

# Prevalence of helminths of importance for human health in stray dogs in Lusaka Zambia

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## ABSTRACT

Stray dogs destined for euthanasia were collected from January 2010 through December 2010 to determine the presence of zoonotic gastrointestinal (GI) helminths in Lusaka district. A total of 33 stray dogs (male=18, female=15) were collected, euthanized and necropsy information obtained via helminthological approach. 100% (33/33) were infected with one or more helminth parasites. Multiple infections involving nematodes and cestodes were the most prevalent (63.6%) followed by nematodes only (33.3%) with cestodes only being the least prevalent (3.0%). The most prevalent GI helminth parasite was *Ancylostoma caninum* (93.9%) with the least prevalent being *Toxocara canis* (6.1%). No positive case of *Trichinella spiralis* was reported from direct trichinostomy examination of striated muscles. The mean count per dog of *A. caninum* was 44.45 (SD ±58.0) with a range of 0 to 223. The presence of three important zoonotic gastrointestinal helminths (*A. caninum*, *T. canis* and *Dipylidium caninum*) reported in this study underscores the importance of controlling helminthosis in stray dogs and stresses the need to establish a national control programme for parasitic diseases in this dog population. This can be achieved through vigorous implementation of the laws governing control of stray dogs and regular deworming of owned dogs. Controlling zoonotic helminths in dogs will ensure a minimal public health risk from the dog population in Zambia since they act as a source of infection to other dogs as well as humans.

## INTRODUCTION

Dogs are the most successful mammals adapted to human habitation worldwide. They have contributed to physical, social and emotional well-being of their owners, particularly children (3, 14). However, despite the beneficial effects, close bonds between dogs and humans remain a major threat to public health, with dogs harbouring a bewildering number of infective stages of parasites transmissible to man and other domestic animals (9, 11 & 14). The close relationship between dogs and humans, the numerous uses to man of these companion animals and their ubiquitous distribution has resulted in them unwittingly participating in sharing over 60 parasite species (5) including *Giardia*, *Cryptosporidium*,

*Toxoplasma*, *Echinococcus*, *Ancylostoma* and *Toxocara* species<sup>18</sup>. Clearly, the close interaction between humans and dogs is an important factor in the epidemiology of zoonotic diseases harboured by dogs. It is a fact that human-dog companionship is a natural relationship and thus controlling parasitic zoonotic diseases communicable between man and dog is a big challenge. One of the strategies of controlling parasitic zoonotic diseases would be through changing human behaviour as it relates to companionship with dogs and encouraging the taking of precautionary steps such as proper washing/sanitizing of hands before eating food. However, changing human behaviour such as improving hygiene levels, providing of safe drinking water and the proper use of sanitary facilities will remain as challenging as controlling stray and feral pet populations<sup>7</sup>. With the ever-increasing population size of stray dogs in Zambia (Personal communication, Dr. M. C. Kanemanema, [DVO], Lusaka), these will undoubtedly be a potential public health problem as several parasites of dogs can also infect man.

Previous studies have been conducted on intestinal parasitism in dogs in Zambia dating to the early 1980s by Islam and Chizyuka<sup>6</sup> which focused on investigating the prevalence of helminth parasites of dogs. The aim of the present study was to determine the prevalence of zoonotic gastrointestinal helminth species in stray dogs in Lusaka, Zambia.

## METHODS

### Study Area

The present study was conducted in Lusaka district of Lusaka province. Lusaka Province covers a total area of about 21,898 square kilometres and is divided into four districts. **Lusaka district** is the largest and capital city of Zambia which is located in the southern part of the province, S15°25'S, 28°17'E at an elevation of 1279m in Zambia.

### Study animals

Animals recruited in the study were dogs destined for euthanasia from two conveniently selected veterinary clinics for a period of 12 months. The inclusion criterion was any dog regardless of age, sex or condition under which euthanasia was being sought was included in the study.

**Key words:** *Gastrointestinal helminths; Lusaka; Prevalence; Stray dog; Zoonoses*

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### Sampling and laboratory analysis

Before sampling, the dog's age was determined from information provided by the owners' and corroborated by estimation from dental examination and the sex recorded. A total of 33 (*male*=18, *female*=15) stray dogs, which are defined in this study as dogs living close to humans, dependent upon human refuse or handouts for food but not owned, or as owned dogs living with humans, but allowed to be free ranging (17), destined for euthanasia, were collected after seeking written consent from the necessary authorities of the two veterinary clinics selected in the study. The subjects were humanely euthanized using intravenous pentobarbitone sodium at 100-200mg/kg (200mg/ml – Euthatal®). The entire gastrointestinal tract (oesophagus to rectum) was extracted by making a midline skin incision from the ventral neck region to the pubis brim. This was followed by accessing the thoracic and abdominal organs *in situ* by performing a thoracotomy via the sternotomy and ventral abdominal midline laparotomy. Recovery of worms was as described by Urquhart *et al.* (20). As soon as the alimentary tract was removed from the body cavity, the stomach, duodenal junction and ileocaecal junction were ligated with nylon to prevent transfer of parasites from one site to the other. The stomach/oesophagus, small and large intestine were separated following ligation of these segments. The oesophagus was examined by palpation for lesions of *Spirocerca lupi* before opening it all the way up to the stomach and examined for presence of worms. The small intestine was opened along its entire length and the contents washed into a bucket, passed through a coarse mesh sieve (aperture 212 µm) and the residues were collected and stored in 200 ml aliquots in well labeled containers and preserved in 10% formalin. The large intestine was opened along its entire length and the contents treated as described for the small intestines.

Striated muscles of the diaphragm, intercostal, masseter, tongue and hamstring were collected and processed for examination for the presence of encapsulated *Trichinella* larvae. These samples were examined using the direct trichinostomy method by squeezing a small sample of about one gram between two thick glass slides and examining for the presence of coiled larvae by direct microscopic examination or using a light source (8).

The collected worms were identified and enumerated as described by Soulsby (16) and Urquhart *et al.* (20).

### Data handling, storage and analysis

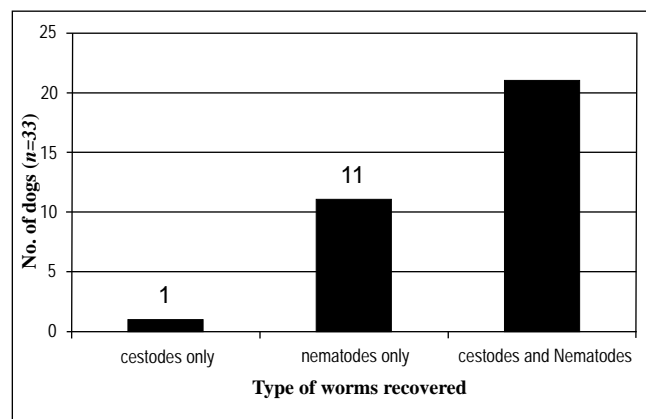
The data was entered into a Microsoft Excel® spreadsheet and data quality verified for entry errors, by comparing data entries with the original data forms. The data was then transferred to SPSS version 16.0 for descriptive and analytical statistics.

## RESULTS

The age of dogs ranged from more than three months old to dogs over five years old. The overall statistics indicated that dogs aged >12 to 60 months were the most sampled dogs (72.7%, 24/33).

Of all the dogs euthanized, 100% (33/33) were infected with one or more helminth parasites. Multiple infections involving nematodes and cestodes were the most prevalent followed by nematodes only with cestodes only being the least prevalent (Figure 1). Thus 63.6% (21/33) of dogs had multiple infections, 33.3% (11/33) had single infection with the nematode *Ancylostoma caninum* and 3.0% (1/33) had a single infection with the cestodes *Dipylidium caninum*.

**Fig. 1:** Number of dogs with single and multiple worm infections (*n* = 33)



The prevalence of the gastrointestinal (GI) helminths recovered on postmortem are presented in Table 1. The most prevalent GI helminth parasite was *A. caninum* (93.9%) with the least prevalent being *Toxocara canis* (6.1%). Other GI helminths recovered were *D. caninum* (63.6%) and *S. lupi* (27.3%). The mean count per dog of *A. caninum* was 44.45 (SD ±58.0) with a range of 0 to 223, while that of *T. canis* was 0.33 (SD ±1.74) with a range of 0 to 10 (Table 2). No *Trichinella spiralis* was reported from the direct trichinostomy examination of striated muscles.

**Table 1:** Prevalence of gastrointestinal helminths in euthanized dogs in Lusaka (*n*=33)

Parasite	No. of dogs infected	Prevalence (%)
<i>Ancylostoma caninum</i>	31	93.9
<i>Dipylidium caninum</i>	21	63.6
<i>Spirocerca lupi</i>	9	27.3
<i>Toxocara canis</i>	2	6.1

The prevalence of gastrointestinal helminths according to the age category is indicated in figure 2. Except for *T. canis* which was only recovered in dogs aged over 60 months and those aged between >24-60 months all the reported helminth species were recovered in all the age categories.

**Table 2:** Mean number of worms recovered per dog according to helminth species

Worm species	mean	SD	Range
<i>Ancylostoma caninum</i>	44.45	±58.0	0 - 223
<i>Toxocara canis</i>	0.33	±1.74	0 - 10
<i>Spirocerca lupi</i>	-	-	-
<i>Dipylidium caninum</i>	-	-	-

## DISCUSSION

Although numerous studies have been done on helminth parasites of dogs in many other countries, hitherto this is the second study conducted in Zambia with the first one having been conducted back in the early 1980s. The paucity of epidemiological information on zoonotic canine helminths in Zambia entails a high risk of transmission from dogs to humans since the majority of the Zambian population is likely to be unaware of the helminths that these dogs tend to harbour.

The prevalence of helminth parasites recovered from euthanized dogs in the present study was very high (100%) perhaps because many of the dogs in the study were stray dogs that were not well cared for and not restricted compared to those reported in other studies<sup>2,6</sup> that were restricted and well cared for. Furthermore, in contrast to our observation, Canto *et al.*<sup>2</sup> found similar prevalences of single and multiple infections. The higher prevalence of mixed/multiple infections than single infections in the present study highlights the complete absence of veterinary care for stray dogs.

However, our finding that *A. caninum* was the most prevalent zoonotic GI helminth followed by *D. caninum*, is similar to findings by Canto *et al.*<sup>2</sup>. Contrary to this observation, Islam and Chizyuka<sup>6</sup> documented a higher prevalence of *D. caninum* than *A. caninum*. This discrepancy could be attributed to the fact that many dogs in the study by Islam and Chizyuka<sup>6</sup> were owned, possibly better cared for and more restricted hence were more likely to have received prophylactic therapeutic ectoparasites and endoparasites treatment than those in our study.

The detection of *T. canis*, *A. caninum* and *D. caninum* in euthanized dogs is intriguing and has public health implications since these parasites are known to cause visceral larval migrans, cutaneous larval migrans and dipylidiasis in humans, respectively<sup>19</sup>. Outbreaks of cutaneous larval migrans have been reported in Italy involving six people and that antibody prevalence of *T. canis* of 8.1% in symptomatic individuals<sup>13</sup>. This potential for human zoonotic disease has rarely been addressed in national disease control programs in Zambia. The high prevalence of these zoonotic intestinal helminth infections in dogs, and the close bonds between dogs and people, definitely entails a high risk of transmission of these helminths to humans.

The prevalence of *S. lupi* was higher (27.3%, 9/33) than previously reported in Zambia (6), Congo DR (15), South Africa (10) and Mexico (2) who found 2% (2/85), 14.6% (7/260), 13% (8/63) and 4.5% (17/378) respectively. Although we may not easily explain this discrepancy, the lower prevalence of *S. lupi* reported in Congo DR could be due to the fact that faecal examination was the only diagnostic technique used in that study unlike our situation where a more sensitive and complete postmortem examination was carried out. Faecal examination has the disadvantage of that repeated examinations are required when the first examination is negative for *S. lupi* since the shedding of eggs is often intermittent<sup>4</sup>.

The fact that no positive case of *T. spiralis* was diagnosed from the post-mortem study of stray dogs in Lusaka does not completely rule out the presence of this worm in the dog population. This is because the diagnostic technique (Trichinoscopy) that was used in this study has been reported to be less sensitive in the detection of *T. spiralis* larvae especially in low-level infections<sup>1</sup>. Two cycles of *Trichinella* infections namely domestic and sylvatic cycles have been described<sup>12</sup>. The term “domestic cycle” refers to the transmission pattern occurring in a swine herd for the following reasons: the consumption of uncooked pork scraps from dining rooms, kitchens, restaurants, and slaughterhouses; the consumption of garbage (i.e., garbage-fed pigs); direct pig to pig transmission due to tail or ear bites or to eating swine carcasses that are not promptly removed from the herd; and transmission through synanthropic animals living near the swine herd (e.g., rats, mustelids, and foxes). The sylvatic cycle is that which occurs in nature among carnivores with cannibalistic and scavenger behaviour. This cycle occurs virtually throughout the world. However, epidemiological surveys have been carried out only sporadically and there is no information on the sylvatic cycle in many countries including Zambia. Based on the findings of the study, it would be desirable to do further research on *T. spiralis* using a more sensitive diagnostic technique like the artificial digestion method as observed by Beck *et al.*<sup>1</sup>. In addition, the sample size of euthanized stray dogs in this study was limited and restricted only to Lusaka, an urban area and thus there is need to extend the study population to include even dogs in rural areas.

In conclusion, the presence of a high multiple helminth species in a single host may imply an elevated environmental contamination with parasite eggs, mainly in public places, creating a high risk of infection for pet dogs and humans, especially small children. Furthermore, the presence of three zoonotic parasites (*A. caninum*, *T. canis* and *D. caninum*) underscores the importance of establishing a national control programme for parasitic diseases in dogs in Zambia. Such a control programme will reduce the risk that dogs will pose to humans especially children and the HIV/AIDS immunocompromised individuals in the country.

## CONFLICT OF INTEREST

The authors of this paper declare that none of them has financial or personal relationships with individuals or organizations that would unacceptably bias the content of this paper.

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