PREVALENCE OF SARCOCYSTIS IN WOLVES AND WHITE-TAILED DEER IN NORTHEASTERN MINNESOTA

Author: Charles W. Emnett

Source: Journal of Wildlife Diseases, 22(2) : 193-195

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-22.2.193

Journal of Wildlife Diseases, 22(2), 1986, pp. 193–195

PREVALENCE OF *SARCOCYSTIS* IN WOLVES AND WHITE-TAILED DEER IN NORTHEASTERN MINNESOTA

Charles W. Emnett
Department of Biology, Christian Brothers College, Memphis, Tennessee 38104, USA

ABSTRACT: The prevalence of *Sarcocystis* (Protozoa: Sarcocystidae) in white-tailed deer (*Odocoileus virginianus*) from northeastern Minnesota was determined by histologic examination of tongue samples. Seventy-nine of 100 deer were infected; infection was higher in yearlings and adults than in fawns. Sporocysts of *Sarcocystis* were found in 3% of 72 wolf (*Canis lupus*) scats. Three of four captive wolves fed muscle from a white-tailed deer naturally infected with *Sarcocystis* shed sporocysts 12–14 days later.

INTRODUCTION

Sarcocystis in white-tailed deer has been documented throughout several regions of the United States and Canada (Karstad and Trainer, 1969; Pond and Speer, 1979; Mahrt and Colwell, 1980; Crum et al., 1981; Crum and Prestwood, 1982; Emnett and Hugghins, 1982; Dubey and Lozier, 1983). The wolf is the primary predator of deer in northeastern Minnesota (Stenlund, 1955; Mech and Frenzel, 1971; Nelson and Mech, 1981), which suggests that this species may be a definitive host of the *Sarcocystis* in deer. The purposes of this study were to determine the prevalence of *Sarcocystis* in wolves and deer from northeastern Minnesota and to determine if the wolf can serve as a definitive host for *Sarcocystis* from deer.

MATERIALS AND METHODS

Tongues from 100 road-killed white-tailed deer were collected in Cook and Lake counties, Minnesota from November 1982 to April 1983. Most samples were obtained in or near the Jonvick wintering yard along Lake Superior. The tongues were frozen and later examined for intramuscular cysts according to method #2 described by Emnett and Hugghins (1982). The prevalence of infection by *Sarcocystis* was determined and a chi-square test was used to detect any significant difference caused by host age or sex.

Wolf scats were collected from May 1982 to April 1983 from sites in central Superior National Forest (SNF) in northeastern Minnesota, and examined for sporocysts using a sugar flotation technique (Levine, 1973). Four captive wolves (three adult, one unknown) used as experimental hosts were part of a U.S. Fish and Wildlife Service colony located just north of St. Paul, Minnesota. All wolves were housed in separate kennels with concrete floors and fed dry-pelleted dog food supplemented with raw venison when available. Because no sporocysts were found in 50 fecal flotations from these wolves during pre-patency, the animals were considered to be *Sarcocystis*-free at the time of experimental feeding.

Tissue for feeding purposes was obtained from a road-killed white-tailed deer in Minnesota. Lean muscle was cut into fine pieces, weighed and placed in a 125-ml flask to which 10 times its weight in digestive fluid was added (Emnett and Hugghins, 1982). The mixture was placed in an incubator at 36 C for 1 hr and stirred periodically. The fluid was then removed, strained through gauze, and the remaining tissue was squeezed to remove excess fluid. Ten ml of the filtrate was centrifuged for 10 min at 649 *g*, the supernatent discarded, and the sediment resuspended in 3 ml of 0.87% NaCl solution. An aliquot was removed with a pipette and one drop placed on a slide with a coverslip and examined for bradyzoites at 400×. *Sarcocystis*-infected muscle was divided into 454-g portions and one fed to each wolf. Scats were collected daily after the initial feeding of infected venison and examined for sporocysts employing the sugar flotation technique. Scats were examined periodically from post-infection day 25 up to day 41 when collection was terminated due to the absence of sporocysts.

RESULTS

Sarcocysts were found in 79 of 100 histologic sections of white-tailed deer (Table 1). A chi-square test revealed no sig-

Received for publication 27 February 1985.

TABLE 1. Prevalence and age-sex distribution of *Sarcocystis* in 100 white-tailed deer from northeastern Minnesota, 1982–1983.

Age	Males		Females	
	Pos.	Neg.	Pos.	Neg.
Fawns	8	7	12	9
Yearlings	9	0	13	1
Adults	3	0	32	4
Unknown	1	—	1	—
Total	21	7	58	14

nificant difference in the prevalence of infection between sexes (1 df, 0.01) or between yearlings and adults (1 df, 0.01), but a significant difference (17.90) was found between fawns and the combined yearling-adult age groups (1 df, 0.01).

Two of 72 (3%) scats collected from wolves inhabiting SNF contained sporocysts of *Sarcocystis*. After ingesting *Sarcocystis*-infected venison, three of four experimental wolves shed sporocysts. Two wolves exhibited a pre-patent period of 12 days and a corresponding 4-consecutive-day patent period. The remaining wolf had pre-patent and consecutive-patent periods of 14 and 2 days, respectively. Only small numbers of sporocysts were shed during patency.

DISCUSSION

The 79% prevalence of sarcocysts was probably a low estimate because of the size and number of tissue sections examined. The estimate also was not considered to be truly representative of the entire northeastern Minnesota region because of different deer densities throughout the area. Deer numbers are lower in the interior of SNF than in the surrounding areas (Mech and Karns, 1977). Even though wolves inhabit the entire northeastern region (Mech, 1973), a greater prevalence of *Sarcocystis* likely would be found in areas of higher deer and wolf densities due to increased predator–prey interactions.

This is the first report of wolves as hosts of *Sarcocystis* in North America. However, the low prevalence of sporocysts found in wolf scats was surprising based upon the number of infected deer and their status as the primary prey of wolves in Minnesota. Due to the relative absence of sporocysts from these randomly collected scats, wolves of the Wood Lake Pack (Mech, pers. comm.) were tracked after killing a deer infected with *Sarcocystis*. Fecal samples were collected and examined from this pack on days 10–11, 15–16, and 30 after the kill. All scats were negative for *Sarcocystis*. The low intensity of infection in free-roaming wolves corresponds with the short patent period and few sporocysts shed by captive wolves, even though sporocysts were not seen from the Wood Lake Pack on day 15–16.

Assuming that the wolf is the primary definitive host in this life-cycle, one explanation for the low infectivity shown by captive wolves is that the deer tissue consumed contained very few sarcocysts. More likely however, is the possibility that the particular species of *Sarcocystis* parasitizing this deer was not one highly infective for the wolf. White-tailed deer harbor at least three species of *Sarcocystis* (Dubey and Lozier, 1983). These findings suggest that either wolves are poor hosts for deer *Sarcocystis* or that reshedding of sporocysts is limited by previous infections. If the patent period and low number of sporocysts shed by wolves during feeding trials are applicable to natural populations, then the high prevalence of *Sarcocystis* in deer might be accounted for by examining wolf populations and food habit studies. Assuming a wolf density in the study area of about one per 52 km^2 (Mech, pers. comm.) and an average consumption of 15 adult deer per yr (Mech, 1971), then approximately 12 parasitized deer per 52 km^2, or one per 4.3 km^2 are eaten by wolves each year and the resulting sporocysts passed into the environment.

Other predators besides wolves might be primary definitive hosts in the carnivore–deer cycle. Coyotes (*Canis latrans*) and dogs (*Canis domesticus*) shed numerous sporocysts after ingesting white-tailed deer tissue containing sarcocysts (Emnett and Hugghins, 1982). However, dogs and coyotes are uncommon in the area surveyed (Mech, 1971), and their low numbers would not be sufficient to account for the high prevalence of *Sarcocystis* found in deer.

More experimental feeding studies are needed to better ascertain the role of the wolf in the *Sarcocystis* life-cycle involving white-tailed deer.

ACKNOWLEDGMENTS

I extend special thanks to L. David Mech, U.S. Fish and Wildlife Service, for his cooperation in obtaining deer tongues, wolf scats, data from radioed wolf packs, and along with Ulysses S. Seal, for the use of captive wolves in feeding experiments. The collection of deer tongues by Bill Peterson of the Minnesota Department of Natural Resources, and scat collection by technicians at the wolf colony is gratefully acknowledged. The assistance of Neil Ballard and Ron Hybertson, Mankato State University, in the use of their facilities and equipment is deeply appreciated. I also wish to thank Stan Eisen, Christian Brothers College, and L. David Mech for reviewing the manuscript and suggesting improvements.

LITERATURE CITED

CRUM, J. M., R. FAYER, AND A. K. PRESTWOOD. 1981. *Sarcocystis* spp. in white-tailed deer. I. Definitive and intermediate host spectrum with a description of *Sarcocystis odocoileocanis* n. sp. J. Wildl. Dis. 17: 567–579.

———, AND A. K. PRESTWOOD. 1982. Prevalence and distribution of *Sarcocystis* spp. among white-tailed deer of the southeastern United States. J. Wildl. Dis. 18: 195–203.

DUBEY, J. P., AND S. M. LOZIER. 1983. *Sarcocystis* infection in the white tailed deer (*Odocoileus virginianus*) in Montana: Intensity and description of *Sarcocystis odoi* n. sp. Am. J. Vet. Res. 44: 1738–1743.

EMNETT, C. W., AND E. J. HUGGHINS. 1982. *Sarcocystis* of deer in South Dakota. J. Wildl. Dis. 18: 187–193.

KARSTAD, L., AND D. O. TRAINER. 1969. *Sarcocystis* in white-tailed deer. Bull. Wildl. Dis. Assoc. 5: 25–26.

LEVINE, N. D. 1973. Protozoan Parasites of Domestic Animals and of Man, 2nd Ed. Burgess Publishing Company, Minneapolis, Minnesota, 406 pp.

MAHRT, J. L., AND D. D. COLWELL. 1980. *Sarcocystis* in wild ungulates in Alberta. J. Wildl. Dis. 16: 571–576.

MECH, L. D. 1971. Wolves, coyotes and dogs. *In* The White-tailed Deer in Minnesota, Symp. Proc., M. M. Nelson (ed.). Minn. Dept. Nat. Resour., St. Paul, Minnesota, pp. 19–22.

———. 1973. Wolf numbers in the Superior National Forest of Minnesota. USDA For. Serv. Res. Pap. NC-97, No. Cent. For. Exp. Sta., St. Paul, Minnesota, 10 pp.

———, AND L. D. FRENZEL, JR., eds. 1971. Ecological studies of the timber wolf in northeastern Minnesota. USDA For. Serv. Res. Pap. NC-51, No. Cent. For. Exp. Sta., St. Paul, Minnesota, 62 pp.

———, AND P. D. KARNS. 1977. Role of the wolf in a deer decline in the Superior National Forest. USDA For. Serv. Res. Pap. NC-148, No. Cent. For. Exp. Sta., St. Paul, Minnesota, 23 pp.

NELSON, M. E., AND L. D. MECH. 1981. Deer social organization and wolf predation in northeastern Minnestoa. Wildl. Monogr. 77: 1–53.

POND, D. B., AND C. A. SPEER. 1979. *Sarcocystis* in free-ranging herbivores on the National Bison Range. J. Wildl. Dis. 15: 51–53.

STENLUND, M. H. 1955. A field study of the timber wolf (*Canis lupus*) on the Superior National Forest, Minnesota. Minn. Dept. Conserv. Tech. Bull. 4: 1–55.