# Infectivity of Canadian Isolates of *Trichinella spiralis nativa* for Swine, Rats and Carnivores

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## ABSTRACT

**The infectivity of *Trichinella spiralis nativa* isolates from widely separated geographic areas of Canada was determined by feeding infected musculature to swine, laboratory rats and carnivores (cats, foxes, ferrets). Low infectivity for swine and rats and high infectivity for carnivores were observed. Light infections were established in four of 16 swine examined between 25 and 53 days postinfection. Feeding of infected porcine musculature to ferrets demonstrated that *Trichinella spiralis nativa* can be passaged through swine even though the infectivity rate is low.**


**Key words:** *Trichinella spiralis nativa*, infectivity, sylvatic trichinosis, swine, rats, carnivores.


## RÉSUMÉ

**Cette expérience visait à déterminer l'infectivité de diverses souches de *Trichinella spiralis nativa* provenant de régions du Canada très éloignées les unes des autres. À cette fin, l'auteur fit manger des muscles parasités à des porcs, des rats de laboratoire, des chats, des renards et des furets. Il constata que l'infectivité s'avérait mitigée, chez les porcs et les rats, tandis qu'elle se révélait marquée, chez les carnivores. Des examens appropriés révélèrent la présence d'une infection bénigne, chez quatre porcs sur 16, entre 25 et 53 jours après la consommation de muscles parasités. L'ingestion de muscles de porcs parasités, par des furets, révéla que** *T. spiralis nativa* peut se propager chez le porc, en dépit d'un faible taux d'infectivité.


**Mots clés:** *Trichinella spiralis nativa*, infectivité, trichinose sylvatique, porcs, rats, carnivores.

## INTRODUCTION

Trichinosis has been recognized for many years as existing in two forms in Canada; sylvatic trichinosis in arctic mammals and urban trichinosis in rats with extension to swine in temperate regions (1). Biological differences between isolates have been described (2,3,4,5) although morphological differences have not been detected (2). However, there is no doubt that arctic isolates (*Trichinella spiralis nativa*) are significantly more resistant than urban isolates (*Trichinella spiralis spiralis*) to low temperatures and refrigeration (3,4,6).

In Canada and the United States refrigeration at −15° C has long been an accepted method of rendering pork and pork products sterile with regard to infections with *T. spiralis spiralis* (7,8). In view of the resistance of *T. spiralis nativa* isolates to low temperatures, the determination of the infectivity of *T. spiralis nativa* for swine becomes important. In 1970, Rausch reported failure to establish infection in a pig by feeding it partially dried meat from an infected arctic fox but successfully infected two young black bears by similar means (9). Later it was reported that *Trichinella* isolates from wild animals from Eurasia and North America were less virulent in pigs and rats than in carnivores (10).

Because little information on the infectivity of *T. spiralis nativa* in swine is available, a preliminary study was undertaken to compare and assess the infectivity of Canadian isolates of *T. spiralis nativa* in swine, rats and carnivores.

## MATERIALS AND METHODS

### *TRICHINELLA* ISOLATES

Four isolates of *Trichinella spiralis nativa* from widely separated geographic regions of Canada were used in this study. Isolate I was from a wolf killed near Nain, Labrador (56° 40′N, 62° 00′W) in April, 1980. The carcass had been frozen outdoors prior to shipping. Isolate II was from a wolf killed near Fort McMurray, Alberta (57° 00′N, 111° 15′W). Musculature from this wolf was held at −10° C prior to its use in this study. Isolate III originally had been recovered from a polar bear in Manitoba (58° 00′N, 95° 00′W) and had been passaged for 23 generations in outbred Swiss Webster mice (Crl COBS CFW (SW)) prior to use. Isolate IV was from a black bear killed near St. Augustine, Quebec (48° 50′N, 71° 45′W) in 1981. The bear meat had been frozen but at what temperatures and for how long are not known.

### EXPERIMENTAL ANIMALS

Pigs were either born and raised in the laboratory or purchased as weanlings from a commercial producer for use in the trials. Foxes and ferrets were ranch raised and purchased as adults. Cats were born and raised for the study. Wistar laboratory white rats were purchased from a commercial animal breeder. All experimental animals were maintained on commercially prepared food. The Canadian Council on Animal Care guidelines outlined in "Guide to the Care and Use of Experimental Animals, Volume I", were followed.

### METHODS OF INFECTION

All animals were fed infected musculature except for pig K (see Table I) which was given infective larvae by

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**TABLE I. Infectivity of *Trichinella spiralis nativa* Isolates Nos. I, II, III for Swine**

| Isolate | Source | Host Passages | Pig | Estimated Larval Dosage | Examination (dpf)[a] | Infection Established (l/g) |
|---|---|---|---|---|---|---|
| I | wolf | fox | A | 119 | 74 | 0 |
| I | wolf | fox — cat | B | 660 | 100 | 0 |
| I | wolf | fox — cat | C | 660 | 100 | 0 |
| I | wolf | fox — cat — fox — ferret — fox | D | 1460 | 32 | 0.016 |
| I | wolf | fox — cat — fox — ferret — fox | E | 1460 | 53 | 0.003 |
| I | wolf | fox — cat — fox — ferret — fox | F | 1460 | 103 | 0 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox — ferret — ferret | G | 1500 | 48 | 0 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox — ferret — ferret | H | 3500 | 50 | 0 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox — ferret — ferret | I | 7000 | 50 | 0 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox — ferret — ferret | J | 10000 | 49 | 0 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox — ferret — ferret | K | 10763[b] | 25 | 0.05 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox — ferret — ferret | L | 15000 | 42 | 0.012 |
| II | wolf | cat — ferret | M | 425 | 71 | 0 |
| II | wolf | cat — ferret | N | 1010 | 71 | 0 |
| III | Polar bear | mouse[c] — ferret | O | 426 | 71 | 0 |
| III | Polar bear | mouse[c] — ferret | P | 1000 | 71 | 0 |

[a]Days postfeeding
[b]Infected by stomach tube
[c]Through 23 generations

stomach tube. Some of the infected musculature fed to swine or rats was routinely fed to a carnivore for comparative purposes. Normal food was withheld for 24 h prior to feeding infected musculature. Larval dosages were estimated by digesting representative samples of the musculature (20-50 g depending upon the amount of musculature available) prior to the feeding trial. Pig K which was given viable larvae via stomach tube was tranquilized by administering 2 mL of xylazine (Rompun, Cutter Laboratories, Inc., Mississauga, Ontario) intravenously followed by ketamine hydrochloride (Ketaset, Rogar/STB, St. Hyacinthe, Quebec) to effect. Animals were killed from 25 to 241 days postfeeding with the majority between 40 and 100 days.

### DIGESTION TECHNIQUE

Infections in musculature were determined by digesting composite samples of tongue, masseter, intercostal, diaphragm, ventral abdominal and psoas muscles with a 0.6% pepsin-0.8% HCl mixture as previously described (8). A minimum of 50 g of musculature from each animal was digested. From swine a minimum of 100 and up to 500 g of musculature were digested.

### TRANSMISSION OF *TRICHINELLA SPIRALIS NATIVA* VIA SWINE

Transmission of *T. spiralis nativa* via swine was determined by feeding 100 or 200 g samples of infected porcine musculature to each of four ferrets. The ferrets were killed from 42 to 170 days postfeeding and musculature was digested for the presence of trichinae.

## RESULTS

The infectivity of *Trichinella spiralis nativa* isolates No. I, II and III for 16 pigs at estimated dosages of 119 to 15,000 larvae is given in Table I. Infections of 0.003 to 0.05 larvae per gram (l/g) of musculature were established in four pigs examined between 25 and 53 days postfeeding.

The infectivity of *T. spiralis nativa* isolates, No. I, II and IV for laboratory rats is given in Table II. Light infections were established in four of five rats given infected musculature.

The infectivity of the four *T. spiralis nativa* isolates for carnivores (ferrets, foxes and cats) is given in Table III. Infections ranging from 3 to 188 l/g were established in carnivores even with light to moderate larval dosages.

Transmission of *T. spiralis nativa* via infected porcine musculature occurred in all ferrets fed such musculature (Table IV).

## DISCUSSION

Isolates of *Trichinella spiralis nativa* from widely separated geographic areas of Canada consistently demonstrated a low infectivity for swine and rats but a much higher infectivity for carnivores, i.e. foxes, cats and/or ferrets which confirms previous observations that *Trichinella* isolates from wild animals from Eurasia and North America were less virulent in pigs and rats than in carnivores (10). Even though infectivity was consistently demonstrated in carnivores, there was considerable variation in the number of larvae established per gram of musculature which was not correlated with the estimated larval dosage nor with host passages. It has been reported that *Trichinella* from wild animals tend to perish or disappear from the

**TABLE II. Infectivity of *Trichinella spiralis nativa* Isolates Nos. I, II, IV for Laboratory Rats**

| Isolate | Source | Host Passages | Estimated Larval Dosage | Examination (dpf) | Infection Established (l/g) |
|---|---|---|---|---|---|
| I | wolf | fox — rat | 7 | 73 | 0.105 |
| I | wolf | fox — ferret — rat | 390 | 60 | 0.028 |
| I | wolf | fox — ferret — rat | 390 | 79 | 0 |
| II | wolf | rat | ND[a] | 86 | 0.006 |
| IV | black bear | rat | 1750 | 241 | 5.1 |

[a]Not determined

TABLE III. Infectivity of *Trichinella spiralis nativa* Isolates Nos. I, II, III, IV for Carnivores

| Isolate | Source | Host Passages | Estimated Larval Dosage | Examination (dpf) | Infection Established (l/g) |
|---|---|---|---|---|---|
| I | wolf | fox — cat | 21 | 73 | 13.2 |
| I | wolf | fox — ferret | 21 | 71 | 13.0 |
| I | wolf | fox — cat — ferret | 396 | 111 | 28.2 |
| I | wolf | fox — cat — fox | 660 | 142 | 4.4 |
| I | wolf | fox — cat — fox | 1320 | 142 | 18.5 |
| I | wolf | fox — cat — fox — ferret | 370 | 125 | 50.6 |
| I | wolf | fox — cat — fox — ferret — ferret | 708 | 87 | 54.6 |
| I | wolf | fox — cat — fox — ferret — fox | 622 | 193 | 36.5 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox | 600 | 49 | 14.0 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox | 600 | 212 | 33.2 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox — ferret | 280 | 72 | 7.6 |
| I | wolf | fox — cat — fox — ferret — fox — ferret — fox — ferret — ferret | 324 | 44 | 188.0 |
| II | wolf | cat | ND[a] | 86 | 3.0 |
| II | wolf | cat — ferret | 141 | 114 | 3.5 |
| II | wolf | cat — ferret — ferret | 250 | 144 | 147.6 |
| III | Polar bear | mouse[b] — ferret | 500 | 130 | 50.5 |
| III | Polar bear | mouse[b] — ferret — ferret | 250 | 144 | 55.1 |
| IV | Black bear | ferret | 1750 | 237 | 93.6 |

[a]Not determined
[b]Through 23 generations

TABLE IV. Transmission of *Trichinella spiralis nativa* to Ferrets via Porcine Infested Musculature

| Ferret | Source of Infected Musculature | Infection in Porcine Musculature (l/g) | Quantity Fed (g) | Examination (dpf) | Infection Established (l/g) |
|---|---|---|---|---|---|
| 1 | Pig D | 0.016 | 100 | 170 | 0.24 |
| 2 | Pig D | 0.016 | 100 | 170 | 0.32 |
| 3 | Pig L | 0.012 | 100 | 42 | 6.50 |
| 4 | Pig K | 0.05 | 200 | 62 | 2.35 |

musculature of swine quickly, mostly during the second month after infection (10). In the present study it is significant that the four pigs, in which one *T. spiralis nativa* isolate was established, were examined between 25 and 53 days postfeeding. Infections were not observed in any pigs held longer but the estimated larval dosages fed to these pigs were not large.

Not withstanding the light infections established in four of 16 pigs given *T. spiralis nativa* infected musculature or larvae and the apparent rapid disappearance of larvae from porcine musculature, the transmission trials in ferrets demonstrated that *T. spiralis nativa* may be passaged through swine. However it has not been determined if *T. spiralis nativa* can be transmitted from pig to pig. Swine containing less than one trichina per gram of musculature are generally not considered capable of causing clinical trichinosis in man (11); it is unlikely that strains of *T. spiralis nativa* in swine would constitute a major epidemological threat to humans. Furthermore, it has been suggested that the comparatively low intensity of trichinosis infection which is typical of arctic mammals may extend to man and account for the discrepancy between the high rate of positive intradermal tests and the comparative rarity of clinical trichinosis among aboriginal peoples in the arctic (9).

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