Environmental contamination with dog excrements – a continuing story

Papajová Ingrid[1*], Papaj Ján[2], Pipiková Jana[1], Juriš Peter[1], Venglovský Ján[3]
(1) Institute of Parasitology SAS, Hlinkova 3, 040 01 Košice, Slovak Republic
(2) FEI TU of Košice, Letná 9, 042 00 Košice, Slovak Republic
(3) University of Veterinary Medicine and Pharmacy in Košice, Komenského 73, 041 81 Košice, Slovak Republic
*Corresponding author: papaj@saske.sk

Abstract
The aim of the presented work was to monitor the occurrence of the propagative stages of intestinal endoparasites in dogs excrements from selected towns in Slovakia. Totally 211 dog's faecal samples from towns Košice, Prešov, Zvolen and Trenčín were examined for the presence of helminth eggs with 25.6 % of the samples being positive. The most prevalent in faeces were the eggs of *Toxocara canis*. Contamination of sand with *Toxocara* eggs in sandpits was also investigated in this work. *Toxocara* spp. eggs were found in 5.7 % sandpits from Košice, 10.0% from Prešov, 16.7 % from Trenčín and 30.0 % from sandpits in Zvolen. Anaerobic stabilisation of organic waste from public areas with a temperature max. up to 35 ºC has only decreased the viability of *A. suum* eggs (by 21 %) and *T. canis* eggs (by 50 %). Environment contaminated with eggs of endoparasites might pose the potential risk for spread of parasitosis among animals, but also in human population.

Introduction
Zoonoses are the diseases common both for animals and people. Parasitozoonoses form a special category of zoonooses. The source of infection could be an animal, but also man in the body of which the agent of infection (parasite) occurs and is able to multiply and spread. Parasites parasitise in people and animals with a various degree of pathogenesis. They are fully adapted for parasitising in the host where they penetrate by various ways.
Regarding the spread of parasitozoonoses, domestic animals (dogs, cats) are of great importance because they live in a close contact with man. Infection and way of transmission of the disease depends on the way of breeding and on the breeding environment where the animal occurs. The most frequent transmission of parasitic diseases is performed by a contact with infected animal, or secondarily by the environment contaminated with developmental stages (oocysts, sporocysts, larvae) of endoparasites [1]. Through faeces of infected dogs and cats the germs of parasitozoonoses spread into the environment (cysts of intestinal parasitic protozoa, the eggs of tapeworms, parasitic nematodes). These germs are able to cause parasitic infections not only in specific hosts, but also in non-specific, e.g. in man. Regarding public health helminthozoonoses caused by *Toxocara* sp. and *Toxascaris* sp. in dogs and cats are very significant, especially due to their zoonotic character connected with the syndrome larva migrans.
The main sources of endoparasitic germs within environment (including those of zoogenous character) are faeces of infected animals. The probability of disease outbreak is higher in stray animals and in animals that are not under veterinary supervision. A new issue has arisen as a result of the growth of the pet population (dogs and cats) in cities as well as in the countryside - and it is animal waste treatment, as faeces are potential source of infective stages of endoparasites. Dog's faeces are regarded as a type of communal waste with no special requirements for collecting and manipulation from the view of public health protection. Therefore, to prevent health risks (for human as well as for animals) and odour nuisance from animal excrements, different methods for a satisfactory utilisation and sanitation have been researched.
The aims of this study were as follows: to monitor the occurrence of the propagative stages of intestinal endoparasites in dogs excrements from selected towns in Slovakia and to study parasitological contamination of sandpits in this towns. The work reported here evaluated also the effect of anaerobic stabilisation (in the piles) of different organic wastes on the survival of model *T. canis* embryonated eggs and unembryonated eggs of *Ascaris suum*.

Material and Methods

A total of 211 faecal samples of unknown dogs were collected at random from the public areas of the cities of Košice, Prešov, Zvolen and Trenčín. After collection, faecal samples were stored at 4 °C and examined for the presence of propagative stages of endoparasites as soon as possible. A flotation method with the Shaeter's flotation solution was used for coprological examination.

180 sand samples from the children's sandpits were collected in different urban areas of Košice, Prešov, Trenčín, Zvolen (courtyard, parks and playgrounds). The sand samples were investigated according to Kazacos [2].

We used the ''artificial contamination of lagoon and organic wastes'' approach to make sure that there is s sufficient number of positive samples in our observations. *A. suum* eggs were isolated by dissection of a distal uterine part of female pig ascaris. The distal uterine ends were then removed to a glass homogenizer and processed. The water suspension of eggs was stored in an Erlenmayer flask in a refrigerator at 4°C.

Grass (60%), leaves (25%), tree branches (5%), soil (10%) and waste from parks and playgrounds (dogs excrements and other) were used at the experiment. All wastes were mixed with soil (approx. 1:3) and 3 piles (2 m high and 25 m long) were built-up. The surface of the piles was not covered with any material to imitate natural conditions and the piles were not aerated during the experiment. After exposure to the environment in the pile samples for parasitological and physico–chemical examination were collected on days 0, 35, 60, 110 and 150 of anaerobic stabilisation.

We used the ''artificial contamination of piles'' approach to make sure that there is s sufficient number of positive samples in our observations.

Model *A. suum* eggs were isolated by dissection of a distal uterine part of female pig ascaris and *T. canis* by dissection of uterine distal ends of *T. canis* females. Model eggs were inoculated by a micropipette into polyurethane carriers, prepared according to Plachý and Juriš [3], at a dose of 1000 eggs per one carrier (a porous cellular plastic – soft expanded polyurethane, commercially known as a plastic foam). For mechanical protection, the carriers were placed to perforated plastic bottles (250 ml) and introduced into the piles.

The viability of exposed unembryonated *A. suum* eggs was determined by incubation up to the embryonated stage in a thermostat at 26°C for 21 days. The viability of exposed embryonated *T. canis* eggs was confirmed by a biological experiment on mice, ICR strain. The larvae present in the brain and muscles were isolated on day 28 after infection using a modified digestive method [4].

The methods used for monitoring physical and chemical properties of organic wastes corresponded to the STN 465 735 [5]. The physical and chemical properties of slurry, as well as the number of demaged eggs were expressed as mean values ± standard deviation ($\overline{X}$ ±SD).

Results and Discussion

Due to the limited open green areas for a dog walking and a rising popularity of keeping dogs in urban agglomeration, their concentration increases in the public areas. Their excrements contaminate the environment and if these dogs are infected they are also a source of infection for other dogs, cats and animals [6]. Out of 211 dog faecal samples, 51 were positive for the presence of the propagative stages of endoparasites, representing the prevalence of 25.6 %. In the examined samples, 4 species of intestinal endoparasites were detected - in particular eggs of *Toxocara* spp., *Trichuris* spp., the family Ancylostomatidae and *Toxascaris leonina*. The occurrence of parasitic species is summarized in Table 1. In samples, collected at random from public areas in Košice the highest prevalence (29.5 %) of endoparasites was recorded, with the eggs of *T. canis* being the most frequent (38.9 %). Our results corresponded with those of Antolová et al. [7] and Szabová et al. [6]. High prevalence of *Toxocara* spp. eggs and eggs of other intestinal helminths in dog populations pointed to the contamination of the environment, in which animals move. Epidemiologically, toxocariasis caused by nematodes *T. canis* and *T. cati* is considered to be one of the most serious parasitic disease of humans. Humans became infected usually orally (*per os*) by ingestion of soil with embryonated *Toxocara* eggs. The high prevalence of canine endoparasites presents a risk factor for dissemination of parasitic propagative stages into the environment. Children population is especially at risk with parasitosis, especially toxocariasis. It was the reason why we monitored also contamination of sandpits in selected towns in Slovakia. Totally 180 sand samples were collected from the children's sandpits of Košice, Prešov, Trenčín and Zvolen from areas with frequent movement of dogs and examined for the presence of the

parasites (Table 2). Presence of the endoparasites found in dogs excrements and sandpits demonstrates a possible risk of human infection.

Table 1. Ocurence of helminth eggs in dog excrements from selected towns of Slovakia

Town	Samples		Eggs in positive samples (%)			
	E	P	*T. canis*	*Trichuris* sp.	*T. leonina*	family Ancylostomatidae
Košice	122	36	38.9	25.0	10.5	7.9
Prešov	10	0	ND	ND	ND	ND
Trenčín	47	13	23.1	23.1	6.1	15.4
Zvolen	32	5	100	ND	ND	ND

P – positive samples, ND - not detected

Table 2. Ocurence of *T. canis* eggs in sandpits from selected towns of Slovakia

Town	Examined samples	Prevalence of *T. canis* eggs (%)
Košice	122	5.7
Prešov	30	10.0
Trenčín	18	16.7
Zvolen	10	30.0

Our results indicate the necessity of safe sanitation of municipal wastes from public area with some potential zoonotic agents. One posibility is the anaerobic stabilisation in the piles. We tested the effect of anaerobic stabilsation on the survival of *A. suum* and *T. canis* eggs. *A. suum* eggs are amongst the helminth eggs most resistant to environmental factors. And this is the reason why they have been chosen as model eggs. *T. canis* eggs infectivity persisting for 3–5 years under favourable conditions. After 150-days of anaerobic stabilisation, 63.47 ± 4.15 eggs of *A. suum* (Figure 1) preserved their viability owning to the effect of anaerobic conditions, low temperature (max. up to 35 ºC), low C:N ratio (to 15:1) and changes in the physico-chemical propreties of the composted organic wastes. We observed a marked effect of anaerobic stabilisation on viability of *T. canis* eggs. After 150 days of the experiment the number of devitalised embryonated *T. canis* eggs increased from 6.12 ± 1.15% to 56.06 ± 0.72%, on average (Figure 1). The infectivity of *T. canis* eggs was confirmed by a follow-up experiment in laboratory mice. A small number of *T. canis* larvae were found in their brain and muscles on day 28 after infection (Figure 2).

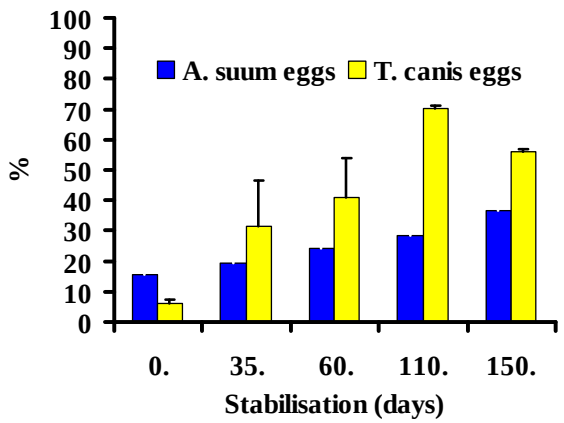

Figure 1. Damaged of *T. canis* and *A. suum* eggs during anaerobic stabilization in piles

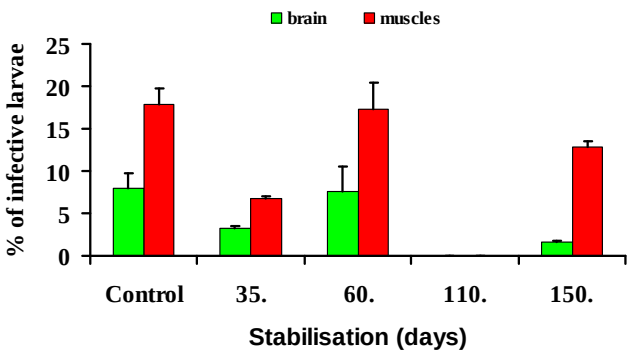

Figure 2. Infectivity of T. canis vital eggs during anaerobic stabilisation in piles

Conclusion and perspectives

The presence of intestinal parasites found in our study confirmed the high risk of human infection with parasitozoonoses. These results indicate the necessity of the veterinary care for dogs and also the need of control and hygienic measures for dog owners. Decrease in numbers of stray animals in urban and rural areas can help to control the risk of parasitic zoonoses transmission. Similarly, covering of sandpits to prevent entry of dogs and cats, creating special areas for dog walking and removing excrements can decrease a potential risk of transmission of parasitic diseases between animals and people.

Dogs excrements pose a source of contamination of the environment in towns. Based on the results, it may be stated that anaerobic stabilisation in the psychrophilic and mezophilic temperature zones failed to devitalise completely the model parasitic germs in organic waste from parks and playgrounds. Therefore this way of treatment is associated with risk of dissemination, survival and potential spread of developmental stages of endoparasites to the environment via anaerobically stabilised organic wastes. The issues of safe sanitation and waste management are highly topical as it has been universally acknowledged that the majority of endoparasitic germs is able to cause infection in animals and humans even a year or two later.

Acknowledgements

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