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Endoparasites of Zoonotic Importance

Maysa A.I. Awadallah

Department of Zoonoses, Faculty of Veterinary Medicine, Zagazig University, Egypt

Abstract: A total number of 50 cats' faeces samples was collected from different areas in Sharkia governorate, Egypt. All samples were examined for the presence of endoparasites. Moreover, 150 serum samples of sheep, goats and cattle (50, each) and 100 sera of human beings [apparently healthy males and females (50), pregnant and aborted women (25, each)] were examined for the presence of anti- *T. gondii* IgG and IgM antibodies. The results revealed that the overall prevalence of infection with endoparasites in the examined cats was 60% (30 out of 50 examined). The most prevalent parasite in cats' faeces was *T. gondii* (50%), followed by *Cryptosporidium spp* (30%), *T. cati* (18%), *Blastocystis spp* (10%), *Strongyloid* and *Cyclospora* (2%, each). The prevalence of anti- *T. gondii* IgG antibodies in sheep versus goats versus cattle was (18% Vs 16% Vs 12%). Twelve percent of the apparently healthy humans were seropositive to anti- *T. gondii* IgG (10% IgG and 2% both IgG and IgM) with high frequency in females (8%) than males (4%). However, the seroprevalence of anti-*T. gondii* IgG in pregnant women examined was 16% (12% IgG and 4% IgG +IgM). IgM antibodies were detected in 8% of cases (4% IgM alone and 4% mixed with IgG). On the other hand, 40% of aborted women had anti-*T. gondii* IgG (28% IgG alone and 12% IgG mixed with IgM). The high infection rate of gastrointestinal helminths in stray cats is considered to be critical from the viewpoints of public health, some of which are responsible for several zoonotic diseases and this is clear from the highest seroprevalence of anti-*T. gondii* antibodies in man. Hence, it is imperative that appropriate control strategies and measures be implemented to prevent and control the infection of stray cats with helminths in order to control such zoonotic diseases in man.

Key words: Toxocara cati · Cryptosporidium · Endoparasites · Toxoplasmosis

INTRODUCTION

Cats and other felines act as definitive hosts for many intestinal parasites, some of which are responsible for several zoonotic diseases as toxoplasmosis, toxocariasis, cryptosporidiosis and others. The close association between cats and humans is responsible for high endemicity of some of these zoonotic diseases [1].

Toxoplasmosis is a zoonotic disease caused by the obligatory intracellular parasite *Toxoplasma gondii*. While, wide ranges act as intermediate hosts for the parasites, the only known final hosts are cats and other felids [2]. Humans acquire the infection through ingestion of vegetables or water contaminated with sporulated oocyst shed in cats' faeces, ingestion of meat carrying tissue cyst and drinking of raw goats' milk containing tachyzoites. Congenital, organ transplantation and blood transfusion transmission is other modes of transmission. Although infection is generally asymptomatic in healthy human beings, the parasite may cause important health problems in pregnant women and immunocompromised people [3]. Similarly in sheep and goats toxoplasmosis is a principal cause of abortion and neonatal death [4]. In contrast in cattle which have high natural resistance to the parasites, *T. gondii* causes subclinical infection [5].

Toxocariasis is another zoonotic disease transmitted from cats to man. It is caused by a nematode parasite, *Toxocara cati*. The most widely recognized source of human infection is ingestion of contaminated soil with eggs containing the 3rd larval stage of the parasite [6] and this occurs most frequently in toddlers. In addition, clinical toxocariais in adult has been documented following ingestion of partial or whole paratenic host, such as raw liver of domestic animals. Uncooked vegetables have also been reported as a probable source of infection, particularly those from farms that utilize animal or human excrement as fertilizers [7]. Visceral and ocular larva migrans are diseases caused by the migration of *Toxocara* larvae through the tissue of people, particularly children. Although these diseases are rare, they can be quite serious, especially when occur in young children.

Corresponding Author: Maysa A.I. Awadallah, Department of Zoonoses, Faculty of Veterinary Medicine, Zagazig University, Egypt, Tel: +02-55-227-3680, Ext: 142, E-mail: maysavet@hotmail.com.

Cryptosporidiosis is a zoonotic protozoal disease caused by *Cryptosporidium* species. Seven species (*C. hominis*, *C. parvum*, *C. felis*, *C. canis*, *C. muris*, *C. meleagridis* and *C. bailey*) have been shown to be associated with human infection [8]. The already shed sporulated oocyst can be transmitted directly between different host species via fecal-oral route, or indirectly via contaminated food or water. A single oocyst is sufficient to produce infection and disease in a susceptible host [9]. Cryptosporidiosis is generally characterized by watery diarrhea, abdominal pain and cramping; the general rule is spontaneous resolution of symptoms [10]. The situation is different for immunocompromised individuals. In these populations, infection can be chronic, leading to malabsorption and potentially death [11].

Blastocystis spp is an anaerobic protozoan that occurs in the intestine of humans and other mammals [12]. Studies reporting the association of *blastocystis* spp with human diseases have been increasing [13]. *Blastocystis* has been implicated in a variety of non-specific symptoms. Intense abdominal disorders, together with pain, diarrhea and constipation were reported in most cases [14].

This work aimed to throw light on endoparasites of zoonotic importance, especially those transmitted from cats to domestic animals and man. Many of them cause economic problems and public health hazards [15].

MATERIALS AND METHODS

A total number of 50 cats' feces samples was collected from different areas in Sharkia governorate, Egypt. All samples were examined for the presence of endoparasites. Moreover, 150 serum samples of sheep, goats and cattle (50, each) and 100 sera of human beings [apparently healthy males and females (50), pregnant and aborted women (25, each)] were examined for the presence of anti- *T. gondii* IgG and IgM antibodies.

Occurrence of Endoparasites in Cats' Faeces

Sampling: Fecal samples were collected from stray cats using baiting with the remnant of fish. Each sample were picked up by the mean of spatula, placed into a clean polyethylene bag and transported to the laboratory with a minimal time of delay [16].

Parasitological Examination: The collected samples were examined by Formalin-ether sedimentation technique where a teaspoonful of faces was mixed in 10ml of water then sieved through 2 layers of gauze in a 15ml centrifuge tube and centrifuged at 1000 rpm for 2 minutes. The supernatant was discarded and the sediment was resuspended in physiological saline then centrifuged at 1000 rpm for 2 minutes. The sediment was suspended in 10% formalin and let to stand for 10 minutes. Three milliliters of ether was added and then the tubes were vigorously shaken and centrifuged at 1000 rpm for 2 minutes. Four layers become visible; the top layer (ether), second (a plug of debris), third (a clear layer of formalin) and the fourth (sediment). The plug was detached and all layers except the sediment were poured off. Sediment was examined under microscope [17].

Prevalence of anti- *T. gondii* IgG and IgM antibodies

Sampling: Animals' sera were collected from different farms and slaughter houses, while, humans' sera were collected from private labs. Five milliliters of blood samples were collected and allowed to clot for 0.5-1 hour. All sera were separated by centrifugation at 2000 rpm for 10 minutes and subjected to serodiagnosis of *T. gondii*.

Serological Investigation of the Collected Sera: Serological investigation of the collected sera for the presence of anti- *T. gondii* IgG and IgM antibodies was done using (Indirect haemagglutination test) using Toxo-HAI Fumoze Kits (LOT, 7679) according to the manufacturers recommendations.

RESULTS AND DISCUSSION

The domestic cat has a long and mostly favorable history in its association with human beings. In modern times, cats are appreciated for their ability to provide companionship [18] as well as for deterring rodents from invading the home [19]. In spite of the above mentioned advantages of cats, they harbor many parasites of zoonotic potential. The illustrated results in Table (1) revealed that the overall prevalence of infection with endoparasites in the examined cats was 60% (30 out of 50 examined). Nearly similar prevalence rates of 58.3 and 65% were respectively reported by Sommerfelt *et al.* [20] in Argentina and Baker *et al.* [21] in South Africa.

Table 1: Frequency distribution of zoonotic endoparasites in 50 cats' faeces

Parasites detected	Frequency	Prevalence
Toxoplasma gondii	25	50%
Cryptosporidium spp	15	30%
Toxocara cati	9	18%
Blastocystis spp	5	10%
Strongyloid	1	2%
Cyclospora	1	2%
Total parasite infection	30	60%

Table 2: Polyparasitism of zoonotic endoparasites in 50- stray cats

Burden	Parasites	Positive samples	%
One	*T. gondii*	7	14
	T. cati	1	2
	Cryptosporidium spp	3	6
Two	*T. gondii+ T. cati*	5	10
	T. gondii+ Cryptosporidium spp	5	10
	T. gondii+ Blastocystis	1	2
	T. gondii+ Strongyloid	1	2
	Cryptosporidium spp + Blastocystis spp	1	2
Three	*T. gondii+ Cryptosporidium spp+T. cati*	3	6
	T. gondii+ Cryptosporidium spp+Blastocystis spp	2	4
Four	*T. gondii+ Cryptosporidium spp+Blastocysti sspp+ Cyclospora*	1	2

The prevalence found in this study is higher than those reported in previous studies; 24.6% in USA [22] and 18.5% in Qatar [16]. On the other hand, Zibaei *et al.* [23] in Iran and Abu-Madi *et al.* [24] in Qatar recorded higher prevalence rates of 95.3 and 80.3% respectively.

Table (2) clarifies that 11 (22%) out of all examined samples were only infected with single species of parasites and 19 (38%) were infected with more than single species. High infection rate of endoparasites in stray cats is considered to be critical from the view point of public health importance.

In the present study, the most prevalent parasite in cats' feces was *T. gondii.* It was isolated from 25 samples (50%). This result is nearly similar to those recorded in Egypt; 45% by Gauss *et al.* [25] and 46% by Samaha *et al.* [26] and lower than the results (78%) obtained by Deeb *et al.* [27]. The higher prevalence of *T. gondii* in cats' feces in this study may be attributed to the fact that, all the examined cats were stray cats that are more reliant on hunting for survival so are more implicated in the parasitic cycle of transmission.

Oocyst of many species of *Cryptosporidium*, including those infecting companion animals and man are basically morphologically and antigenically indistinguishable, therefore molecular tools are needed to determine the species isolated [28]. In the studies in which genotyping of the *Cryptosporidium* oocysts recovered from the feces of cats has been attempted and has been successful; results have demonstrated that most infection in cats are caused by host-specific *C. felis* [29]. *C. muris* and *C. parvum,* are occasionally reported in cats [30]. In developing countries, *C. felis* is responsible for as much as 3.3% of overall Cryptosporidiosis cases in children [31].

Tables (1, 2) verify that *Cryptosporidium spp* was detected in 15 cats' faeces (30%). This result agrees with the worldwide prevalence that ranged from 0-29% [31].

It is obvious from Tables (1, 2) that the 3rd most prevalent endoparasite was *T. cati* (18%) which is known to be the most common intestinal round worm in cats and has been implicated in zoonotic disease in humans (Visceral larva migrans) [6]. The lowest values (0.5-11%) being mentioned in cats from arid areas as Qatar and South Africa [24, 21]. The obtained result agrees with that (13.3%) of Arbabi and Hooshyar [32]. However, this result is higher than those recorded by Abu-Madi *et al.* [16] in Qatar. Their results were 0.8%. On the other hand, the obtained results is lower than those reported by Yaman *et al.* [33] in Turkey (62.5%) and Zibaei *et al.* [23] in Iran (42.6%).

It has been suggested that the *Blastocystis* is zoonotic [34] but there is insufficient evidence to either support or refute this. *Blastocystis spp* appear to be the 4th widely spread endoparasites in cats' feces (Tables 1, 2). It was detected in 10% of the examined cats. Data on the presence of this organism in cats and dogs are extremely limited [35]. Prevalence rates of 70 and 16.8% in the feces of cats were recorded respectively by Duda *et al.* [35] in Australia and Arbabi and Hooshyar [32] in Iran. Low prevalence rate of *Blastocystis* in this study may be attributed to the destruction of the parasites due to its high fragility [36].

Table (3) illustrates the occurrence of anti- *T. gondii* IgG antibodies in sheep, goats and cattle. The occurrence of anti- *T. gondii* IgG antibodies in sheep versus goats (18% Vs 16%) is nearly similar to the results obtained by many authors using the same test (IHAT); Esmat [37], Mohamed & Eisa [38] & Saleh *et al.* [39] in Egypt. Their results were (24.3% Vs 21.5%), (18.2% Vs 15.9%) and (21.98% Vs 12.93%), respectively.

Higher prevalence rate in sheep was recorded by Shaapan *et al.* [40] in Egypt. They recorded infection rates ranged from 34 to 43.7% in the same sample.

Table 3: Occurrence of anti-*T. gondii* IgG antibodies in sheep, goats and cattle using indirect haemagglutination test

				Seropositivity in relation to titer				
Animal species	Total examined	Positive	Percent	1/160	1/320	1/640	1/1280	1/2560
Sheep	50	9	18	3	2	2	1	1
Goat	50	8	16	2	2	3	1	0
Cattle	50	6	12	3	2	1	0	0
Total	150	23	15.33	8	6	6	2	1

They concluded that the variation between the obtained results may be due to difference in the sensitivity and specificity of the serological test used.

Regarding the occurrence of anti- *T. gondii* IgG antibodies in goats, higher results of 63.31 and 74.8% were recorded respectively by Rodriguez-Ponce *et al.* [41] in Spain and Teshale *et al.* [42] in Ethiopia.

The difference in prevalence amongst sheep compared to goats may be due to variation in feeding habits, where goats frequently crop the top of the grass and smaller trees, rather than taking the lower part of the plant [43].

Bovine abortion due to *T. gondii* infection may result in a reduction of milk production and culling of animals and thus a substantial economic loss [44]. The seroprevalence of *T. gondii* infection in cattle has been studied in many countries. It varies between countries, regions, herds, methods of diagnosis and even at different times in the same herd. In this study, 12% of the examined cattle were seropositive to anti- *T. gondii* IgG antibodies. Seroprevalence rates of 9, 0 and 2.3%, were recorded, respectively in; Central Ethiopia [45], Iran [43] and China [46].

On the other hand, higher seroprevalence of 93.5% was previously recorded in Turkey [47]. The difference in the prevalence of toxoplasmosis in different animal species may be explained by difference in susceptibility to *T. gondii* infection and this view is also supported by Dubey and Streitel [48].

The finding of this study concurred with the literature in that the relative species seroprevalence was sheep > goats > cattle [49]. Lower seropositivity in cattle compared to goats and sheep may be attributed both to difference in susceptibility and humeral response to the parasites, as well as to difference in management methods [50].

During a primary infection, a cat seeds millions of oocysts daily for a period of 1-3 weeks. These oocysts may survive in soil and water for over a year [51] thereby, enhancing the probability of transmission to intermediate hosts including man [52]. The disease is asymptomatic, but is serious in pregnant women and immunocompromised persons.

Serologic tests represent the most commonly used method to establish the diagnosis; documentation of recent seroconversion is the best evidence of recent infection. IgG antibodies appear within 1-2 weeks of infection, peak in 6-8 weeks and then decline over the next two years; they remain detectable for life. IgM antibodies may appear with in 1st week of infection and generally decline within a few months; however, they sometimes persist for years after the initial infection. Thus the presence of IgM antibodies should not be used to confirm a recent infection [53].

Table (4) shows that 12% of the apparently healthy humans were seropositive to anti- *T. gondii* IgG (10% IgG and 2% Both IgG and IgM). The seroprevalence of anti- *T. gondii* IgG is similar to those recorded in Canada [54] and Egypt [38]. Their respective results were 14% in veterinary staff and 14.3% in shepherds. In contrary, higher seroprevalences of 60 and 64% were recorded respectively in; cats' owners in Mexico [55] and butchers in Brazil [56]. High prevalence rates in all studies may be attributed to the common exposure of the examined groups to local risk factors as contact with cats and soil in its vicinity, consumption of vegetables and ingestion of undercooked meat.

Table (4) also clarifies that the seroprevalence tend to be higher in females (8%) than males (4%). This disagrees with Formont *et al.* [57] who reported higher prevalence of anti-*T. gondii* IgG in males than females. Higher results in females in this study may be attributed to women frequently work in kitchen and can be infected through meat either through contaminated hand when not observing the basic rules of personal hygiene or through tasting of undercooked meat up on cooking.

Pregnant women are essential source of infection for their neonates. The gestational age during which the maternal infection occurs is important. Although, the frequency of fetal infection is higher when maternal infection occurs later in the pregnancy (3rd trimester) [58], the sequellae are more sever when maternal infections occur early in the 1st trimester [59].

Table (4) reveals that the seroprevalence of anti-*T. gondii* IgG in pregnant women examined was 16% (12% IgG and 4% IgG +IgM). IgM antibodies were

Table 4: Occurrence of anti-*T. gondii* IgG and IgM antibodies in different human groups

	Seropositivity in relation to type of antibodies					
	IgG		IgM		IgG+IgM	
Human groups	No.	%	No.	%	No.	%
Apparently healthy males	2	4	0	0	0	0
Apparently healthy females	3	6	0	0	1	2
Total	5	10	0	0	1	2
Pregnant	3	12	1	4	1	4
Aborted	7	28	0	0	3	12

N.B: Number of examined apparently healthy humans is 50

Number of examined pregnant and aborted women is 25, each

Fig. 1: Cryptosporidium spp (Oocyst)

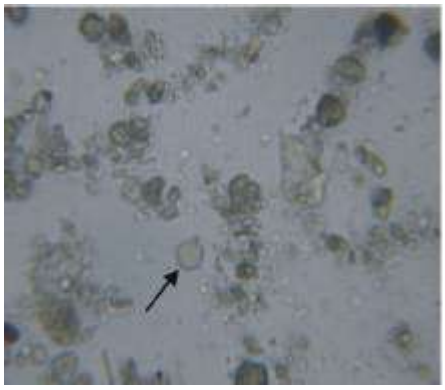

Fig. 2: Toxocara cati (egg)

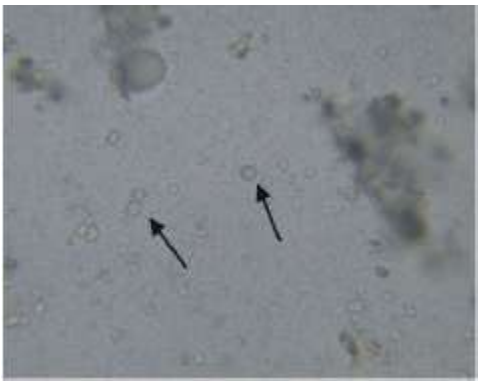

Fig. 3: Blastocystis spp (Oocyst)

Fig. 4: Toxoplasma gondii (Oocyst)

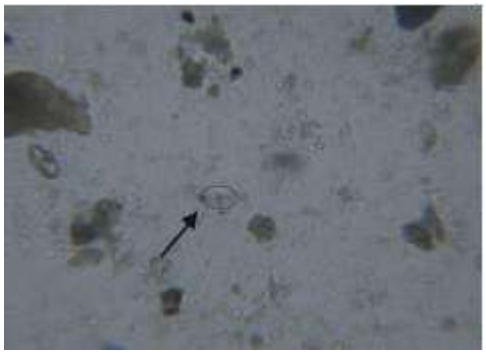

Fig. 5: Toxoplasma gondii (Sporulated oocyst)

detected in 8% of cases (4% IgM alone and 4% mixed with IgG). This agrees with Laila Nimri *et al.* [60] and Alvarado-Esquivel *et al.* [61]. The results of the first authors were 12% for IgG and 2.7% for IgM, however, those of the latter authors were 8.2% IgG and 2.3% IgM. Higher anti-*T. gondii* IgG seroprevalence rates of 71 and 62.2% were recorded in Cuba [62] and Beirut [63], respectively.

Regarding the occurrence of anti-*T. gondii* IgG in aborted women, 40% of the examined cases had

anti-*T. gondii* IgG (28% IgG alone and 12% IgG mixed with IgM. This agrees with Mohamad and Eisa [38] whose results were 38%. Higher prevalences of 80 and 57.5% were previously reported by Shuhaiber *et al.* [54] and Samaha *et al.* [26], respectively. On the other hand, El-azazy [64] recorded lower prevalence rate of 19.5%.

In conclusion, the high infection rate of gastrointestinal helminthes in stray cats is considered to be critical from the view point of public health importance, some of which are responsible for several zoonotic diseases and this is clear from the high seroprevalence of anti-*T. gondii* antibodies in man and animals. Hence, it is imperative that appropriate control strategies and measures be implemented to prevent and control the infection of stray cats with helminthes in order to control such zoonotic diseases in man and animals.

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