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Prevalence of *Sarcocystis odocoileocanis* from White-tailed Deer in Alabama and its Attempted Transmission to Goats

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ABSTRACT: Sarcocysts of *Sarcocystis odocoileocanis* were found in tissue sections of hearts and tongues examined by light microscopy from 30 (88%) of 34 white-tailed deer (*Odocoileus virginianus*). Hearts were infected less often (13 of 34, 38%) than were tongues (30 of 34, 88%). Sarcocysts of *Sarcocystis odoi* were not observed in the white-tailed deer examined. A gray fox (*Urocyon cinereoargenteus*) excreted sporocysts after consuming tongues of white-tailed deer infected with *S. odocoileocanis*. Two goats inoculated with either 50,000 or 500,000 sporocysts of *S. odocoileocanis* isolated from the gray fox did not have sarcocysts in tissue sections of the heart, tongue, diaphragm, or esophagus when examined 122 days postinoculation. Dogs fed these tissues from control or inoculated goats did not pass sporocysts in their feces. The present study demonstrates: (1) a high prevalence of *S. odocoileocanis* infection in white-tailed deer in Alabama, and (2) that goats are not suitable intermediate hosts for *S. odocoileocanis*.

Key words: *Odocoileus virginianus*, white-tailed deer, *Sarcocystis odocoileocanis*, *Sarcocystis odoi*, *Urocyon cinereoargenteus*, gray fox, goat.

Several studies have demonstrated *Sarcocystis* spp. infections in white-tailed deer, *Odocoileus virginianus* (Karstad and Trainer, 1969; Pond and Speer, 1979; Mahrt and Colwell, 1980; Crum and Prestwood, 1982; Emnett and Hugghins, 1982; Dubey and Lozier, 1983; Emnett, 1986). Prevalences of 44 to 79% were reported in these studies.

Two species of *Sarcocystis* (*S. odocoileocanis* and *S. odoi*) have been described from white-tailed deer (Crum et al., 1981; Dubey and Lozier, 1983). Definitive hosts for *S. odocoileocanis* are canids (Crum et al., 1981; Crum and Prestwood, 1982; Emnett and Hugghins, 1982; Emnett, 1986). Sporocysts of *S. odocoileocanis* isolated from dogs are apparently infectious for domestic sheep and cattle (Crum et al., 1981). Less is known about the biology of *S. odoi* from white-tailed deer. Domestic cats are the only known definitive host for this species (Dubey and Lozier, 1983).

Structurally, the sarcocysts of *S. odocoileocanis* can be differentiated from those of *S. odoi* based on the thickness of the sarcocyst wall. The sarcocyst wall of *S. odocoileocanis* is 2–3 μm thick, while the sarcocyst wall of *S. odoi* is 5–10 μm thick (Dubey and Lozier, 1983). A third type of sarcocyst has been described from white-tailed deer that is structurally very similar to *S. odoi* sarcocysts (Dubey and Lozier, 1983); no transmission data have been reported for this type of sarcocyst found in white-tailed deer.

The present study was conducted to: (1) determine the prevalence of *S. odocoileocanis* and *S. odoi* infections in white-tailed deer in Alabama, and (2) determine if domestic goats are suitable intermediate hosts for *S. odocoileocanis*.

Tongues and hearts from 34 hunter-killed white-tailed deer were examined for the presence of sarcocysts by light microscopic examination of formalin fixed, paraffin embedded, hematoxylin and eosin stained tissue sections. Two regions of the tongue (apex and body) and two regions of the left ventricle (near the apex and central portion of the ventricular wall) were examined from each deer. The sexes and ages of the deer were unknown. Deer were collected during the hunting seasons of 1984–1985, 1985–1986 and 1986–1987 in Lee and Macon counties, Alabama.

A gray fox, *Urocyon cinereoargenteus*, was used to obtain sporocysts of *S. odocoileocanis* (Emnett and Hugghins, 1982). This fox had been housed in the laboratory for 3 mo prior to being fed the tongues of four white-tailed deer that contained *S. odocoileocanis* sarcocysts. The fox was fed commercial dry dog chow (Jim Dandy Chunk Style Dog Ration, Jim Dandy Corporation, Decatur, Alabama 35601, USA) and water ad libitum during the course of this study except on the day it was fed tongues. No sporocysts were observed in the feces of this gray fox by coverslip flotation using Sheather's sugar solution (Ernst and Benz, 1981) 1 day prior to the feeding of *S. odocoileocanis* infected white-tailed deer tongues. The gray fox began passing *S. odocoileocanis* sporocysts in its feces 8 days postfeeding of white-tailed deer tongues and it was euthanized by intravenous injection of an overdose of pentobarbital (Beuthanasia-D, Schering Corporation, Kenilworth, New Jersey 07033, USA) 4 days later. Its small intestine was removed and processed as described by Dubey (1980) to obtain sporocysts for experimental inoculation of goats.

Three mixed breed goats were used to determine if they were susceptible to infection with *S. odocoileocanis* sporocysts. The goats had been born in stalls that were on raised plastisol-coated floors in an isolation building, weaned from their does and raised in an isolation building to prevent exposure to canine or feline feces. Goats were 6–9 mo old when two were inoculated orally with 50,000 or 500,000 *S. odocoileocanis* sporocysts. One goat was not inoculated and served as a control. Inoculated and control goats were maintained in separate isolation facilities and fed goat ration (Auburn Experimental Goat Pellets, custom formulated by Flint River Mills, Bainbridge, Georgia 31717, USA) and water ad libitum for 122 days postinoculation (PI). Goats were observed once daily for clinical signs of sarcocystosis (Dubey et al., 1981).

Goats were euthanized by intravenous overdose of pentobarbital 122 days PI. The heart, tongue, esophagus, and diaphragm were removed from each goat at necropsy. Samples of each tissue were fixed in 10% neutral buffered formalin and processed for light microscopic examination. The remaining portions of these tissues were pooled by goat and fed separately to each of three dogs. The dogs were obtained from the College of Veterinary Medicine (Laboratory Animal Care Facility, Auburn University, Alabama 36849, USA). They had been housed individually for 1–2 mo prior to consumption of goat tissues and had not been fed meat during this period. Examinations of individual fecal samples from these dogs by coverslip flotation using Sheather's sugar solution were negative prior to the feeding of goat tissues. The feces from each dog were examined by coverslip flotation using Sheather's sugar solution for sporocysts on days six through 17 postfeeding of goat tissues.

Of the 34 white-tailed deer examined, 30 (88%) tongues and 13 (38%) hearts contained sarcocysts. At no time was infection of the heart found when the tongue was not infected. Sarcocysts were thin-walled and structurally consistent with those of *S. odocoileocanis*. Thick-walled sarcocysts of *S. odoi* or *Sarcocystis* sp. were not observed.

None of the goats developed clinical signs of sarcocystosis. Sarcocysts were not observed in tissue sections of the heart, tongue, diaphragm, or esophagus from inoculated or control goats. None of the dogs fed goat tissues passed sporocysts in their feces.

The majority of studies conducted on *Sarcocystis* spp. infections in white-tailed deer were performed prior to the published descriptions of *S. odocoileocanis* and *S. odoi* (Karstad and Trainer, 1969; Pond and Speer, 1979; Mahrt and Colwell, 1980; Crum and Prestwood, 1982; Emnett and Hugghins, 1982), or the two species were not differentiated (Emnett, 1986). Dubey and Lozier (1983) found *S. odoi* in tissue sections of three of 17 (18%) white-tailed

deer examined with this technique. In our study, *S. odoi* or other thick-walled sarcocysts were not observed in tissue sections of the hearts or tongues from 34 white-tailed deer. This reflects either an absence of *S. odoi* in our study area or a low tissue density of *S. odoi* sarcocysts in the white-tailed deer we examined.

Our study reports the highest prevalence of *Sarcocystis* spp. infection in white-tailed deer examined to date. Dogs are widely used to hunt white-tailed deer in Alabama (Dunkelberger et al., 1985), and this is a popular method of hunting in our area. Hunters often feed raw white-tailed deer meat to their hunting dogs. This practice probably results in a high *S. odocoileocanis* infection rate in these dogs and therefore an increased exposure of deer to sporocysts excreted by these hunting dogs.

Crum et al. (1981) reported infections in calves and sheep experimentally inoculated with sporocysts of *S. odocoileocanis*. We were unable to demonstrate sarcocysts in goats inoculated with *S. odocoileocanis* sporocysts and unable to produce infections in dogs fed muscle tissues from these goats in the present study. Therefore, it seems unlikely that goats are susceptible to infection with *S. odocoileocanis* isolated from white-tailed deer.

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