

Brief Communication

**SHEDDING OF HAMMONDIA HEYDORNI-LIKE OOCYSTS
BY FOXES FED MUSCULAR TISSUE OF REINDEER
(RANGIFER TARANDUS)**

As part of a study on the life cycle of *Sarcocystis* of reindeer (*Rangifer tarandus*), silver foxes (*Vulpes vulpes*), blue foxes (*Alopex lagopus*) and dogs were fed muscular tissue of adult reindeer slaughtered at abattoirs in Kautokeino and Karasjok, Finnmark county, Norway. The carnivores had been conventionally reared, but had never been given raw meat before. The carnivores were coccidia-free at the start of the experiments. Faeces were collected daily and examined for the presence of oocysts and sporocysts after flotation with a saturated salt solution.

Four separate experiments were carried out, using skeletal (mostly abdominal and thoracic) and/or cardiac muscle from 1 or 2 reindeer in each experiment. The skeletal muscle contained numerous macroscopically visible sarcocysts. Each carnivore was given 0.3—0.5 kg of muscular tissue in a single feeding.

A total of 12 foxes and 6 dogs were given raw meat, 4 foxes and 1 dog were given meat that had been kept frozen at -21°C for 2 or 5 days, and 4 foxes and 2 dogs acted as uninoculated controls.

None of the control animals, and none of the animals given meat that had been kept frozen, shed any oocysts or sporocysts during the experiments. Of the 18 carnivores given raw muscular tissue, 8 foxes shed small, unsporulated oocysts, while 11 foxes and 4 dogs shed sporocysts (Table 1).

Table 1. Shedding of oocysts and/or sporocysts by foxes and dogs fed muscular tissue of reindeer.

Experiment No.	Carnivores fed muscular tissue	Carnivores shedding	
		unsporulated oocysts	sporocysts
1	4 foxes, 2 dogs	4 foxes	4 foxes
2	2 foxes	2 foxes	1 fox
3	4 foxes, 2 dogs	—	4 foxes, 2 dogs
4	2 foxes, 2 dogs	2 foxes	2 foxes, 2 dogs

The 8 foxes started shedding oocysts 7 days post inoculation (DPI), and excreted oocysts for 6–23 days. On the first 4–5 days of patency they were shed in very large numbers, but later on only in low numbers.

The unsporulated oocysts were spherical to subspherical, pale, with a smooth, one-layered wall without a micropyle. They contained a spherical sporont consisting of coarse granules. Ninety-five unsporulated oocysts measured 10.7–15.3 (12.5 ± 1.0) \times 9.7–12.8 (11.1 ± 0.7) μm ($\bar{x} \pm s$). Sporulation was completed in less than 3 days at room temperature. Each sporulated oocyst contained 2 sporocysts with 4 sporozoites. Thirty sporocysts measured 7.0–9.0 (7.9 ± 0.7) \times 5.5–7.3 (6.4 ± 0.4) μm .

Foxes and dogs started shedding sporocysts 11–17 DPI, and shed sporocysts for at least 4 weeks. The sporocysts averaged $14.4 \times 10.4 \mu\text{m}$ in size, and each contained 4 sporozoites and a granular sporocystic residual body.

These sporocysts are considered to represent sporocysts of 1 or more species of *Sarcocystis* of reindeer (intermediate host), with the dog and the fox as definitive hosts. This will be dealt with in more detail in another paper.

The small, unsporulated oocysts shed by foxes in the present investigation, are considered to be oocysts of *Hammondia heydorni*. The oocyst morphology, the length of the prepatent period, and the mode of oocyst shedding are consistent with earlier descriptions of this parasite (*Levine & Ivens 1965, Heydorn 1973, Dubey & Fayer 1976*).

Oocysts of *Hammondia heydorni* have previously been found in the faeces of dogs fed tissues from naturally infected cattle, water buffalo, goats and moose, in the faeces of a coyote fed tissues from a naturally infected goat, and in the faeces of dogs and/or coyotes fed muscular tissue from cattle, sheep, goats and dogs experimentally infected with *Hammondia heydorni* oocysts (*Heydorn 1973, Dubey & Fayer 1976, Dubey & Williams 1980*). Dogs have not produced oocysts after ingestion of oocysts. Thus, *Hammondia heydorni* is considered to have an obligatory two-host life cycle with herbivores as natural intermediate hosts, and dogs and coyotes as definitive hosts.

However, *Hammondia heydorni*-like oocysts have also been found in the faeces of foxes fed tissues from sheep (*Ashford 1977*) and roe deer (*Entzeroth et al. 1978*). In the present investigation 8 foxes shed *Hammondia heydorni*-like oocysts after

ingesting muscular tissue from reindeer. As no dogs shed oocysts, it remains to be conclusively determined whether the fox is another definitive host for *Hammondia heydorni*, or definitive host for another species of *Hammondia*. Anyway, the reindeer must act as intermediate host with infectious stages of this parasite in its muscular tissue, although no tissue stages other than of *Sarcocystis* could be histologically demonstrated.

In the present investigation both silver and blue foxes shed *Hammondia heydorni*-like oocysts and *Sarcocystis* sporocysts. Under natural conditions in Finnmark it is likely that the red fox (*Vulpes vulpes*) and the arctic fox (*Alopex lagopus*), of which the silver fox and the blue fox, respectively, are colour mutants, act as definitive hosts for these coccidian parasites of reindeer.

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