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RESEARCH ARTICLE

Prevalence of Parasites Detected in Domestic Dogs from Konya Province: A Retrospective Study

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Abstract

Parasitic infections caused by helminth, protozoa, and ectoparasites pose a threat to animal and human health due to clinical changes and transmission of potentially zoonotic agents. This study's objective was to assess parasitic diseases in dogs admitted to the Selcuk University Veterinary Faculty Animal Hospital (SUVFAH) between 2015 and 2021. Fecal, blood, and skin samples sent to the laboratory of the Department of Parasitology, Faculty of Veterinary Medicine were examined. The majority of samples (n = 846) were collected from domestic dogs, and only 49 were from shelter dogs. During the study period, 33.74% (302/895) of the dogs tested positive for at least one parasite, including single (29.83%), double (4.63%), triple (0.14%) and quadruple (0.14%) internal parasite infections. This study revealed that the prevalences of protozoan and rickettsial parasites, including *Isospora* spp., *Giardia duodenalis, Sarcocystis* spp., *Entamoeba histolytica,* and *Ehrlichia canis* in dogs from Konya province, were 7.01%, 26.79%, 1.26%, 0.7%, and 5.26%, respectively. On the other hand, the prevalences of helminthic parasites *Toxascaris* spp., *Trichuris* spp., *Anyclostoma* spp., *Uncinaria* spp., *Dipylidium caninum*, *Taenia* spp. and *Mesocestoides* spp. were 0.14%, 0.42%, 0.42%, 0.42%, 0.42%, 0.42% and 0.14%, respectively. As ectoparasitic infestations, 11.66% *Demodex canis* infestation and 0.61% myiasis cases were encountered. Although most of the dogs in the study were owned, the rate of internal and external parasite infection/infestation was high. In this case, pet owners have a great responsibility to prevent parasitic infections in pets, which are the source of many parasitic agents with zoonotic properties.

Key Words: Dog, ectoparasites, helminths, protozoa, zoonoses

Konya İlindeki Evcil Köpeklerde Tespit Edilen Parazitlerin Prevalansı: Retrospektif Bir Çalışma

Öz

Helmint, protozoa ve ektoparazitlerin neden olduğu paraziter enfeksiyonlar, klinik değişiklikler ve potansiyel zoonotik ajanların bulaşması nedeniyle hayvan ve insan sağlığı için tehdit oluşturmaktadır. Bu çalışmanın amacı, 2015-2021 yılları arasında Selçuk Üniversitesi Veteriner Fakültesi Hayvan Hastanesine (SUVFAH) başvuran köpeklerdeki paraziter hastalıkları değerlendirmektir. Selçuk Üniversitesi Veteriner Fakültesi Parazitoloji Ana Bilim Dalı Laboratuvarına 2015-2021 yılları arasında gönderilen dışkı, kan ve deri örnekleri incelenmiştir. Örneklerin çoğunluğu (n = 846) evcil köpeklerden ve sadece 49'u barınak köpeklerinden toplanmıştır. Çalışma süresi boyunca, köpeklerin %33.74'ü (302/895) tekli (%29.83), ikili (%4.63), üçlü (%0.14) ve dörtlü (%0.14) iç parazit enfeksiyonları dahil olmak üzere en az bir parazit için pozitif test edilmiştir. Bu çalışma Konya ili köpeklerinde, *Isospora* spp., *Giardia duodenalis*, *Sarcocystis* spp., *Entamoeba histolitica* ve *Ehrlichia canis* gibi protozoon ve riketsiyal parazitlerin prevalanslarının sırasıyla %7.01, %26.79, %1.26, %0.7 ve %5.26 olduğunu ortaya koymuştur. Diğer yandan helmintik parazitlerden *Toxascaris* spp., *Trichuris* spp., *Anyclostoma* spp., *Uncinaria* spp., *Dipylidium caninum*, *Taenia* spp. ve *Mesocestoides* spp. prevalansı da sırasıyla %0.14, %0.42, %0.42, %0.42, %0.42 ve %0.14 olarak tespit edilmiştir. Ektoparaziter enfestasyonlar olarak da %11.66 *Demodex canis* enfestasyonu ve %0.61 miyaz vakasına rastlanmıştır. Çalışmadaki köpeklerin çoğu sahipli olmasına rağmen, iç ve dış parazit enfeksiyonu/enfestasyonu oranı yüksektir. Bu durumda zoonoz özellik gösteren birçok paraziter etkenin kaynağı olan evcil hayvanlarda paraziter hastalıkların önlenmesi için evcil hayvan sahiplerine büyük sorumluluk düşmektedir.

Anahtar Kelimeler: Ektoparazit, helmint, köpek, protozoa, zoonozlar

INTRODUCTION

Domestic dogs (*Canis familiaris*) are the most popular pets among the carnivores (1). Due to their positive effects on adults' and children's social, physical, and psychological health, dogs are kept for many beneficial purposes. Additionally, they are utilized for security, rehabilitative programs, sports, hunting, life-saving, and money production through breeding and sale. There are many factors that can affect a dog's life, and parasitic diseases are one of the most important. The prevalence of internal and external parasites in domestic dogs can vary depending on various factors such as geographical location, climate, living conditions, and preventive measures taken by dog owners. The parasites commonly affecting domestic dogs in many parts of the world include ticks, fleas, intestinal worms (such as hookworms, roundworms, whipworms, and tapeworms), and heartworms. Gastrointestinal parasites are one of the main obstacles to canine health and well-being. They cause direct and indirect losses (2). The majority of intestinal parasites that cause morbidity and mortality in dogs are zoonotic, such as *Ancylostoma* spp., *Toxocara canis*, *Toxascaris leonina*, *Capillaria* spp., *Uncinaria* spp., *Trichuris vulpis*, *Taenia*/*Echinococcus*, *Mesocestoides* spp., and *Sarcocystis* spp. (3). Because of their natural life cycle and the ability of cysts/eggs to remain viable and infective for long periods after being shed in soil, gastrointestinal protozoa and helminths are typically the most prevalent parasites, resulting in environmental contamination and the spread of parasite infections among animal populations and humans (4,5). Dogs and humans share the same environment, which allows gastrointestinal parasites to contaminate human food, drink, and skin. This can lead to diseases with life-threatening consequences (6). Dogs can become infected with gastrointestinal parasites via intrauterine and galactogen transmission (e.g., *Toxocara canis, Ancylostoma caninum,*) or later in life by consuming the infectious stages of protozoa or helminths (6). Whether helminths or protozoa, these parasites typically result in reduced performance, growth retardation, increased susceptibility to other infectious diseases, and, in rare instances, severe clinical symptoms (7). The most severe infections and morbidity rates occur in newborns and puppies, where intestinal parasites can be lethal, especially when paired with other infectious disorders such as parvoviral enteritis (8, 9). Furthermore, some canine intestinal parasites, such as *Taenia* spp. and *Sarcocystis* spp., can spread to farm animals, causing major economic losses (10). However, understanding the epidemiology of canine parasites is necessary to limit the risk of human infections, particularly for pregnant women, children, and immunocompromised individuals (11).

External parasites of dogs include ectoparasites such as ticks, fleas, lice, and mites. They frequently dwell as blood-sucking parasites on the skin, causing pruritis and hypersensitivity reactions, and may serve as vectors for a variety of infections of veterinary or public health concern (12). In Türkiye, dogs are frequently let to roam freely and stray on main city roadways, scavenge for food scraps near garbage dumps. These procedures expose dogs to a wide range of parasitic diseases including external parasites (12).

Rickettsial infections are caused by bacteria from the order Rickettsiales, as well as the genera *Neorickettsia*, *Orientia*, *Anaplasma*, *Neoehrlichia*, *Rickettsia*, and *Ehrlichia* are seen in dogs (13). In Türkiye, ehrlichiosis is one of the most frequent tick-borne diseases of dogs. Clinical infections in dogs are prevalent, but the disease is rarely observed in other hosts (ticks and cats) (14, 15). Canine monocytic ehrlichiosis (CME) is the name of the disease that is primarily linked to *E. canis* infections that are severe in dogs. According to Mylonakis et al. (2019), CME may be one of the leading causes of life-threatening pancytopenia in dogs in *E. canis*-endemic regions as well as Türkiye and South East Asia (16). This viewpoint is supported by the occurrence of *R. sanguineus* across Türkiye (17).

The purpose of this study was to ascertain the prevalence of ectoparasites, hemoparasites, and gastrointestinal parasites in dogs, together with a remark on zoonotic agents, in the province of Konya, Türkiye.

MATERIAL AND METHODS

Feces, blood, and skin samples sent to the Selcuk University Veterinary Faculty Parasitology Department Laboratory, Konya between 2015 and 2021 were included in the present study. Konya is the largest province in the country by area and has a variety of geographical and climatic features that could influence parasite prevalence. To determine gastrointestinal helminth fauna in owned and shelter dogs, fecal samples were collected from 713 dogs and analyzed using Native, Fulleborn flotation, and Benedek sedimentation methods (18). All fecal samples were first macroscopically screened for the presence of nematodes and proglottids of cestodes. 0.9% isotonic saline solution was used for the Native fecal examination method, saturated salt water for the flotation method, and distilled water for the Benedek sedimentation method. According to the literature, oocysts, cysts, and eggs were identified based on morphological characteristics (18-20). Skin samples and maggot larvae of 163 dogs were collected in sterile petri dishes and sent to the laboratory for analysis. The debris is then placed on a microscope slide, coverslipped, and inspected with a 10 × microscope objective. The material was put on a slide, then 10% potassium hydroxide was added in five drops. After placing a cover slip over the sample, it was examined under a microscope to check for the presence of mites, larvae, or ova (21). Under a stereozoom microscope, maggot larvae were visible, however the genus of the larvae could not be identified. Blood samples were taken from 19 dogs. Thin blood smears were made from EDTA-anticoagulated blood, dried in the open air, fixed in absolute methanol for 3-5 minutes, stained with 10% Giemsa solution for 45 minutes to an hour, washed with tap water, and dried. The smears were checked for blood protozoans using a light microscope (100X), and pathogens were investigated by scanning 100 microscopic fields.

RESULTS

As a result of the study ecto- and endoparasites were detected in 302 (33.74%) of 895 dogs. During the study period, 33.74% (302/895) of the dogs tested positive for at least one parasite, including a single (29.83%), double (4.63%), triple (0.14%), and quadruple (0.14%) internal parasite infections. This study revealed that the prevalences of protozoan and

rickettsial parasites, including *Isospora* spp., *Giardia duodenalis, Sarcocystis* spp., *Entamoeba histolytica,* and *Ehrlichia canis* in dogs from Konya province, were 7.01%, 26.79%, 1.26%, 0.7%, and 5.26%, respectively. On the other hand, the prevalences of helminthic parasites *Toxascaris* spp., *Trichuris* spp., *Anyclostoma* spp., *Uncinaria* spp., *Dipylidium caninum*, *Taenia* spp. and *Mesocestoides* spp. were 0.14%, 0.42%, 0.42%, 0.42%, 0.42%, 0.42% and 0.14%, respectively. As ectoparasitic infestations, 11.66% *Demodex canis* infestation and 0.61% myiasis cases were encountered. The parasites detected in the study are shown in Table 1 and Table 2 and the total parasite prevalences are shown in Table 3.

Table 1. Single parasitic infection rates in dogs between 2015-2021

Helminths	(n:713)	Positive	Prevalence(%)
Nematod			
Toxocara spp.		30	4.21
Toxascaris spp.		1	0.14
Cestod			
Dipylidium caninum		3	0.42
Taenia /Echinococcus spp.		3	0.42
TOTAL	713	37	5.19
Protozoans	(n:713)		
Giardia spp.		164	23
Isospora spp.		29	4.07
Sarcocystis spp.		6	0.84
Entamoeba spp.		3	0.42
Chilomastix spp.		1	0.14
TOTAL	713	203	28.47
Blood protozoans	(n:19)		
Ehrlichia spp.		1	5.26
TOTAL	19	1	5.26
Ectoparasites	(n:163)		
Demodex spp.		19	11.66
Sarcoptes spp.		3	1.84
Otodectes cynotis		2	1.23
Trichodectes canis		1	0.61
Anal myiasis/Dipteran larvae		1	0.61
TOTAL	163	26	15.95

Table 2. Mix parasitic infection rates in dogs between 2015-2021

Parasites	n:713	Positive	Prevalence(%)
Toxocara spp.+ *Isospora* spp.		4	0.56
Toxocara spp.+ *Giardia* spp.		9	1.26
Isospora spp. + *Giardia* spp.		13	1.82
Sarcocystis spp.+ *Giardia* spp.		1	0.14
Anyclostama spp.+ *Uncinaria* spp.		1	0.14
Giardia spp.+ *Entamoeba* spp.		1	0.14
Giardia spp. + *Anyclostoma* spp.		1	0.14
Isospora spp.+ *Sarcocyctis* spp.		2	0.28
Isospora spp.+ *Mesocestoides* spp.		1	0.14
Total dual infection	713	33	4.63
Isospora spp.+ *Entamoeba* spp. + *Giardia* spp.		1	0.14
Total triple infection	713	1	0.14
Trichuris spp. + *Toxocara* spp. + *Ancylostoma* spp. + *Giardia* spp.		1	0.14
Total quadruple infection	713	1	0.14

Table 3. Total parasite prevalences

Helminths	Prevalence(%)
Nematod	
Toxocara spp.	6.17
Toxascaris spp.	0.14
Trichuris spp	0.14
Anyclostoma spp.	0.42
Uncinaria spp.	0.14
Cestod	
Dipylidium caninum	0.42
Taenia /Echinococcus spp.	0.42
Mesocestoides spp.	0.14
Protozoans	
Giardia spp.	26.79
Isospora spp.	7.01
Sarcocystis spp.	1.26
Entamoeba spp.	0.7
Chilomastix spp.	0.14
Blood protozoans	
Ehrlichia spp.	5.26
Ectoparasites	
Demodex spp.	11.66
Sarcoptes spp.	1.84
Otodectes cynotis	1.23
Trichodectes canis	0.61
Anal myiasis	0.61

DISCUSSION AND CONCLUSION

Dogs, which play an important role in human life, are associated with many zoonotic microorganisms of parasitic origin. Among these, helminths and gastrointestinal protozoa are the most important enteropathogens causing death in dogs (22). The aim of our study was to determine the prevalence of canine gastrointestinal parasites, hemoparasites and ectoparasites with a focus on zoonotic agents in a large dog population from different districts of Konya. Such studies were necessary due to the lack of large and recent data on the subject. In order to minimize the incidence of parasitic diseases, especially their transmission to humans, the factors influencing their epidemiology should be well understood. Factors such as geographical region, climate, intermediate or final host population, pre-patent or patent period of infection, diagnostic method, and drug use are reflected in the study results and cause differences (22).

Among the protozoa, infections with *Cryptosporidium* spp., *Giardia* spp., *Sarcocystis* spp., and *Isospora* spp. are commonly encountered in dogs (23). In this study, different protozoan species (*Isospora* spp., *Giardia* spp., *Sarcocsyt* spp. and *Entamoeba* spp., *Ehrlichia* spp. and *Chilomastix* spp.) were found in 203 (28.47%) of a total of 713 dogs. The majority of parasites detected in this investigation were protozoa. The prevalence of *G. duodenalis* (26.79%) was higher than the other parasites found in the dogs in this study. However, molecular assays and parasite genotyping are necessary to identify the species and assemblages involved, as well as to assess their zoonotic potential (24). *Giardia* is a common protozoa affecting a wide range of animals, including humans with global significance. They are the most frequent gastrointestinal pathogens for dogs and cats in developed areas, infecting around one billion people

worldwide (25). A review by Ballweber and colleagues notes that the reported prevalence of *Giardia* in feces varies from study to study, and that this variation is partly related to geography, detection method, age of the animal, whether the animal was symptomatic or not, and where the animal was housed (26).

Canine coccidiosis is a disease generally caused by protozoa of the *Isospora* species. The disease causes colitis or enteritis in dogs and has a high mortality rate. The presence of *Isospora* spp. in dogs was found to range from 5.5% to 26.45% in Türkiye (27-30). The prevalence of *Isospora* species was determined to be 7.01% in this study. In a study conducted in Konya province by Uslu et al. (30), the infection rate (26.45%) was found to be higher than in previous studies. This situation is thought to be related to the age of the dogs (2-6 month old puppies) sampled in the study. Canine coccidiosis usually causes clinical signs in young puppies, and infection rates decrease in later periods or the infection progresses asymptomatically (7). The rate of *Isospora* spp. detected in our study is the findings of a very wide age range of dogs.

Sarcosporidiosis is a protozoan infection that rarely causes diarrhoea in the final host dogs. Since sarcosporidiosis is particularly severe in intermediate host ruminants and causes economic losses, most of the studies are focused on ruminants in Türkiye (31, 32). The frequency of *Sarcocystis* spp. in dogs varied between 0.8 and 81.6% in the few studies conducted in dogs in Türkiye (23,27,30,33). In this study, *Sarcocystis* spp. sporocysts were found in 1.26% of the fecal samples examined and the prevalence value obtained was found to be compatible with the results of other studies.

Entamoebiasis (amibiasis), which is common in tropical and subtropical regions and is mostly caused by *Entamoeba histolitica*, which infects humans, is rare in some wild and domestic animals, including cats and dogs. Canine amibiasis has been reported to be of human origin, and it has been suggested that transmission is the result of ingestion of parasite cysts with contaminated water and food, or that *Musca domestica* may act as a mechanical vector (34). In a study conducted by Denizhan and Karakuş (23) in Türkiye, *Entamoeba histolytica* was found at a rate of 11.48%. In this study, *Entamoeba* spp. prevalence was found to be 0.7%. This rate was found to be lower than in the study conducted in Türkiye. This may be due to the fact that there were fewer stray dogs in contact with human remains in our study and most of our material consisted of owned dogs.

The most prevalent canine gastrointestinal (GI) helminths are *Toxocara* sp., *Toxascaris* sp., *Echinococcus* spp., *Taenia* spp., *Ancylostoma* spp., *Dipylidium* spp., *Uncinaria* spp., *Capillaria* spp., and *Trichuris* spp. (35). *Toxocara* spp., *Echinococcus* spp., and *Ancylostoma* spp. are particularly significant in both underdeveloped and emerging countries due to the limited use of antiparasitic medications, low socioeconomic conditions, and a lack of education (36). The genera/species distribution of helminths detected in dogs in Türkiye is mainly based on necropsy or fecal examination of street/owned dogs; the most common species reported are *T. canis*, *T. leonina*, hookworms, *Taenia* spp., and *D. caninum*. In studies on the prevalence of intestinal helminths in dogs in Türkiye, it was found that the prevalence of parasites ranged from 19.4% to 86.96% (30,37-43).

Toxocara canis is a soil-associated nematode that is known as the most frequent intestinal parasite in dogs and wild canids (44). Furthermore, it has been linked to visceral and ocular larval migrans in humans. *T. canis* prevalence has been estimated to be between 4.2% and 51% in Türkiye (41, 45). In the current study, *T. canis* was found in 6.17% of fecal samples. In a study conducted in Konya province by Uslu et al., (30), the infection rate (33.06 %) was found to be higher than in previous studies. It was thought that the reason for this situation was the young age (2-6 months old puppies) of the dogs and the fact that they were stray dogs. Due to transplacental and transmammary transmission, puppies are more susceptible to infection. Additionally, immunity to certain parasites is typically gained with age, most likely as a result of one or more infections (46). The dogs in our study ranged widely in age from puppy to adult.

In the current study, the prevalence rates of *Toxascaris* spp. (0.14%), *Trichuris* spp. (0.14%), *Anyclostoma* spp. (0.42%), *Uncinaria* spp. (0.14%), and cestodes such as *D. caninum* (0.42%), *Taenia* spp. (0.42%), and *Mesocestoides* spp. (0.14%) were very low, which is consistent with the results of some other studies but contradicts others. However, it should be noted that the diagnostic technique used in our study (centrifugal flotation) is more specific for nematodes than for cestodes, which may explain the relatively low prevalence of cestodes in our study (47). In addition, the majority of the dogs studied were on a strict diet with no access to raw meat or carcasses, reducing the likelihood of taeniid tapeworm contamination (48).

Taenia spp. prevalence in dogs is reported to be between 6.1% and 46.0% in Türkiye (38,49,50) and 1.1-33.0% abroad (51-53). In this study, *Taenia* spp. prevalence was determined as 0.42%. This result is lower than the values determined both in Türkiye and abroad. The fact that *Taenia* spp. could not be identified with eggs in the fecal examination, and no ring was observed in the macroscopic examination, suggesting that these eggs may also be *Echinococcus granulosus* eggs.

The prevalence of *Dipylidium caninum*, one of the canine cestodes of zoonotic importance, was found to be between 0.3-52% in Türkiye (30,38,41,45,54-56). In our study, *D. caninum* prevalence was determined as 0.42%. Compared to other studies conducted in this study, *D. caninum* 12.5% in Hatay (54), 3.5% in Van (38), 4.3% in Eskişehir and 2.9% in Afyonkarahisar (45), 2.8% in Kayseri (41) and 2.8% in Diyarbakır (56) was found to be lower than the most of the reported rates, and higher than a study conducted in Konya (55). It is thought that the differences in prevalence values may be due to the differences in the rates of flea or lice infestation, such as *Ctenocephalides canis*, *C. felis*, *Pulex irritans,* and *Trichodectes canis*, which are the vectors of *D. caninum* in dogs, from region to region. According to the results of this study and other studies conducted in Türkiye, *D. caninum* can be considered as a common cestode across Türkiye.

Mites are found throughout the world and have an affinity for a diverse group of mammalian hosts, including humans. With more than 30,000 described species, the most important mites causing dermatopathies found in the Canidae family are *Otodectes cynotis*, *Sarcoptes scabiei*, *Demodex canis,* and *Cheyletiella* spp. (57). Canine demodicosis is a

well-known skin disease seen in veterinary medicine. It is a dermatological disorder caused by mites colonizing the hair follicles and sebaceous glands. Erythema, alopecia, comedones, follicular hyperkeratosis, pustules, crusts, and seborrhea are all dermatological alterations (58). In Türkiye, *Demodex* species have been reported morphologically and molecularly from various companion animals (59-63). In this study, *Demodex canis* was detected at a rate of 11.66 %. Myiasis is defined as the parasitism of some Diptera larvae in human and animal tissues and natural cavities, feeding on dead or living tissues of the host at certain times and causing lesions there. Myiasis is a frequently encountered condition worldwide, including Türkiye (64-70). In previous studies conducted in Konya province, several cases of traumatic myiasis have been reported in dogs, other animals, and humans (70-73). In our study, it was detected at a low rate of 0.61%. The reason for this low rate is thought to be the fact that the majority of the dogs included in the study are domestic dogs and another reason is the problems experienced in the registration of myiasis cases.

Ehrlichiosis is caused by tick-transmitted rickettsial microorganisms of the Anaplasmatacea family. *Ehrlichia canis*, *E. chaffeensis,* and *E. ewingii* are the most important species threatening human and animal health, particularly in dogs. Severe infections in dogs are mainly associated with *E. canis* and the disease caused by this microorganism is called canine monocytic ehrlichiosis (74). CME is mainly characterised by fever, anorexia, generalised lymphadenomegaly, mucosal pallor, lethargy, depression, and splenomegaly. Hypothermia may even occur in severely pancytopenic dogs (74). In this study, the blood sample sent from the veterinary hospital was diagnosed with light microscopy than confirmed with a commercial ELISA kit (Asan Easy Test *E. canis,* Asan Pharm, Korea). Studies conducted in Türkiye have shown that *E. canis* is the only species detected in dogs. CME is common in Türkiye and the prevalence of the disease has been determined by serological and molecular studies (15,75-82). In our study, *E. canis* was determined to be 5.26%.

Besides all this, each dog provided a single fecal sample, and each sample was examined just once. Notwithstanding these drawbacks, the study's data clearly show how environmental contamination endangers the health of farm and companion dogs as well as humans, including pet owners and herders. It is, therefore, advisable for those concerned to seek veterinary advice on how to reduce the incidence of parasitic disease. Public awareness campaigns or creative, informative, and engaging educational programs should be used to inform pet owners about the importance of regular deworming and ectoparasite control.

This study confirmed the prevalence of zoonotic gastrointestinal parasites in dogs in Konya, Türkiye. These parasites constitute a serious public health danger, hence dog deworming programs must be instituted. Other effective preventive strategies include dog management and feces collection, as well as preventing dog feces from contaminating soil and water.

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CONFLICT OF INTEREST

There is no conflict of interest to be declared by the authors.

AUTHOR CONTRIBUTIONS

The initial draft, preparation, conceptualization, technique, and study were conceived and written by CC and MI. The tests were carried out by CC, AE, ŞY, and DSY, who also edited and amended the manuscript. Each author accepted the submitted version of the paper and made contributions to it.

ETHICAL STATEMENT

In our study, we did not examine live animals. We examined faeces, blood and skin samples, which were sent to the laboratory for diagnostic purposes.

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