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Predilection Muscles and Physical Condition of Raccoon Dogs (*Nyctereutes procyonoides*) Experimentally Infected with *Trichinella spiralis* and *Trichinella nativa*

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Mikkonen T, Oivanen L, Näreaho A, Helin H, Sukura A: Predilection muscles and physical condition of raccoon dogs *(Nyctereutes procyonoides)* experimentally infected with *Trichinella spiralis* and *T. nativa.* Acta vet. scand. 2001, 42, 441-452. – The predilection muscles of *Trichinella spiralis* and *T. nativa* were studied in 2 experimental groups of 6 raccoon dogs *(Nyctereutes procyonoides),* the third group serving as a control for clinical signs. The infection dose for both parasites was 1 larva/g body weight. After 12 weeks, the animals were euthanized and 13 sampling sites were analysed by the digestion method. Larvae were found in all sampled skeleton muscles of the infected animals, but not in the specimens from the heart or intestinal musculature. Both parasite species reproduced equally well in the raccoon dog. The median density of infection in positive tissues was 353 larvae per gram (lpg) with *T. spiralis* and 343 lpg with *T. nativa.* All the infected animals had the highest larvae numbers in the carpal flexors *(M. flexor carpi ulnaris).* Also tongue and eye muscles had high infection levels. There were no significant differences in the predilection sites between these 2 parasite species. Trichinellosis increased the relative amount of fat, but not the body weight in the captive raccoon dogs. Thus, *Trichinella* as a muscle parasite might have catabolic effect on these animals.

zoonosis; trichinellosis; nematode; parasite; larval distribution; symptoms; body weight; canidae.

Introduction

The raccoon dog *(Nyctereutes procyonoides)* is a medium sized carnivore about 5-8.5 kg of weight (*Kauhala* 1992) originating from eastern Asia. It has colonised most parts of Finland rapidly during the last decades (*Helle* & *Kauhala* 1991). The colonisation started with the introduction of the raccoon dog to the western regions of the former Soviet Union. This species has now permanently settled in Finland and has high population densities.

In Finland, raccoon dogs are often (50%) found to be infected with *Trichinella* (*Mikkonen et al.* 1995). The prevalence of trichinellosis in other Finnish wildlife is also high compared e. g. to Denmark (*Enemark et al.* 2000) and Germany (*Wacker et al.* 1999) where foxes are comparatively seldom infected (0.001% and 0.07%). In Finland the prevalence in foxes is 30%-62% and in lynx 40%-70% (*Hirvelä-Koski et al.* 1985, *Oksanen et al.* 1998, Anonymous 1999, *Mikkonen et al.* 2000). In Norway 8.5% of 697 foxes were found to carry *Trichinella* (*Prestrud* *et al.* 1993) whereas in Sweden 20% of the examined foxes were *Trichinella*-positive (*Ronéus & Christensson* 1979). Also in Russia, *Trichinella* is less common among wildlife: the parasite was found in 20% of foxes and 14% of raccoon dogs (*Bessonov* 1994*)*.

Until the early 1980's, domestic trichinellosis was found only occasionally in official meat inspections of Finnish pork, although positive samples from imported pork were observed (*Rislakki* 1956, *Oivanen & Oksanen* 1994). Domestic trichinellosis appeared in Finland at the time when the population density of the raccoon dog increased and seemed to reach the critical host density where it could serve as a potential reservoir and vector for rabies (*Nyberg et al.* 1992). Besides rabies, the population density of the raccoon dog has also been linked to abundance of sylvatic trichinellosis in lynx (*Oksanen et al.* 1998). Furthermore, *Oivanen & Oksanen* (1994) found fox trichinellosis to be rare in northern Finland, where the raccoon dog does not survive, but common in the southern parts of Finland were the population density of the raccoon dog is high.

To be an ideal reservoir, the host must tolerate the parasite. The parasite is then capable of reproducing efficiently in the host. The raccoon dog has turned out to be a versatile host for *Trichinella.* At least 4 *Trichinella* species have been found in natural infections of this canine; *T. pseudospiralis* (*Fukumoto et al.* 1988), *T. nativa, T. britovi* (*Wu et al.* 1998), and *T. spiralis* (*Yamaguchi* 1991). These 4 species have also been isolated in raccoon dog samples from Finland (*Oivanen et al.* 2002).

We hypothesize that the raccoon dog has a central role in the sylvatic cycle of trichinellosis in Finland, and the abundance of the parasite in sylvatic cycle is reflected in findings in domestic animals. The raccoon dog has also expanded its distribution area in Middle Europe (*Nowak* 1984, *Wlodek & Krzywinski* 1986). Intriguingly, there is also a report of a human outbreak from Korea caused by raccoon dog meat (ICT, 2001). Thus, it is essential to study the infection in raccoon dogs in details.

The aim of this study was to determine experimentally the predilection sites of muscle larvae of both domestic *Trichinella spiralis* and sylvatic *T. nativa* in the raccoon dog and study the influence of infection on the host's physical condition.

Materials and methods

Experimental animals and inoculation

Eighteen 3-month-old male raccoon dogs were purchased in the autumn from the Fur Animal Research Station (Juankoski, Finland) of the Institute of Applied Biotechnology, University of Kuopio. Three brothers from 6 different litters were divided into 3 groups. The 6 animals in each group were all from different litters, 4 with 1 father and 2 with another. During the experiment, animals were raised individually indoors without physical contact with other animals. The cages were placed in an unheated building but sheltered from wind and rain. Dry fur-animal feed and water were served ad libitum throughout the experiment. Some anorectic animals received processed canned cat feed for a few days to stimulate their appetite.

This experiment is part of an extensive study of effects of *Trichinella* infection in the raccoon dog (see also *Näreaho et. al.* 2000). The Ethical Committee on Animal Experiments of the Faculty of Veterinary Medicine approved the experiment.

Before the start of the experiment the raccoon dogs had a 10-day period to acclimatise to their new environment. Prior to the infection, the raccoon dogs were fasted for 12 h to ensure the palatability of the inoculum. Six animals were infected with *T. nativa,* 6 with *T. spiralis* and 6 served as a control group. The inoculum was given in mouse meat containing *Trichinella* to the raccoon dogs per os. The infection dose was 1 larva/g of body weight with both *Trichinella* species (range 6350-10800 larvae).

Trichinella isolates and preparation of inoculum

Both *Trichinella* isolates were from Finland: *T. spiralis* (ISS559) derived from domestic swine, and *T. nativa* (ISS558) from a wild raccoon dog. Species identification had been confirmed at the Trichinella Reference Centre in Rome (Istituto Superiore di Sanità) in 1997. The strains had been maintained in Swiss mice for 4 generations before the experiment. To obtain infective larvae for raccoon dogs, 2 groups of Swiss mice were infected, one with *T. nativa* and the other with *T. spiralis.* After 12 weeks, these mice were euthanised and the carcasses were pooled and minced with a standard kitchen mincer. The pooled mice meat sample had about 1300 larvae per gram (lpg) (*T. spiralis*) and 150 lpg (*T. nativa*).

Muscle samples and physical condition

After 12 weeks with the infection the raccoon dogs were euthanised by deep sedation with an intra-muscular injection of medethomidine 60 μg/kg (Domitor®, Orion, Espoo, Finland) and a combination of fenpipramidehydrochloride 0.015 mg/kg & methadonehydrochloride 0.3 mg/kg (L-Polamivet®, Hoechst Roussel Vet, Wiesbaden, Germany) followed by an intracardial T 61® injection (emputramid 200 mg, mebetzonjodid 50 mg, tetracainhydrochlorid 5 mg, Hoechst Roussel Vet, Wiesbaden, Germany). The animals were weighed to the nearest 5 g and their body lengths were measured. After skinning and evisceration the animals were weighed again. All the fat from the abdominal cavity was removed and weighed. The amount of subcutaneous fat was not measured. To determine the sexual maturity of the raccoon dogs, the caudal part of epididymis was fixed in 4% formaldehyde, embedded in paraffin and stained with Haematoxylin-Eosin for histological analyses.

Altogether 13 sites were chosen for the experiment. The muscles selected for the examination were: the tip of the tongue, the muscles of the eye *(Musculi bulbi),* the masticator muscles *(Musculus masseter),* the diaphragm, the wall of the abdomen (*M. obliquus externus* and *internus abdominis* with *M. transversus abdominis* muscles), 2 samples from the back (*M. longissimus lumborum* and *M. iliopsoas*), the forelimb (*M. triceps brachii* and *M. flexor carpi ulnaris*) and hind limb (*M. vastus lateralis* and *M. gastrocnemius*). We also sampled the heart and small intestine. In larger muscles or muscle groups 5-10 g were sampled and in the smaller ones, such as the eye muscles, the entire muscle group - cleaned from the orbital fat - was used. Muscles were freed from tendons and fascia and minced with a pair of scissors. After that the samples were artificially digested by the HCl-pepsin Stomacher–method according to a modified European Economic Community's Commission Directive 84/319/EEC (*Anon.* 1984). The larvae were counted on a Petri dish under a stereomicroscope (30X).

The weight of each raccoon dog's liver, spleen, kidneys and heart was recorded with Mettler PE 600 scales.

Faecal observations

Faeces of the experimental animals fell through the bottom of cages on the dishes below the wire net bottom. The factors considered were: the colour and consistency of stools, the amount of blood in the droppings and the amount of larvae passing through the intestine. For the larvae, the droppings were examined by the Baermann method (*Georgi & Georgi* 1990) from 2-8 g samples. Samples were examined with a stereomicroscope on a Petri dish. The amount of recognised blood was evaluated vi-

Table 1. The densities of *Trichinella nativa* and *T. spiralis* in examined muscles and muscle groups.

Muscle	RI [1)]	*T. nativa* (n=6) Median lpg	Range	RI	*T. spiralis* (n=6) Median lpg	Range
*M. flexor carpi ulnaris**	18	683.2	592-1151	22	840.7	296-1091
Eye	12	519	220-602	12	418.5	138-786
Tip of the tongue	12	498.2	252-642	13	519.3	121-690
*M. iliopsoas**	10	412.6	197-678	5	148.5	87-213
M. masseter	9	379.3	250-485	7	256.8	127-465
M. gastrocnemius	8	296.5	268-515	9	295.7	167-545
Diaphragm	8	319.5	258-427	7	243.2	165-279
M. triceps brachii	7	264.3	194-401	7	262.2	124-321
Mm. oblique abdominis	6	211.6	162-391	6	201.4	95-363
M. vastus lateralis	6	222.1	177-308	7	246.7	161-392
M. longissimus dorsi pars lumbar	5	191.9	158-331	4	154.5	71-187
Total	101	342	158-1151	99	353	71-1091
Heart	0	0	0	0	0	0
Intestine	0	0	0	0	0	0

[1)] RI gives the relative infection level using the total lpg of each animal as a reference, median lpg and the range of larvae per gram of sample.
*Differences between the 2 parasites were significant ($p<0.05$, Kruskal-Wallis nonparametric AOV).

sually by classifying samples in 3 groups +, ++, +++. Two faecal samples pre-infection and 14 samples post-infection, over a 2-week period, were collected. Animals were also observed daily for clinical symptoms.

Statistical analysis

The total larval density, calculated striated muscle specimens of each animal, was used to describe the level of infection. To compare the distribution of larvae between and within individuals, a relative measure in percentages (RI; relative infection) was calculated for each sampling site, using the lpg-number of all the examined positive muscle of the certain individual animal as a 100% reference value; $RI=100*(lpg_{examined\ muscle} / lpg_{total})$, in which lpg_{total} is a sum of all the individual muscle densities (lpg).

When comparing the distribution of larvae in different muscle groups, we used Kruskal-Wallis one way analysis of variance. The difference in the predilection muscles between 2 groups was examined by a Friedman 2-factor analyses of variance (ANOVA).

The abdominal fat/eviscerated body weight ratio of the raccoon dogs was calculated by fat percent, which was used as a body condition measurement. The Fisher exact test was used for evaluation of a possible association between the intestinal symptoms and the occurrence of parasites. Linear analysis of variance (ANOVA) was used for comparing the body weight and the weight of organs between groups (eviscerated weight as a covariate). The statistical software package Statistix for Windows (Analytical Software 1996) was used for statistical analysing of the data.

Results

Predilection sites

At the termination of the experiment all the infected animals revealed heavy parasite loads. From 13 examined muscles/muscle groups

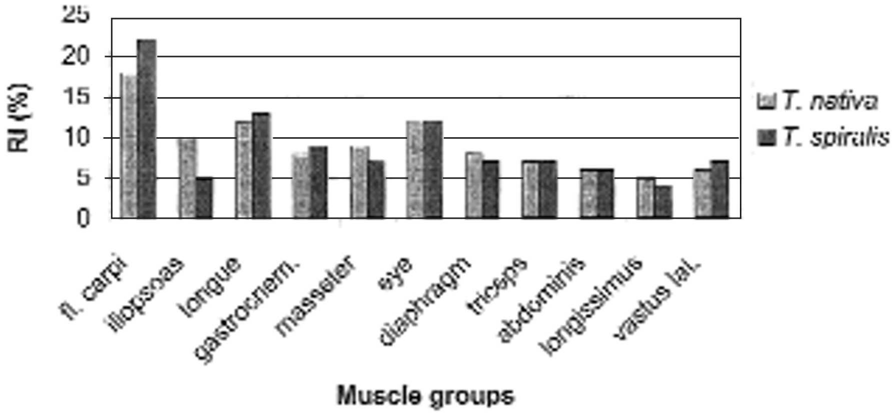

Figure 1. Distribution of *Trichinella spiralis* and *T. nativa* in all positive muscle samples. Numbers given represent the relative number of muscle larvae in the raccoon dogs.

Trichinella larvae were recovered in all 11 skeletal muscles of the infected raccoon dogs, but no larvae were found in the heart and small intestine in any of the animals. The densities of *Trichinella* positive tissue varied between 71-1091 larvae per gram (lpg) (median 353 lpg) in the *T. spiralis* and 158-1151 lpg (median 342 lpg) in the *T. nativa* group (Table 1). The highest larval burdens were found in the front leg muscle, *M. flexor carpi ulnaris,* for both groups. *M. flexor carpi ulnaris* was the most heavily infected muscle in every *Trichinella* positive animal. Also the tongue and eye muscles were good indicators of the infection (Fig. 1). Unexpectedly, *Trichinella* was also found in 1 control animal at a low density: 0.08 larva/g of muscle in a pooled 300 g digestion sample.

The larval distribution (RI) between the striated muscles of individual raccoon dogs differed significantly both in *Trichinella spiralis* (Kruskal-Wallis statistic 38.9, df 10, $p<0.0001$) and *T. nativa* (Kruskal-Wallis statistic 43.3, df 10, $p< 0.0001$) groups (Fig. 1). *T. spiralis* animals had a significantly higher relative larval count in the carpal flexors than did those in the *T. nativa* group (Kruskal-Wallis statistic 5.0, $p<0.05$), whereas *T. nativa* was more prone to *M. iliopsoas* (Kruskal-Wallis statistic 5.8, $p<0.05$) than was *T. spiralis* (Table 1.). There were no significant differences in the predilection sites between these 2 parasite species, when comparing RI -values of positive muscles in individual animals with Friedman 2-way non-parametric AOV (Friedman statistic 0.4, df 1, $p>0.05$), although *T. nativa* did show a higher level of infection.

Both *T. spiralis* and *T. nativa* reproduced equally well in the raccoon dog. The total sum of lpg in examined muscles did not differ between *T. spiralis* and *T. nativa* animals (Kruskal-Wallis Statistics 0.4, $p>0.5$).

Physical condition

Variables referring to the physical condition (body weight, the amount of fat, weight of tested organs etc.) of the raccoon dogs are shown in Table 2. The infected control animal was excluded when testing the effects of trichinellosis on the raccoon dogs.

There was no significant difference in the body

Table 2. Variables considering physical condition of the raccoon dogs.

Variable	*T. nativa* (n=6)		*T. spiralis* (n=6)		Control (n=5)	
	Mean	Range	Mean	Range	Mean	Range
Body weight (g)						
Beginning	7225	6350-8500	7650	5750-10300	8433	6200-10150
End	9191	8150-10750	10175	8900-12650	10958	9300-12500
Growth (g) [1)]	1966	100-3800	2525	1200-3650	2525	1300-4300
Fat (g)	152	90-210	185	133-267	137	93-206
Fat % [2)]	2.4#	1.5-3.1	2.6#	2.2-3.1	1.7**	1.4-1.9
Relative weight (%)[2)]						
Heart	0.52	0.47-0.62	0.49	0.44-0.54	0.47	0.32-0.61
Liver	5.43	4.09-7.61	4.28	3.78-4.76	3.97	3.04-5.09
Spleen	0.21	0.18-0.26	0.24	0.15-0.3	0.21	0.15-0.29
Kidney	0.44	0.36-0.58	0.37	0.35-0.39	0.34	0.25-0.44

[1)] The growth of the animals is the difference of the body weight in the beginning and the end of the experiment.
[2)] Calculated from the eviscerated body weight. **; significant differences ($p<0.01$) between infected animals and controls tested by ANOVA and Bonferroni, #; differences not significant.

weight between infected and non-infected animals at the termination of the experiment (ANOVA, $p>0.05$, controlled by the body weight at the beginning of the experiment). Nor did the growth of the raccoon dogs during the experiment differ between the 3 groups (ANOVA, $p>0.05$, initial body weight as a covariate).

Because there were no differences in physical condition (fat %) between *T. spiralis* and *T. nativa* infected animals (ANOVA, $p>0.05$), these 2 infected groups were pooled together. The physical condition of the animals was connected to the occurrence of the parasites (ANOVA, $p<0.01$), the infected raccoon dogs being significantly more fatty than uninfected animals. However, the absolute amount of fat (g) did not differ between infected and uninfected animals (ANOVA, $p>0.05$, initial body weight as a covariate). The difference in eviscerated body weight between infected and uninfected animals was significant (ANOVA, $p<0.05$, initial body weight as a covariate) the infected animals having lower body weight than the uninfected.

The weights of the tested organs did not differ between the infected and uninfected raccoon dogs (ANOVA, $p>0.05$ in all examined organs, eviscerated body weigh as a covariate). The test results are not shown. The mean weight of the heart in all the animals was 34.4 g (range 27.5-39.6 g). Correspondingly, the mean weight of the spleen was 15.5 g (range 10.3-23.4), the liver 320 g (range 229-452 g) and the mean weight of right kidney was 26.9 g (range 20.1-38.7 g).

Faecal observations

The most prominent sign of trichinellosis was that a few raccoon dogs lost their appetite soon, few days after infection. Poor consumption of feed continued in some individuals even for 5 or 6 weeks. Although the total amount of the faeces was not measured, it is worth noting that during the 2-week period, when the faecal droppings were examined, the amount of faeces from most of the infected animals was very small. Unlike the controls, it was often not possible to get even a sample as small as 5 g from the infected raccoon dogs. Coprostasis was present only once or twice in 4 animals in all the test groups and was not analysed statistically. Also in the early phase of the experiment, the infected animals seemed to shed more hair than the controls, but this factor was not statistically analysed.

Short-term diarrhoea was observed in 5 *T. spiralis* and 5 *T. nativa* – infected animals, whereas 3 animals from the control group had diarrhoea during the 2-week-sampling period. The difference between the control and infected animals was not significant (Fisher exact test, $p>0.05$).

Four *T. spiralis* and 5 *T. nativa* infected animals had haematochezia 2 weeks after the beginning of the experiment, whereas blood was found only once from 1 sample of a control animal. The infected groups were pooled together and they showed bloody faeces significantly more often than the controls (Fisher exact test, $p<0.01$).

Larvae passing through the intestine were found only in the *T. spiralis* group during the two-week period. All together 124 larvae were found for 2-6 days after the infection from all the 6 animals infected with *T. spiralis*. The stage of larvae found was not determined.

Maturity

Seven raccoon dogs were able to produce spermatozoa. The 3 oldest males in the *T. spiralis* and control group were mature, but there was only 1 mature animal in the *T. nativa* group, but the difference was not statistically significant.

Discussion

T. nativa is found from sylvatic animals (*Pozio* 1998), whereas *T. spiralis* is more typical for the synanthropic cycle (*Pozio et al.* 1992a). Sylvatic *Trichinella* species are supposed to reproduce better in a natural host (*Leiby & Bacha* 1987). Our raccoon dogs had been kept for only a few generations as fur animals and thus they probably had not genetically diverged far from their wild relatives. Therefore our hypothesis prior to the experiment was that *T. nativa* infected animals would be carrying heavier infections than the *T. spiralis* group. Surprisingly, all the infected animals were found to have high numbers of parasites regardless of the species involved.

Reproductive capacity has been reported to be higher in *T. spiralis* than in *T. nativa* in different host species e.g. in mice and guinea pigs (*Bolas-Fernandez & Wakelin* 1989, 1990, *Pozio et al.* 1992b; *Webster et al.* 1999). The fecundity is also dependent on the host's response to infection (*Wakelin & Goyal* 1996) as well as on the host species (*Webster et al.* 1999). The larval counts of these 2 parasites show both *T. nativa* and *T. spiralis* to be well adapted to the raccoon dog or vice versa.

The infection was administered in a rather high dose, 1 larva/g body weight, the total number of the given larvae varying from 6350 to 10800. Differences between predilection sites are more obvious when an animal is heavily infected. In heavy infections the predilection sites depend on the larvae's saturation in the muscles, whereas in light infection the distribution relies on the blood flow in the muscle (*Serrano et al.* 1999). Also *Christensson & Lunsjö* (1994) reported that the distribution of *Trichinella* depends on the infection level in pigs.

We found similar pattern in other studies on predilection muscles of wild animals (*Kapel et al.* 1994, 1995). Earlier has been pointed out that the larval density probably depends on the motorial potential of the muscle more than the actual activity of these muscles (*Henriksen* 1981, *Kapel et al.* 1994). Our results support these findings. In addition to eye and tongue muscles, distal extremities of the raccoon dogs were heavily infected despite the fact that the animals lived in cages where their movement was restricted. The highest larval burden in *M. flexus carpi ulnaris* might be a reflection of the raccoon dogs' habit of digging and using fore legs. According to *Kapel et al.* (1995, 1998), predilection sites also seem to be more dependent on the host species than the parasite species. Interestingly, *T. spiralis* differed from *T. nativa* being even more prone to infect the carpal flexors.

One control animal showed mild infection of 0.08 lpg in a large pooled digestion sample. Serological findings by ELISA indicated that the contamination has happened during the experiment, not before it. The contaminated animal had no specific antibodies at the beginning of the experiment, but seroconverted 3 weeks later than experimentally infected animals (*Sukura et al.* 2002, in press). Because the hygiene at every turn during the experiment was of a very high standard and the animals were handled separately, there is no clear explanation of the contamination and the source of the infection remains unclear.

Because the contaminated animal was slightly infected, the possible influence on the physical condition of the animal was probably small. However, in this study we decided to exclude this animal from the control group.

Body weight as well as the amount of fat often indicates an animal's physical status. Although weight loss of the infected raccoon dogs was remarkable in the first 2 weeks post infection (*Näreaho et al.* 2000), the body weight at the end of the experiment did not differ significantly between the infected and control animals. Loss of weight has been reported i.e. in human patients (*Mäkelä* 1970, *Gould* 1970) and hamsters (*Behnke et al.* 1994), but in the raccoon dog it seemed to be found only in the intestinal phase of infection (*Näreaho et al.* 2000). Also *Trichinella*-infected dogs lost weight 2 weeks after infection, but after that their body weight increased rapidly to initial level (*Schanbachter & Nations* 1978). Neither the occurrence of *Trichinella* nor the density of infection affected the body weight of naturally infected foxes (*Prestrud et al.* 1993) and raccoon dogs (*Mikkonen et al.* 1995).

Several studies have demonstrated impaired absorption during the intestinal phase of trichinellosis (*Castro & Bullick* 1983). Intestinal larvae, using host's food resources or interfering with absorption could be one reason for the weight loss of infected animals during the intestinal phase of the infection. However, there was no difference at the end of the experiment between the *T. nativa* and *T. spiralis* group despite the longer intestinal phase of *T. nativa.*

The longevity of adult *Trichinella* in different species or isolates is controversial. In Martínez-Fernándes and Sanmartín-Durán's experiment (1981) *T. nativa* stayed longer in the intestine than *T. spiralis.* This was also evident in this study; *T. spiralis* larvae were found in the faeces for 2 to 6 days post infection during two weeks follow up, whereas no *T. nativa* larvae could be detected. However, opposite results also exist (*Sukhdeo & Meerovitch* 1980, *Chadee et al.* 1983). *Sukhdeo & Meerovitch* (1980) assumed that the duration of the adults living in the intestine is determined by the infectivity of the parasite, so that the least infective isolates leave first and the most infective last. We could not confirm this, because both *T. spiralis* and *T. nativa* bred equally well in this host. *T. nativa* staying longer in the intestine than *T. spiralis* might indicate the parasites' better adaptation to the natural host (*Leiby & Bacha* 1987). It is also possible that the larvae found in the faeces have not fastened on the intestinal wall.

Interestingly, animals with *Trichinella* had a higher relative amount of fat than the controls. The relative proportions of fat but not the absolute amounts of fat of the raccoon dogs differed between the infected and control animals. Therefore, it indicates that the difference is in the bone and muscular compartments of the eviscerated body. This result suggests that *Trichinella* as a muscle parasite might have catabolic effect on these animals. One possible explanation for the phenomenon could be that the protein metabolic necessary for building the muscles is disturbed by the parasite.

One of the most common clinical features reported in human trichinellosis has been diarrhoea (*Gould* 1970, *Pozio et al.* 1993, *Capo & Despommier* 1996). The strength of the symptoms depends on the *Trichinella* species involved, and the infection dose (*Pozio et al.* 1993, *Capo & Despommier* 1996, *Jongwutiwes et al.* 1998). Diarrhoea usually appears during the first week post-infection and lasts until the end of the fifth week (*Capo & Despommier* 1996). Some infected raccoon dogs had diarrhoea, but it was rather mild and usually disappeared after 2 weeks of infection.

Intestinal haemorrhage is rare in human trichinellosis (*Gould* 1970). In our infected raccoon dogs bloody faeces were found significantly more often than in controls. Mucosal irritation in strong diarrhoea could also cause bleeding, but in this case it can not be the only reason, because there was no significant difference in the consistency of faeces between the test groups. However, faeces were not studied after the 2-week period and thus possible differences in haemorrhaging could not be identified later.

An evident sign in these animals was loss of appetite, which was directly related to the amount of faeces. Constipation and small amount of faeces could also be due to intestinal muscular dysfunction caused by a nematode induced intestinal infection (*Barbara et al.* 1997, *Venkova et al. 1999*).

Maturity seems to be more dependent on the age of raccoon dogs than the effect of trichinellosis. The animals were born within 1 month of each other and the older ones had reached maturity, but younger ones had not.

This study indicates that the raccoon dog can act as an efficient reservoir for both sylvatic and domestic trichinellosis.

According to these results, the authors would recommend the *M. flexor carpi ulnaris* and the tongue as practical indicator muscles of *Trichinella* when routinely examining raccoon dogs in survey studies.

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Sammanfattning

Predilektionsort i muskulatur och fysisk kondition hos mårdhundar (Nycterentes procyonoides) experimentellt infekterade med Trichinella spiralis och T. nativa.

Predilektionsort av *T. spiralis* och *T. nativas* i muskulaturen undersöktes med hjälp av 2 testgrupper innehållande sex mårdhundar var. En grupp infekterades med *T. spiralis,* den andra med *T. nativa.* En tredje grupp fungerade som kontrollgrupp för kliniska symptom.

Infektionsdosen för båda parasiterna var 1 larv/gr kroppsvikt. Djuren avlivades efter 12 veckor och muskelprov från 13 olika lokalisationer undersöktes med hjälp av digestionsmetoden. Alla skelettmuskelprov från de infekterade djuren innehöll larvar, medan inga larvar påträffades i prover från hjärt- och

tarmmuskulatur. De 2 undersökta parasitarterna förökade sig lika bra i mårdhundarna. Infektions intensitetens median i positiv vävnad var 352 larvar per gram (lpg) för *T. spiralis* respektive 343 lpg för *T. nativa.*
Alla infekterade djur uppvisade det högsta larvantalet i *M. flexor carpi ulnaris.* Tunga och ögonmuskulatur visade sig också vara goda indikatorer för infektionen. De 2 parasiterna uppvisade ingen signifikant skillnad i predilektionsort.
Trikinellos ökade den relativa fettmängden, men inte kroppsvikten, hos de undersökta mårdhundarna. Därav antas *Trichinella* som muskelparasit kunna ha en katabolisk effekt hos dessa djur. Både djur infekterade med *T. spiralis* och djur med *T. nativa* led av blodig avföring signifikant oftare än kontrollgruppens djur i experimentets tidiga skeden. De infekterade djuren hade däremot inte diarre signifikant oftare än kontrolldjuren.

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