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Evaluation of strongyloidiasis in kennel dogs and keepers by parasitological and serological assays

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Abstract

Strongyloides stercoralis is an intestinal nematode with worldwide distribution, particularly in tropical and subtropical regions. Due to the low sensitivity of traditional parasitological methods, the detection of serum specific antibodies may serve as an alternative test for the diagnosis. The aims of the present study were to verify the occurrence of *S. stercoralis* and the presence of specific IgG antibodies to the parasite in kennel dogs and keepers, using parasitological and serological assays. A total of 181 dogs were examined from 7 breeding kennels in the city of Uberlândia, southeastern region of Brazil and distributed as follows: kennel A ($n = 41$), kennel B ($n = 16$), kennel C ($n = 11$), kennel D ($n = 63$), kennel E ($n = 11$), kennel F ($n = 18$) and kennel G ($n = 21$). Fecal and serum samples from 11 keepers responsible for kennel cleaning and dog control were also collected in five of the seven kennels (two from kennel A, one from kennel B, four from kennel D, two from kennel E and two from kennel G). Overall, enteroparasites were detected by parasitological assays in 66, 36.5% (95% CI: 2.5–43.4%) of the 181 dogs tested. Only one (0.6%) dog was copropositive for *S. stercoralis*. Among the keepers only one fecal sample, 9.1% (95% CI: 8.6–9.4%) was positive for hookworm by the Lutz method. Serological assays showed that 44 (24.3%) of the 181 dogs were seropositive for *S. stercoralis* in at least one of the tests in the following kennels: 21 (11.6%) in kennel A; 1 (0.6%) in kennel B; 5 (2.7%) in kennel C; 6 (3.3%) in kennel D; 1 (0.6%) in kennel E; 9 (4.9%) in kennel F and 1 (0.6%) in kennel G. Among the keepers no *S. stercoralis* seropositive samples were identified using IFAT but 2 (18.2%) of the keepers from kennel D and 1 (9.1%) from kennel G were seropositive by ELISA. The present study demonstrated that the occurrence of *S. stercoralis* infection in kennel dogs and keepers is low in the city of Uberlândia and that serological assays can contribute to the diagnosis of canine as well as human strongyloidiasis.

Keywords: Parasitological diagnosis; Serological diagnosis; *Strongyloides stercoralis*; Dogs; Enteroparasites

1. Introduction

Strongyloides stercoralis is an intestinal nematode that infects dogs, cats, monkeys and humans. With worldwide distribution, this parasite is most common in tropical and subtropical regions (Grove, 1996; Lam et al., 2006). The transmission of strongyloidiasis can be by autoinfection, which occurs when larvae in the intestine develop precociously to the infective L3 form and invade the intestinal wall. In this case the disease may remain chronic for several years (Concha et al., 2005).

Strongyloidiasis presents three possible outcomes in the infected host: (i) self-cure by *S. stercoralis* elimination; (ii) the chronic form supported by

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autoinfection and (iii) hyperinfection or the form disseminated by larvae in ectopic sites. These factors are highly dependent on the host's immune response and the evasive capacity of the parasite (Grove and Northern, 1982; Grove et al., 1983). In human strongyloidiasis the chronic infection, when limited to the gastrointestinal tract, is clinically non-apparent in most cases. Hyperinfection and dissemination can lead to the death of individuals with protein-caloric malnutrition, cancer, renal transplant, systemic lupus erythematosus, acquired immunodeficiency syndrome (AIDS), or tuberculosis as well as of alcoholics or those receiving treatment with immunosuppressor drugs (Oliveira et al., 2002; Keiser and Nutman, 2004; Concha et al., 2005; Vigg et al., 2006). Hyperinfection is even more highly associated with the use of glucocorticoid steroids (Genta, 1992).

Canine strongyloidiasis can be a problem in breeding kennels, affecting mostly puppies, since a large number of dogs are present in small areas, sometimes associated with poor hygienic conditions and seasons of high temperature and humidity (Hendrix et al., 1987). The moment of infection in the pregnant bitch is a critical factor for the determination of the transmammary route as well as the extension of *S. stercoralis* transmission to newborn pups. Thus, if a bitch is lactating when infected with *S. stercoralis* L3, transmammary transmission almost certainly takes place (Shoop et al., 2002). On the other hand, Mansfield et al. (1996) found that the infecting L3 form does not stay in dogs's tissue for any length of time. As a result, there is no hypobiotic store of L3 to initiate transmammary transmission as occurs in cases of *S. papillosus* (cattle, sheep and goats), *S. ransoni* (swine) and *S. westeri* (equine). Therefore, *S. stercoralis* seems to behave more like *S. ratti* and *S. venezuelensis* in rats, causing infection only when the mother is infected by L3 while nursing the young. There is, thus, little evidence that this route may be important in the cycle of *S. stercoralis* in dogs (Soulsby, 1982), since an outside source of infectious L3 is needed to initiate transmammary transmission in a nursing bitch. Additionally, if such a source is present, the pups in a kennel are probably be at greater risk of being infected from this external source than from the few larvae that pass through the milk.

The parasitological diagnosis of canine strongyloidiasis has been performed through the fecal flotation and Baermann (1917) methods, as well as the agar plate method of Koga (Koga et al., 1991) and the direct smear of fresh feces to detect the presence of eggs, or rhabditiform or filariform larvae of the parasite (Hendrix et al., 1987). However, due to the low sensitivity of these methods, serological assays have also been employed. Recently, we developed an indirect fluorescent antibody test (IFAT) using *S. stercoralis* as a particulate antigen on slides and an enzyme-linked immunosorbent assay (ELISA) using saline soluble antigen for the detection of IgG antibodies to *S. stercoralis* in serum samples from domesticated dogs (Ferreira-Júnior et al., 2006). In this latter study we demonstrated natural *S. stercoralis* infection in dogs, indicating that IFAT and ELISA combined with parasitological methods may be useful in the determination of *S. stercoralis* in exposed or infected animals. For the identification of human strongyloidiasis, the most frequently used methods are also IFAT on slides (Costa-Cruz et al., 1997) and ELISA (Gam et al., 1987; Conway et al., 1993; Sato et al., 1995).

Little is known as to the dynamics of transmission of strongyloidiasis between dogs and the people associated with them. There is, in this context, at least one case report of a kennel keeper having contracted strongyloidiasis from the dogs in his care (Georgi and Sprinkle, 1974). The aims of the present study were to verify the occurrence of *S. stercoralis* and the presence of specific IgG antibodies to the parasite in kennel dogs and their keepers, by parasitological and serological assays.

2. Materials and methods

2.1. Ethical aspects

All procedures were carried out according to the guidelines for animal experimentation (CIOMS, 1985; COBEA, 1991) and the dogs' owners as well as the kennel keeper were informed of the results. The study was approved by the Ethics Committee on Research of the Federal University of Uberlândia.

2.2. Dogs, fecal and serum samples

The number of dogs needed to provide statistical significance was calculated as previously described (Rodrigues, 1986; Machado and Costa-Cruz, 1998). From the necessary 174 dogs the sample size was enlarged to 181 dogs, of which 109 were purebred and 72 crossbred; 72 were male and 109 female. Age ranged from 1 month to 7 years, with 63 of the 181 dogs (34.8%) under 1 year of age. The animals were obtained from seven breeding kennels in the city of Uberlândia, State of Minas Gerais, southeastern region of Brazil and were distributed as follows: kennel A ($n = 41$), kennel B ($n = 16$), kennel C ($n = 11$), kennel D ($n = 63$), kennel E ($n = 11$), kennel F ($n = 18$) and kennel G ($n = 21$).