

SARCOCYSTIOSIS IN DOGS IN SEVERAL REGIONS OF SERBIA

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The results of an investigation related to Sarcocystis spp. infection of dogs in Serbia are presented in this paper, for the first time after 25 years. In order to investigate the prevalence of sarcocystiosis in dogs, 448 dogs were examined. Considering feeding and living conditions, the dogs were divided in to 5 categories (city dogs - 100, village dogs - 188, dogs from a shelter - 54, military dog farm - 42 and dogs from private kennels - 64). Considering age, they were divided in to four groups (puppies - 49, young dogs 6 months to 1 year of age - 86, 1-3 year old dogs -117 and 196 dogs older than 3 years). The results obtained show that 2.46% (11/448) of the examined dogs were positive. Significant differences in the presence of sporocysts were established among the categories. The highest rate of positive cases was found in the dogs from the shelter (5.56%), followed by village dogs (3.72%) and there was no difference between these categories. There was a 1% positive rate among city dogs, while there were no positive animals in the remaining two categories. Considering age, significant differences were detected among all groups in respect to the presence of infected dogs ($p < 0.10$). The highest rate was found in the group of dogs older than 3 years (4.59%), then in the group of dogs aged 1-3 years (1.71%), while there were no positive animals in the other two groups.

Key words: sarcocystiosis, dogs, prevalence, feeding, age

INTRODUCTION

Sarcocystiosis is parasitic disease of a great number of domestic and wild animals and humans, caused by coccidia, members of the genus *Sarcocystis* spp. These are parasites with an obligatory two host life cycle, forming cysts in muscular and nervous tissue of intermediate hosts (Rommel *et al.*, 1972). In general, carnivores and humans are the final hosts, in whose digestive tract the sexual phase of development takes place, while herbivores and omnivores are intermediate hosts, because the asexual phase of the life cycle of *Sarcocystis* spp. takes place in their musculature and vascular system (Heydorn and Rommel 1972a, 1972b).

In the last thirty years, over one thousand publications have provided information about the *Sarcocystis spp.* life cycle, clinical symptoms of disease in humans and animals, immunity, diagnostic methods and the importance of sarcocystiosis as a zoonosis (Smith, 1994).

There are numerous investigations concerning the prevalence of sarcocystiosis in dogs as final hosts in many countries (Potters 1978, Streitl and Dubey 1976, Boch *et al.* 1980, Mc Kenna *et al.* 1980, Collins *et al.* 1983, Svobodova *et al.* 1984, Haralabidis *et al.* 1988., Goethe and Reichler 1990., Abo Sehada and Ziyadeh 1991, Epe *et al.* 1993.).

Moreover, a significant prevalence of sarcocystiosis in intermediate hosts has been established. However data concerning the prevalence of sarcocystiosis in intermediate hosts in Serbia are sparse (Perović 1990., Katić - Radivojević Sofija 1990.), and there is only one article (Šibalić *et al.* 1977) reporting *Sarcocystis spp.* in dogs.

Considering that dogs are a possible source of infection for intermediate hosts and there are no data about the prevalence of sarcocystiosis in dog populations in Serbia in the last 25 years, the aim of this paper was to present some results showing the extent that dogs can be infected and afterwards become a source of infection for intermediate hosts.

MATERIAL AND METHODS

In order to investigate the epizootic situation in respect to sarcocystiosis, different categories of dogs were examined, considering living conditions and feeding: 100 city dogs (I), 188 village dogs (II), 54 dogs from an animal shelter (III), 42 dogs from a military farm (IV) and 64 dogs from private kennels (V). Considering age, the dogs were divided in to four groups: 49 puppies under 6 months of age, 86 young dogs 6-12 months old, 117 dogs 1-3 years old, and 196 mature dogs older than 3 years. Feces samples were collected from northern and southern Banat, southern Srem, Belgrade, Niš and their suburbs. Three feces samples, originating from each of the 448 examined dogs, were packed in small plastic bags and kept in a refrigerator at a temperature of + 4 °C until they were examined. Every sample was accompanied by certain anamnestic data, concerning age, sex, life conditions (in the house, in backyard, at large etc.), feeding (raw or cooked meat or offal) and location.

The presence of sporocysts of *Sarcocystis spp.* in dog feces was investigated by the method of flotation using saturated saline water (NaCl) solution (Boch *et al.* 1980.). All samples were examined within 48 hours.

The proportion of positive cases in the categories or groups and differences between them were analyzed by Z-test. The homogeneity of proportion was analyzed by the chi-square test (χ^2).

RESULTS AND DISCUSSION

Sporocysts of *Sarcocystis spp.* were found in feces samples originating from 11 (2.46%) of the 448 examined dogs (Figure 1.). The dimensions of the

sporocysts were 14-15 x 9-10,5 μm . They were oval, sporulated, with 4 sporozoites inside.



Figure 1. *Sarcocystis spp.* oocyst (sporocyst) in dog feces (x1000)

The species of the sporocysts detected could not be established, but considering anamnestic data, the sources of infection were probably pork, mutton and beef, which means that the species must have been different.

Sarcocystis spp. sporocyst findings in the examined samples are given in Table 1.

Similar data concerning the prevalence of sarcocystiosis in dogs were presented by Streitel and Dubey (1976.), who reported that 1.8% of the examined dogs were positive. Epe *et al.* (1993.) reported a rate of 2.5% positive cases in feces samples that originated from 3329 dogs. Low rates of infected dogs were given by many investigators (Deumer 1984., Svobodova *et al.* 1984., Haralabidis *et al.* 1988., etc.).

The first and only investigation on *Sarcocystis spp.* prevalence in our country (Šibalić *et al.* 1977.) revealed very high rates of infected dogs of 70% (14/20) and 35% (7/20), in two kennels respectively. The same investigation showed that the rate of infection in individually kept dogs was 4.6% (13/282), which is also higher than data obtained in this investigation. High rates of infected dogs were given by several authors (Abo Shehada and Ziyadeh 1991, Boch *et al.*, 1980.). The highest prevalence of *Sarcocystis spp.* infected dogs was established in New

Zealand (McKenna *et al.* 1980) and in the Sidney area in Australia (Collins *et al.* 1983), 59% and 29%, respectively.

Table 1. Prevalence of *Sarcocystis spp.* in the examined dogs, in relation to feeding and living conditions

Category	number of examined dog (n)	dogs confirmed for presence of oocysts /sporocysts	%	dogs fed raw meat and offals occasionally or permanently	%	dogs with manifested clinical signs (diarrhoea)	%
I	100	1	1	4	4	3	3
II	188	7	3.72	140	74.46	3	1.59
III	54	3	5.56	–	–	–	–
IV	42	–	–	–	–	–	–
V	64	–	–	–	–	1	1.56
total (Σ)	448	11	2.46	144	32.14	7	1.56

Statistical significance: $\chi^2 = 6.98$ for $p < 0.15$

Considering living and feeding conditions in relation to rate of positive cases, significant differences between categories were found here. The highest rate, 5.56% (3/54), of positive cases was in the category of dogs in shelter. It was the least homogenous category, consisting of stray dogs and found dogs. Their way of life and feeding was unknown until arrival at the shelter. Afterwards, they consumed cooked and pelleted rations. An important issue concerning dogs in this category was that they had been brought to the shelter recently, previously living as strays.

The number of village dogs found to be positive was 3.72% (7/188). This category was very similar to the previous one considering the high rate of intake of carcasses, raw meat and offal (74.64%). There was no significant difference between the prevalence in these two categories of dogs ($\chi^2 = 0.36$ for $p > 0.20$).

In the category of city dogs (100) only one dog was positive (1%). Based on anamnestic data, four dogs were fed raw meat.

Seven of the 448 examined dogs manifested diarrhea during a long of period time, which did not response to antibiotic and sulfonamide therapy, but none of them was sarcocystiosis positive.

There were no positive cases among dogs from the military farm and private kennels. Considering the fact that these dogs were living and fed under controlled conditions, it is obvious that, the quality of life and feed have great importance in the prevalence of sarcocystiosis in dogs. Absence of *Sarcocystis spp.* infected dogs in the military dog farm was obvious. These dogs live under controlled con-

ditions, with cooked meals and limited moving space. Moreover, the absence of positive dogs in private kennels, in contrast to previous investigations (Šibalić *et al.* 1977) is a consequence of the fact that breeders today avoid feeding their dogs with raw meat, offal and bones.

Considering age and the incidence of positive cases in the observed dogs, significant differences among the groups were found ($\chi^2=7.41$, $p<0.10$), as presented in Table 2.

Table 2. Prevalence of *Sarcocystis* spp. in the examined dogs in relation to age

Age group	examined dogs (n)	dogs confirmed for presence of oocysts/sporocysts	%	dogs fed raw meat and offals occasionally or permanently	%	dogs with manifested clinical signs (diarrhoea)	%
1 st group (under 6 months)	49	–	–	4	8.16	6	12.24
2 nd group (6-12 months)	86	–	–	15	17.44	1	1.16
3 rd group (1-3 years)	117	2	1.71	37	31.62	–	–
4 th group (3 years and older)	196	9	4.59	88	44.89	–	–
total (Σ)	448	11	2.46	144	32.14	7	1.56

Statistical significance: $\chi^2 = 7.41$ for $p<0.10$

The highest rate of infected dogs were found in the group of dogs older than 3 years 4.59% (9/196) followed by the group 1-3 years of age 1.71% (2/117). The difference between these two groups was significant ($\chi^2=1.80$ for $p<0.20$).

The absence of positive cases in groups 1 and 2, consisting of dogs younger than 1 year could be explained by fact that there were small numbers of raw meat eating dogs, 8.16% (4/49) and 17.44% (15/86), respectively. On the other hand, the numbers of raw meat consuming dogs in groups 3 and 4, older than 1 year were higher: 31.68% (37/117), and 44.89% (88/196), respectively.

The number of positive cases in groups 2 and 3 could be considered as significant with high risk ($\chi^2=1.49$ for $p<0.25$), as well as between groups 2 and 4 ($\chi^2=4.08$ for $p<0.05$).

There were no positive cases in the first two groups, consisting of young dogs, but infection of puppies is possible, according to some authors (Goethe and Rechler 1990). This possibility was demonstrated by a challenge of raw, infected beef fed to puppies, at 4 weeks old (Obrenović and Katić - Radivojević, unpublished data). The prepatent period lasted 11 days, while sporocyst shedding lasted until 72 days p.i.

It is important to point out the mostly inapparent course of sarcocystiosis in dogs. Data obtained in our investigations show that were found eggs of helminths (*Toxocara spp.*, *Trichuris spp.*, *Ancylostomidae*, *Dipylidium caninum*, *Taenia spp.*) in *Sarcocystis spp.* positive samples of dog feces.

Sarcocystis spp. positive dogs were observed during a long period, and two of them were found to be positive 3 months after the previous cessation of shedding sporocysts. These two animals were village dogs, originating from the same yard, allowed unrestrained movement and consuming pork offal. All presented data point to the fact that *Sarcocystis spp.* induce either a mild immune response, or no immune response at all, and possible reinfection can occur (Rommel *et al.* 1972, Heydorn and Rommel 1972a, Srivastava *et al.* 1987, Hussain *et al.* 1987).

The importance of the way of feeding and living conditions in sarcocystiosis outbreaks is obvious, which is confirmed in our investigation and also by Mešković (1982) and Collins *et al.* (1983).

Considering all the facts that were brought out, the basic measure in prevention of sarcocystiosis should be interruption of the life cycle of *Sarcocystis spp.*, which means that definitive host infection and consequent shedding of oocysts/sporocysts must not be allowed. Raw meat and offal feeding should be avoided; swine, cattle or any intermediate host carcasses must not be available to dogs, as one of the basic measures of communal hygiene.

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SARKOCISTIOZA PASA U NEKIM REGIONIMA SRBIJE

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SADRŽAJ

U ovom radu se prvi put u poslednjih 25 godina iznose rezultati ispitivanja infekcije pasa sa *Sarcocystis spp.* u Srbiji. U cilju ispitivanja rasprostranjenosti sarkocistioze kod pasa, ukupno je ispitano 448 pasa koji su prema uslovima držanja i načinu ishrane podeljeni u 5 kategorija (gradski psi - 100; seoski psi - 188; psi iz prihvatnog centra - 54; psi iz vojne odgajivačnice - 42; psi iz privatnih odgajivačnica - 64), a prema starosti u 4 starosne grupe (štenad - 49, mladi psi od 6 meseci do 1 godine - 86; psi od 1 do 3 godine - 117; psi stariji od 3 godine - 196 pasa). Ustanovljena je prevalenca infekcije od 2.46% (11/448). Između ispitivanih kategorija su ustanovljene značajne razlike ($p < 0.15$) u pogledu pozitivnih nalaza. Najveći procenat pozitivnih jedinki je ustanovljen u kategoriji pasa iz prihvatnog centra (5.56%), a zatim u kategoriji seoskih pasa (3.72%), a između ovih kategorija nisu utvrđene značajne razlike. U kategoriji gradskih pasa je ustanovljen 1% pozitivnih jedinki, dok u preostale dve kategorije nije bilo pozitivnih slučajeva. Uzi-
majući u obzir starost ispitivanih pasa, ustanovljene su značajne razlike u pogledu prisustva sporocista u fecesu ispitivanih pasa ($p < 0.10$). Najveći procenat pozitivnih nalaza je ustanovljen u grupi pasa starijih od 3 godine (4.59%), zatim u grupi pasa u starosti 1-3 godine (1.71%), dok u preostale dve starosne grupe nije bilo pozitivnih slučajeva.