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INTESTINAL HELMINTH AND COCCIDIAN PARASITES IN STRAY DOGS HOUSED IN THE MUNICIPAL ANIMAL SHELTER OF NUR-SULTAN CITY AND RECOMMENDATIONS FOR A PARASITE CONTROL

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Abstract

Faecal samples of 114 stray dogs, older than one year of age and housed at the municipal animal shelter of Nur-Sultan city (Astana), were examined by the Fuelleborn method for gastrointestinal parasites in April 2019. Faecal stages of 6 different helminth and 2 coccidian parasites were detected in 49 (43%) of the samples: *Toxascaris* (*Ts*.) *leonina* was the most prevalent species (29.8%), followed by *Toxocara canis* (4.4%), taeniids (possibly *Echinococcus* sp., 4.4%), *Dipylidium caninum* (3.6%), ancylostomatids (probably *Uncinaria stenocephala*, 1.8%) and *Trichuris vulpis* (1.8%). *Cystoisospora canis* oocysts and *Sarcocystis* sp. sporocysts were detected in 4.4% and 0.9% of the samples, respectively. Mixed infections of *Ts. leonina* with other parasites were found in 17 cases (14.9%). These results show that the control of parasite infections of dogs housed in the shelter should be substantially improved to reduce the risk of parasite transmission to both animals and humans; it aims to improve the health of animals and to minimize the risk of human infection with zoonotic parasites, such as *Toxocara* and *Echinococcus*.

Keywords: shelter, dog, intestinal parasites, coprological study, eggs, sporocysts, oocysts, mixed infections, prevalence.

Introduction

The global total dog population was estimated at approximately one billion animals in 2010, and the estimated number for Kazakhstan was more than 1.6 million dogs. The estimates assume that at least 10% of the dogs are strays [1]. Stray dogs are a significant problem in many countries, including Kazakhstan, especially because of the risk of transmission of

rabies to humans [2]. The prevalence of gastrointestinal parasites and ectoparasites is usually high in shelter dogs, and the intensity of infection is much heavier than in owned animals [3]. Free-ranging dogs also play an important role in the transmission of zoonotic parasites, such as the tapeworm *Echinococcus granulosus* and the roundworm *Toxocara canis*, which may cause clinical disease in humans (cystic echinococcosis and larva migrans syndrome, respectively) [4]. Therefore, stray dogs had been often killed in many countries in the past to protect humans from these infections.

However, dogs are the first domesticated animals (approximately 35,000 years before present) [5], and since then they have become “man’s best friend”. Therefore, the management and control of stray dog populations have been changed in the decades due to the significant social demand in terms of animal welfare. In Nur-Sultan city (the former Astana) the regulations, established and approved by the city government in early 2017, mandate that stray animals are not subject to killing but admitted to the municipal animal shelter, where they are temporarily kept until new owners are found [6].

According to the internationally valid rules of the World Organization for Animal Health (OIE) a program to control stray dog populations may include inter alia the following points [7]:

- improvement of the general health of dogs, reduction of the number of stray animals in a city or region;
- reduction of the risk of zoonotic diseases including parasitoses (e.g., echinococcosis);
- prevention of both the environmental contamination with infectious agents and the infection of other animals.

Of course, the success of appropriate activities is based inter alia on the knowledge of the health status of the shelter animals, including the infection with endoparasites (tapeworms, nematodes, protozoa) and ectoparasites (mites, ticks, fleas). Therefore, the purpose of this preliminary study was to receive current data on the intestinal parasite fauna of stray dogs housed at the municipal animal shelter of Nur-Sultan city, as a basis for recommendations of the parasite control in the shelter in future.

Material and methods

Study population

Approximately 400 dogs of both sexes, mostly mongrels and adult animals, were housed at the municipal shelter of Nur-Sultan city (Figure 1-4) at the time of this study. Most of them had been captured as strays by the ‘Astana Vetservice’ from various urban and suburban districts; a small number of dogs had been handed over by their owners to the shelter due to care problems in the households.

Faecal analysis

Fresh faecal samples were collected from 114 stray dogs of both sex, older than one year of age and housed in individual cages at the shelter in April 2019. The samples were first macroscopically examined for excreted cestode proglottids or nematode specimens and then processed by the qualitative Fuelleborn method using saturated sodium chloride solution (specific density: 1.2) as flotation fluid [8] in the Prof. Kadyrov Parasitology Laboratory of S. Seifullin Kazakh Agro Technical University. Parasite stages found were determined according to their morphological characteristics (see Figure 5).

Figure 1- Municipal shelter of Nur-Sultan city, April 2019 (©photos: C. Bauer).

Figure 2- Municipal shelter of Nur-Sultan city, April 2019 (©photos: C. Bauer).

Figure 3- Municipal shelter of Nur-Sultan city, April 2019 (©photos: C. Bauer).

Results

A total of 49 (42.9%) of the 114 dogs examined were positive for at least one parasite species. Faecal stages of 6 different helminth and 2 coccidian parasites were detected: *Toxascaris* (*Ts*.) *leonina* eggs were the most prevalent stages, followed by *Toxocara* (*T*.) *canis* eggs, taeniid (possibly *Echinococcus* sp., see [9]) eggs, *Dipylidium* (*D*.) *caninum* egg capsules, ancylostomatid eggs (probably *Uncinaria stenocephala*, see [9]), and *Trichuris* (*Tr*.) *vulpis* eggs. Additionally, *Cystoisospora* (*C*.) *canis* oocysts and *Sarcocystis* sp. sporocysts were found (Table 1). Mixed infections of *Ts. leonina* with other parasites (*T. canis*, ancylostomatids, *D. caninum*, taeniids, or *Sarcocystis* sp.) were found in 14 dogs (14.9%). Figure 2 presents the morphology of the parasite stages detected.

Table 1 - Intestinal parasite stages found in faecal samples of stray dogs (*n* = 114) aged >1 year and housed in the municipal animal shelter of Nur-Sultan city (April 2019)

Parasite species	Stage found	Number of positive dogs	Prevalence (%)	Zoonotic importance
Toxascaris leonina	Egg	34	29.8	-
Toxocara canis	Egg	5	4.4	+
Ancylostomatid sp.	Egg	2	1.8	+
Trichuris vulpis	Egg	2	1.8	-
Taeniid sp.	Egg	5	4.4	+
Dipylidium caninum	Egg capsule	4	3.6	**(+)**
Cystoisospora canis	Oocyst	5	4.4	-
Sarcocystis sp.	Sporocyst	2	1.8	-

Discussion

The most interesting result of this study was the high prevalence of the infection with the roundworm species *Ts. leonina* confirming the data of a previous necropsy study in stray dogs from northeast Kazakhstan (24%) [9]. It is similar to the data reported from wolves in southern Kazakhstan (39%) [10], as well as from stray dogs in Dagestan, southern Russia (13–40%) [11] and Iran (18%) [12]. However, this canine roundworm species was much lower prevalent in shelter dogs from Moscow and other Russian cities (0–12%) [13], and in stray dogs from many other regions of the world, such as the Van region, Turkey (13%) [14], Jordan (3%) [15], cities of Madrid and Barcelona, Spain (6% and 4%, respectively) [16, 17], Osaka, Japan, (0.5%) [18] or city of Queretaro, Mexico (2%) [19]. Differences in the respective local climate condition or hygiene situation may be partly responsible for these large regional differences in the prevalence of *Ts.*

leonina, but further factors influencing its occurrence have to be found to explain them plausibly.

Some of the parasites detected in the stray dogs (*Ts. leonina*, *T. canis*, ancylostomatids, *Tr. vulpis*, and *C. canis*) have a so-called **direct (homoxenous) life cycle** with only one host species involved. Thus, infectious parasite stages are directly transmitted from one dog to another one, usually after a certain period of the development in the environment. For example, *T. canis*-infected dogs shed worm eggs with their faeces. Infectious stages develop in the eggs within 2–3 weeks. Later on, they are ingested by other dogs from the ground; however, these stages can also survive for a long period of time (months or years) in the environment [20]. Of course, shelters often provide ideal conditions for a transmission of homoxenous parasites due to contaminated soil, overcrowding, group-housing and close contact among the animals (see also Figure 1) [3]. Incoming dogs should always be considered infected with parasites; therefore, they must be treated with appropriate antiparasitic drugs as soon as possible after arrival at the shelter. Additionally, minimum hygiene standards [21] have to be applied to prevent the transmission of these parasites.

Other parasite species found (taeniids, *D. caninum*, and *Sarcocystis* sp.) have a so-called **indirect (heteroxenous) life cycle** in which two different host species are obligatorily involved. For example, dogs are the so-called definitive hosts of taeniid tapeworms (*Taenia* spp., *Echinococcus* (*E.*) *granulosus*) and of certain *Sarcocystis* spp. They shed respective stages (worm eggs or sporocysts) with the faeces. Specific intermediate hosts, e.g., rodents (rats, mice) for certain *Taenia* spp. or sheep and other ruminants for *E. granulosus*, must ingest these faecal stages from the environment. Thereafter the stages being infectious to dogs (cysticercus, hydatid cysts or sarcocysts, respectively) develop in muscle tissue or liver of the respective intermediate host. Finally, dogs become infected by ingestion of this tissue [20]. In other words, a direct transmission of these heteroxenous parasite species from dog to dog is principally not possible. In order to protect dogs from new infections with these parasites, they must be offered no raw meat as food and must not ingest small mammals in the shelter. Of course, tapeworm-infected dogs must be treated with a cestocidal compound as soon as possible to prevent the dissemination of eggs and the contamination of the environment.

Parasite infections are not always clinically apparent; for example, the roundworm species *Ts. leonina*, being the most prevalent parasite detected in our study, is considered as unimportant because it neither causes clinical disease in dogs nor is of zoonotic relevance [22]. However, many other parasite species can cause serious diseases in dogs, at least in case of heavy infection: *T. canis*, especially in puppies [3, 20], *Cystoisospora* spp. [23], *Uncinaria* [24] and *Trichuris* [25]. Additionally, some of them pose a risk to public health causing zoonotic diseases, e.g., *Echinococcus* (cystic echinococcosis) and *Toxocara* (larva migrans

syndrome) [4]. Again, all incoming dogs must be treated with appropriate antiparasitic compounds as soon as possible in the shelter also to minimize the risk of accidental infection of shelter workers and other people [3].

Recommendations for a parasite control in the municipal animal shelter

The present results indicate that both the parasite control of dogs and general management practice (see also Figure 1) in the municipal shelter of Nur-Sultan city are more or less improper. Therefore, they have to be substantially improved to reduce the risk of transmission of parasite and other infectious diseases to both animals and people.

For this, a standard operating procedure (so-called “SOP”) should be written in consultation with veterinarians to ensure that health care practices are routinely implemented by all staff members of the shelter. The shelter workers (both employees and volunteers) have to be informed about possible infection risks and trained in appropriate preventive measures. Protective clothing, gloves, rubber boots etc. must be free available for the staff members. The implementation of measures should be monitored by a veterinarian. All measures, vaccinations and treatments of each individual animal should be recorded in a “shelter diary”. Concerning parasites, the SOP should contain parasite-related subjects in addition to general hygiene practices and core vaccinations against infectious diseases (in dogs: rabies, canine distemper, infectious canine hepatitis, leptospirosis, and parvovirus) [21]. Important parasite-related “no-go” and “go” subjects are listed in Table 2.

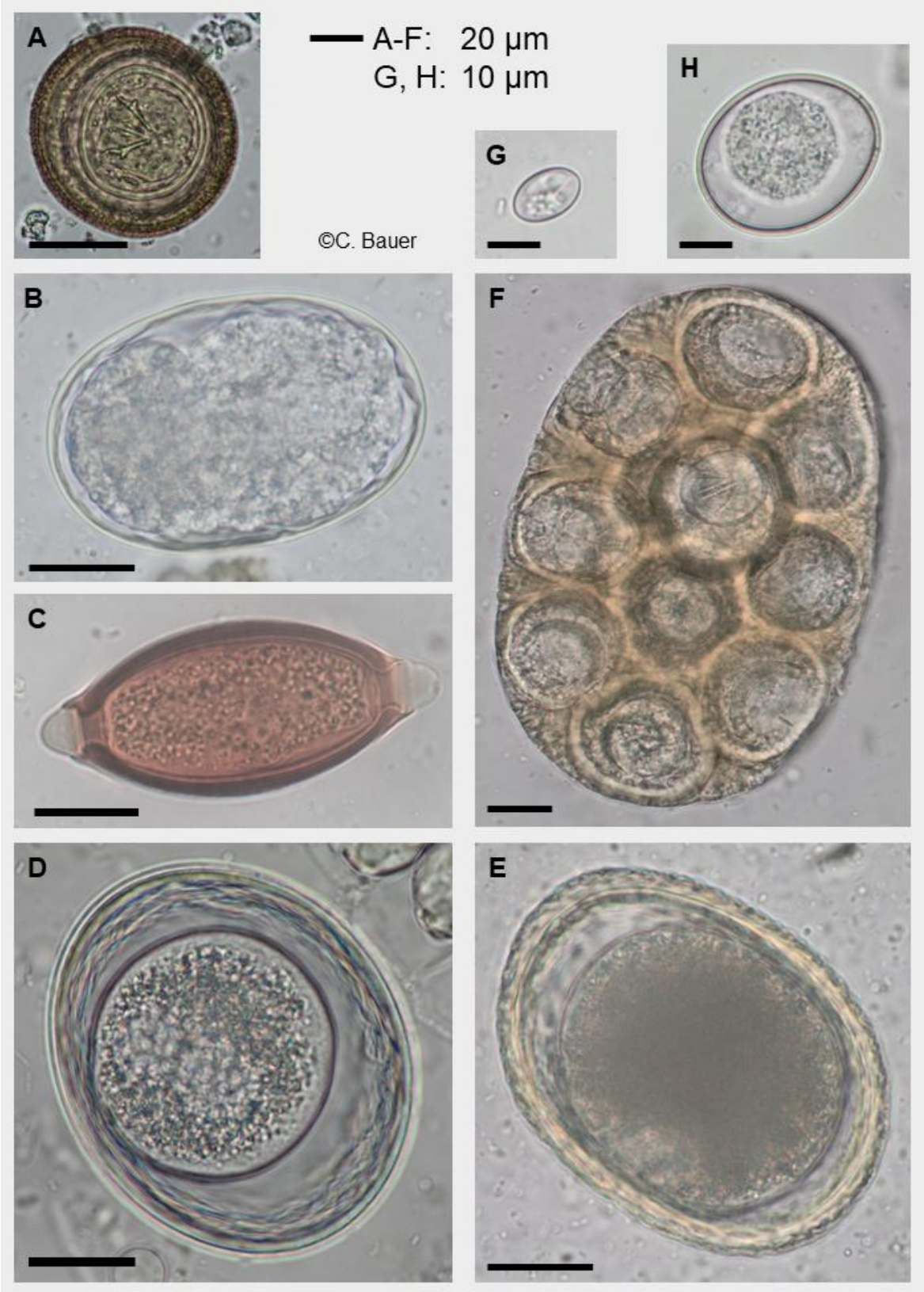

Figure 5 - Parasite stages found: (A) taeniid egg – (B) ancylostomatid egg – (C) *Trichuris vulpis* egg – (D) *Toxascaris leonina* egg – (E) *Toxocara canis* egg – (F) *Dipylidium caninum* egg capsule – (G) *Sarcocystis* sp. sporocyst – (H) *Cystoisospora canis* oocyst. Scale bar = 20 µm (A–F) or 10 µm (G, H).

Table 2 - General and parasitic-related “no-go” and “go” subjects in dogs housed animal shelters

Absolute **“no-go” subjects**	Recommended **“go” subjects**
Outdoor areas with soil and/or grass surface	Outdoor areas with concrete ground
Wooden enclosures and kennels	Enclosures and kennels with concrete, tiled or metal floor and walls
Improper, irregular or missing cleaning and/or disinfection of kennels and outdoor areas	Daily physical cleaning of kennel and outdoor areas (removal of faeces, urine, etc.), followed by disinfection (best physically by burning or hot water steam); disposal (best burning) of the faeces
No rodent control, possibility to catch and ingest rodents	Proper rodent control in stable houses and food storage areas
Feeding of dogs with raw meat or offal of slaughtered animals	Feeding of dogs with dry food, can food or cooked meat only
Missing treatments against internal and external parasites	Treatment of each dog against both internal and external parasites as soon as possible after arriving; use of a broad-spectrum anthelmintic compound having a high efficacy against tapeworms and nematodes; use of an ectoparasiticide having a persistent acaricidal and insecticidal activity (e.g., for one month). Regular repetition of treatments throughout the stay in the shelter. Deworming of animals before leaving the shelter.

References

1. Gompper M.E. The dog–human–wildlife interface: assessing the scope of the problem. In: Gompper M.E. (ed.) Free-Ranging Dogs and Wildlife Conservation. // Oxford University Press, 2014. – P. 9-54.

2. Sultanov A.A., Abdrakhmanov S.K., Abdybekova A.M. et al., Rabies in Kazakhstan. // PLoS Negl. Trop. Dis. – 2016. – V. 10 (8) - P. e0004889.

3. Raza A., Rand J., Qamar A.G., Jabbar A., Kopp S. Gastrointestinal parasites in shelter dogs: occurrence, pathology, treatment and risk to shelter workers. // Animals. – 2018. – V. 8. – No. 108 – P. 1-23.

4. Torgerson P.R., Rosenheim K., Tanner I. et al. Echinococcosis, toxocarosis and toxoplasmosis screening in a rural community in eastern Kazakhstan. // Trop. Med. Int. Health. – 2009. – V. 14. – P. 341-348.

5. Galibert F., Quignon P., Hitte C., Andre C. Toward understanding dog evolutionary and domestication history. // Comptes Rendus Biologies. – 2011. – V. 334. – P. 190-196.

6. Anonymous. Stray cats and dogs in Astana will no longer be shot. // Казахстанская правда (https://www.kazpravda.kz/en). – 11 May 2017.

7. Anonymous. OIE - Terrestrial Animal Health Code. // World Organisation for Animal Health (OIE) Paris, 11th ed. (ISBN 978-9290448259), 2011. – P. 382-396.

8. Ыбраев Б.К., Бауэр К., Лидер Л.А., Жаманова Ә.М. нвазиялық аурулар диагностикасы. // Алматы Бастау (ISBN 978-6012812534), 2017. – С. 23-24.

9. Lider L., Kereev J., Bauer C. Helminth fauna of stray dogs in north-east Kazakhstan. // Tierärztliche Praxis G. – 2010. – V. 38. – P. A21.

10. Abdybekova A.M., Torgerson P.R. Frequency distributions of helminths of wolves in Kazakhstan. // Vet. Parasitol. – 2012. – V. 184. – P. 348-350.

11. Трунова С.А., Нурмагомедова С.Г. Сезонная динамика зараженности собак гельминтами в равнинном поясе Дагестана // Российский паразитологический журнал. – 2017. – Т. 42 № 4. – С. 358–360.

12. Hajipour, N. A survey on the prevalence of *Toxocara cati*, *Toxocara canis* and *Toxascaris leonina* eggs in stray dogs and cats' faeces in Northwest of Iran: a potential risk for human health. // Trop. Biomed. – 2019. – V. 36 – 143-151.

13. Ястреб В.Б., Шайтанов В.М. Кишечные паразитозы взрослых собак и кошек, содержащихся в приютах для бездомных животных // Российский паразитологический журнал. – 2017. – Т. 39. № 1 – С. 9-13.

14. Orhun R., Ayaz E. Prevalence of helminths in dogs in the region of Van and their potential public health significance (in Turkish). // Turk. Parazitol. Derg. – 2006. – V. 30. – P. 103-107.

15. El-Shehabi F.S., Abdel-Hafez S.K., Kamhawi S.A. Prevalence of intestinal helminths of dogs and foxes from Jordan. // Parasitol. Res. – 1999. – V. 85 – P. 928-934.

16. Miró G., Mateo M., Montoya A. et al. Survey of intestinal parasites in stray dogs in the Madrid area and comparison of the efficacy of three anthelmintics in naturally infected dogs. // Parasitol. Res. – 2007. – V. 100 – P. 317-320.

17. Gracenea M., Gómez M.S., Torres J. Prevalence of intestinal parasites in shelter dogs and cats in the metropolitan area of Barcelona (Spain). // Acta Parasitologica. – 2009. – V. 54. – P. 73-77.

18. Kimura A., Morishima Y., Nagahama S. et al. A coprological survey of intestinal helminthes in stray dogs captured in Osaka Prefecture, Japan. J. Vet. Med. Sci. – 2013. – V. 75. – P. 1409-1411.

19. Cantó G.J., García M.P., García A. et al. The prevalence and abundance of helminth parasites in stray dogs from the city of Queretaro in central Mexico. // J. Helminthol. – 2011. – 85. – 263-269.

20. Deplazes P., Eckert J., Mathis A., Von Samson-Himmelstjerna G., Zahner H. Parasitology in Veterinary Medicine. // Academic Publishers Wageningen (ISBN 978-9086862740), 2016. – 653 p.

21. Newbury S., Bliss M.K., Bushby P.A. et al. Guidelines for Standards of Care in Animal Shelters. // Association of Shelter Veterinarians, Apex, NC, USA (https://www.sheltervet.org/). – 2010. – 58 p.

22. Fisher M.A., Murphy M.G., Siedek E.M. Epidemiology of *Toxascaris leonina* infection post-weaning within a colony of dogs. // J. Helminthol. – 2002. – V. 76. – P. 27-29.

23. Dubey J.P., Lindsay D.S. Coccidiosis in dogs - 100 years of progress. // Vet. Parasitol. – 2019 – V. 266. – P. 34-55.

24. Walker M.J., Jacobs, D.E. Pathophysiology of *Uncinaria stenocephala* infections of dogs. // Vet. Annuals. – 1985. – V. 25. – P. 263-271.

25. Kirkova Z., Petkov P., Goundasheva D. Clinical and haematological studies in dogs, experimentally infected with *Trichuris vulpis*. // Bulg. J. Vet. Med. – 2005. – V. 8. – P. 141-148.

НҰР-СҰЛТАН ҚАЛАСЫНДАҒЫ ЖАНУАРЛАРҒА АРНАЛҒАН МУНИЦИПАЛДЫ БАСПАНАДА БАҒЫЛАТЫН ҚАҢҒЫБАС ИТТЕРДІҢ ІШЕК ГЕЛЬМИНТТЕРІ МЕН КОКЦИДИОЗДЫҚ ПАРАЗИТТЕРІ ЖӘНЕ ПАРАЗИТТЕРМЕН КУРЕСУ ЖОЛДАРЫ БОЙЫНША ҰСЫНЫСТАР

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Түйін

Тұрғындар үшін экологиялық қауіпсіз ортаны қалыптастыру мақсатында қала иттері популяцияларының паразиттермен инвазиялануын мониторингтеу қазіргі ветеринарлық қызметтің өзекті мәселесі болып саналады.

Осы зерттеулердің міндетіне Нұр-Сұлтан қаласындағы иесіз иттердің гастроинтестиналды паразитофаунасын анықтау жатады.

Нұр-Сұлтан (Астана) қаласының жануарларға арналған муниципалды баспанасында бағылатын 114 иесіз иттің нәжіс сынамалары Фюллеборн әдісімен ішек паразитарлық энтеропатогендеріне зерттелінді.

Гельминттердің алты түрінің және протозойлықтардың екі түрінің паразитарлық элементтері 49 (43%) жануарларда табылды. Иттердің *Toxascaris* (*Ts*.) *leonina* түрімен инвазиялану экстенсивтігі 29,8%, *Toxocara canis* – 4,4%, тениидтермен (*Echinococcus* sp. болуы ықтимал) – 4,4%, *Dipylidium caninum* – 3,6%, анкилостоматидтермен (*Uncinaria stenocephala* болуы мүмкін) – 1,8% және *Trichuris vulpis* – 1,8% болды. *Cystoisospora canis* ооцисталары және *Sarcocystis* sp. спороцисталары, сәйкесінше, 4,4% және 0,9% сынамаларда анықталды. *Ts. leonina* басқа паразиттермен аралас инвазиясы 17 (14,9%) жануарлардан табылды.

Жануарлардың денсаулығын жақсарту және адамның *Toxocara* және *Echinococcus* сияқты зооноз паразиттермен залалдану қаупін ең төмен деңгейге дейін азайту үшін баспанадағы иттердің инвазиялануын түсіретін паразиттерге қарсы іс-шаралар кешені ұсынылады.

Кілттік сөздер: баспана, ит, ішек паразиттері, копрологиялық зерттеу, жұмыртқалар, спороцисталар, ооцисталар, аралас инвазиялар, инвазиялану экстенсивтілігі.

КИШЕЧНЫЕ ГЕЛЬМИНТЫ И КОКЦИДИОЗНЫЕ ПАРАЗИТЫ БРОДЯЧИХ СОБАК, СОДЕРЖАЩИХСЯ В МУНИЦИПАЛЬНОМ ПРИЮТЕ ДЛЯ ЖИВОТНЫХ ГОРОДА НУР-СУЛТАН И РЕКОМЕНДАЦИИ ПО БОРЬБЕ С ПАРАЗИТАМИ

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Резюме

Мониторинг инвазирования паразитами популяций городских собак с целью обеспечения экологически безопасной среды для населения считается актуальной задачей современной ветеринарной службы.

Настоящие исследования ставили целью выявление гастроинтестинальной паразитофауны бродячих собак города Нур-Султан.

Пробы фекалий 114 собак, содержащихся в городском центральном муниципальном приюте для животных, исследовали методом Фюллеборна на кишечные паразитарные энтеропатогены.

Паразитарные элементы шести видов гельминтов и двух простейших обнаружили у 49 (43%) животных. Экстенсивность инвазии собак видом *Toxascaris* (*Ts.*) *leonina* составила 29,8%, *Toxocara canis* – 4,4%, тениидами (возможно, *Echinococcus* sp.) – 4,4%, *Dipylidium caninum* – 3,6%, анкилостоматиды (вероятно, *Uncinaria stenocephala*) – 1,8% и *Trichuris vulpis* – 1,8%. Ооцисты *Cystoisospora canis* и спороцисты *Sarcocystis* sp. выявили в 4,4% и 0,9% пробах, соответственно. У 17 животных (14,9%) наблюдали смешанные инвазии *Ts. leonina* с другими паразитами.

Для оздоровления животных и минимизацию риска заражения человека зоонозными паразитами, такими как *Toxocara* и *Echinococcus*, в приюте предлагается комплекс противопаразитарных мероприятий по снижению инвазирования собак.

Ключевые слова: приют, собака, кишечные паразиты, копрологическое исследование, яйца, спороцисты, ооцисты, смешанные инвазии, экстенсивность инвазии.