

Age-Dependant Prevalence of Endoparasites in Young Dogs and Cats up to One Year of Age

Dieter Barutzki¹ (✉), Roland Schaper²

¹ Veterinary Laboratory Freiburg, P.O. Box 100120, 79120 Freiburg i. Br., Germany

² Bayer Animal Health GmbH, 51368 Leverkusen, Germany

Corresponding author:

Dieter Barutzki

✉ E-mail: barutzki@labor-freiburg.de

Abstract

The results of parasitological examination of faecal samples from 1,206 cats and 2,319 dogs of known age up to one year were analysed. Eggs of *Toxocara canis* were detected in dogs for the first time at the beginning of the 3rd week, oocysts of *Isospora* spp. and cysts of *Giardia* spp. at the beginning of the 4th week p.p. High infection rates with *Giardia* spp. (52.5 %) were demonstrated in the 12th week, *I. canis* (30.0 %) in the 15th week, *I. ohioensis*-complex (44.0 %) in the 6th week, *Isospora* spp. (50.0 %) in the 7th week and *T. canis* (22.2 %) in the 4th week p.p. Co-infections with *Isospora* spp. + *Giardia* spp. (28.0 %), *T. canis* + *Isospora* spp.

(16.0 %) and *T. canis* + *Giardia* spp. (12.0 %) were mainly seen in the 6th week p.p. In cats, oocysts of *Isospora* spp. and cysts of *Giardia* spp. were seen from the 3rd week and eggs of *Toxocara cati* from the 5th week p.p. High infection rates with *Giardia* spp. (66.7 %) were demonstrated in the 11th week, *Isospora* spp. (33.3 %) and *I. felis* (33.3 %) in the 15th week, *I. rivolta* (10.3 %) in the 10th week and *T. cati* (11.4 %) in the 8th week p.p. Co-infections with *T. cati* + *Isospora* spp. (9.1 %) were found in the 5th week, *Isospora* spp. + *Giardia* spp. (8.2 %) in the 12th week and *T. cati* + *Giardia* spp. (2.5 %) in the 22nd week p.p.

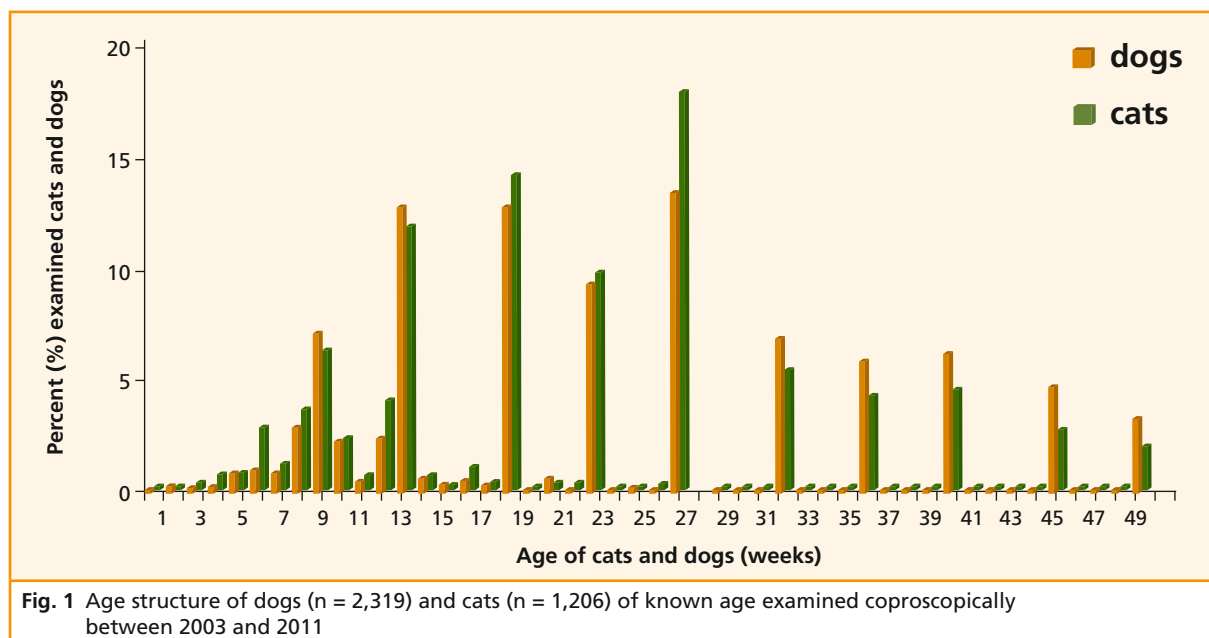
Introduction

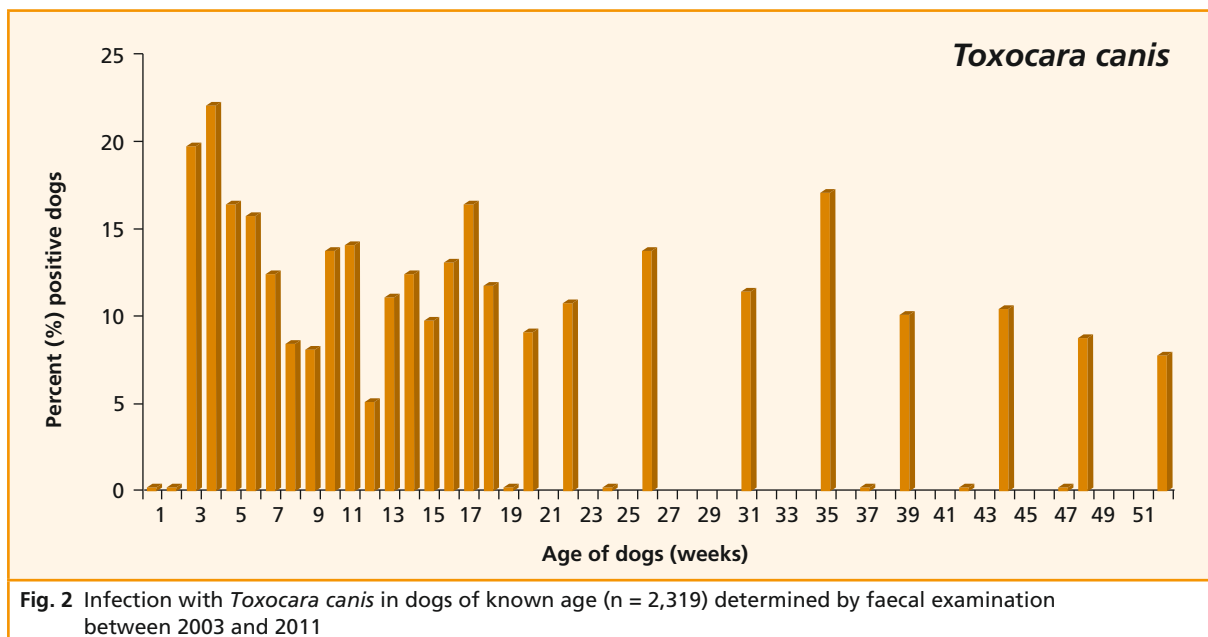
Toxocara spp., *Isoospora* spp. and *Giardia* spp. are the most common parasites in the digestive tract of dogs and cats. These endoparasites are of significance as they produce diarrhoea and malabsorption in their hosts. In litters they can be responsible for failure to gain weight or weight loss, causing small and weak puppies. A subclinical course of an infection may considerably alter the growth and development of a pup. In clinical cases, even severe dehydration and death can occur. In addition, *Toxocara canis* and *Giardia* spp. are zoonotic parasites and are therefore of major public-health significance. These endoparasites have a worldwide distribution and are also endemic in Germany. Large-scale analysis of coproscopic examination performed by Barutzki and Schaper (2003, 2011) has shown that puppies and young animals under 12 months of age are more often infected with endoparasites than older dogs and cats. But to date there are only a few data on the prevalence of endoparasites and the relevance of co-infections with *Toxocara* spp., *Isoospora* spp. and *Giardia* spp. in young cats and dogs. In the study

presented here, the results of coproscopic examination of faecal samples from young pets were analysed to illustrate the development of the age-dependant parasite burden in young cats and dogs up to one year of age.

Materials and methods

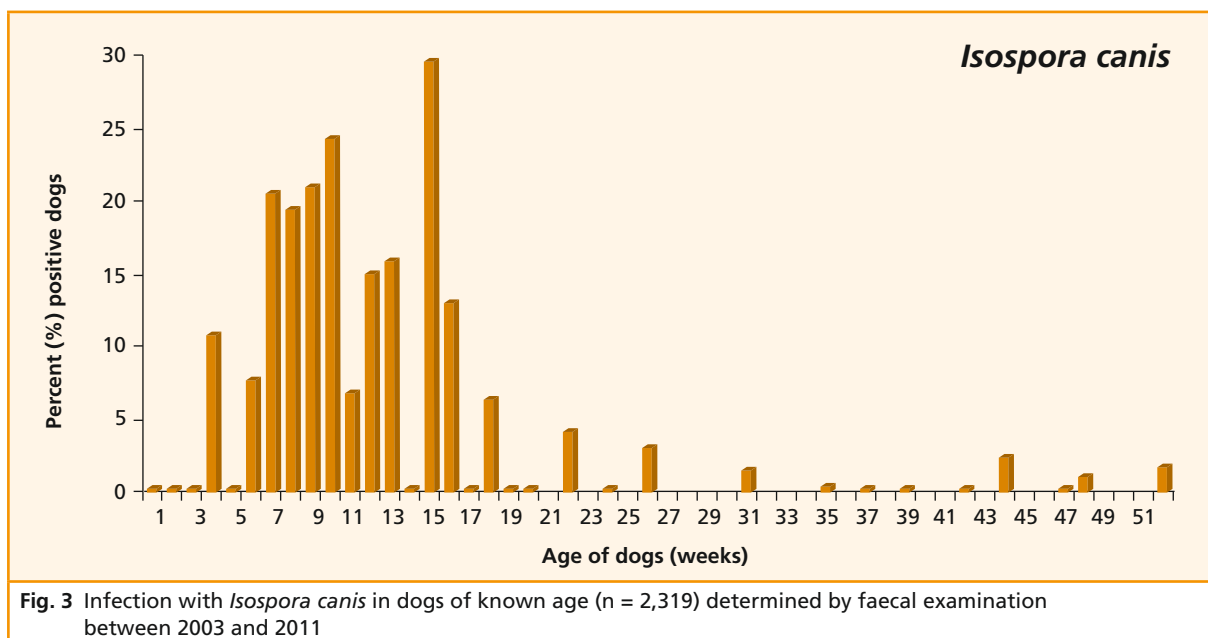
Between 2003 and 2011, faecal samples from 25,834 privately owned dogs and 7,290 cats of known age in Germany were examined for endoparasites by the commercial Veterinary Laboratory Freiburg. The reasons for submitting the samples were gastrointestinal disorders, routine examination, animal vaccination, general health check or not mentioned. Age data of 2,319 dogs and 1,206 cats (Fig. 1) up to one year of age provided the basis for analysing the age dependence of infections with *Toxocara* spp., *Isoospora* spp. and *Giardia* spp. in young pets. All specimens were tested by a standardised flotation method with a saturated salt solution containing zinc chloride and sodium chloride (specific gravity 1.3). To detect *Giardia*, samples were analysed using a coproantigen ELISA (ProSpecT[®]





Giardia Microplate Assay, Remel Europe Ltd, distributed by Sekisui Virotech GmbH, Germany) or a sodium acetate formaldehyde (SAF) technique (Marti and Escher 1990) to concentrate cysts of *Giardia*. The results of the coproscopic examinations were recorded and analysed in an Access data bank (Microsoft Access 2007). Due to inadequate

morphological characteristics, infections with *I. ohioensis*, *I. burrowsi* and *I. neorivolta* found in dogs were documented as *I. ohioensis*-complex. These three protozoan species do not show discriminative morphological criteria in terms of oocyst size or structure and can therefore not be separated by microscopic examination (Lindsay et al. 1997).



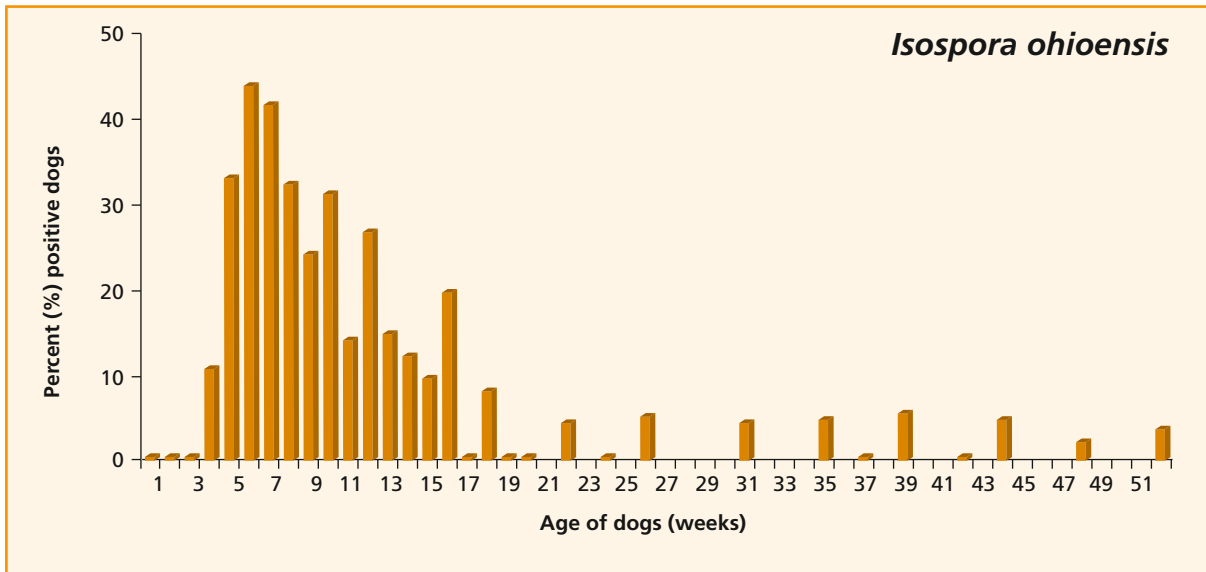


Fig. 4 Infection with *Isospora ohioensis*-complex in dogs of known age (n = 2,319) determined by faecal examination between 2003 and 2011

Results

A total of 2,319 dogs and 1,206 cats were included in the study and subdivided into 52 age groups at intervals of one week, starting from birth up to one year of age (Fig. 1). Cats and dogs less than 4 weeks

of age were rarely tested for parasites. Most of the animals examined were up to 6 months old. The percentage of sampled cats and dogs per week increased with age from the 3rd to the 26th week p.p., with maximum rates of 13.9% for dogs and 18.0% for cats, and decreased in older age groups.

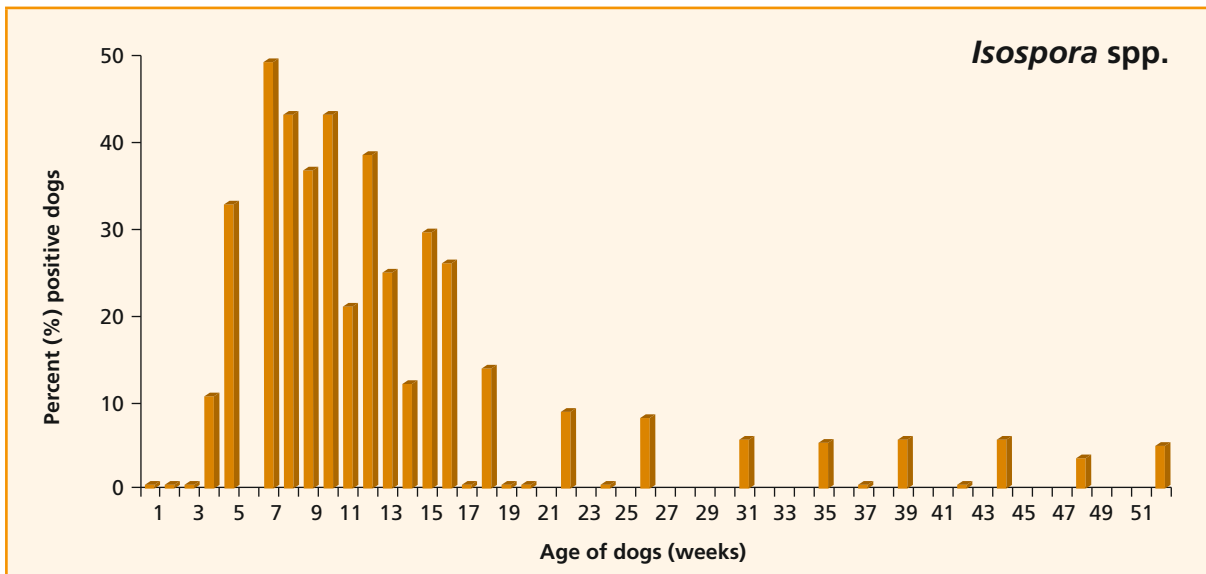


Fig. 5 Infection with *Isospora spp.* in dogs of known age (n = 2,319) determined by faecal examination between 2003 and 2011

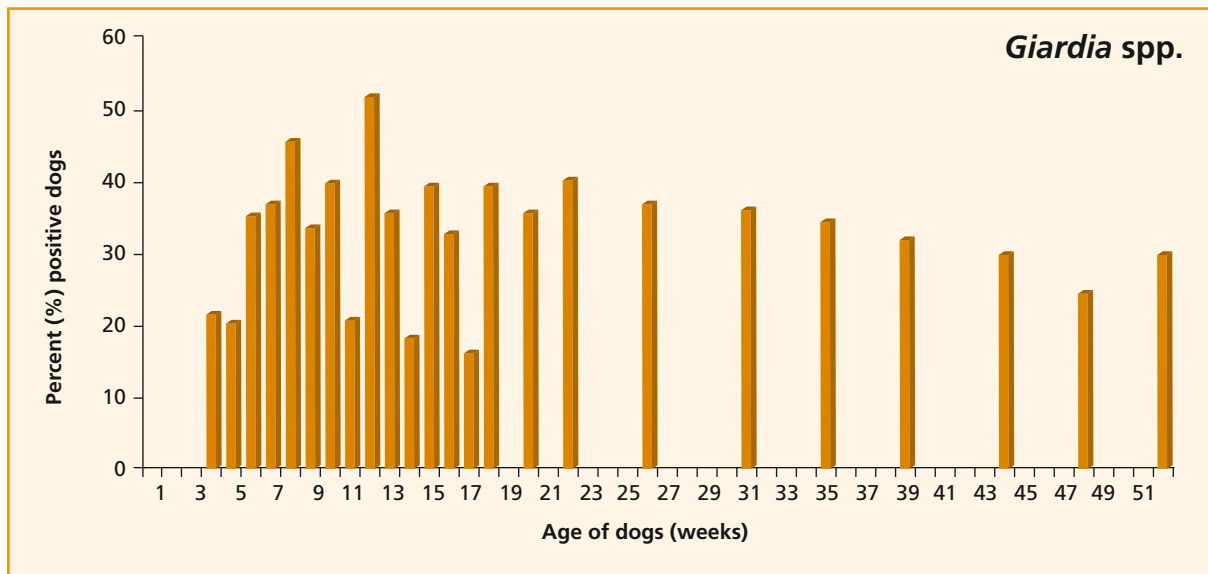


Fig. 6 Infection with *Giardia* spp. in dogs of known age (n = 2,319) determined by faecal examination between 2003 and 2011

Eggs of *Toxocara canis* were detected in dogs (Fig. 2) for the first time at the beginning of the 3rd week. The highest infections rates with *T. canis* (22.2%) were found in the age group with 4-week-old puppies. In groups between 6 and 36 weeks of age, the percentage of *T. canis*-positive dogs showed only

minor variations and decreased in older dogs to 8.9%. Dogs infected with *Isospora canis* (Fig. 3), *I. ohioensis*-complex (Fig. 4) and *Isospora* spp. (Fig. 5) displayed a corresponding pattern of excretion of exogenous stages. The first oocysts were detected in 4-week-old puppies, and the highest

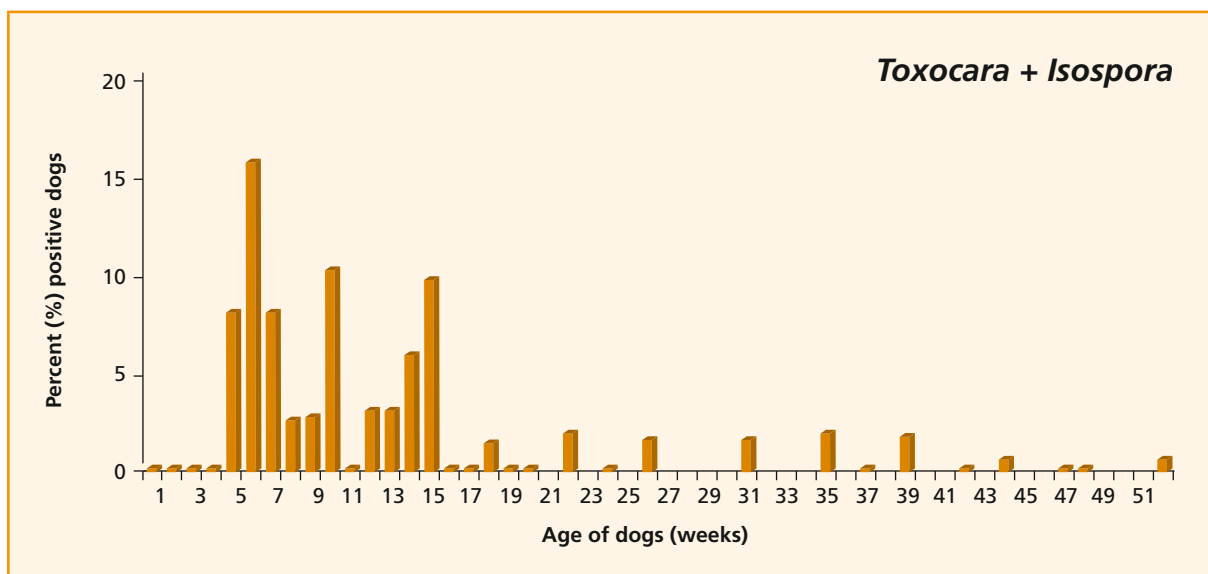


Fig. 7 Co-infection with *Toxocara canis* + *Isospora* spp. in dogs of known age (n = 2,319) determined by faecal examination between 2003 and 2011

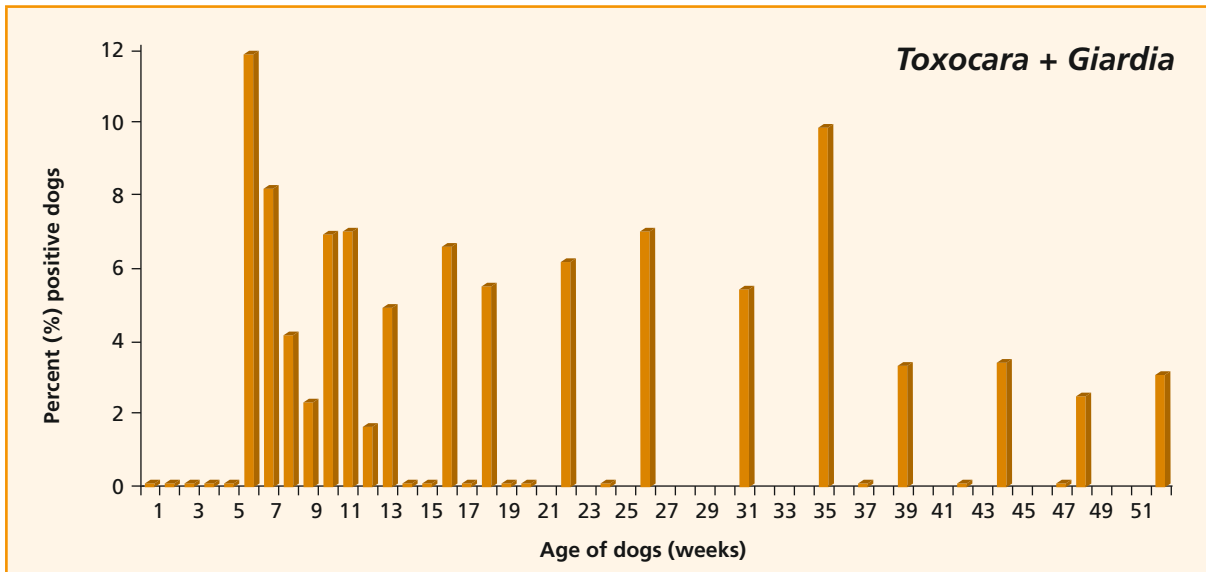


Fig. 8 Co-infection with *Toxocara canis* + *Giardia* spp. in dogs of known age (n = 2,319) determined by faecal examination between 2003 and 2011

levels of *I. ohioensis*-complex (44.0%), *I. canis* (30.0%) and *Isospora* spp. (50.0%) were recorded at the age of 6 weeks, 15 weeks and 7 weeks, respectively. After the 18th week of age, the percentage of *Isospora* spp.-positive dogs decreased markedly and remained below 9 % until the end of the

examination period. Dogs started to excrete cysts of *Giardia* spp. (Fig. 6) in the 4th week p.p. and showed the highest percentage rates (52.5 %) at the age of 12 weeks p.p. The percentage of *Giardia* spp.-positive dogs barely declined until the end of the empirical study, varying between 25.3 % and

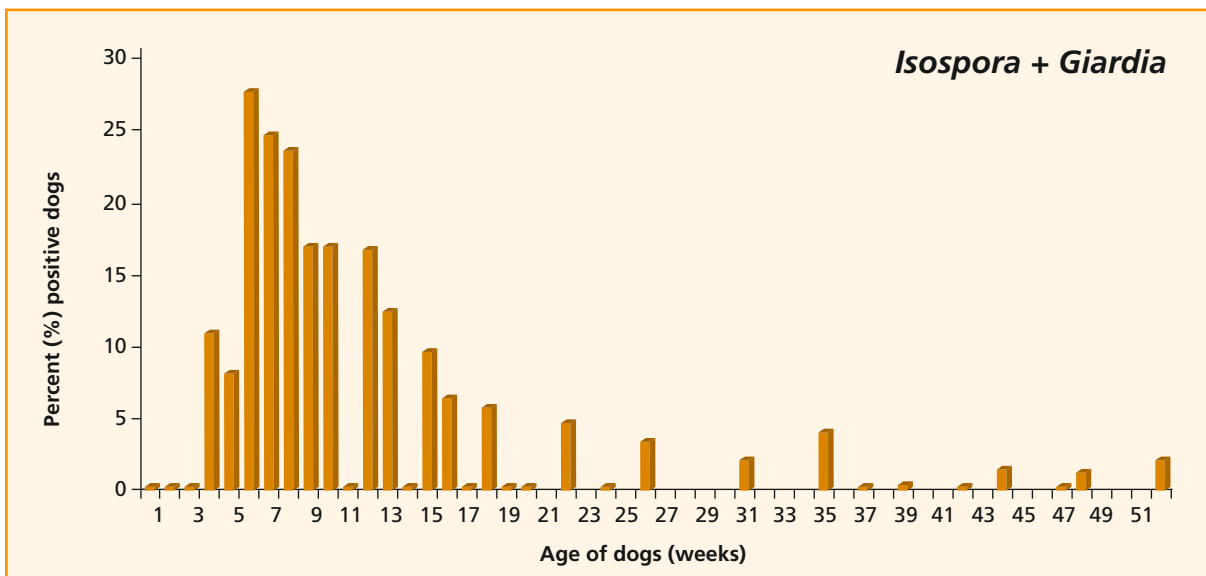
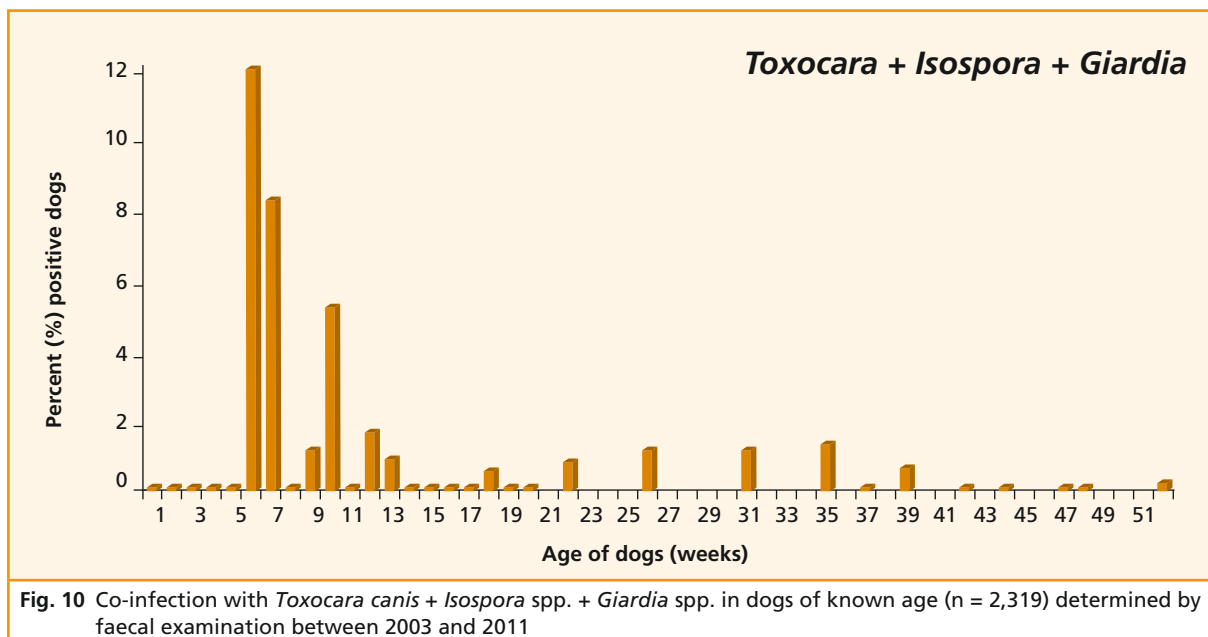
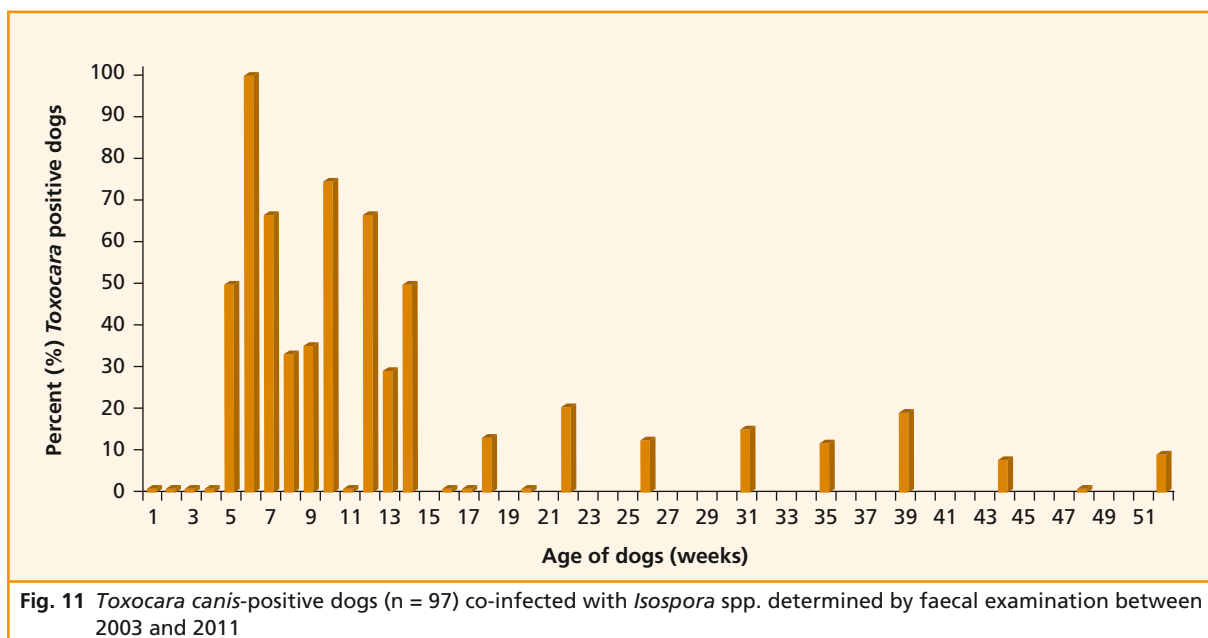


Fig. 9 Co-infection with *Isospora* spp. + *Giardia* spp. in dogs of known age (n = 2,319) determined by faecal examination between 2003 and 2011



41.0%. Co-infections with *T. canis* + *Isospora* spp. (16.0%) (Fig. 7), *T. canis* + *Giardia* (12.0%) (Fig. 8) and *Isospora* spp. + *Giardia* spp. (28.0%) (Fig. 9) were mainly seen in the 6th week p.p. These figures show co-infections with *T. canis* + *Isospora* spp. + *Giardia* spp. peaking in the 6-week group (12.0%)

(Fig. 10). *T. canis*-positive dogs (Fig. 11) were mostly co-infected with *Isospora* spp. between the 6th and 14th weeks p.p., with the highest rates between the 6th and the 12th weeks p.p. After the 16th week, the percentages ranged between 0% and 20.8%.



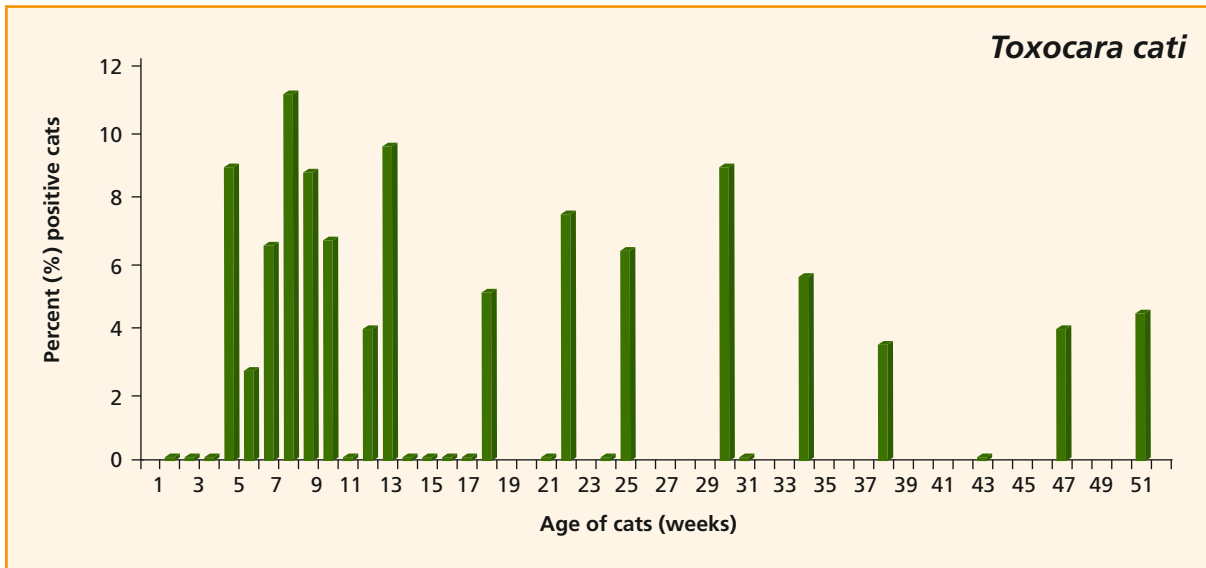


Fig. 12 Infection with *Toxocara cati* in cats of known age (n = 1,206) determined by faecal examination between 2003 and 2011

In cats, eggs of *Toxocara cati* (Fig. 12) were seen for the first time from the 5th week p.p., oocysts of *Isospora felis* (Fig. 13), *Isospora rivolta* (Fig. 14), *Isospora* spp. (Fig. 15) and cysts of *Giardia* spp. (Fig. 16) from the 3rd week p.p. High infection rates with *Giardia* spp. (66.7%) were seen in the

11th week, with *Isospora* spp. (33.3%) and *I. felis* (33.3%) in the 15th week, with *I. rivolta* (10.3%) in the 10th week and with *T. cati* (11.4%) in the 8th week p.p. High percentages of co-infections with *T. cati* + *Isospora* spp. (Fig. 17) (9.1%) were found in the 5th week, with *T. cati* + *Giardia* spp. (2.5%)

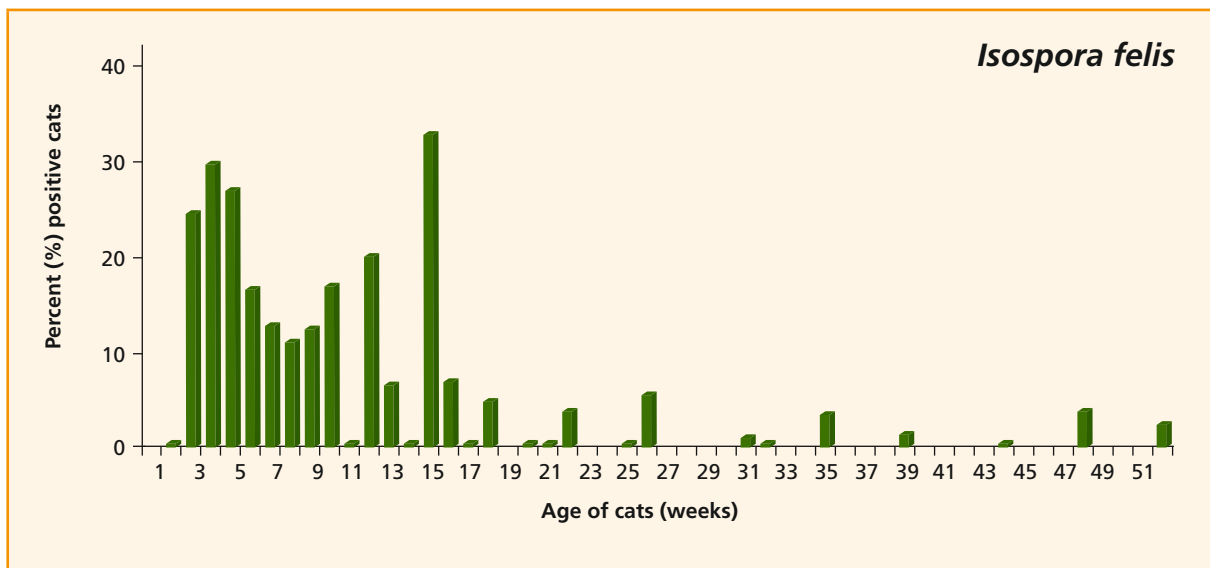


Fig. 13 Infection with *Isospora felis* in cats of known age (n = 1,206) determined by faecal examination between 2003 and 2011

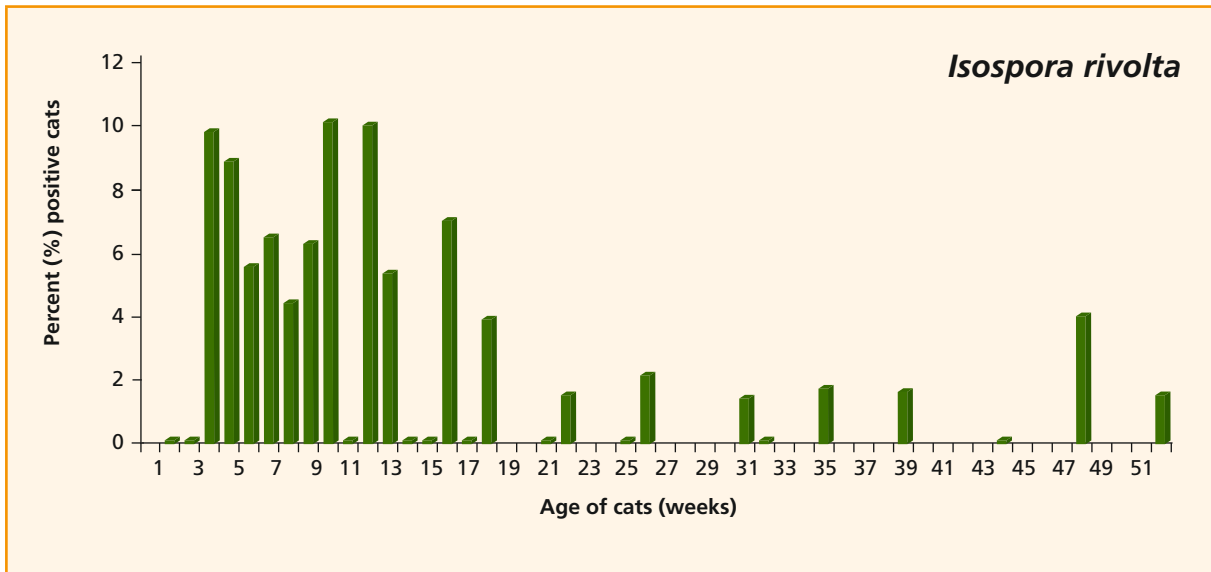


Fig. 14 Infection with *Isospora rivolta* in cats of known age (n = 1,206) determined by faecal examination between 2003 and 2011

in the 22th week p.p. (Fig. 18) and with *Isospora* spp. + *Giardia* spp. (8.2%) in the 12th week p.p. (Fig. 19). Triple co-infections with *T. cati* + *Isospora* spp. + *Giardia* spp. were not seen.

Discussion

This study presents a detailed age-dependent analysis of infections with *Toxocara* spp., *Isospora* spp. and *Giardia* spp. in young cats and dogs in Germany. The results confirm earlier studies and

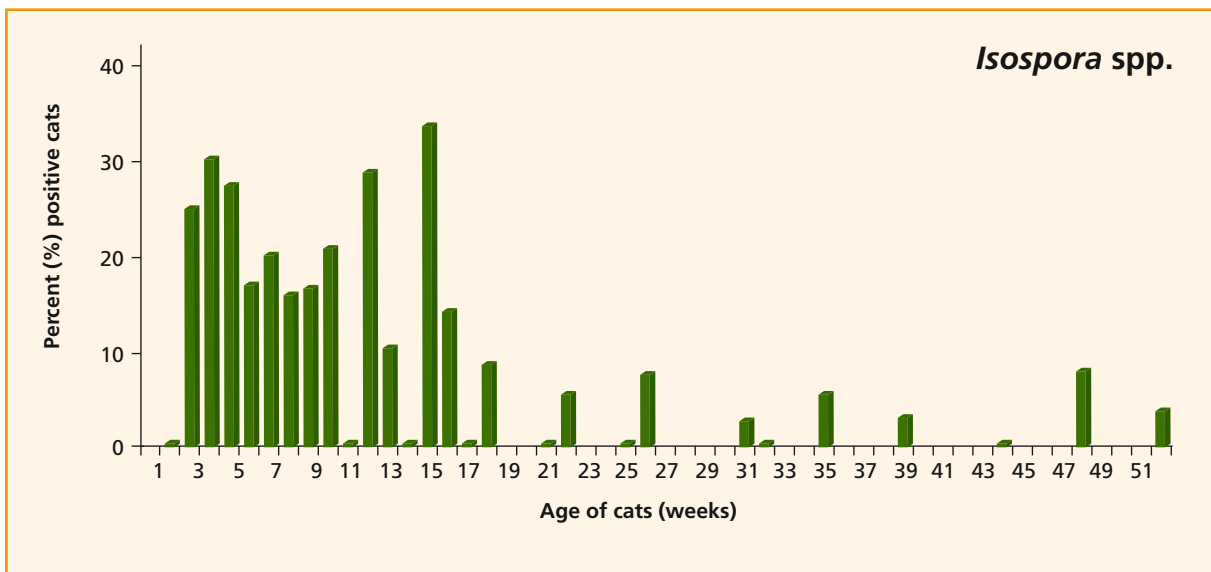


Fig. 15 Infection with *Isospora* spp. in cats of known age (n = 1,206) determined by faecal examination between 2003 and 2011

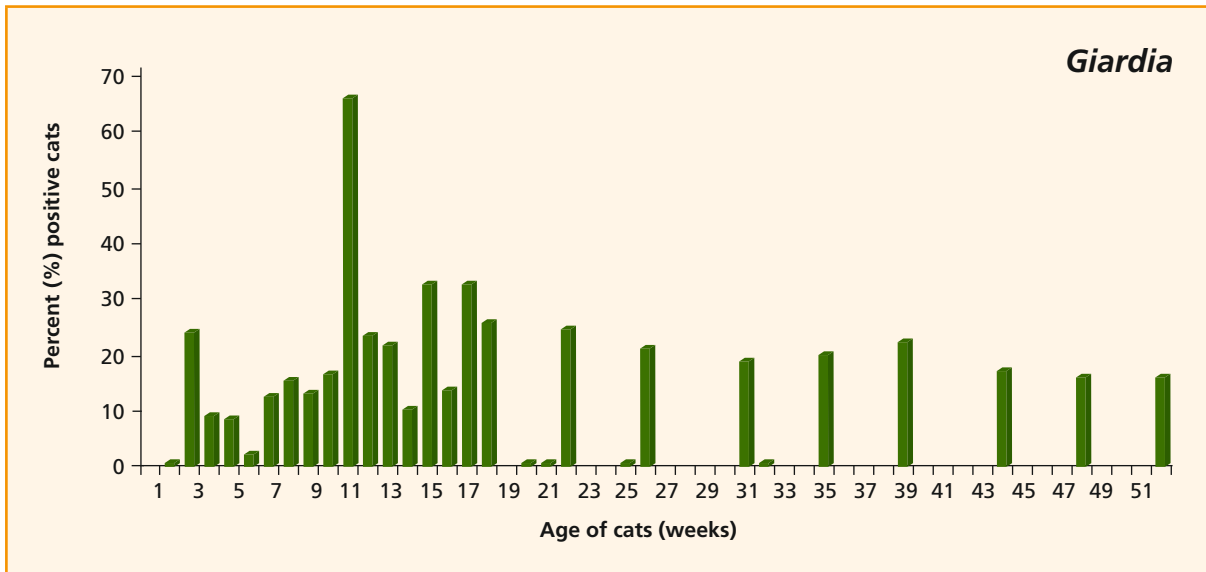


Fig. 16 Infection with *Giardia* spp. in cats of known age (n = 1,206) determined by faecal examination between 2003 and 2011

demonstrate that puppies and young animals are more likely to be infected with helminths and protozoa than older dogs and cats (Dauguschies et al. 2000; Barutzki and Schaper 2003; Buehl et al. 2006). This is also in keeping with a survey carried out in dogs from Murcia in Spain, which showed higher prevalence rates of *T. canis* in dogs up to

one year of age compared to older age groups (Martinez-Carrasco et al. 2007), a higher prevalence of *Giardia* spp. in dogs and cats in young animals in Australia (Swan and Thompson 1986), and a higher infection rate with *Giardia* spp. in dogs under 12 months of age in the UK (Batchelor et al. 2008). This holds true even for stray dogs, which are more

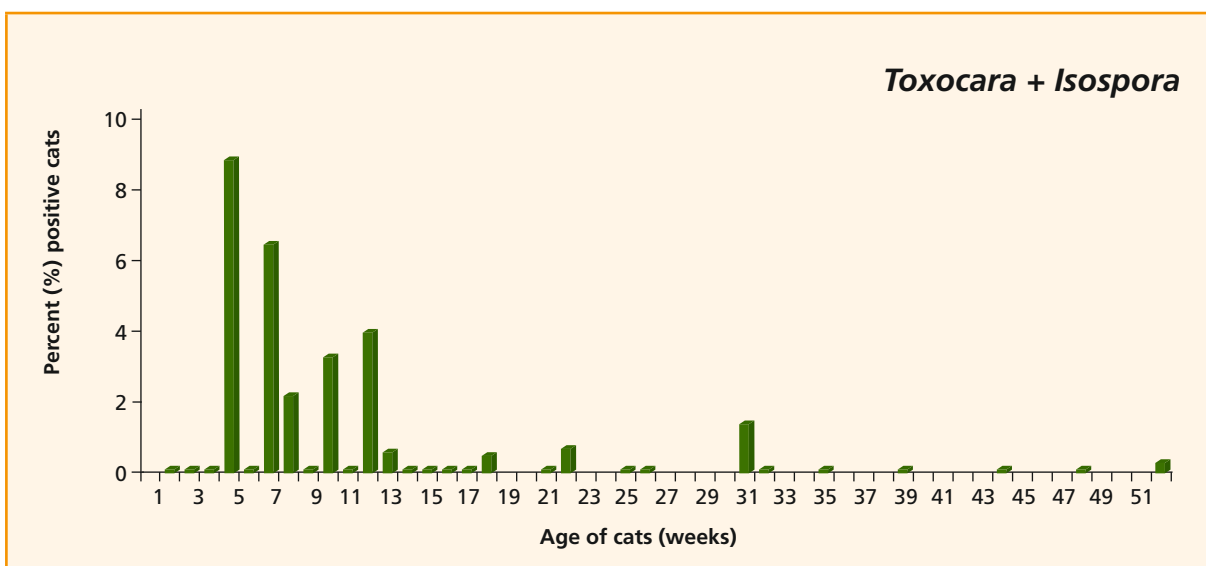
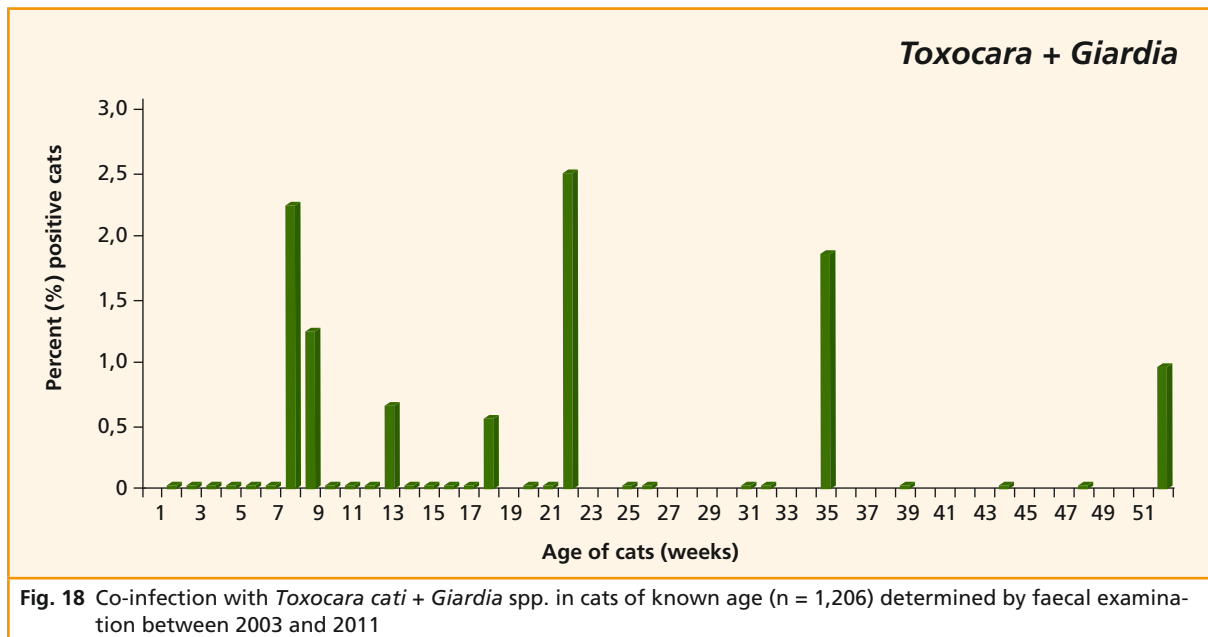
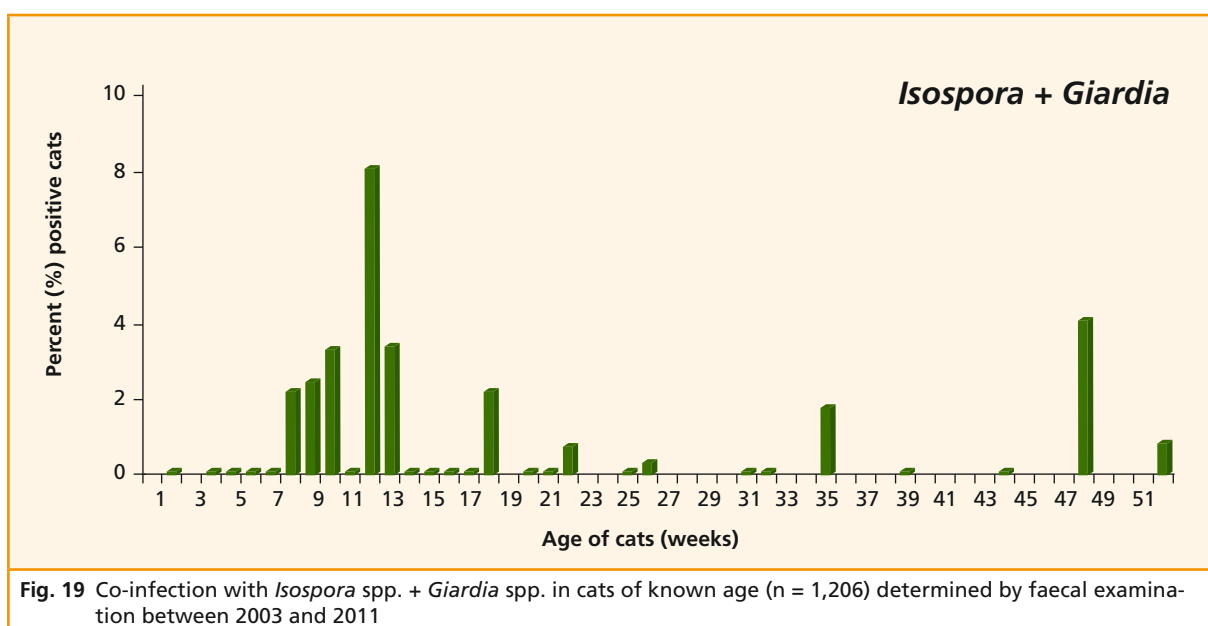


Fig. 17 Co-infection with *Toxocara cati* + *Isospora* spp. in cats of known age (n = 1,206) determined by faecal examination between 2003 and 2011



likely to be infected in age groups up to one year with endoparasites in Iran (Daryani et al. 2009) and with *T. canis* in Mexico City (Eguía-Aguilar et al. 2005) and in the Slovak Republic (Antolová et al. 2004). Accordingly, young stray dogs were found to shed nematode eggs in faeces more frequently than adult animals in Brazil (Oliveira-Sequeira et al.

2002). In contrast, there are only isolated studies which show no significant differences in the prevalence of helminth parasites in stray dogs between young and adult animals (Cantó et al. 2011). The high risk potential for mono-infections in young dogs is confirmed by higher co-infection rates with endoparasites in young dogs compared to older



dogs. Young dogs up to 12 months of age were identified as a risk factor for infection in dogs. *Giardia* cyst-positive dogs showed a high percentage of co-infections with *Toxocara canis* and *Isoospora ohioensis* (Mircean et al. 2012). In the study presented here, the percentage of dogs infected with *Isoospora* spp. + *Giardia* spp. and *T. canis* + *Isoospora* spp. + *Giardia* spp. showed a distinctive peak in the 6-week-old group. *T. canis*-positive dogs had the highest percentages of co-infections with *Isoospora* spp. between the 6th and 14th weeks p.p. Age below 6 months has been identified as a risk factor for cats and dogs to be infected with intestinal parasites. This finding results from cross-sectional studies in Italy (Riggio et al. 2012) on infections with intestinal and lung parasites, in Nigeria (Sowemimo 2007) on the prevalence and intensity of infection with *T. canis* in dogs, in Chile (López et al. 2006) on dogs with gastrointestinal symptoms and *Giardia*, *Isoospora* and *Toxocara canis* and young cats with *Isoospora*, and in Greece (Haralabidis et al. 1988) on infection with *T. canis*. A longitudinal study in Norway focusing on the occurrence of *Giardia* in dogs during their first year of life likewise showed the highest level in dogs more than 6 months old, but the differences between the age groups were not statistically significant (Hannes et al. 2007). Results from a study by Fok et al. (2001) suggest higher prevalence rates in some eastern European countries compared to western European countries. But independently of the region, the authors reported a higher prevalence of *T. canis* in pups aged less than three months. This high level of parasite infection especially in young animals highlights the necessity of monitoring parasites by routine faecal examination to demonstrate the parasite burden and of a strategic deworming programme, hygiene measures, and appropriate use of disinfectants in puppies and kittens in particular.

Conclusion

In summary, it can be concluded that dogs and cats are frequently infected with helminth and

protozoan endoparasites. Young cats and dogs up to one year of age in particular show high infection rates with endoparasites. In age groups up to 3 and 6 months, the risk of cats and dogs being infected with ascarids, coccidia and *Giardia* increases indirectly proportionally to the age of the animals. The following specific aspects must be observed when breeding cats and dogs:

- ▶ Dogs and cats show a concurrent profile of infections with *Toxocara* spp., *Isoospora* spp. and *Giardia* spp.
- ▶ Puppies and kittens up to 6 months of age are most frequently infected with endoparasites.
- ▶ Patent infections with *Toxocara* in dogs and cats are first found in the 3rd and 5th week of life, respectively, *Isoospora* spp. and *Giardia* spp. in the 4th and 3rd week p.p., respectively.
- ▶ In dogs, high infection rates with *Toxocara canis* are seen in the 4th week, with *Isoospora* spp. in the 7th week and with *Giardia* spp. in the 12th week p.p.
- ▶ Co-infections in dogs with *T. canis* + *Isoospora* spp., *T. canis* + *Giardia* spp. and *Isoospora* spp. + *Giardia* spp. are mainly seen in the 6th week p.p.
- ▶ In cats high infection rates with *T. cati* occur in 8th, with *Giardia* spp. in the 11th and with *Isoospora* spp. in the 15th week p.p.
- ▶ Co-infections with *T. cati* + *Isoospora* spp., *Isoospora* spp. + *Giardia* spp. and *T. cati* + *Giardia* spp. in cats can be expected in the 5th, 12th and 22th week p.p., respectively.

Ethical standards

All of the studies reported herein were performed in compliance with current applicable local laws and regulations.

Conflict of interest

D Barutzki is the director of the Veterinary Laboratory Freiburg. R Schaper is an employee of Bayer Animal Health GmbH. Bayer Animal Health GmbH provided financial support for performance of data analysis.

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