

PREVALENCE OF TOXOCARA INFECTION IN DOMESTIC DOGS AND CATS IN URBAN ENVIRONMENT

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Toxocariasis is the type of helminthic infection found in dogs and cats most often. It is a zoonotic disease that presents a serious threat to the national public health. Urban environment favors transmission of toxocara from animals to people; soil is the key element of such transmission. To learn the degree of toxocara invasion in domestic cats and dogs living in Moscow, we studied their feces for 7 years applying the flotation method. We found that in domestic dogs the intensity of toxocara invasion was 2.43%, but there is a big difference between puppies and adult animals: 5.53% of the former, twice as much as the latter, suffered from the invasion. The intensity of infection in adult cats was 3.97%; kittens, same as puppies, were more prone to host toxocara: 10.44% of those examined did. In general, 5.75% of cats had toxocara, which is twice as much compared to dogs; the figure applies to all ages. Stable infestation of domestic animals with this species of helminths makes them a constant source of toxocara eggs contamination in urban environments, which ups the risk of larvae toxocariasis for people.

Keywords: prevalence of toxocariasis, toxocara, domestic dogs, domestic cats

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РАСПРОСТРАНЕНИЕ ТОКСОКАРОЗНОЙ ИНВАЗИИ У ДОМАШНИХ СОБАК И КОШЕК В ГОРОДСКИХ УСЛОВИЯХ

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Токсокароз — один из самых распространенных гельминтозов собак и кошек. Заболевание является зоонозом и представляет серьезную проблему для отечественного здравоохранения. В городской среде создаются благоприятные условия для передачи токсокар от домашних животных к человеку, при этом почва играет ведущую роль в распространении данной инвазии. С целью изучения интенсивности инвазии токсокарами домашних собак и кошек, проживающих на территории г. Москвы, в течение 7 лет проводили исследование фекалий флотационным методом. Показано, что в среднем интенсивность инвазии токсокарами у домашних собак составляет 2,43%, но при этом зараженность щенков в 2 раза выше, чем взрослых особей и составляет 5,53%. Средняя интенсивность инвазии у взрослых кошек составляет 3,97%, а у котят — 10,44%. В целом зараженность кошек токсокарами составляет 5,75%. Исследования показали, что в целом зараженность кошек токсокарозом в 2 раза выше, чем у собак, во всех возрастных группах. Стабильная зараженность домашних животных данным видом гельминтов делает их постоянным источником обсеменения городской среды яйцами токсокар, что создает напряженную эпидемическую обстановку в плане возможности заражения людей ларвальной формой токсокароза.

Ключевые слова: распространенность токсокар, токсокароз, собаки, кошки

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Toxocariasis is a parasitic disease caused by *Toxocara* nematodes that affects dogs and cats. Mature helminth worms concentrate in the small intestine of carnivores; reaching soil with the excrements of infected animals, toxocara eggs remain alive and capable to invade a host for a long period of time. Toxocariasis in dogs and cats is one of the most common helminth infections in the city of Moscow. Some reports claim that 11.9% to 18.1% of all domestic dogs living in the city suffer from this disease; as for the stray dogs of Moscow, the infection rate is up to 55% [1, 2]. The share of domestic cats hosting toxocara is 11.1%. Prenatal and transmammmary

mechanisms of disease transmission makes youngest animals especially susceptible to the invasion of *Toxocara* nematodes [3]: all (100%) stray puppies and over a half (57.1%) of stray kittens host the worms [4, 5].

Soil is the key media where the larvae survive and through which toxocariasis spreads [6]. The main source of contamination and subsequent invasion is the feces of infected animals; toxocara eggs, especially those capable of infecting animals, are very resistant to the adverse factors of the environment [7]. Analysis of the soil collected in Moscow revealed that the average content of toxocara eggs is 13.5%

(range — from 1.1% to 46.9%); at the playgrounds adjacent to residential housing the figure was 14.8% [8, 9]. One study put the number of toxocara eggs found in 1 kg of the Moscow's soil at 25 to 500 pieces [1]. Contamination was the highest in the areas where people walk their dogs.

Human toxocariasis is primarily a chronic disease. After infection, toxocara larvae migrate through the human organism carried by lymph and blood flow, which results in damage to various tissues and organs and sensitization by the parasite's metabolism byproducts. Clinical manifestations of human toxocariasis are varied, but generally they translate into damage to internal organs, liver and lungs for the most part, but also eyes and the central nervous system. Cutaneous toxocariasis causes changes peculiar to *larva migrans*. There is a number of factors that define the severity of the disease, including the number of infectious eggs swallowed, frequency of reinvasion, response of the organism to the damage done and antigenic effect produced by migrating larvae, their concentration site. Combined, such factors shape the development of pathological changes and the disease prognosis in general [10].

Most often, *Toxocara* nematodes invade adults who often contact animals and/or contaminated soil (occupational hazard) and children whose personal hygiene skills are yet insufficient. Infection occurs more often in rural areas, where contact with soil is more common and domestic animals are not subjected to preventive dehelminthization [11]. However, the well-developed social infrastructure in big cities does not eliminate the threat of contracting toxocariasis [12]. The number of domestic dogs grows, and stray dogs and cats migrate freely, which translates into the growing number of toxocara infested sites in the cities and ensures continued activity of those that already exist. Quite often, numerous owners of domestic dogs walk their pets in small parks and squares and do not pick the excrements their animals leave there. As a rule, dogs and cats enter playgrounds freely, and sandboxes have no lids or tarpaulins. Stray cats cover their excrements with sand or loose earth, which turns

playground sandboxes into toxocariasis infection reservoirs dangerous to children.

Throughout the country, researchers analyze the spread of human toxocariasis, as well as the degree of the population's seropositivity to the antigens of these nematodes. The figures received are various. Overall, the occurrence of human toxocariasis in Russia doubled from 2003 to 2007 [12]. For example, in Tula the level of seropositivity is 19.3%, in Ekaterinburg — 2%, in Vladivostok — 8.6%, up to 20.8% in the Altai Republic, in Moscow — up to 17%. In the south of Russia the infection rate is 14.6 to 36.4%, which is 2–3 times higher than in other parts of the country [5, 12–15].

The role *T. canis* and *T. cati* nematodes play in the current situation is yet to be established. Single cases of feline toxocara infection in human beings were registered (damage to eyes and internal organs reported) [16]. Current examination methods, serological identification of toxocara do not allow establishing the type of nematodes the patient is infected with.

The purpose of our research was to investigate the prevalence of toxocara invasion of gastrointestinal tract of domestic dogs and cats in Moscow.

METHODS

The study lasted 7 years, from 2011 to 2017. *Pasteur* veterinary lab and the K. I. Skryabin All-Russian Scientific Research Institute of Fundamental and Applied Parasitology of Animals and Plants were the facilities where we analyzed 1632 samples of feces of domestic dogs and 1146 sample of feces of domestic cats. The samples were delivered to the laboratory in the special plastic or glass containers.

The feces were examined using ammonium nitrate (density of 1.24), flotation method. Biological microscope *Biolam* (LOMO; Russia) was used to study the samples, magnification $\times 10$, $\times 40$. After examination, samples were decontaminated through autoclaving.

Table 1. Indices of infection by *Toxocara* of domestic dogs

Year	Puppies, total	Infected, of them	EI (%)	Adult dogs	Infected, of them	EI (%)	Total	Infected, of them	EI (%)
2011	13	1	7.69	35	1	2.85	48	2	4.16
2012	83	2	2.4	225	3	1.33	308	5	1.62
2013	74	8	10.8	219	3	1.36	293	11	3.75
2014	64	3	4.68	195	3	1.53	259	6	2.31
2015	97	4	4.12	201	2	14.3	298	6	2.01
2016	75	3	4	185	2	1.08	260	5	1.92
2017	46	4	8.6	120	1	0.83	166	5	3.01
Total	452	25	5.53	1180	15	1.27	1,632	40	2.45

Note: EI — the extensity of infestation.

Table 2. Indices of infection by *Toxocara* in domestic cats

Year	Kittens, total	Infected, of them	EI (%)	Adult cats	Infected, of them	EI (%)	Total	Infected, of them	EI (%)
2011	19	1	5.26	57	1	1.75	76	2	2.63
2012	51	6	11.76	151	1	0.66	202	7	3.46
2013	56	7	12.5	147	6	4.08	203	13	6.4
2014	57	6	10.5	127	4	3.14	184	10	5.43
2015	56	5	8.92	140	4	2.85	196	9	4.59
2016	51	5	9.1	121	7	5.78	172	12	6.97
2017	26	3	11.53	87	10	11.49	113	13	11.5
Total	316	33	10.44	830	33	3.97	1,146	66	5.75

Note: EI — the extensity of infestation.

RESULTS

The average rate of toxocara infestation in domestic dogs is 2.45% (Table 1). Throughout the term of the research, we have witnessed various degree of infection: in adult animals it ranged from 0.83 to 2.85%, in puppies from 2.4 to 10.8%. On the whole, the prevalence on the parasite infection in puppies is two times higher than in adult dogs, reaching an average of 5.53% (Fig. 1).

Table 2 shows the data on toxocara infestation in domestic cats: the average rate for adult animals is 3.97%, minimum registered in 2012 (0.66%) and maximum in 2017 (11.49%). Same as puppies, kittens suffer infestations more often than adult cats (10.44%). Overall, 5.75% of cats host toxocara. Figure 2 and Figure 3 show the results of studies reporting that cats are infested with such nematodes twice as often as dogs (both adult and young animals).

DISCUSSION

Analysis of literature describing the like research efforts has shown that toxocara infestation in dogs and cats is the one diagnosed more often than other intestinal helminthiases, but the rates of infestation vary [4, 18–20]. The studies report that up to 7.3% of adult domestic dogs suffer the infection, while the share of toxocara nematodes hosts among puppies is 30.2%; the figures for cats are 11.1% (adult animals) and up to 33.3% (kittens) [4]. Researchers that studied stray dogs and cats have registered the maximum infestation rate in puppies (100%) and kittens (57.1%) [4]. Such differences in research depend on the category of animals selected. For example, the data we have outlined above describes domestic cats and dogs and shows that the toxocara infection rate among them is quite low. This may be due to the specifics of parasitological research in a commercial laboratory, which is the destination veterinarians send their patients to for analysis when there is a suspected case of toxocariasis or owners of domestic dogs and cats wish to subject their pets to examination.

Nonintensive invasions without clinical symptoms peculiar to toxocariasis often cancel the need to suspect that the animal suffers this type of helminthiasis. There is no doubt that a general screening of all domestic dogs and cats would produce higher infestation rates.

CONCLUSIONS

The study conducted has shown that there is a functioning site of toxocara infestation within the boundaries of the megalopolis of Moscow. This nature of this disease is zoonotic; it poses serious social and medical dangers since the infection can be contracted by people via the components of their environment contaminated with invasive toxocara eggs.

Thus, timely and regular laboratory examinations, treatment and preventive dehelminthization of pets would allow reducing the risk of contamination of urbanized territory with toxocara eggs. Stray animals have not been subjected to such activities for a long period of time, which made them a source of infestation targeting both other dogs and cats and human

beings. Epidemiologists need to regularly examine soil and samples from sandboxes in search for toxocara eggs, as well as recommend property managing companies to fence playgrounds in order to prevent neglected stray animals from entering them.



Fig. 1. *T. canis* eggs



Fig. 2. *T. cati* egg



Fig. 3. *T. cati* invasive egg

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