) in cattle.

Adult animals are carriers and potential source of infection to the newborn calves, which can be exposed to the infection a few days after birth, while they are with their mothers (Rodriguez-Vivas et al. 1996).

Eimeria zuernii and *E. bovis*, cosmopolitan species, are considered with the most pathogenic for calves (Ernst & Benz 1986, Marshall et al. 1998) among species frequently observed in cattle (Figueiredo et al. 1984, Rebouças et al. 1988, Rebouças et al. 1994, Adams et al. 2011) and they are responsible for clinical eimeriosis with severe diarrhea, dehydration, loss of weight and appetite, weakness, apathy, and secondary bacterial infections, resulting in economic losses (Ernst & Benz 1986, Kwon & Jang 2000, Daugschies & Najdrowski 2005) which, according to Santos (2015), in dairy herds, from 2002, losses were approximately US $ 400 million/year worldwide. In practice, as longer time the animals get in contact with the protozoa, greater is the retardation in the animal development.

Endo and ectoparasite controls were classified as a major concern for organic farmers in the UK (Halliday et al. 1991, Roderick & Hovi 1999). In European farms of organic management, it is necessary attention with subclinical coccidiosis as auxiliary measure of control; repeated use of pasture for heifers should be avoided in consecutive periods (Nielsen et al. 2003). Mixed infections in cattle with more than one species of *Eimeria*, is the rule, where there is an occurrence of pathogenic species, associated with clinical signs justifies the assumption of eimeriosis (Daugschies & Najdrowski 2005). Still, it is worth noting that, with regard to the influence of the environment and the management of the production system can be responsible or not for the higher incidence of the disease in the herd. In the case of calves raised in homes, attached to chains, individual or collective hutch housing, everything can be accentuated if there is no proper cleaning to the authoring environment making irreversible the infection (Santos 2015). In Argentina, *E. zuernii* has a variable behavior during the whole study. Although coccidiosis have been excluded from a large number of animals in some of them could be observed at 20 days after birth; however, in certain cases, when associated with clinical signs, can not establish an infection behavior pattern. The appearance is so fragile that animals with 50 days of age have clinical coccidiosis due to *E. zuernii* infection (Sánchez et al. 2008).

In conventional farming systems, the control of bovine coccidiosis is done by treating animals with antiparasitic products and allopathic medicines (Kwon & Jang, 2000, Mundt et al. 2003, Mundt et al. 2005, Mundt & Daugschies 2010, Van Arsdall 2011). On the other hand, rural properties that are intended to organic production must meet the standards contained in the Brazilian legislation that regulates organic production in Brazil, restricted the use of allopathic and advocated the use of homeopathy and/or herbal medicine for controlling diseases of livestock (Brazil 2011). Alternative control strategies are needed to ensure a sustainable balance among the most common parasites and actions in organic livestock (Hovi et al. 2003). In livestock, the

organic emphasis is on the prevention of diseases, instead of treatment by using conventional anti-parasitic or allopathic drugs (Thamsborg et al. 1999).

This paper aims to emphasize the development of clinical coccidiosis in nursing and weaned calves in a dairy organic farm in a subtropical region in the State of Rio de Janeiro, Brazil.

MATERIAL AND METHODS

Locality

Over a period of 24 months, the study was developed from July 2013 to May 2015, in an area belonging to the Integrated Agroecological Production - SIPA (Fazendinha Agroecológica Km 47), technical cooperation project between Embrapa/Agrobiology, Embrapa/Solos , the Agricultural Research Company of the State of Rio de Janeiro (PESAGRO-Rio/Seropédica Experimental Station) and the Universidade Federal Rural Rio de Janeiro (UFRRJ) (de Almeida et al. 2003) at the Municipality of Seropédica in the State of Rio de Janeiro, Brazil.

Animals

The herd consisted of 40 crossbred dairy animals (Gyr x Holstein), divided into lots of young and adult animals. Young divided into two batches: nursing calves (birth to 7 months), which was the batch studied in this work, and weaned calves (7 months to 18 months or 330 kg), and a lot of adult animals comprising dry and lactation cows and a bull.

All animals used in the experiment were subject to the Ethical Research Commission protocol # 9291031115 under the Project "Dynamics studies of coccidiosis on an organic dairy farm in the micro region of Itaguai, State of Rio de Janeiro".

Animal handling

Calves and heifers in lactation (from birth to weaning with seven months). Suckle calves and heifers were kept in four paddocks (rotationally grazed) near the milking barn to facilitate its movement. They were brought daily to the presence of dairy cows (mothers) during milking to stimulate milk letdown. The feeding system of the calves was natural controlled, where suckled suckler calves directly into the theta around 4 kg of milk/day. After milking, calves were kept together with cows for a period of two hours after they were come back to their paddocks. Animals were provided with drinking water *ad libitum* , shade and trough for mineral supplement. All calves remained with their mothers during the first three days of life for suckling colostrum, after this period were transferred to the calf stables, which was collective, well-ventilated and constructed so as not to retain moisture and receive sunlight. On the first day of age, the bandage cord (10% iodine solution) for each animal was done. The animals were identified (name and number) with earring (individual), and received a leather collar for easy handling and to avoid injuries or accidents resulting from tugs and restraint by the ears. All calves were weaned at seven (7) months old. Males and females were discarded or transferred to the batch weaned calves. The feeding of suckle calves and heifers consisted essentially of milk once a day, supplemented with grazing Tifton 85 (*Cynodon dactylon* (L.) Pers.), African Star (*Cynodon plectostachyus* (K. Schum.) Pilg.) and Angola's grass (*Brachiaria mutica*) possibly received hay Gliricidia (*Gliricidea sepium* (Jacq.) Steud.) in the trough.

Calves weaned (7 months to 330 kg body weight). Animals are kept in paddocks reserved for this category of animal. Four paddocks are used in rotation, provided with shade, trough for mineral salt and water *ad libitum*, composed primarily of (*Brachiaria brizantha* (Hochst.) Stapf.) and Angola grass (*Brachiaria mutica* (Forssk.) Stapf.). The diet composition of the of weaned calves is basically the pasture.

Sanitary management

The established health management system (Florião 2013) was developed for the SIPA Fazendinha Agroecológica Km 47 project, which is based on the set: animal welfare, strategic control of parasites and homeopathic therapy, always stressing it is the prevention and aspect more important in relation to treatment.

Homeopathic medicines have been prepared by the School Pharmacy Dr. José Barros da Silva of Brazil Hahnemanniano Institute, Rio de Janeiro, RJ. Drugs in accordance with the rules of the Brazilian Pharmacopoeia in the form of net presentation, and packaged in appropriate containers amber glass. The route of administration was oral, nasal or vaginal.

The basic requirements under Article 60 of MAPA in # 46, are as follows (Brazil 2011): (1). Follow the principles of animal welfare at all stages of the production process; (2) Maintain hygiene and health throughout the breeding process, consistent with current health legislation and the use of products not authorized for use in organic production; (3) To adopt preventive health techniques; (4) To offer nutritional, healthy food, quality and proper quantity according to the nutritional requirements of each species; (5) Giving water quality and adequate quantity, free of chemical and biological agents that may compromise their health and vigor, product quality and natural resources, according to the parameters specified by law; (6) Use sanitary facilities, functional and comfortable; and (7) To allocate, in an environmentally appropriate way, waste production.

Vaccinations against FMD, brucellosis, clostridial diseases, Salmonellosis and anger, followed the current calendar in health-monitoring SFA/MAP. Homeopathy was the adopted therapy for treatment and prevention of major diseases of dairy cattle as homeopathic protocol developed for this production system (Florião 2013).

Installations for the lactating cows, which occurs the morning, meeting with their calves and installations are scraped and washed with water daily, so that there is no manure accumulation and does not favor the proliferation of parasites, with the same purpose, the place where the flock remains during the day, they are shaved once a week.

Monitoring eimeriosis

Collection of samples and tests. Fecal Samples of individual are collected directly from the rectum and place in plastic bags with identification containing the animal's name and date of collecting. Animals which showing clinical eimeriosis, fecal samples were collected in different day until the disappearance of clinical symptoms, totaling 6 collections in the first period (July 2013 to May 2014) and 6 sampling in the second period (July 2014 to May 2015). The samples were conditioned in cool boxes and latter processed to determine and diagnosis of the species of the genus *Eimeria*. Samples are placed in glass bottles with a screw, properly identified and in each sample is added to five parts of aqueous solution of potassium dichromate (K_2Cr2O_7), 2.5% (w/v). The screening is done at the laboratory of Coccidia Coccidiosis, former PSA (Embrapa/UFRRJ), Department of Animal Parasitology, Annex 1, Veterinary Institute in the UFRRJ.

Processing the samples. The analysis of each stool sample was made according to Ueno & Gutierrez (1983) and determines OoPG (oocysts per gram feces). The positive sample was poured into a Petri dish and kept at room temperature until the checking that a value was ≤ 70% of sporulated oocysts of each sample, this percentage were evaluated with the aid of a binocular microscope (Karl Zeiss, Germany).

After sporulation, the oocysts were separated from potassium dichromate by modified flotation technique with a saturated sugar solution (500g sucrose, 350 mL water and 5 mL phenol) via centrifugation for five minutes at 447 x G described by Sheather (1923) and modified by Duszynski & Wilber (1997). Thereafter it was added to each conical tube with saturated sugar aid to the edge boundary to form a converging meniscus, which is gradually deposited a cover slip of 12 x 24 cm. This coverslip was maintained for a period of 10 minutes. After this period, the coverslip was removed and placed on the surface of a glass slide for microscopy.

Species identification. Morphological aspects of sporulated oocysts are based on phenotypic characteristics, highlighted by Tenter et al. (2002). Species identification are based on Levine & Ivens (1970) and Levine (1973) and based on oocyst morphological structures (Berto et al. 2014).

Every month, the herd was heavy for monitoring the gain and maintenance of body weight and all animals were submitted to clinical examination.

The animals with clinical symptoms of eimeriosis are removed from the preventive regimen and use of homeopathy and/or herbal medicine within the parameters that regulates organic production in Brazil.

RESULTS AND DISCUSSION

In the first year of the study, from July 2013 to May 2014, there were two episodes of acute coccidiosis, characterized by bloody diarrhea consisting of blood clots (Figure 1) and weight loss and dehydration; however, no loss of appetite in two of the animals in the feeding category. The same clinical coccidiosis came to be repeated in the second evaluation period, from June 2014 to May 2015; however, two older calves weaned in category (Table 1).

The results of this study were observed previously by Ernst Benz & (1986), Marshall et al. (1998) and Daugschies & Najdrowski (2005) in relation to the occurrence of acute eimeriosis characterized by clinical severity, eliminating blood and pieces of the intestinal mucosa as well as high concentration of oocysts during the diarrheal process. But differ from them, regarding the lethality of clinical evolution, none of the affected animals showed negative progression of the disease, without any depressive

Figure 1. Calves with acute coccidiosis in an organic dairy farm: bloody diarrhea (**A**), tenesmus and presence clot (**B**); bloody fecal sample and blood clot (**C**).

Table 1. Acute bovine eimeriosis in dairy calves under organic production system in a subtropical region in the State of Rio de Janeiro, Brazil.

Cases	Age in days	OoPG[a] (Days)		
		1º	3º	5º
Nursing (July 2013/May 2014):				
1º	30	400.400[b, k]	97.000[w]	4.400[z]
2º	30	358.900[b, k]	2.700[y]	900[z]
Weaned (June 2014/ May 2015):				
3º	230	4.600[c,k]	4.500[w]	500[z]
4º	707	57.200[d,k]	1.900[w]	3.900[z]

[a]Oocysts per gram of feces; [b] *Eimeria zuernii* (87,5%) e *Eimeria cylindrica* (12,5%); [c] *E. zuernii* (78,59%), *E. bovis* (17,65%) e *E. bukidnonensis* (11,76%); [d] *E. zuernii* (92,86%) e *E. bovis* (7,14%); [k] bloody diarrhea and clots; [w] liquid; [y] líquid and reddish; normal.

behavior, nor worsening in the clinical situation and rapidly evolving to improvement of clinical signals.

Cases of acute eimeriosis occurred suddenly, in the first period were affected two category weaned calves (both aged around 30 days), said clinical situation occurred shortly after abrupt change in management, when it was reduced to amount of milk supplied to suckle calves. The other two cases occurred during the second period of the study, after occurrence of fire in the area of pastures, causing the batch of calves weaned come into pasture destined cows, with such abrupt change in management, two calves of the weaned category (with age of 230 days and another with 707 days of life) developed clinical signal of eimeriosis. This condition corroborate with Fayer (1980) and Sánchez et al. (2008) information, which state that the clinical eimeriosis is aggregated to stress in the same way that Rebhun (2000) and Noronha Junior & Buzetti (2002), reported that any stressor can cause the sudden onset of clinical coccidiosis in cattle.

When examining the feces of animals were observed the presence of hundreds of oocysts of *Eimeria* whose majority was consisted of *E. zuerni*, including the blood clots consisted of pieces of mucosa with a significant amount of oocysts of this species. Other species, such as: *Eimeria cylindrica* Wilson, 1931, *E. bovis* and *Eimeria bukidnonensis* Tubangui, 1931, were presented in animals with clinical eimeriosis (Table 1).

In all cases there was a clinical mixed infection with at least one pathogenic species (Figure 2), these data are consistent with Daugschies & Najdrowski (2005), Ernst & Benz (1986) and Marshall et al. (1998) who claim that among the various species involved, especially *E. bovis* and *E. zuernii* are responsible for severe clinical disease. Similarly to Daugschies & Najdrowski (2005) and Bangoura & Daugschies (2007) state that in cattle mixed infections is the rule.

The animals were treated with homeopathic medication on the day of eimeriosis clinical signs occurred and recovery from the fifth day after the treatment was initiated which indicated that the management system was competent in reestablishing health for the studied herd.

From the results of monthly weighing of the two nursing calves, it can be concluded that all animals have not failed to weight gain, starting with 50 kg and 36 kg each of the first weight and reaching weaning with 130 kg and 116 kg, respectively (Table 2) with the milk supply (4 Kg/day) and pasture with

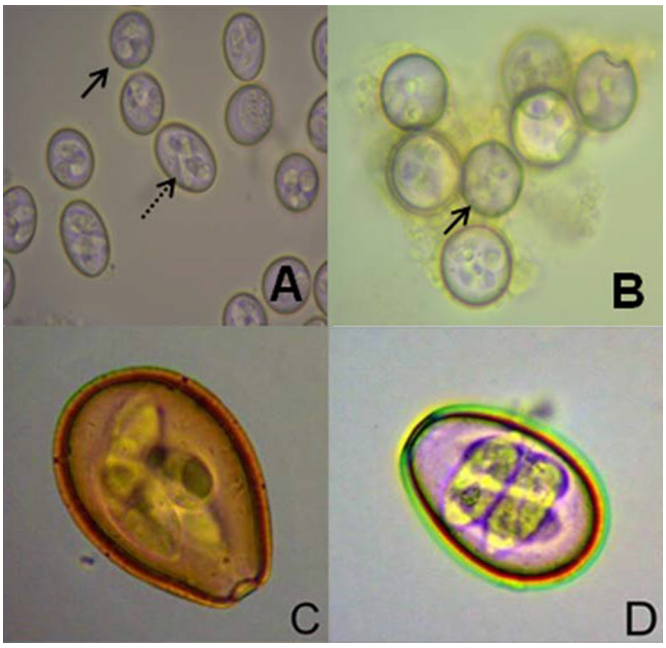

Figure 2. Calves with acute coccidiosis in an organic dairy breeding: Mixed infection with *Eimeria zuernii* (→) and *Eimeria cylindrica* (→) in suckler calves (A). Obj. 25X and mucosa fragment containing oocysts of *E. zuernii* coming from weaned calves (B). Obj 40X. *Eimeria bukidnonensis* (C) and *Eimeria bovis* (D). Obj. 100X. Saturated Sheater' Solution.

Figure 3. Appearance of the body calves (**A** and **B**) at the time of weaning (6 and 7 months respectively), which showed acute eimeriosis (the first month of life).

Table 2. Performance of nursing calves on acute eimeriosis under organic production system from June 2013 to March 2014.

Clinical Cases	Monthly body weight (kg) (kg)								
	1[a]	2[a]	3[a]	4[a]	5[a]	6[a]	7[a]	8a	9[a]
1st	50	63[a]	71	82	104	130	-[d]		
2nd	36	48[a]	50	68	76	98	102	116	-[d]

[a] Acute eimeriosis; [d] weaned.

Table 3. Performance of weaned calves on acute bovine eimeriosis under organic production system from June 2014 to May 2015.

Clinical Cases	Monthly body weight (kg)											
	1[a]	2[a]	3[a]	4[a]	5[a]	6[a]	7[a]	8[a]	9[a]	10[a]	11[a]	12[a]
3th	-	-	-	-	-	128[a]	126	136	148	160	168	175
4th	228	232	249	266	270	268[a]	274	305	320	348	362	364

[a] Acute eimeriosis.

occasional supplementation with forage (*Glirucidea* sp.), without supplying concentrate. Similarly to the results of monthly weight of two weaned calves which also had eimeriosis clinical signals (Table 3), they had little variation no weight gain in the month of occurrence of acute eimeriosis, but returning to weight gain soon. It is note worthy that the category of weaned calves was maintained solely on pasture without bulky or concentrates in the trough supplementation.

The results observed in this study agrees with the study of Freitas et al. (2002) and Campos & Lizieire (2014) which claim that steers (Holstein x GIR/ Zebu) (Table 3) should start with 30 to 32 kg of body weight (BW), and arrive at weaning from 120 kg to 130 kg BW, while maintaining a minimum adequate weight gain during the rearing (calves weaned) (Table 3) from 215 to 330 kg BW may start the reproductive life; highlighting, the fact that animals of this work did not receive concentrate supplementation, and even then were consistent with expected performance. Moreover, these results differ from Daugschies & Najdrowski (2005), Ernst & Benz (1986) and Marshall et al. (1998), Santos (2015) and Fontes (2015) regarding the statement that acute eimeriosis caused by *E. zuernii* cause necessarily compromising animal performance with reduced weight gain and delayed development. It also does not agree with the statement of Fontes (2015) that in clinical eimeriosis, even when the animal recovers, damage of the intestine is irreversible, thus responsible for the stunted growth.

CONCLUSION

The proposed organic management for the dairy farm was relevant in establishing the health of the studied herd. Only some of the animals had clinical signs of acute eimeriosis. In calves breastfeeding clinical signs appeared at 30 days old during the first study period, occurring shortly after abrupt change in management, when it was reduced the amount of milk supplied to animals of this extract. The other two cases observed occurred during the second period of the study, after fire in the area of pastures, causing the batch of calves weaned come into pasture destined cows, with such abrupt change in management developed clinical signs of acute eimeriosis. The most frequent species were *E. zuernii* more frequently in both extracts, followed by *E. cylindrica* in animals in lactation and *E. bovis* and *E. bukidnonensis* weaning extract. The recovery of the animals was performed only with the return to the management and previously proposed the use of homeopathic medication. In addition, the recovery of body weight gain within the set for the Gir breed and its crossbreeds was expressive.

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