

## Original Article

## Endoparasites detected in faecal samples from dogs and cats referred for routine clinical visit in Sardinia, Italy



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## ABSTRACT

This study aimed to update data on the prevalence of intestinal and lung parasitic infections in owned dogs and cats in Sardinia, Italy. Examinations on faecal samples from 619 dogs and 343 cats routinely referred to the Veterinary Teaching Hospital of the University of Sassari were performed between the years of 2011 and 2015. Individual faecal samples were analysed using the Wisconsin technique for copro-microscopic examination and the Baermann technique for the presence of lungworm larvae.

Endoparasites were found in 34.9% and 43.4% of examined dogs and cats, respectively. Helminthic infections (21.2% in dogs and 32.6% in cats) occurred more frequently than protozoan infections (17.9% in dogs and 17.8% in cats). In both dogs and cats, the most common parasites were ascarids (12.1% and 15.7%), *Cystoisospora* spp. (10.2% and 10.8%), *Giardia duodenalis* (9.4% and 8.5%), and hookworms (7.9% and 5.5%). Evidence of bronchopulmonary nematode infections were found in 0.8% of examined dogs and in 15.8% of examined cats. Age was identified as a risk factor, with animals younger than 6 months more frequently infected than older animals, while no significant association was observed for gender.

This study demonstrated that endoparasites in owned dogs and cats of Sardinia have considerably high prevalence. Veterinary practitioners and pet owners should be more aware of these infections and should adopt more effective and standardized control practices.

## 1. Introduction

Sardinia is the second largest island in the Mediterranean Sea, with an area of 23,821 km<sup>2</sup>. It is situated between 38° 51' and 41° 15' latitude north and 8° 8' and 9° 50' longitude east. The island is known as a holiday destination. Statistical data on tourism indicate that > 1.9 million people visited Sardinia in 2012 (1.9% of tourism in Italy), with a 42% increase in visitors from 2000 to 2012 (Pipia et al., 2014a). The island also has a high number of pets; at present 360,406 dogs are listed in the regional canine registries, while no data are available for the cat population (Ministero della Salute, [http://www.salute.gov.it/anagcaninapublic\\_new](http://www.salute.gov.it/anagcaninapublic_new)). This number considerably increases in summer, due to the movement of tourists with their pets, recognised as a potential route for the introduction and spread of endemic and non-endemic pathogens (Otranto et al., 2013; Genchi et al., 2011; Varcasia et al., 2004).

Endoparasitoses caused by intestinal and respiratory helminths are frequently reported in dogs and cats and can lead to severe clinical

signs. For this reason, they are regarded as important pathogens in companion animal clinical practice (Riggio et al., 2013; Traversa et al., 2010; Claerebout et al., 2009; Epe, 2009; Sager et al., 2006). Sardinia is endemic for cystic echinococcosis caused by *Echinococcus granulosus* in animals and humans, with 2111 human hospitalizations between 2001 and 2011 (Centro Nazionale di Riferenza per l'Echinococcosi/Idatidosi, "CeNRE"; [http://www.izs-sardegna.it/CeNRE\\_Epu.cfm](http://www.izs-sardegna.it/CeNRE_Epu.cfm)). Moreover, intestinal and lung parasites of dogs and cats include zoonotic species; *Toxocara* spp. and *Ancylostoma* spp., are responsible for visceral and cutaneous larva migrans syndromes in humans, while *Eucoleus aerophilus* is the causative agent of human pulmonary capillariasis (Riggio et al., 2013; Lee et al., 2010; Traversa et al., 2010; Claerebout et al., 2009; Sager et al., 2006; Sommerfelt et al., 2006). In addition, there are suggestions in the medical literature that *Trichuris vulpis* should be added to the list of zoonotic parasitic infections of people (Dunn et al., 2002; Márquez-Navarro et al., 2012). Reports of human infections are few, open to interpretation, and no definitive proof has yet been obtained; the subject, nevertheless, warrants further investigation and

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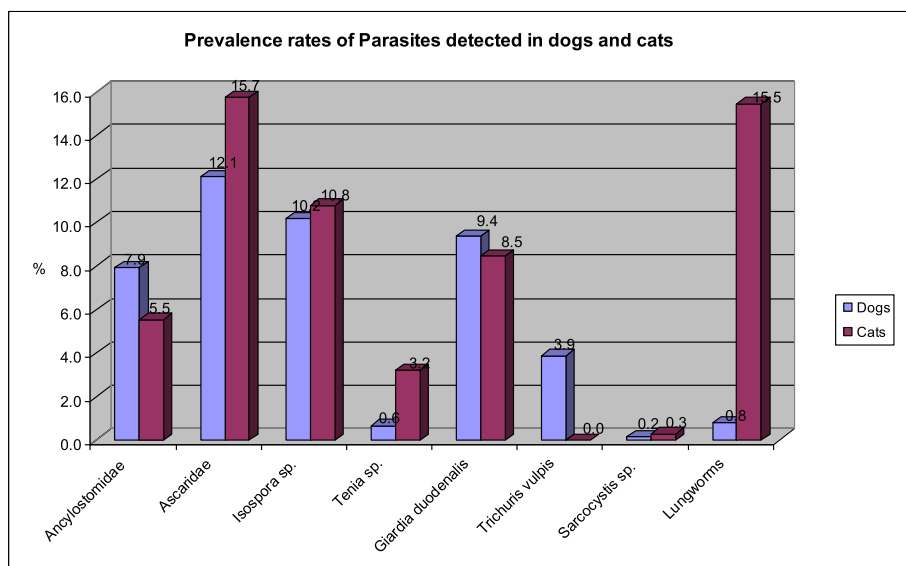


Fig. 1. Prevalence of parasites detected in dogs and cats.

consideration. However, no data on these zoonotic parasites in humans are available for Sardinia.

Many of these intestinal parasites display a direct life cycle, with the oral-faecal route being the most common. A major component of their spread is the high number of eggs or oocysts shed into the environment. Therefore, control measures are based on systematic anthelmintic treatments aimed at preventing or reducing the shedding of eggs or oocysts as well as the adoption of hygienic measures to decrease environmental contamination. However, despite the extensive use of anthelmintic treatments, high prevalence of some intestinal nematode species (e.g., *Toxocara canis*, hookworms, and *Trichuris vulpis*) was recently observed in owned dogs in Switzerland and Belgium (Claerebout et al., 2009; Sager et al., 2006), and the reduced efficacy of anthelmintic treatments was thought to be one of the potential causes for these findings (Riggio et al., 2013; Sager et al., 2006).

Epidemiological studies on endoparasites in pets are important to assess prevalence and to establish appropriate measures of veterinary care and pet-owner education. Even though patent infections caused by several internal helminths can be readily diagnosed by faecal examination, copro-microscopic diagnosis is not routinely performed during general veterinary visits since the control of internal parasites usually is achieved by administering anthelmintic treatments at pre-determined intervals.

Thus, a constant surveillance of the epidemiology of the most important or emerging parasitoses, such as those caused by endoparasites, is of paramount importance. Hence, the present survey aimed to update data on the prevalence of intestinal and lung parasitic infections in owned dogs and cats and to identify potential risk factors for infection.

## 2. Materials and methods

Faecal samples of 619 owned dogs (326 males and 293 females) and 343 owned cats (183 females and 160 males) referred between 2011 and 2015 for routine vaccination or clinical visit at the Veterinary Teaching Hospital of the University of Sassari were examined for endoparasites. For each sampled animal, data on sex, age, and stool consistency were recorded. Stool consistency of each sample was classified as normal (well formed), pasty (soft, not well formed) or diarrhoeic (liquid), as described by Pipia et al. (2014b). Faecal samples were withdrawn from the rectum in accordance with animal welfare standards or from the ground immediately after defecation and stored at 4 °C until examination; faecal analyses were performed within 24 h of collection.

Copro-microscopic examination for internal parasites was

performed using the Wisconsin technique. Briefly, approximately 3 g of the faecal sample were examined with centrifugation/flotation (626 g for 10 min) using a zinc sulphate (ZnSO<sub>4</sub>) flotation solution (specific gravity: 1.2) as described by Pipia et al. (2014b). Faecal samples were also examined for the presence of first-stage larvae (L1) of lungworms using the Baermann technique. Approximately 5 g of the sample were wrapped in a cheesecloth and placed in a funnel filled with water for 24 h at room temperature. Afterwards, the sediment obtained with centrifugation (626 g for 10 min) was microscopically examined at 100 × magnification for L1 (Pipia et al., 2014a).

### 2.1. Ethical statement

This study was executed following the recommendations of European Council Directive (86/609/EEC) on the protection of animals and all the samples were recovered during routine vaccination or clinical visit at the Veterinary Teaching Hospital of the University of Sassari.

### 2.2. Statistical analysis

Data were recorded into an electronic spreadsheet (Excel®, Microsoft Corp., Redmond, WA, USA), and difference in prevalence was statistically tested using the Chi-Square for independence (Epi-Info® 6.0, CDC/WHO, Atlanta, GA, USA).

## 3. Results

Overall, 34.9% of examined dogs and 43.4% of cats tested positive for endoparasites; difference between prevalence for the two host species was statistically significant ( $\chi^2 = 6.84$ ;  $P = 0.008$ ). Among positive animals, 76.8% of dogs and 69.1% of cats were infected with one parasite, while 19% of dogs and 24.8% of cats harboured two different parasites. Few positive animals (2.8% of dogs and 5.4% of cats) were parasitized by three different parasites, and only 1.4% of dogs and 0.7% of cats were infected by more than three parasites.

The parasites detected and their prevalence are summarized in Fig. 1. Helminth infections (21.2% in dogs and 32.6% in cats;  $\chi^2 = 20.1$ ;  $P < 0.0001$ ) were more frequent than protozoan infections (17.9% and 17.8% in dogs and cats, respectively). In dogs, the detected parasites were ascarids (12.1%; *T. canis*: 11%, *Toxascaris leonina*: 1.1%), *Cystoisospora* sp. (10.2%), *Giardia duodenalis* (9.4%), hookworms (7.9%), *T. vulpis* (3.9%), taeniid (0.6%), and *Sarcocystis* sp. (0.2%). Among cats, the recovered parasites were ascarids (15.7%; *Toxocara*

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