

Trichinosis in Bears in Northeastern United States

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TRICHINELLA SPIRALIS has been identified in at least 36 wild mammalian species in the United States, but wildlife is rarely a direct cause of trichinosis in man in this country (1). The exceptions are sporadic cases due to the consumption of inadequately cooked bear and wild swine meat (2). For example, in 1931 in Solano County, Calif., 18 persons acquired trichinosis and one died after eating bear meat jerky. Five of these cases were described in 1932

(3). In 1954 and 1963 outbreaks in human beings caused by consumption of infected bear meat occurred in the northeastern United States (4,5). In 1968, eight persons in Alaska acquired trichinosis after consuming bear meat that had been frozen for at least 3 weeks (6).

Since two of the three outbreaks of trichinosis caused by bear meat which have been reported since 1954 occurred in the northeastern United States and this area contains a substantial population of black bears that are prey to hunters, we believed that knowledge of the prevalence of trichinosis in black bears in the northeastern United States would be of value.

Methods and Materials

A survey was therefore undertaken with the cooperation of the wildlife conservation personnel of Maine, New Hampshire, New York, Pennsylvania, Vermont, and West Virginia (see box). Specimens were collected in the field by State game biologists as bear kills were being checked and recorded. One-square-inch pieces of meat were taken from the tongue, diaphragm, heart, psoas, and intercostal muscles of the

bear; (during 1968 and 1969 only tongue and diaphragm samples were requested). These pieces were then sealed in plastic bags containing 25 gm. of sodium borate as a preservative and mailed to the Epidemiologic Services Laboratory, Center for Disease Control, Atlanta, Ga. The date and location of the kill, the name of the hunter and collector, and the age and sex of the animal were included with each specimen.

The specimens were examined by a modification of the artificial digestion Baerman technique used by Zimmermann (7, 8). A weighed sample of muscle was finely minced by hand and placed in a Baerman apparatus. This device consists of a 20-mesh screen fitted into a 6-inch funnel, which was connected to a centrifuge tube by a piece of rubber tubing. The equipment was cleaned and sterilized after each use to prevent cross-contamination. The minced tissue was covered with a solution of 0.5 percent pepsin and 0.7 percent concentrated hydrochloric acid and incubated 18 hours at 37° C. Trichina larvae, freed from the muscle, passed through the screen and settled into the centrifuge tube.

At the time of the study, all the authors were with the Epidemiology Program, Center for Disease Control, Health Services and Mental Health Administration. Dr. Harbottle, who now privately practices veterinary medicine in San Jose, Calif., was an Epidemic Intelligence Service veterinary epidemiologist in the Parasitic Diseases Branch. Mrs. English is a microbiologist, Epidemiologic Services Laboratory Section, Bacterial Diseases Branch, and Dr. Schultz is chief of the Parasitic Diseases Branch. Tearsheet requests to Dr. Myron G. Schultz, Epidemiology Program, Center for Disease Control, Atlanta, Ga. 30333.

After 15 hours, the digesting material on the screen was stirred and allowed to settle for 3 more hours. The tube was then removed, and all contents were examined under a dissecting microscope. Any trichina larvae found were counted, and the intensity of the infection was determined by calculating the number of larvae per gram of tissue.

Periodically, samples of pig or rat muscle known to be infected were tested by the same procedure, and in every instance larvae were recovered. The sensitivity of this basic procedure was shown by Zimmermann's recovery of larvae from five or six samples of 100–125 gm. of ground pork to which a single larva had been added. We were able to recover 50 percent of the larvae from specimens known to have an intensity of infection of one larva per gram.

Results

A total of 654 tissue samples (average weight 7.4 gm.) from 372 black bears were examined for trichinosis. Forty animals were examined in 1967, 115 in 1968, and 217 in 1969. Of the 372 animals, 158 came from New York, 77 from Pennsylvania, 60 from Vermont, 33 from Maine, 28 from West Virginia, and 16 from New Hamp-

shire. The percentage of black bears killed during the 3-year survey which were examined for trichinosis was similar in New York, Pennsylvania, Vermont, and West Virginia (10.1–16.7 percent) but was lower in Maine and New Hampshire (1.0–2.5 percent) because of logistical problems (see table). Three hundred animals were identified as adults and 36 as cubs; the ages of 36 were not specified.

Five animals (1.34 percent) were infected with *T. spiralis*; two of these were from New York, and one each was from Pennsylvania, Vermont, and West Virginia. In the four States in which infected animals were found, 10 percent or more of the black bears killed were examined for trichinosis. The intensity of infection varied from 22 to 750 larvae per gram of tissue.

Discussion

When our study began there was no information in the literature on the prevalence of trichinosis in bears in the continental United States. In Alaska, Rausch and his co-workers had examined 23 black bears, five of which were infected with *T. spiralis* (12). During the second year of our study, Babbott and Day reported none of 35 black bears shot in Vermont were infected

Collectors of Specimens

The following persons assisted in collecting specimens for this study: Lemuel G. Halterman, former Epidemic Intelligence Service officer, Center for Disease Control; Howard E. Spencer, Jr., acting chief, game division, Department of Inland Fisheries and Game, Maine; Harold C. Lacaillade, game biologist, Fish and Game Department, New Hampshire; Stuart Free, senior wildlife biologist, Wildlife Research Laboratory, New York; Robert L. Miller, conservation biologist, Division of Fish and Game, New York; Ernest J. Witte, V.M.D., Veterinary Public Health Department, Pennsylvania; Harvey Roberts, director, division of research, Game Commission, Pennsylvania; Charles H. Willey, game biologist, Fish and Game Department, Vermont; and James W. Rawson, game research biologist, Department of Natural Resources, West Virginia.

with this parasite (13). In another recent survey in Montana, Capt. J. B. Winters, Parasitology Division, 1st U.S. Army Medical Laboratory, Fort Meade, Md., found that 31 of 45 grizzly bears and four of 27 black bears were infected with *T. spiralis* (personal communication to Harbottle, 1970).

Our survey revealed that five of 372 (1.34 percent) of the

Survey of black bears in northeastern United States for trichinosis, 1967–69

State	Estimated bear population (10, 11)	Total killed during survey ¹	Number tested	Number infected	Percent of kill tested	Percent of population tested
Maine	12,000	3,200	33	0	1.0	0.3
New Hampshire	1,100	631	16	0	2.5	1.5
New York	4,000	1,560	158	2	10.1	4.0
Pennsylvania	1,800	513	77	1	15.0	4.3
Vermont	2,500	359	60	1	16.7	2.4
West Virginia	575	236	28	1	11.9	4.9
Total	21,975	6,499	372	5	5.7	1.7

¹ Total number of bears killed during the years in which the State participated in the survey.



***Euarctos americanus* (American black bear)**

Photo by E. P. Haddon, Bureau of Sport Fisheries and Wildlife

black bears in the northeastern United States were infected with *T. spiralis*. From this sample we can therefore say, with 95 percent confidence, that the true prevalence is not less than 0.15 percent and not greater than 2.5 percent. The prevalence in black bears is four times greater than in garbage-fed swine in the United States and 13 times greater than in grain-fed swine (14).

The significance of trichinosis in bears was highlighted by an incident in Vermont in 1969. In October 1969, samples of the tongue and diaphragm from a black bear killed in that State were found to be infected with trichina larvae (29 larvae per

gram of meat). We notified the Vermont Fish and Game Department, whose personnel in turn notified the hunter. The hunter, a woman, had shot the bear on September 3, 1969, and had eaten a meal of the well-cooked meat with no ill effects. She sold the rest of the meat to a local game club for its annual feast, which 25 to 50 persons were expected to attend. Fortunately, the feast had not yet taken place, and the meat was destroyed.

The hazard of ursine trichinosis for man was also exemplified in Pennsylvania. We found that a black bear which had been shot in that State on November 28, 1968, was infected with 110 tri-

china larvae per gam of meat and notified the State public health veterinarian. He discovered that meat of this bear had been distributed among six families and that members of three families had eaten the meat. Trichinosis was not confirmed in any of them, however, undoubtedly because the meat had been well cooked. The other three families had discarded the meat they received. One of these families disposed of it in a nearby open garbage dump where bears are known to feed.

A study of the dietary habits of black bears in the Northeast (15) has shown that during the fall and winter, when vegetation

is scarce, more than 50 percent of their food is carrion, insects, and garbage. The normal bear hunting seasons are the fall and early winter, the times when bears are most likely to contract trichinosis. Thus, the hunter is at maximum risk of eating meat from a bear that has been recently infected with *T. spiralis*. Moreover, hunters and gourmets of wild game may be unaware of this disease in bears; inadequate cooking or refrigeration of the meat would also further increase the risk of infection.

We suggest that hunters be alerted to the dangers of trichinosis from bears, possibly by a warning attached to the hunting license. Bear meat, like pork, should be cooked to an internal temperature of 137° F. (16). We also suggest that garbage dumps be fenced or filled at frequent intervals to prevent scavenging by bears. Although trichinosis will persist in many wildlife species, these measures will minimize the risk of sporadic transmission from bears to man.

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A study of 372 black bears from Maine, New Hampshire, New York, Pennsylvania, Vermont, and West Virginia in the period 1967-69 showed that five (1.3 percent) were infected with *Trichinella spiralis*. In bears in the northeastern United States, therefore, the prevalence of trichinosis is four times greater than in garbage-fed swine in the United States and 13 times greater than in

grain-fed swine. Hunters should be warned at the time they obtain their hunting tags of the possibility of contracting trichinosis from eating bear meat. All bear meat should be thoroughly cooked.

Two possible outbreaks of trichinosis were indirectly prevented when recipients of bear meat were notified that tests results showed the meat was infected.