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# Occurrence of *Campylobacter jejuni* and *Giardia species* in Muskrat (*Ondatra zibethica*)

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**A total of 189 muskrat fecal samples were surveyed for *Campylobacter* and *Giardia* species. *Campylobacter jejuni* was recovered from 47.5% of these samples, and *Giardia* species were detected in 82.5%. These findings indicate that muskrat may be of importance to the health both of humans and of domestic animals.**

In recent years several waterborne outbreaks of human diarrheal disease have occurred in various rural and mountainous areas of the United States. Some of these have occurred among recreationists frequenting high mountain areas (1, 8), while others have been associated with municipal water systems (4, 10, 14, 18). *Giardia lamblia* has been implicated as the causative agent in many of these outbreaks, but in some instances *Campylobacter jejuni* has been reported as the responsible agent (3, 5, 21).

Beaver (*Castor canadensis*) and muskrat (*Ondatra zibethica*) have been reported to be important reservoirs of *G. lamblia* in watersheds (6, 9), but except for birds, little information is available regarding wild animal reservoirs of *Campylobacter* spp. Wild animals in which *Campylobacter* spp. have been reported include bank voles (*Clethrionomys glareolus*) (7), birds (13, 15, 19), and the blue hare (*Lepus timidus*) (17).

Preliminary studies in our laboratory suggested that muskrat also might be an important carrier of *Campylobacter* spp. If this were the case, then these animals could serve as an important reservoir of *C. jejuni* both for humans and for domestic animals. The purpose of the present study was to assess the role of muskrat as a possible source of *Campylobacter* infection. These animals also were examined for *Giardia* spp. to provide additional information on the occurrence of this parasite in muskrat populations.

Fresh muskrat scats collected between April 1983 and August 1984 from banks of streams and ponds were screened for *Campylobacter* and *Giardia* species. The majority of the specimens were obtained from 10 different locations in Kittitas County in central Washington. Of the samples examined, six were from the Snake River drainage in southeastern Idaho. The samples were collected in sterile containers and in most cases were returned to the laboratory for immediate analysis. For those specimens which could not be processed within 2 h after collection, the samples were inoculated into Amies transport medium (Difco Laboratories, Detroit, Mich.) and transported to the laboratory on ice.

To culture the *Campylobacter* spp., fecal samples were inoculated into CEB enrichment broth (16). After incubation, the CEB cultures were streaked onto campy blood agar plates (2). Both the CEB broth enrichment cultures and the campy blood agar plates were incubated for 48 h at 42°C in an anaerobe jar containing a Campy-Pak (BBL Microbiology Systems, Cockeysville, Md.) gas-generating packet. *Campylobacter* cultures that developed on the campy blood agar plates were streaked onto the same medium for isolation and purification and subsequently were frozen at −70°C for later study. Analysis of the specimens for *Giardia* spp. was done either by examining trichome-stained direct smears of the fecal samples or by a membrane filter method described previously (20).

A total of 189 specimens was examined in this study. *Campylobacter* spp. were isolated from nearly half (47.5%) of the specimens, and *Giardia* spp. were detected in 82.5% of the samples. Nearly all of the specimens from which *Campylobacter* spp. were isolated also were positive for *G. lamblia* (47%).

To determine the identity of the *Campylobacter* isolates, we screened colonies of presumptive *Campylobacter* spp. from each culture for motility by using phase-contrast microscopy and for Gram characteristics by using a 0.8% carbolfuchsin counterstain. Isolates with typical *Campylobacter* morphology and motility were further characterized by testing for catalase, oxidase, nitrate reduction, growth at 25 and 42°C, growth in 3.5% NaCl, hippurate hydrolysis, and nalidixic acid sensitivity with the methods described by Harvey and Greenwood (11). The isolates were tested for glucose utilization by using the procedures described by Hugh and Leifson (12), and colonies also were tested for hydrogen sulfide production in triple sugar iron agar (Difco).

A total of 59 *Campylobacter* isolates from muskrat were examined with the tests described above. Based on the characteristics studied, all *Campylobacter* isolates were identical and conformed to the taxonomic criteria of *C. jejuni*.

This study showed that *C. jejuni* is widespread among muskrat populations. The organism was isolated from samples taken from 9 of the 10 collecting sites in Kittitas County and from the study site in southeastern Idaho. The widespread distribution of *Campylobacter* spp. in muskrat and the high incidence of infection observed in these animals indicates that they may act as an important vector and reservoir for the etiological agent of campylobacteriosis. Muskrat also have been implicated as a reservoir of *Giardia* spp. (9), and the present study showed that a high percentage of these animals harbor this parasite. It is of interest to note that the two pathogens were found together in nearly 50% of the specimens examined. Whether this represents a commensal relationship between the two organisms is not clear, and additional studies are needed to substantiate such a relationship.

The habits of muskrat are such that they lend themselves to the transmission of waterborne disease agents. These

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animals characteristically inhabit areas adjacent to streams and ponds, and they deposit fecal material near or in bodies of water where it can readily become disseminated. The finding of both *C. jejuni* and *Giardia* spp. in the feces of these animals indicates that muskrat may be an important reservoir of disease both for humans and for domestic animals.

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