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# CONTAMINATION OF PUBLIC PLACES AT CENTRAL BELGRADE MUNICIPALITIES WITH DOGS PARASITES - RESULTS OF A THIRTY YEAR STUDY (1993-2023)

*Ivan Pavlović*[174]

## Abstract

A steady increase in the number of dogs is a serious sanitary-epidemiological problem of urban areas. Those animals permanent contaminated those areas with faeces which present a significant health problem from human. If it is known that a dog excretes an average of 100 grams of feces per day, it is easy to determine, based on an insight into the number of animals in the city, that the amount of dog excrement that is excreted daily passes several tons per day. Dogs are carriers and hosts of a large number of zoonotic parasites species which eggs were eliminated by faeces and contaminate urban areas. Those parasites, transmitted to human by faecal contamination, especially to children which play at those dirty places. From these reason at Belgrade we had parasitological research of that places continuously since 1993. Throughout this period, this study was performed for scientific purposes and were unprofitable (which is sometimes caused misunderstanding in the institute), exception of three occasions when the city government paid for this study (in 2002, 2011 and 2012). Here we presented our results of a thirty year study (1993-2023) of contamination of parks and public places at central Belgrade municipalities with dog parasites.

**Key words:** *Dogs, parasites, zoonoses, environmental contamination, Belgrade*

## Introduction

The constant increase in the number of dogs, strays and pets, represents a serious epidemiological and ecological problem of urban areas in the world and in our country. In the close coexistence of pets in the immediate environment of people, public areas, especially streets and parks, are constantly polluted with dog feces. If it is known that a dog excretes an average of 100 grams of feces per day, it is easy to determine, based on the number of animals in the city, that the amount of dog feces excreted daily exceeds several tons per day. Contamination of urban areas with dog excrement is a ubiquitous problem of global proportions to which highly developed countries are equally exposed, almost to the same extent as third world countries

[174] Ivan Pavlović, PhD, Principal Research fellow, Academician of IRASA, RANS, AVM, Scientific institute of Veterinary Medicine of Serbia, dripavlovic58@gmail.com, ORCID 0000-0003-4751-6760

[1].The difference is only in the types of parasites (due to geographical position, climatic and socioeconomic factors) and the dogs that carry them. In countries with a high standard, they are pet animals, while developing countries are threatened by stray dogs. Either way, *Toxocara canis, Ancylostomidae*spp., *Echinoccocus granulosus, Strongyloideus stercoralis, Dipyllidium caninum, Giardiaintestinalis* or *Amoeba* spp. they don't know borders, dog breeds or owner statutes, they will infect them all equally if given the chance [2,3].

Until the beginning of the 90s, Belgrade had a negligible population of pets and stray dogs, and there were legal provisions obliging pet owners to do mandatory deworming, clean public areas after them and responsible ownership. As a result, public areas, parks and green areas were minimally contaminated with dog feces. At the beginning of the 90s and the breakup of Yugoslavia, there was a state of war in the surrounding area, UN sanctions on the FRY, inflation, etc. These negative events lead to an economic crisis and the consequent abandonment of pets by old owners who could not financially support them. These animals bred freely, and the population of stray dogs grew significantly and became a city problem, as did the contamination of public areas with their feces.

In the light of these events, parasitological control of the contamination of public green areas in Belgrade began. Starting from 1993 to 2023, parasitological control of parks and green areas of the central city municipalities, the municipalities that make up the wider urban core and New Belgrade, was continuously carried out.

Throughout this period, this study was performed for scientific purposes and were unprofitable (which is sometimes caused misunderstanding in the Institute), exception of three occasions when the city government paid for this study (in 2002, 2011 and 2012). Here we presented our results of a thirty year study (1993-2023) of contamination of parks and public places at central Belgrade municipalities with dog parasites.

## Sampling and examinations

Samples of soil and grass samples and dog faeces were taken from the parks and public places in central city municipalities - Stari Grad, Palilula, Vračar and Savski Venac and New Belgrade. The examination is carried out using the sedimentation and flotation method as well as the modified method according to Pavlovic. The intensity of the infection is determined using the method according to McMaster and Stoll. We presented modified method of testing soil and sand for the presence of parasite eggs according to Pavlovic [3, 4, 5, 6].

## Examination in period 1993-1996

During the first five years of research (1993-1996) it was established that 65,90 % of soil samples, 12.5% of sand samples from children's playgrounds and 59.23% of dog feces samples contained parasite eggs. At examined locations eggs of *Toxocara canis* were found in 48,76% soil samples, *Ancylostomidae* sp.in 39,23%, *Dipylidium caninum* in 33.96%, *Trichuris vulpis* in 14.29% and *Taenia* sp. in 7.19% [7, 8].

In that period, the primary polluters of parks and public areas were abandoned dogs. These were mostly pets that the owners could no longer keep for economic reasons and let them out on the street where they mated uncontrollably so that their number visibly increased.

The Secretariat for Environmental Protection of Belgrade was informed of the results of the research and measures were taken to control stray dogs and clean children's playgrounds. These researches were also supported (though not financially) by the city administration, which began to pay much more attention to this urban problem.

## Examination in period 1997-2002

In the period 1997-2002, began the arrangement of the city's central park areas, which was reflected in the general reduction of the pollution of sand for children's play to only 0.2% and green areas to 50.22 %. Durng examination period eggs of *Toxocara canis* were found in 46.56%, *Ancylostomidae* sp. in 37.31%, *Dipyllidium caninum* in 33.43%, *Trichuris vulpis* in 10.93%. *Toxascaris leonina* in 7.81% and *Taenia* sp in 6.12% [9].

In this period, especially after 2000, the central city municipalities began to conduct targeted research on this problem and to finance such research. Based on the results of the research, measures were taken in terms of the revitalization and renovation of parks and children's playgrounds as well as public areas. Communal hygiene has been strengthened and visible progress has been achieved in the cleanliness of city streets [10].

## Examination in period 2003-2007

During the next five years (2003-2007), population of pet dogs was gaining momentum and their numbers began to increase more and more on the streets of the city. Soon the main change on the ground was related to the fact that owned dogs became as big polluters of public places as stray dogs. In this period, began the examination into the contamination of green areas in New Belgrade.

At the same time, the administration of the city is through its secretariats extensive rehabilitation of park areas and educational activity through the media about responsible ownership and the importance of dog parasites for human health continued. This was done through TV and radio broadcasts, education of children in kindergartens and through leaflets. This education was adapted to the age of children who were taught about responsible ownership, dog behavior and hygiene measures after playing with dogs. For the needs of the dog owner, appropriate leaflets were prepared on the importance of vaccination and deworming of dogs, which were given to them in veterinary clinics [3].

In the period 2005-2006, the Ministry of Agriculture, in cooperation with Scientific Institute of Veterinary Medicine of Serbia, produced manuals, brochures and leaflets about echinococcosis and toxoplasmosis, which were given to veterinary schools and clinics [11].

The results were already seen during subsequent controls, when contamination was found on 45.90% of the examined surfaces. *Toxocara canis* was found in 42.82% of

samples, *Dipylidium caninum* in 37.19%, *Ancylostomidae* sp. in 31.70%, *Taenia* sp. .in 4.31%, *Toxascaris leonina* .in 3.65% and *Trichuris vulpis* in 2.43% [12].

## Examination in period 2008-2011

In the period 2008 - 2011, visual instructions, notices and markings were made for areas designated for off-leash dogs as well as where dogs are not allowed. In the same period, a system of baskets with PVC bags for the disposal of dog feces (doggypot system) was created, and since 2011, eco zones or dog parks have been formed in some parks. In this period, extensive research into the contamination of green areas in New Belgrade was carried out [13].

At some time we continued with the education of children of preschool age and also of children in the lower grades of elementary school. Central city municipalities have marked areas for dogs in all major parks, and communal hygiene in public places has been strengthened. The application of the dogipot system was successfully implemented so that more and more parks had these baskets. It also started with the distribution of leaflets in buildings in the central parts of the city (Stari Grad), where holders and bags for collecting dog excrement before going out for a walk were placed in some places.

Animal protection societies joined the educational activity and made a significant contribution to this action.

Finally the aforementioned Strategy of the city of Belgrade in solving the problem of unowned dogs and cats was adopted at the Assembly of the City of Belgrade held on September 21, 2011, based on Article 54, Paragraph 2 of the Law on Animal Welfare, Article 20 of the Law on Local Self-Government, and Articles 25 and 31 of the Statute of the City of Belgrade [14].

Based on the performed parasitological control of soil contamination from parks, the presence of parasite eggs was found in 39.06%. Eggs of *Toxocara canis* were found in 36.56%, *Ancylostomidae* sp. in 27.31%, *Dipyllidium caninum* in 23.43%, *Trichuris vulpis* in 10.93%, *Strongyloides stercoralis* and *Toxascaris leonina* in 7.81% and *Taenia* sp in 6.12% [15].

## Examination in period 2012-2016

In the period 2012-2016, the trend of building dog parks within city parks continued, the education program on responsible ownership and landscaping of public areas continued [16].

During 2011 and 2012, the city, through the city institution Veterina Beograd, financed extensive research into parasitic contamination in six city municipalities, including larger and smaller parks. As part of the implementation of the Strategy, shelters for dogs were formed where sterilization, vaccination and deworming were carried out. Eco-zones or dog parks were also created in larger parks, which were fenced and equipped with suitable furniture for dogs to play. Cleaning of these parks was carried out every two weeks, as well as parasitological control [17].

After 2013, with the new city administration, these education programs gradually stopped, as did the media campaign about responsible ownership. Construction of dog parks continued, only in a much smaller number than was foreseen in the program for the period 2011-2015.
Control of green areas and parks showed the success of the adopted Strategy and the percentage of contamination decreased to 30.45%. In this period the average percentage of *Toxocara canis* eggs found was 29.68%, *Ancylostomidae* sp. 21.18%, *Dipyllidium caninum* 26.56%, *Strongyloides stercoralis* 6.81%, *Toxascaris leonina* 5.97%, and *Trichuris vulpis* 2.68% and *Taenia* sp. 2.25% [18].

## Examination in period 2017-2023

The results indicate that the implementation of this strategy has stabilized the population of abandoned animals. The implementation of mass sterilization resulted in a 50% reduction in the number of abandoned dogs. In full cooperation with all other organizations with animal welfare goals, mass adoption was launched.
Although some activities from the strategy were now reduced, the positive effect it brought was evident despite that. The positive effect of these measures was observed during regular parasitological controls of parks and green areas [19]. But in this period it was done only for scientific purposes.
Parasites contamination has grown to 44.08% of soil samples and 58.33% dog faeces. *Ancylostomidae spp*. were found at 27.44% soil samples and 29.16% dog faeces, *Toxocara canis* at 26.88% and 28.37%,, *Dipyllidium caninum* at 17.67% and 27.42%, *Toxascaris leonina* at 4.23% and 4.39%, *Strongyloides stercoralis* at 3.37% and 4.78%, *Taenia* -type helminths at 1.51% and 1.71%. and *Trichuris vulpis* at 1.02% and 1.09% [20].

## Conclusion

Research into the contamination of parks and green areas in Belgrade began in 1993 with the aim of determining the degree of contamination by zoonotic parasites of dogs. Until then, these studies were carried out sporadically in the world, and the results obtained indicated their importance for preserving the health of the urban environment. From the initial research, they moved into a continuous research that lasted for thirty years. In the same period of time, the same number of samples were taken from the same locations and examined.
Over time, these researches took two directions - the first was focused on cooperation with the city authorities, which, especially in the first decade of the 20th century, accepted these researches as part of a comprehensive solution to the municipal problems of the city. The consequences resulting from them were in the form of improving the hygiene of city couples and children's playgrounds and the adoption of the Strategy of the city of Belgrade in solving the problem of unowned dogs and cats [14].
The second direction was of a purely scientific nature and during these years urban ecology was developed, which pointed out the ecological importance of parasitic contamination of green areas in Belgrade and the influence of climatic factors on them

[21]. During the research was developed the Method of testing soil and sand for the presence of parasite eggs and protected by the Institute for Intellectual Property of the Republic of Serbia in 2017 [6]. After thirty years of these important examinations, the research ended with the retirement of the initiator and the main (and only) enthusiastic researcher in this field.

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