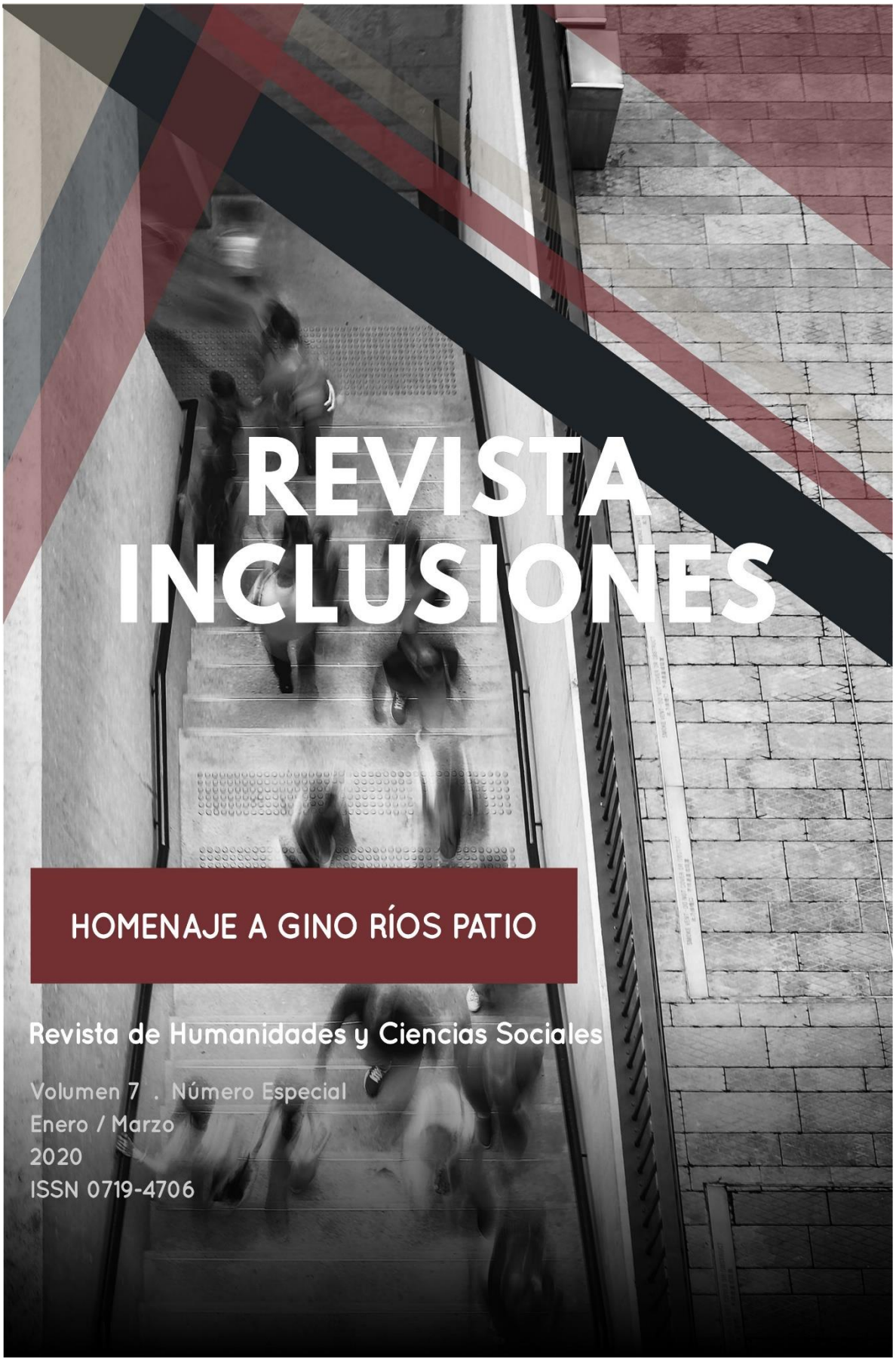

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THE SPREAD OF TOXOCARIASIS IN DOGS AND CATS IN TYUMEN AND THE EFFICIENCY OF THERAPEUTIC PRODUCTS

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Abstract

The article presents the results of studying the spread, the seasonal dynamics of toxocariasis in dogs and cats in Tyumen, and the degree of animals' infestation depending on the age, gender, feeding type, and living conditions. The degree of soil and vegetable samples contamination with the eggs of Toxocara has been shown. The results of testing the efficiency of anthelmintic drugs for the treatment of toxocariasis is dogs and cats are provided.

Keywords

Toxocariasis – Dogs – Cats – Distribution – Anthelmintic drugs

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Introduction

By their prevalence rate, parasitic diseases in animals and humans are leading in the world. In many countries, an increased incidence rate of dangerous zoonoses, such as toxocariasis, is noted. The pathogens of toxocariasis are nematodes of genus *Toxocara* parasitizing in adult carnivorous mammals, mainly dogs — *T. canis* and cats — T. *mystax (T. cati).* It is known that about 40 % of the dogs worldwide are infected with *T. canis*, and the intensity of infestation is high enough[1]. The average prevalence rate of intestinal toxocariasis in dogs on the European continent is about 15 %, in the USA — 4.6 to 7.3 %, and in some regions of tropical countries, it reaches 93 %. Studies of cats showed that 42 % of the animals were infected by Toxocara in Dublin, 55 % — in the North-East of Spain, 43 % — in Mexico, 31 % — in France, and 39.1 % — in Poland. Examination of 542 domestic cats in Japan showed that the most infested animals were aged from 1 to 6 months kept indoors — 27.1 % vs 17.9 % kept outdoors. Fenestration was higher in females than in males (45.8 and 41.3 %, respectively)[2].

In Russia, toxocariasis of dogs and cats was studied in various regions. The infestation rate of domestic dogs by *T. canis* in Moscow, on average, amounted to 18.1 ± 2.1 %, while in stray dogs, it was 25.9 ± 6.0 %; the infestation rate of cats by *T. mystax* was observed in groups of animals at the age of 1 to 12 months; the extensivity of infestation reached 21.7 %. The average contamination of the soil in playgrounds areas by the eggs of Toxocara was 14.8 ± 1.7 %[3]. In Kostroma, toxocariasis is registered in 12 ± 1.3 % of the dogs. Puppies 1 – 5 months of age are infected by Toxocara by 21 – 41 %, dogs at the age of up to 1 year — by 6 % to 8 %, at the age of 1 – 3 years — by 7 %; and animals older than 3 years are free from imaginal forms of *T. canis*[4].

In the population of city dogs in Novosibirsk, toxocariasis is registered in 30.5 % of the animals with the intensity of infestation of 12.8 specimens. In the population of city cats, the extensivity of infestation reaches 40.2 % with the intensity of 6.4 specimens[5]. In Saratov, the extensivity of dogs' infestation was 63.6 %[6], in Voronezh, cats were infected by Toxocara by 32.1 ± 3.8 %, and dogs — by 31.2 ± 7.6 %[7]. Quite a high extensivity of

[1] N. S. Malysheva; N. A. Samofalova; D. G. Grigoriev; N. A. Vagin; A. S. Elizarov; K. A. Gladkikh y E. E. Shuikina, "Problema toksokaroza v sovremennykh usloviyakh i sovershenstvovanie podkhodov k ego profilaktike". Scientific notes: Electronic Scientific Journal of the Kursk State University num 1 Vol: 25 (2013).

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[3] M. V. Guzeeva, "Rol i mesto redkikh gelmintozov v parazitarnoi patologii v Rossii": Abstract of Dissertation. Candidate of Medical Sciences. Moscow. 2009.

[4] A. G. Mikhin, "Toksokaroz sobak (epizootologiya, immunodiagnostika, patomorfologiya, lechenie)": Abstract of Dissertation. Candidate of Veterinary Sciences. Moscow. 2004 y A. G. Mikhin; E. F. Lozhkin y M. D. Novak, "Rasprostranenie, vozrastnaya i sezonnaya dinamika toksokaroza sobak v g. Kostrome". Kostroma: Materials of international scientific and practical Conference Actual Issues of Science in Agriculture" num 2 (2004): 130-131.

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toxocariasis infection (EI) is observed in dogs in Volgograd — 64.3 %[8], in the Chechen Republic — 76.0 %[9], in Omsk — 60.7 %[10], and in the Chukotka Autonomous Region — 56 %. The EI was lower in Perm — 17.9 %[11], Rostov-on-Don — 13.9 %, in the Samara region — 16.5 %, in Vologda — 14.5 %, in Cherepovets — 16.5 %, Altai region — 10.3 %[12] , and in Tyumen — 15.9 to 48.6 %[13].

In modern conditions, the infestation is becoming the most socially significant geohelminthosis with a very high risk of human infestation in the world[14,15,16,17]. The serological prevalence rate of toxocariasis has the highest values in Colombia (68.2 %); the prevalence rate of people in Puerto Rico is 53.6 %, in Taiwan – 51.4 %, and in the USA – 26.3 %. These figures are much lower in the Netherlands (6.1 %) and, the lowest are in Japan (3.6 %)[18]. In the United States alone, about 10,000 cases of toxocariasis are identified annually. Almost 14 % of the people in this country that own pets are infected with toxocariasis. At the age of 2 to 3 years, no less than 2% of childen are seropositive, and at the age of 4 to 10 years — 10 to 12 % of the children. As stated by the US Center for Disease Control, visceral toxocariasis is detected in 20 %, eye toxocariasis — in 67 %, and asymptomatic toxocariasis — in 13 % of the cases[19]. Rural residents are more frequently infected than urban inhabitants. In terms of gender, the group of up to 14 years of age is dominated by boys; in older groups, the shares of sexes equalize[20]. Studies in recent years have shown a relatively low prevalence rate of toxocariasis in Western Europe — 2 to 5 %, while in developing countries, this figure varies between 14 and 37 %.

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[8] A. N. Shinkarenko, “Ekologiya parazitov sobak i mery borby s vyzyvaemymi imi zabolevaniyami v Nizhnem Povolzhye”: Dissertation. Dr. of Veterinary Sciences. Volgograd 2005.

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[20] W. Poeppl; H. Herkner; S. Tobudic; A. Faas; G. Mooseder; H. Burgmann y H. Auer, “Exposure to Echinococcus multilocularis, Toxocara canis, and Toxocara cati in Austria: a nationwide cross-sectional seroprevalence study”, Vector Borne Zoonotic Dis. Vol: 13 num 11 (2013): 798-803.

Interestingly, the highest incidence rate is noted in tropical countries (Bali, West Indies) — 86 to 92.8 %[21].

Analysis of the dynamics of toxocariasis incidence rate in Russia may show that in 2011 the incidence rate was 2.32 per 100 thousand of the population. The toxocariasis incidence rate in children of up to 17 years of age in 2011 was 5.73 per 100 thousand of the population. In 2012, it was 2.33 per 100 thousand of the population (increased by 0.43 %). The toxocariasis incidence rate in children up to 17 years of age increased by 12.38 %, and amounted to 5.72 per 100 thousand of the population. In 2013, the incidence rate of this zoonosis in adults was 2.12 per 100 thousand of the population (reduced by 9.02 %), and among children up to 17 years of age — 4.88 per 100 thousand of children of this age. If compared to 2012, the toxocariasis incidence rate decreased by 14.69 %. In 2014, 2.19 cases were registered per 100 thousand of the population (increased by 3.31 %). Among children at the age of up to 17 years, the incidence rate was 5.37 per 100 thousand children at this age (increased by 10.04 %). In 2015, 1.72 cases were registered per 100 thousand of the population, and among children at the age of up to 17 years, the incidence rate was 3.59 per 100 thousand of the population[22].

Materials and Methods

To study the prevalence of toxocariasis in dogs and cats in Tyumen, the authors performed in vivo (scatological) studies of the animals owned privately, kept at nurseries of various organizations, and stray animals.

For the scatological studies, Fulleborn's method was used[23]. For this purpose, a 1 g of analyzed sample of feces was placed into a mortar, and filled with 3 – 5 ml of a saturated solution of sodium chloride, thoroughly stirred with a glass rod; the solution gradually was topped up to 15 ml, as the mixture was stirred. After that, the mixture was poured through a sieve into a clean container and left to settle for 40 min. After that, by touching a metal loop to different points of the surface of the suspension, 3 drops of the solution were taken and applied to a glass slide for microscopy. The metal loop was annealed over the flame of an alcohol lamp before each sampling. With this, only fresh samples of feces were taken, and the top layer was taken that had not been in contact with the floor or the soil. Over 800 samples of feces from dogs and 500 samples from cats were studied.

Results and Discussion

Analysis of the results of studying the seasonal dynamics of toxocariasis showed that the extensity of infestation was high throughout the year. It was found that the mature animals' infection rate by Toxocara in various periods of the year varied (12.4 – 49.5 % for dogs; 22.3 – 32.4 % for cats), which was consistent with the data of other authors about the high degree of animals' infestation. The studies showed that the epizootic process of toxocariasis in dogs was predictable. In the summer months (June through August), the

[21] P. A. Overgaauw y F. van Knapen, "Veterinary and public health aspects of Toxocara spp", VetParasitol Vol: 193 num 4 (2012): 398-403.

[22] V. V. Yerofeyeva, "Ekologo-epidemiologicheskie problemy toksokaroza v Rossii", Biological Sciences num 6 Vol: 60 (2017): 15-19.

[23] GOST R 54627-2011. Agricultural ruminant animals. Methods of laboratory helminthology diagnostics (Moscow: Standartinform, 2013).

extensivity of infestation reached a maximum of 46.8 ± 3.4 %, in the autumn months (September through November) — 27.7 ± 1.8 %. By the winter (December through February) it stabilized at the minimum value of 14.2 ± 1.3 %, and in the spring months (March through May) a new increase to 24.5 ± 1.3 % was observed. Thus, a high infestation rate in dogs was found in all seasons, but especially in the summer. The increased level of infestation in the summer in the population of dogs was determined by increasing the number of young animals, which usually are the main transmitters of adult Toxocara.

In the population of cats, toxocariasis was noted in all seasons of the year. The seasonal dynamics of toxocariasis in cats were characterized by a stable level in all periods of the year. In the winter, in the spring, in the summer, and the autumn, the incidence rate was 27.8 ± 2.8, 25.3 ± 2.2, 31.2 ± 2.7, and 27.2 ± 1.6 %, respectively, which was confirmed by research studies of other authors[24].

In analyzing the results of scatological studies of privately owned dogs and the dogs kept at nurseries of organizations, the dependence of the infestation rate on the age was discovered. For instance, about 80 % of the cases of toxocariasis in the dogs that belonged to nurseries of various organizations occurred in young animals before the age of 12 months; dogs at the age of 1 to 6 years and older were less prone to the disease — 6.5 % and 5.4 %, respectively (toxocariasis at the age of more than 6 years was observed in female dogs after the birth of the puppies).

In the dogs owned privately, the highest share of the incidence rate of this infestation was noted at the age of less than 6 months — 83.8 %. After that, it reduced between 6 to 12 months of age, and between 1 and 6 years, the infestation rate remained at the same level — 8.1 %. Animals older than 6 years were free from adult Toxocara.

The highest share of incidence rate in the population of cats was registered at the age of 1 to 6 years — 39.3 %. Before the age of 6 months, it was slightly lower — 25.7 %, and from 6 to 12 months — 22.3 %. The least infected was the group at the age of more than 6 years, where toxocariasis was noted in 9.6 % of the cases.

In studying the spread of toxocariasis in carnivores, depending on the gender, it was found that in dogs, the disease was more frequently registered in males (55.2 %) than in females (44.8 %). In the population of cats, in males, it was 57.4 %, and in females — 42.6 %. In assessing the spread of toxocariasis depending on the feeding conditions, the authors examined several groups of animals of various age (the animals that received commercial diet — dry and wet food, the animals that received both commercial and natural food, and the animals fed only on natural products). At the end, the difference in the toxocariasis infestation between the dogs fed on commercial diets and homemade food turned out to be insignificant. This can be explained by the fact that animals were infested mostly when walked outdoors. Dogs tend to pick up and eat foreign objects (bones, sticks, feces of other animals, etc.), contact with the source of infection when playing or fighting, which results in an infestation. However, one should take into account the fact that toxocariasis is noted mainly in young animals (at the age of up to 6 months), which is due to the intrauterine and transmammary infection.

[24] M. V. Guzeeva, “Rol i mesto redkikh gelmintozov v parazitarnoi patologii v Rossii”: Abstract of Dissertation. Candidate of Medical Sciences. Moscow. 2009.

In cats, the difference in the lower infestation rate in the animals fed on commercial diets can be explained by higher immunity on the background of the balanced diet of commercial feed, since the animals fed on natural and mixed feed do not get enough minerals. One should also take into account the fact that many members of the cat family are predators. The factor of their infection from rodents may also not be excluded.

In general, studying the spread of toxocariasis in dogs and cats considering the diet showed that most frequently the infestation occured in predatory animals that were exposed to the environment.

In assessing the invasion rate in various breeds, it was found that the most infected were service dogs.

Infected animals are the source of spreading Toxocara eggs. During the sanitary-parasitological studies of the soil, it was found that its contamination with the eggs of Toxocara in Russia varied from 1 – 3 to 50 – 60 % in various regions, with the intensity of infestation equal to 1 – 10 eggs per 100.0 g of soil[25]. According to the selective studies of the soil samples in Tyumen, 11.3 % were positive, and 4.2 % samples of vegetables were positive, which confirmed the data of other researchers[26]. These data showed that in the cities, the situation was unsafe for the health of people and animals.

To find the most efficient means of carnivorous therapy in the case of toxocariasis, the authors chose the anthelmintic drugs that were often recommended and used by practicing veterinarians.

As a result of the drug tests, it was found that they all were highly efficient for treating toxocariasis in dogs (94 – 100 %) and cats (95 – 100 %) (Table 1 and 2).

Drug (active substance)	Dosage and duration of using the drug	Efficiency, %
Advocate imidacloprid — 100 mg, and moxidectin — 25 mg	1 ml per 4 – 10 kg of the animal body weight	94 – 100
Azinox plus Praziquantel — 50 mg, pyrantel pamoate — 150 mg	1 tablet per 10 kg of the animal body weight 2 times with the interval of 10 days	97 – 100
Helmynthal syrup moxidectin – 1.5 mg/ml and praziquantel – 25 mg/ml	1 ml per 2 kg of the animal body weight	98 – 100
Dirofen – paste 20 pyrantel pamoate – 15 mg and 45 mg, and praziquantel — 5 mg and 15 mg	1 ml per 1 kg of the animal body weight.	96 – 100
Milbemax milbemycin oxime — 2.5 and 12.5 mg, praziquantel — 25 and 125 mg/tablet	1 tablet per 1 – 5 kg of the animal body weight	98 – 100

[25] L. N. Starchikova, “Toksokaroz. Obshchee zabolevanie zhivotnykh i cheloveka”, Taxes. Investment. Capital num 1 (2003).

[26] M. V. Guzeeva, “Rol i mesto redkikh gelmintozov v parazitarnoi patologii v Rossii”: Abstract of Dissertation. Candidate of Medical Sciences. Moscow. 2009.

Pyrantel – suspension 250 mg of pyrantel	5 mg/kg of the animal body weight, one-time administration	97 – 100
Prasicide — suspension 45 mg of pyrantel pamoate, 45 mg of febantel, 15 mg of praziquantel	1 ml per 3 kg of the animal body weight, one-time administration	98 – 100
Prasicide — Tablets of 150 mg of pyrantel pamoate and 50 mg of praziquantel	1 tablet per 10 kg of the animal body weight, one-time administration	98 – 100
Stronghold 6 % or 12 % of selamectin	1 ml per 10.1 – 20 kg of the animal body weight	95 – 100
Troncil 50 mg of praziquantel, 144 mg of pyrantel embonate and 150 mg of febantel	1 tablet per 5 – 10 kg of the animal body weight, one-time administration	96 – 100
Endoguard 10 Febantel — 150 mg, pyrantel pamoate — 144 mg, praziquantel — 50 mg, ivermectin — 0.06 mg.	1/2 of tablet per 2.5 – 5 kg of the animal body weight	98 – 100
Reference	-	-

Table 1
Efficiency of anthelmintic drugs for treating toxocariasis in dogs

Drug (active substance)	Dosage and duration of using the drug	Efficiency, %
Drontal pyrantel embonate — 230 mg; praziquantel — 20 mg,	1 tablet per 4 kg of the animal body weight, one-time administration	97 – 100
Caniquantel plus 50 mg of praziquantel and 500 mg of fenbendazole	1 tablet per 10 kg of the animal body weight, one-time administration	98 – 100
Profender 21.4 mg of emodepside and 85.8 mg of praziquantel.	0.7 ml per 2.6 – 5.0 kg of the animal body weight, one-time administration	96 – 100
Stronghold 6 % or 12 % of selamectin	0.75 ml per 2.6 – 7.5 kg of the animal body weight, one-time administration	95 – 100
Troncil K 20 mg of praziquantel and 230 mg of pyrantel embonate	1 tablet per 3 – 4 kg of the animal body weight, one-time administration	96 – 100
Cestal Cat 20 mg of praziquantel, 230 mg of pyrantel embonate	1 tablet per 2 – 4 kg of the animal body weight, one-time administration	97 – 100
Reference		-

Table 2
Efficiency of anthelmintic drugs in case of toxocariasis in cats

Besides, the treatment of intestinal toxocariasis in domestic carnivores cannot often be confined to only anthelmintic drugs.

In the case of the manifestation of clinical symptoms, symptomatic therapy is used. Therapy is used most frequently for young animals (2 – 6 months old) and is seldom used for older animals.

Symptomatic therapy should be carried out simultaneously in several directions:

- normalization of the disturbed functions of the organism as a result of Toxocara parasitism;

- restoration of the functions of the affected organs and systems through the use of pharmacological products; and

- removing or preventing the adverse effects of the environmental factors, keeping, and feeding conditions.

Conclusion

Thus, the studies have shown that toxocariasis is a widespread infestation of dogs (12.4 – 49.5 %) and cats (22.3 – 32.4 %) in Tyumen, which greatly complicates the epidemiological and epizootological situation in the city. Therefore, prevention of toxocariasis is not only a priority task for the veterinary medicine, but is a significant social problem, which requires the combined action of veterinary and health care specialists with the participation of the employees of public utilities. For dogs and cats treatment in case of toxocariasis, the use of medicines based on praziquantel, pyrantel, selamectin, moxidectin, ivermectin ensures the efficacy of 94 – 100 %.

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