

**Occurrence of natural infection by *Giardia sp.* in goats and sheep reared in extensive system in cerrado of Piauí, Brazil****Ocorrência da infecção natural por *Giardia sp.* em caprinos e ovinos criados em sistema extensivo no cerrado do Piauí, Brasil**

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**ABSTRACT**

The present study aimed to identify natural infection by *Giardia* sp. in fecal samples collected from goats and sheep raised in an extensive system in the Cerrado biome of Piauí, Brazil. Two hundred fecal samples from goats and sheep (100 for each species) were collected from 6 properties located in the municipality of Bom Jesus, Piauí, Brazil. In addition, data regarding properties and animals, including species, age, sex, and identification number, were collected. The samples were processed using the centrifugal-flotation technique in zinc sulfate and analyzed using optical microscopy (magnification 40×). Of the 200 samples analyzed, 70 (35%) were positive for *Giardia* sp., with goats exhibiting an absolute and relative frequency of 37/100 (37%) and adult females being more affected (25/62 [40.32%]), while 33/100 (33%) sheep were positive, with greater positivity also observed in adult females (17/55 [30.90%]). Results of this study demonstrate for what is to our knowledge the first time that goats and sheep raised extensively are exposed to infection by *Giardia* sp. in Bom Jesus, Piauí. This is also presumably the first report to describe giardiasis in goats and sheep in the state of Piauí, Brazil.

**Keywords:** giardiasis, small ruminants, protozoan.

**RESUMO**

O presente estudo teve como objetivo identificar a infecção natural por *Giardia* sp. em amostras de fezes de caprinos e ovinos criados em sistema extensivo no bioma cerrado do Piauí, Brasil. Foram coletadas 200 amostras de fezes de caprinos e ovinos, sendo 100 para cada espécie, em 6 propriedades localizadas no município de Bom Jesus, Piauí, Brasil. Além das amostras, foram coletados dados das propriedades e dos animais, como espécie, idade, sexo e número de identificação. As amostras foram processadas pela técnica de centrifugo-flutuação em sulfato de zinco e analisadas em microscópio óptico (40x). Das 200 amostras analisadas, 70 (35%) foram positivas para *Giardia* sp., observando uma frequência absoluta e relativa de: 37/100 (37%) para caprinos, sendo as fêmeas adultas mais acometidas (25/62 [40,32%]) e com relação aos ovinos, sendo observado uma maior positividade também em fêmeas adultas (17/55 [30,90%]). Este estudo demonstra pela primeira vez que, caprinos e ovinos criados de forma extensiva, estão expostos a infecção por *Giardia* sp. no município de Bom Jesus, Piauí, sendo este também o primeiro relato da ocorrência da giardiase em caprinos e ovinos no estado do Piauí, Brasil.

**Palavras-chave:** giardiase, pequenos ruminantes, protozoário.

## 1 INTRODUCTION

*Giardia* species (sp.) is one of the main zoonotic enteropathogenic protozoans that leads to considerable economic losses associated with mortality and morbidity in farm animals (GEURDEN et al., 2010; SWEENEY et al., 2011). The prevalence of parasitic infections in small ruminants varies widely, ranging from 1.5% to 89.2% in sheep, and 4% to 43.5% in goats (RYAN & ZAHEDI, 2019; WANG et al., 2016). Although giardiasis manifests in both humans and animals, it is more frequent in dogs and ruminants (ALOISIO et al., 2006).

The transmission of this pathogen is associated with the ingestion of viable cysts through direct orofecal contact or indirectly through the ingestion of contaminated water or food. Moreover, it is frequently caused by human giardiasis transmitted by drinking contaminated water (ADAM et al., 2016; ADAM, 2001). The source of infection can be humans, and/or domestic and wild animals, which may also be associated with risk factors such as contact with farm animals (SUDRÉ et al., 2012).

Small ruminants infected by *Giardia* sp. may be asymptomatic; however, when symptomatic, these animals may present with persistent or occasional pasty diarrhea; losses in feed conversion ratio; reduction in weight gain, milk production, and carcass weight (BOMFIM et al., 2005).

In 2017, the Brazilian Institute of Geography and Statistics reported reaching 8,260,607 heads for goats and 13,789,345 heads for sheep, 63% of which were present in the northeast and 23.9% in the southern region. Despite the economic and social importance of goats, sheep, and nationally grown herds, there is a lack of information regarding different enteropathogens, such as giardiasis, in small ruminants in regions of Brazil (EMBRAPA, 2018). Accordingly, the present study aimed to identify natural infection by *Giardia* sp. in goats and sheep in an extensive farming system in the Cerrado biome of Piauí, Brazil.

## 2 MATERIALS AND METHODS

This work was performed in the municipality of Bom Jesus, Piauí (PI), located at latitude 09°04'28" south and longitude 44°21'31" west, with an altitude of 277 m and an area of 5,469 km<sup>2</sup>. The municipality is located in the Cerrado biome in southern Piauí, a development territory known as the *Chapada das Mangabeiras*, belonging to the macro-region Cerrado, and is located approximately 650 km from the capital, Teresina. The study was performed in accordance with the Ethics Committee on Animal Experimentation of the Federal University of Piauí under number 190/16.

The properties were selected using non-probability convenience sampling (REIS, 2009). Two hundred feces samples (100 sheep, 100 goats) from 6 properties were collected directly from the

animals' rectal ampulla (approximately 5 g) with the aid of sterile procedure gloves. The following information was collected for each animal: date of collection, species, age, sex, identification number, and observational information regarding the environment.

After collection, the samples were labeled and packed in isothermal boxes (4°C) containing reusable ice packs and subsequently transported and analyzed at the Animal Parasitic Diseases Laboratory of the Veterinary Hospital of the Federal University of Piauí, Campus Professora Cinobelina Elvas.

The samples were processed using the centrifugal-flotation technique in 33% modified zinc sulfate (FAUST et al., 1938) and analyzed using optical microscopy (magnification, 40×) to assess the presence or absence of *Giardia* sp. cysts, for which two slides were analyzed per sample to increase the sensitivity of the examination.

### 3 RESULTS AND DISCUSSION

Of the 200 stool samples evaluated from sheep and goats, 35% (70/200) were positive for *Giardia* sp.: goats 37% (37/100); and 33% sheep (33/100). The positivity observed in the present study indicated a high infection rate for both goats and sheep, similar to the study by ROBERTSON (2009), who reported an average prevalence of *Giardia* sp. in goats and sheep (20% and 25%, respectively).

There was a higher positivity of infection in adult female goats (40.32% [25/62]), which was the category with the highest frequency of animals among the properties; all goat categories, and their respective positives are summarized in Table 1. These results differ from those in the study by ZHANG et al. (2012), who reported a higher prevalence of *Giardia* sp. in goatlings, and that animals were more susceptible to infection than adult humans.

**Table 1.** Occurrence of *Giardia* species cysts in fecal samples from goats raised in extensive system in the municipality of Bom Jesus-PI, Brazil, according to category

Sex	Category	Total Animals	Positive	Frequency (%)
Male	Young	15	5	33.33
	Adult	6	2	33.33
Female	Young	17	5	29.41
	Adult	62	25	40.32
<b>Total</b>		100	37	37

For sheep, a higher percentage of positivity was observed in young females (47.36% [9/19]) compared with the other categories (Table 2). When assessing the proportion of infected animals

according to age and sex, female lambs had a higher infection rate than adult females, which was consistent with a study by TZANIDAKIS et al. (2014), in which infection was higher in lambs than in adults.

**Table 2.** Occurrence of *Giardia* species cysts in fecal samples from sheep raised in an extensive system in the municipality of Bom Jesus-PI, Brazil, according to category

Sex	Category	Total Animals	Positive	Frequency (%)
Male	Young	20	5	25
	Adult	6	2	33.33
Female	Young	19	9	47.36
	Adult	55	17	30.90
<b>Total</b>		100	33	33

According to TZANIDAKIS et al (2014), the frequency of *Giardia* sp. in goats and sheep is potentially associated with the lack of sanitary conditions in herds. In the present study, there was poor sanitary management in all of the properties visited, with little to no control of water quality, inadequate facilities, and improper waste disposal.

It was also observed that drinking fountains were from natural sources such as rivers, artisanal wells and dams, and the feeders were contaminated with animal feces, which were possible main sources of contamination. The presence of other domestic animals on farms, such as chickens, dogs, cats, horses, and cattle, was an additional risk factor for infection of small ruminants (SUDRÉ et al., 2012).

The lack of programs to control gastrointestinal parasites render animals more susceptible to infection by helminths and protozoa, worsening the condition of giardiasis in these animals, as observed by RADAVELLI et al. (2014), in which 91.6% of the producers raised goats without parasitic control in the herd, and the owners reported constant mortality of goats due to diarrhea.

Considering the rearing system, SUDRÉ et al. (2012) reported that confinement animals are more likely to be infected than those extensively created, which may also be associated with a lack of adequate management and climatic conditions of the rearing facility/environment, thus corroborating the increase in positivity of *Giardia* sp. in the present study.

Although a higher prevalence of infection was observed in adult animals in the present study, several studies have reported a greater association with younger animals, with a decrease in the occurrence of infection with advancing age, being less frequent in adult animals due to the acquisition of immunity (BOMFIM et al., 2005; JAFARI et al., 2014).

CASTRO-HERMIDA et al (2007) reported that adult animals can play an important role as a source of infection. Sanitary management and correct zootechnical practices can be useful because animals can be separated according to categories, such as age and sex, avoiding infection of younger animals and contamination of the environment.

The adult sheep and goats in the present study exhibited a higher absolute frequency of positive animals, representing a potential source of infection for young animals by the release of more cysts in the environment. A study by CASTRO-HERMIDA et al. (2005) reported the release of 18 to 1500 cysts *Giardia* sp. per gram of feces per animal; however, these animals did not exhibit signs of clinical giardiasis representing an overt source of environmental contamination to the herd.

In the present study, goats exhibited a higher prevalence of *Giardia* sp. infection than sheep, which may be related to the possible eating habits of these animals, given that sheep are more selective in their choice of food and, thus, ingest fewer parasites. Another factor predisposing goats to infection is their ability to escape from fenced areas, thus coming into contact with more contaminated environments and carrying new pathogens into the herd (ROBERTSON, 2009; TZANIDAKIS et al., 2014).

According to ADAM et al. (2016), the ingestion of water contaminated with *Giardia* sp. cysts represents the main source of infection for humans and animals, corroborating the characteristics of the properties analyzed in the present study, in which drinking fountains and water did not pass through any treatment, and were likely sources of contamination in the animals. Moreover, this does not rule out transmission by eating food contaminated with fomites, hands, and licking by infected animals.

#### **4 CONCLUSION**

To our knowledge, this was the first study to demonstrate that goats and sheep raised extensively are exposed to infection by *Giardia* sp. in the municipality of Bom Jesus, Piauí, and is also the first report of the occurrence of giardiasis in goats and sheep in the state of Piauí, Brazil.

#### **DECLARATION OF CONFLICTS OF INTEREST**

*We have no conflict of interest to declare.*

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