коров, больных послеродовым эндометритом и терапевтическая эффективность некоторых препаратов / Л. Н. Рубанец // Ученые записки Витебской ордена «Знак Почета» государственной академии ветеринарной медицины. – 1998. – Т. 34. – С. 68 – 71. 5. Нежданов, А. Г. Влияние утеротона на заболеваемость коров субинволюцией матки и их воспроизводительную функцию / А. Г. Нежданов, К. А. Лободин // Теоретические и практические аспекты возникновения и развития болезней животных и защита их здоровья в современных условиях : материалы Международной конференции, посвященной 30–летию Всероссийского научно-исследовательского ветеринарного института патологии, фармакологии и терапии, 3–4 октября 2000 года, г. Воронеж. – Воронеж, 2000. – Т. 1. – С. 188–189. 6. El-Azab, E. A. Effect of some uterotonic drugs on expulsion of placenta in dairy cows / E. A. El-Azab, S. M. Sharawy, F. M. Labib // Congress proceedings. – 1988. – Vol. 3. – P. 205–206. 7. Ершов, Ф. И. Система интерферона в норме и при патологии / Ф. И. Ершов // Природа интерферонов. – М. : Медицина, 1996. – С. 34–38. 8. Интерфероногены: перспективы клинического применения / М. Г. Романцов [и др.]. – Москва, 1998. – 39 с. 9. Скориков, В. Н. Применение бычьих рекомбинантных α-,γ-интерферонов и простагландина $F_{2\alpha}$ для профилактики острого послеродового эндометрита у коров / В. Н. Скориков // Ветеринарный фармакологический вестник. – 2019. – № 2 (7). – С. 51–55. 10. Скориков, В. Н. Применение бычьих рекомбинантных α-, γ–интерферонов для профилактики острого послеродового эндометрита у коров / В. Н. Скориков, В. И. Михалёв // Ветеринарный фармакологический вестник. – 2019. – № 1 (6). – С. 69–72.

References. *1. Turchenko, A. N. Etiologiya i lechenie poslerodovogo endometrita korov / A. N. Turchenko // Veterinariya. – 2001. – № 7. – S. 35–37. Galon, N. Factors affecting fertility of dairy cows in Israel / N. Galon, Y. Zeron, E. Ezra // J. Reprod. Dev. – 2010. – Jan. 56. – S. 8–14. 3. Gavrish, V. G. Furapen – novyj preparat dlya profilaktiki i lecheniya endometrita u korov / V. G. Gavrish, V. S. Avdeenko // Nauchnye aspekty profilaktiki i terapii boleznej sel'skohozyajstvennyh zhivotnyh : materialy nauchnoj konferencii, posvyashchennoj 70–letiyu FVM VGAU im. K. D. Glinki. – Voronezh, 1996. – S. 64–65. 4. Rubanec, L. N. Mikroflora matki korov, bol'nyh poslerodovym endometritom i terapevticheskaya effektivnost' nekotoryh preparatov / L. N. Rubanec // Uchenye zapiski Vitebskoj ordena «Znak Pocheta» gosudarstvennoj akademii veterinarnoj mediciny. – 1998. – T. 34. – S. 68 – 71. 5. Nezhdanov, A. G. Vliyanie uterotona na zabolevaemost' korov subinvolyuciej matki i ih vosproizvoditel'nuyu funkciyu / A. G. Nezhdanov, K. A. Lobodin // Teoreticheskie i prakticheskie aspekty vozniknoveniya i razvitiya boleznej zhivotnyh i zashchita ih zdorov'ya v sovremennyh usloviyah : materialy Mezhdunarodnoj konferencii, posvyashchennoj 30–letiyu Vserossijskogo nauchno-issledovatel'skogo veterinarnogo instituta patologii, farmakologii i terapii, 3–4 oktyabrya 2000 goda, g. Voronezh. – Voronezh, 2000. – T. 1. – S. 188–189. 6. El-Azab, E. A. Effect of some uterotonic drugs on expulsion of placenta in dairy cows / E. A. El-Azab, S. M. Sharawy, F. M. Labib // Congress proceedings. – 1988. – Vol. 3. – P. 205–206. 7. Ershov, F. I. Sistema interferona v norme i pri patologii / F. I. Ershov // Priroda interferonov. – M. : Medicina, 1996. – S. 34–38. 8. Interferonogeny: perspektivy klinicheskogo primeneniya / M. G. Romancov [i dr.]. – Moskva, 1998. – 39 s. 9. Skorikov, V. N. Primenenie bych'ih rekombinantnyh α-,γ-interferonov i prostaglandina F2α dlya profilaktiki ostrogo poslerodovogo endometrita u korov / V. N. Skorikov // Veterinarnyj farmakologicheskij vestnik. – 2019. – № 2 (7). – S. 51–55. 10. Skorikov, V. N. Primenenie bych'ih rekombinantnyh α-, γ–interferonov dlya profilaktiki ostrogo poslerodovogo endometrita u korov / V. N. Skorikov, V. I. Mihalyov // Veterinarnyj farmakologicheskij vestnik. – 2019. – № 1 (6). – S. 69–72.*

Поступила в редакцию 11.01.2022.

DOI 10.52368/2078-0109-58-1-55-59
UDC 619:616.995.1

INTESTINAL PARASITIC PATHOGENS OF DOGS FROM HOMELESS ANIMAL SHELTERS (NUR-SULTAN, KAZAKHSTAN)

***Lider L.A. ORCID ID 0000-0001-5842-0751, **Bauer Ch. ORCID ID 0000-0002-6671-2102,**
***Ussenbayev A.Ye. ORCID ID 0000-0002-1508-7335, *Berdikulov M.A. ORCID ID 0000-0002-1304-0354,**
***Seitkamzina D.M. ORCID ID 0000-0003-2245-9317, *Aitbay A.B. ORCID ID 0000-0002-5346-180X,**
***Zhanabayev A.A. ORCID ID 0000-0002-1267-3814**
*****Saken Seifullin Kazakh Agrotechnical University, Nur-Sultan, Kazakhstan
******Justus Liebig University Giessen, Germany

Faecal samples of 114 stray dogs older than one year of age and kept at the central animal shelter in Nur-Sultan City were examined by the Fuelleborn method for gastrointestinal parasites. Faecal stages of 6 different helminth and 2 protozoan parasites were detected in 49 (42.9%) of the samples: Toxascarisleonina eggs were most prevalent (29.8%) followed by Toxocaracanis (4.4%) and taeniid eggs, possibly of Echinococcus sp. eggs (4.4%), Dipylidiumcaninum egg capsules (3.6%), Trichurisvulpis eggs (1.8%), ancylostomatid eggs (1.8%). Cystoisosporacanisoocysts and Sarcocystis sp. sporocysts were detected in 4.4% and 0.9% of the samples, respectively. Mixed infections with T. leonina and other parasites were found in 17 cases (14.9%). These results showed that control of parasite infections in the animal shelter should be strongly improved, also to prevent the infection of humans with zoonotic parasites. ***Keywords****: shelter, dog, coprological study, prevalence, intestinal parasites*

Introduction. Parasitic diseases cause significant damage to human health and their economic activity, despite the increase in the sanitary-hygienic level of the population of developed countries. It is proved that the environment is polluted by eggs of geohelminthes and cysts of pathogenic protozoa, which can be a

source of the population infection. For example, in 2000-2012 eggs of *Toxocara spp., Ascaris spp., Trichuris spp.*, and cysts of *Giardia spp.* were found in 41.3% of soil and sand samples in Voronezh [1]. It is believed that stray dogs are of paramount importance in the spatial distribution of parasitic elements in populated areas, especially in urban areas, [2]. Therefore, studies of the fauna of carnivorous parasites are relevant, since it is impossible to develop an effective system of antiparasitic measures without assessing the current state of biodiversity of parasites in a city and identifying the circle of their hosts [3].

It is well known that dogs become infected with many types of endoparasites, including helminths and protists, including the causative agent of such a dangerous zoonosis as echinococcosis. The possibility of transplacental vertical invasion of *Toxocara canis* provides a high level of infection of puppies. In addition, protozoan parasites such as *Giardia spp..*and *Isospora spp.*. are often observed in young animals. These parasites pose a threat to the health of dogs, and in some cases for humans. The veterinary service and animal owners are directly responsible for controlling such a situation and are required to take appropriate measures to prevent infection of animals and the population.

The main role in the spread of helminth infections is played by stray dogs, which, as far as possible, are caughting by a special service for catching dogs and placing them in shelters. But, shelters for dogs are a source of the spread of various parasitic infections and many scientists in the world have been studying them.

Dogs entering shelters can carry gastrointestinal parasites that may pose serious risks to other animals, shelter staff and visitors. Shelters provide an environment that could facilitate the spread of parasitic infections between animals. Nematodes and protozoa that transmit through ingestion or skin penetration are major enteric parasites of concern in shelter settings. *Ancylostoma spp., Uncinaria stenocephala, Toxocara canis, Toxascaris leonina, Trichuris vulpis* and *Dipylidium caninum* are the major helminths while *Giardia, Cryptosporidium, Isospora spp.* and *Sarcocystis spp.* are the most prevalent protozoan parasites in shelter dogs. The prevalence of gastrointestinal parasites in shelter dogs is typically higher than in owned dogs [4].

M.F. Sommer et al. (2017) examined 134 fecal samples for the presence of gastrointestinal parasites using the concentration method of merthiolate-iodine-formalin (MIFC), as well as Giardia-coproantigen using an enzyme-linked immunosorbent assay (ELISA) in dogs living in two private shelters in Belgrade, Serbia. Taeniid eggs were identified by PCR and sequence analysis. Overall, at least one of nine different endoparasites was detected in 75.4% (101/134) of the dogs. *Giardia duodenalis* coproantigen was found most frequently (45.5%; 61/134), followed by eggs of *Ancylostomatidae* (41.0%; 55/134), oocysts of *Hammondia/Neospora* (11.2%; 15/134), eggs of *Toxascaris leonina* (9.7%; 13/134), oocysts of *Isospora canis* (8.2%; 11/134), eggs of *Trichuris vulpis* (6.7%; 9/134), cysts of *Sarcocystis spp.* (4.5%; 6/134), eggs of *Toxocara canis* (3.0%; 4/134) and eggs of *Taenia spp.* (1.5%; 2/ 134). The results of the study confirm a high parasitic burden in the investigated shelter dogs and call for an effective deworming program including an improved hygiene management in the affected facilities [5].

D. Otrantoet al. (2017) claim that Sheltered and stray dogs represent reservoirs of zoonotic parasites worldwide, especially in the context of the current global changes and economic crisis. Stray dog populations are an underestimated problem in several countries, and management policies are virtually nonexistent, or not applied, particularly in developing nations. Relocation of stray dogs from southern to northern countries of Europe has contributed to the establishment of parasites and/or their vectors in previously nonendemic areas. Poverty and low public health standards may further worsen the welfare of dogs in developing and industrialized countries [6].

The control of intestinal helminthiasis is based on evidence from monitoring the dynamics of pathogens through ongoing diagnostic studies of animals. Thus, conducting studies on assessment of the invasive diseases prevalence in order to inform dog owners and organization of appropriate veterinary activities is relevant for modern society.

The aim of this work was to study the infection of parasitic intestinal enteropathogens in the population of dogs in a shelter for homeless animals in the city of Nur-Sultan, and to identify invasions that are potentially dangerous to human health.

Material and methods of research. *Study population.* The shelter of homeless animals in the city of Nur-Sultan was organized by the akimat under the pressure of the society for the protection of animals. During the study period, about 400 dogs were kept here, which were captured in various areas of the city by the AstanaVetService or surrendered by the owners due to the impossibility of further care for the animals. According to the established rules, which are approved by the city akimat, animals are not subject to euthanasia and are in the shelter until there are new owners. Dogs were of both sexes, not purebred or of different breeds, most of the animals belonged to the adult age group.

Skatology. In April 2019, feces from 114 dogs kept in individual enclosures over the age of one year were taken. Samples were collected in the morning before cleaning the enclosures and delivered to the Professor Kadyrov's Laboratory of Parasitology in S. Seifullin Kazakh Agro-Technical University where for a day they were examined by the Fulleborn flotation method with a saturated sodium chloride salt (with a solution density of up to 1.2).

From the upper meniscus of each test treated with a salt solution, at least three sample drops were removed using a wire loop, placed on a glass slide, covered with a coverslip and examined under a light microscope at a magnification of ×40, ×100. Parasites were determined as species by the morphological characteristics of helminth eggs and protozoa oocysts. Due to the similarity of eggs of the families Ancylostomatidae and Taeniidae, as well as sporocysts of the genus *Sarcocystis*, they were not differentially diagnosed to species. Waste material was disposed by autoclaving.

Results of the research. Laboratory studies showed that 49 or 42.9% from the studied group of shelter dogs were infested by intestinal enteropathogens of parasitic etiology. At the same time, part of the detected parasites belonged to zoonoses (table 1).

Table 1 - Parasitic enteropathogens of the digestive tract of dogs in a shelter of stray animals (n=114)

Taxonomic affiliation of parasites	Invasive elements	The number of positive tests	Theprevalence,%	Zoonotic nature
Toxascarisleonina	Helminth eggs	34	29.8	-
Toxocara canis	Helminth eggs	5	4.4	+
Trichuris vulpis	Helminth eggs	2	1.8	-
Ancylostomatidae	Helminth eggs	2	1.8	+
Dipylidium caninum	Capsules	4	3.6	+
Taeniidae	Helminth eggs	5	4.4	+
Cystoisospora canis	Oocysts	5	4.4	-
Sarcocystis sp.	Sporocysts	2	1.8	±
The number of worm-infested dogs		49	42.9	

During coproscopy of fecal specimen, Toxascarisleonina eggs were detected in 29.8%, Toxocaracanis – 4.4%, Trichurisvulpis – 1.8%, Ancylostomatidae – 1.8%, Taeniidae – 4.4%, and Dipylidiumcaninum cocoons – 3.6% of animals. Oocysts of Cystoisosporacanis were found in 4.4% and sporocysts of Sarcocystis sp. – 1.8% of the livestock kept in the shelter (table 1).

Thus, the dogs of this shelter were most often infested with ascarids of the *Toxascarisleonina* and the *Toxocaracanis*, the second species being parasites dangerous to humans. Apparently, the conditions of detention in the shelter (high humidity and non-compliance with sanitary and hygienic requirements) are conducive to maintaining the biotic potential of ascarid type helminths.

Among protozoal diseases in dogs, cystoisosporoses with an invasion rate of 4.4% were recorded. The invasion intensity varied from several units to dozens of oocysts in the field of the microscope view. In this case, the clinical manifestations of isosporosis were completely absent.

Sarcocystosis was observed in 1.8% of dogs. The transmission of the invasion takes place with the participation of the intermediate host, so the dogs become infected with sarcocysts when they were feeding them raw meat or when they eat rodents. In animals in whose feces sarcosporidiumoocysts were detected, as a rule, no changes in the digestive tract and general condition were noted.

It should be noted that the spread of parasitic protozoa among dogs is due to many factors. On one hand, this is directly related to the biological characteristics of protozoa and, first of all, to their high stability in the external environment, which ensures the transmission of invasion from an infected animal to a healthy one. On the other hand, favorable conditions are created not only for the spread of intestinal protozoa, but also for the introduction of protozoa previously not registered in the city due to increasing migration, an increase in the population of stray animals, as well as violation of the conditions for keeping dogs in the shelter.

According to our studies, parasites in the intestinal tract occurred in the form of monoinvasion, and in 14.9% of animals parasitocenoses formed, mainly in the form of associations of two or three enteropathogens (Table 2). At the same time, the composition of all parasitocenoses included the species *T. leonina*, which both in terms of prevalence and invasion intensity was the dominant type of parasitocenosis of the intestines of dogs. We assume that this specificity of parasite infection in the shelter under study is determined by the high crowding of animals, when due to the lack of individual enclosures, most dogs live in flocking conditions.

This provides the conditions for parasitic infestations, especially those transmitted by the oral-fecal route. Several studies comparing different dog populations (domestic, stray and in kennels) showed higher infection of animals in shelters and kennels than pets, due to the fact that keeping dogs in a limited area leads to an increase in environmental contamination and an increased risk of infection [7, 8]. Thus, ideal

conditions are brought about in shelters for the rapid spread of intestinal parasites from single animals to a large part of the population [9].

Table 2 – Poly invasion of intestinal parasites of dogs (n=114)

Composition of parasite associations	Invasive elements	The number of positive tests	Theprevalence,%	Zoonoticnature
Double invasion				
T.leonina + *T.canis*	Eggs	4	3.6	+
T.leonina + Ancylostomatidae	Eggs	1	0.9	+
T.leonina + *D.caninum*	Eggs, cocoon	3	2.6	+
T.leonina +Taeniidae	Eggs	2	1,8	+
T.leonina + *Sarcocystis*sp.	Eggs, sporocyst	2	1.8	±
Triple invasion				
T.leonina + *D.caninum* +Taeniidae	eggs, cocoons	5	4.4	

In general, a poly invasion of two articulations of different species composition was found in 10.5% of the animals studied. However, we assume that the actual picture of the intestinal parasitocenoses of dogs in this shelter is represented by a much larger set of species, since the present studies were carried out by a method the diagnostic effectiveness of which is limited to a specific set of species. Therefore, it is desirable to conduct additional coprological studies, including the use of molecular biological and enzyme-linked immunosorbent assays, to identify the complete picture of the invasion in dogs by parasitic enteropathogens.

For example, in Romania, a comprehensive study by coproscopic and molecular diagnostic methods in 71.2% of dogs of different populations (farm, shelter, shepherd and domestic) revealed Giardia cysts, which were found in association with T.canis (26.9%), Isosporaohioensis (23.1%), Ancylostomacaninum (17.3%), Uncinariastenocephala (13.5%), T.vulpis (11.5%), Hammondiaheydorni/Neosporacaninum (9.6%), Sarcocystis spp. (9.6%), Isosporacanis (7.7%), Capillariaaerophila (5.8%), Strongyloidesstercoralis (93.8%), Dipylidiumcaninum (1.9%) and T.leonina (1.9%). Moreover, the highest rates of invasion were observed in shelter animals [10].

In Portuguese animal shelters, in 23% of dogs also found a predominance of Giardia in combination with enteric pathogens such as *Ancylostoma spp*., *Isospora spp*., *T.canis*, *Trichuris spp*. and *T.leonina*[11]. The parasitofauna of the intestinal tract of stray dogs in Tirana, Albania, included three species of protozoa and cestodes, five species of nematodes and one species of acantocephalus, with up to six species for each individual [12]. Thus, the literature data confirm our results and confirm that in the intestines of dogs, under the condition of crowded content, associations of parasites representing different taxonomic groups are formed.

Our studies have revealed a fairly diverse species composition of intestinal parasitic pathogens, and nematodes and cestodes, including zoonotic species, are the most common parasites in the stray dog population of Nur-Sultan. The degree of clinical display of intestinal parasitosis is diverse and depends on several factors: the type of invasion and its intensity, the age and condition of the animal's body, the presence of a diseases combination of a bacterial or viral nature.

Studies aimed at determining the species composition of intestinal parasites are necessary for the successful treatment of animals and are also of great scientific importance, which consists in observing the dynamics of the spread of parasitoses among animals and humans. These observations will correctly assess the current epizootic situation and give recommendations on reducing the spread of intestinal parasites among carnivores and the population.

It should be noted that similar epidemiological studies of stray dog populations in shelters are carried out to identify factors that contribute to the emergence of parasitic diseases and pathogens, including zoonotic ones, to develop appropriate measures to minimize the level of tension of the endemic state of carnivorous and human parasitoses.

Conclusion. Enteropathogens are important components of the biocenosis fauna, which affect the well-being of animal populations. In a shelter for homeless animals in Nur-Sultan, 42.9% of dogs were infested with intestinal parasitic enteropathogens, including pathogens of zoonoses. The invasion rate of the Toxascarisleonina sheltering dog population was 29.8%, Toxocaracanis 4.4%, Taeniidae 4.4%, Dipylidiumcaninum 3.6%, Trichurisvulpis 1.8% and Ancylostomatidae 1.8%. Cystoisosporacanisoocysts were found in 4.4% and Sarcocystis sp. – 0.9% of the animals. At the same time, in 14.9% of dogs in the intestines parasitocenoses of two and three types of parasites with the dominance of T. leonina were observed. To prevent the invasion of people by zoonoses and make the right decisions in organizing optimal management of intestinal enteropathogens in the shelter, it is necessary to systematically monitor the infection of dogs with helminths and other internal parasites.

References. *1. Menyaylova, I. S. Kishechnyyeinvaziiplotoyadnykh v gorodeVoronezhe [Intestinal carnivore infestations in the city of Voronezh] / I. S. Menyaylova, S. P. Gaponov // Russian Parasitological Journal. – 2012. – No 2. – P. 30–33. 2 Moskvina, T. V. Parazitarnyyeboleznisobakikoshek v g. Vladivostoke [Parasitic diseases of dogs and cats in Vladivostok] / T. V. Moskvina, L. V. Zheleznova // Russian parasitological journal. – 2017. – Vol. 39, is. 1. – P. 55–58. 3. Estimation of canine intestinal parasites in Córdoba (Spain) and their risk to public health / F. J. Martinez–Moreno [et al.] // Vet. Parasitol. – 2007. – Vol. 143, № 1. – P. 7–13. 4 Gastrointestinal Parasites in Shelter Dogs: Occurrence, Pathology, Treatment and Risk to Shelter Workers / J. Raza [et al.] // J. Animals (Basel). – 2018. – № 8 (7). – P. 108. doi: 10.3390/ani8070108. 5. Silaghi Gastrointestinal parasites in shelter dogs from Belgrade, Serbia / M. F. Sommer [et al.] // J. Veterinary Parasitology: Regional Studies and Reports. – 2017. – № 7. – P. 54–57. DOI: 10.1016/j.vprsr.2017.01.001. 6. Zoonotic Parasites of Sheltered and Stray Dogs in the Era of the Global Economic and Political Crisis / D. Otranto [et al.] // J. Trends in Parasitology. – 2017. – Vol. 33, No 10. – P. 813–825. DOI:https://doi.org/10.1016/j.pt.2017.05.013.7. Prevalence of Giardia duodenalisand Cryptosporidium spp. in dogs from different living conditions in Uberlandia, Brazil / M. J. S. Mundim [et al.] // Vet. Parasitol. – 2007. – Vol. 144. – P. 356–359. 8. Meireles, P. Survey of giardiosis in household and shelter dogs from metropolitan areas of Curitiba, Parana state, Southern Brazil / P. Meireles, F. Montiani-Ferreira, V. Thomaz-Soccol // Vet. Parasitol. – 2008. – Vol. 52. – P. 242–248. 9. Bowman, D. D. Internal Parasites / D. D. Bowman // Infectious Disease management in animal shelters / eds. L. Miller, K. Hurley. – Iowa : Wiley-Blackwell, 2009. – P. 209–221. 10. Mircean, V. Prevalence and risk factors of Giardia duodenalis in dogs from Romania / V. Mircean, A. Györke, V. Cozma // Vet. Parasitol. – 2012. – Vol. 184, I. 2–4. – P. 325–329. 11. Intestinal parasites in dogs and cats from the district of Évora, Portugal / F. S. Ferreiraa [et al.] // Vet. Parasitol. – 2011. – Vol. 179, I. 1–3. – P. 242–245. 12. Principal intestinal parasites of dogs in Tirana, Albania / D. Xhaxhiu [et al.] // Parasitol. Research. – 2011. – Vol. 108, I. 2. – P. 341–353.*

Поступила в редакцию 17.11.2021.