CRYPTOSPORIDIUM IN DRINKING WATER SOURCES AND ITS ZOONOTIC IMPORTANCE

BY

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ABSTRACT

Cryptosporidium recently joined the list of diseases transmitted via water. In the present study, *Cryptosporidum* oocysts were detected in the fresh surface water of Ismailia Canal, water of a manual water pump in a village and drinking water of common water troughs of calves, sheep and goat houses. However, *Cryptosporidium* oocysts were not detected in the examined water samples of tap water, which supplied by water treatment plants.

The overall prevalence rate of *Cryptosporidium* spp. oocysts among the examined animals which in close proximity to the sources of drinking water in the investigated area, in the present study, was 6.98%(108 out of 1548 fecal samples). Young farm animals (Age ? one month) were the most heavily infected with *Cryptosporidium*, since that 31(15.4%) of 201 calves, 28(9.9%) of 282 buffalo calves, 18(17.1%) of 105 lambs and 9(16.4%) of 55 kids harbored *Cryptosporidium* oocysts. The infection rates were significantly higher in calves (42.4%) and buffalo-calves (33.3%) had diarrhoea than the others had no diarrhoea (7.7% and 3.2% respectively) ($P < 0.001$). In the histopathological examination, *Cryptosporidium* infections were concentrated in the distal small intestine of calf and were associated with mild to moderate villous atrophy. The lowest *Cryptosporidium* infection rates were found among the examined adult farm animal species. *Cryptosporidium* infection rates in dog and rat fecal specimens were 2.6% and 6.3% respectively.

On the other hand regarding the public health significance of cryptosporidiosis, the overall *Cryptosporidium* infection rate among the examined human beings was 3.5% (33 out of 939 human stool specimens). More infections were recorded in young age group less than 10 years (7.3%), while the infection rates ranged from 0.97 to 3.5% among the other older age groups. There was no significant difference in human infection rates between males (4.3%) and females (2.8%). The prevalence of human infection was higher in the rural areas (4.4%) than that reported in the urban areas (2.1%). The infection rates among persons who were in contact with farm animals with or without dogs and cats (4.1% and 4.9% respectively) were significantly higher than those reported in others in contact with only dogs and cats (1.8%) and without contact with animals (1.6%) ($P < 0.05$). Generally, more *Cryptosporidium* infections were reported among human and animals in the warmer or more humid months.

The current research indicates that water sampling has demonstrated that *Cryptosporidium* is ubiquitous in the environment and always likely to be present as a waterborne pathogen. The higher prevalence of cryptosporidiosis may relate to relative lack of clean water and sanitary facilities and large number of animals in

close proximity to residence. The major sources for oocysts, which infect humans, are other infected humans, animals and the environment, particularly water.

INTRODUCTION

Cryptosporidiosis, a zoonoses caused by *Cryptosporidium* species, is a coccidial protozoan infection causing diarrheal illness in a variety of hosts including humans and domestic animals (Dubey et al., 1990). In most instances, outbreaks of waterborne diseases occur in water systems with inadequate or no disinfection. However, there are new concerns about emerging pathogens, such as *Cryptosporidium*, that appear even in high-quality water supplies (Craun et al., 1994).

The epidemiology of cryptosporidiosis centers upon the availability and concentration of oocysts in the immediate environment. The oocyst has a tough, environmentally resistant outer shell which encloses four naked sporozoites (Current, 1989). If they are not exposed to extremes of temperature, they probably remain viable for several months. Oocysts also are resistant to many commonly used farm disinfectants (Campbell et al.1982). Moreover, Cryptosporidial oocysts are shed in the feces already fully developed and capable of infecting new hosts immediately (Dubey et al., 1990).

Experimental infectivity trials with *Cryptosporidium parvum* in various animal species (Miller et al., 1990 and Blewett et al., 1993), including adult human volunteers (DuPont et al., 1995), indicate that ingestion of low numbers of viable oocysts can initiate infection in susceptible hosts. Thus, it is recognized that environmental contamination with small numbers of infectious oocysts can pose a significant threat to livestock and to public health.

Water for drinking or swimming can serve as a vehicle for transmission of the oocyst stage (Anon, 1986 and Gallaher et al., 1989). Waterborne is enhanced by the oocyst`s small size (3.5-5.5 um), long-lasting infectivity in the environment, resistance to standard water disinfecting procedures applied to control other water-borne pathogens, and suboptimal treatment of source water by water treatment facilities (Lisle and Rose, 1995). Contaminated water has the potential to cause extensive outbreaks of illness due to the size of populations served by some distribution systems and the large numbers of people who use some recreational water facilities (Tillett et al., 1998). Several outbreaks of *Cryptosporidium* infections acquired through public drinking water systems have been reported in the United States (Gallaher et al., 1989; Leland et al., 1993; Mackenzie et al. 1994; Goldsmith et al., 1996 and Roefer et al., 1996), England (Rush et al., 1990; Joseph et al., 1991; Richardson et al. 1991 and Bridgeman et al., 1995), Scotland (Smith et al., 989) and Canada (Pett et al., 1993). In view of the lack of information regarding *Cryptosporidium* in the drinking water sources in Egypt.This study was carried out in Ismailia Province to determine the existence of *Cryptosporidium* oocysts in the sources of drinking water with throwing the light on its zoonotic importance in the investigated area.

MATERIALS AND METHODS

(1)-Sampling

During the period from October 1998 to October 1999, a total of 125 water samples (the size of each sample 10 liters) were taken from different sources of drinking water in Ismailia Province; Tap water after treatment in Ismailia water treatment plants (38), manual water pumps of some villages (24), fresh surface water of Ismailia Canal before treatment in water treatment plants (41) and common water troughs of calves (18), sheep and goat houses (4) in the investigated areas. water samples were collected in screw capped plastic containers.

During the period of this study, a total of 1548 fecal specimens were taken from different animal species which were in close proximity to the sources of drinking water in the investigated area; 376 cattle (201 calves and 175 cows), 424 buffaloes (282 calves and 142 cows), 337 sheep (105 lambs and 232 ewes), 148 goats (55 kids and 93 adult goats), 135 dogs and 128 rats. Farm animal fecal samples were collected in screw capped wide mouth plastic containers (50 ml) from different animal farms and from animals submitted for clinical examination during the Medical Caravans of Society Service and Environmental Development of Suez Canal University.

Dog fecal samples were collected from adjacent places to water sources. While, rats (*Rattus norvegicus*) were captured from the investigated area.

On the other hand, 939 human stool specimens were collected in screw capped wide mouth plastic containers (50 ml) from patients visiting the outpatient clinic of Ismailia hospital, Transported health units of Ismailia Public Health Department and Medical Caravans of Society Service and Environmental Development of Suez Canal University in the different villages of Ismailia Province. These subjects were requested to answer series of questions in order to obtain more information such as name, address, age, sex, occupations, and occurrence of gastrointestinal symptoms and history of animal contacts.

Intestinal specimens were taken from 12 recently dead calves, which were available during this study. These specimens were immediately fixed in 10% neutral buffered formalin.

All previous specimens were transported immediately to the laboratory in the Faculty of Veterinary Medicine, Suez Canal University, for processing and microscopical examination to detect *Cryptosporidium* spp.

(11)- Microscopical examination

Water samples were processed as described by Ongerth and Stibbs (1987). The method accomplished by filtering water samples. The final filters were cut apart, repeatedly washing in sterile saline solution and all collected washings were centrifuged to concentrate the debris eluted from the filters. Moreover, the eluted debris was concentrated by flotation in a saturated sucrose solution (500 gm granulated sucrose, 320 ml distilled water and 6.7 ml-liquefied phenol) as described by Anderson (1981). The float material was transferred and spread by a disposable

culture loop onto the microscope slide, air-dried and fixed in methanol for 10 min. and stained by Modified Ziehl-Neelsen stain (Henricksen and Polenz, 1981).

All fecal samples of human and animals were processed by the concentration using the flotation in a saturated sucrose solution. One drop of fluid from the levitation suspension (meniscus) was deposited on a glass slide, coverglassed and examined microscopically at 400X. In cases of delayed examination, storage of fecal samples were by suspending each specimen in two volumes of 2.5% potassium dichromate solution (Willson and Acres, 1982). The levitation suspension was farther examined for detecting *Cryptosporidium* oocysts by other confirmatory tests; Iodine wet mount (Ma and Soave, 1983), Modified Ziehl-Neelsen staining technique and Giemsa stain (Pohjola, 1986).

Intestinal specimens, which were taken from the available recently dead calves and fixed in 10% neutral buffered formalin, dehydrated in ethanol and embedded in paraffin. Sections cut at 5 um were stained with Hematoxylin-Eosin (HE) and microscopically examined by higher magnification, 400X and an oil immersion lens, 1000X.

The analysis of data was achieved by Chi-square (X^2).

RESULTS

The existence of *Cryptosporidium* oocysts in water samples from different sources of drinking water was determined by using the modified Ziehl Neelsen staining technique as shown in table (1). The existence rates of *Cryptosporidium* spp. oocysts according to the number of the examined water samples were 2 (4.9%) out of 41 fresh surface water samples of Ismailia Canal, one (4.2%) out of 24 manual pump water samples, 7 (38.9%) out of 18 water samples of common water troughs of calf houses and one (25%) out of 4 water samples of common water troughs of sheep and goat houses. However, *Cryptosporidium* oocysts were not detected in the examined water samples of treated tap water, which supplied by water treatment plants.

The prevalence of *Cryptosporidium* infection in the examined animals summarized in table (2). The overall prevalence rate of *Cryptosporidium* spp. oocysts among the examined animal fecal samples was 6.98%(108 out of 1548 fecal samples). Young farm animals (age ? one month) were the most heavily infected with *Cryptosporidium*. It was found that 31(15.4%) of 201 calves, 28 (9.9%) of 282 buffalo calves, 18(17.1%) of 105 lambs and 9 (16.4%) of 55 kids had *Cryptosporidium* sp. oocysts. The *Cryptosporidium* infection rates were significantly higher in calves (42.4%) and buffalo-calves (33.3%) had diarrhoea than the non-diarrheic ones (7.7% and 3.2 % respectively)($P < 0.001$). Developmental stages of *Cryptosporidium* sp. were detected in the microvillous border of the enterocytes of a calf small intestine (fig., 1). *Cryptosporidium* infections were concentrated in the distal small intestine and were associated with mild to moderate villous atrophy.

Low infection rates were found among the examined adult farm animal species; 1(0.6%) of 175 cows, 4(1.7%) of 232 ewes and 5(5.4%) of adult goats. *Cryptosporidium* oocysts were not found in the feces of the examined buffalo-cows. *Cryptosporidium* infection rates in dogs and rats were 2.6% and 6.3% respectively

The prevalence of *Cryptosporidium* spp. oocysts among the examined animals according to the seasons illustrated in table (3). The infection rates were relatively varied according to the months of the year during the period of this study. Generally, more *Cryptosporidium* infection rates were reported among animals in warmer and more humid months.

On the other hand, the prevalence of *Cryptosporidium* infections among the examined human beings was summarized in table (4). The overall prevalence rate was 33(3.5%) out of 939 human stool samples. More infections were recorded in young age groups less than 10 years (7.3%), while the infection rates were ranged from 0.97 to 3.5% among the other older age groups. *Cryptosporidium* infection rate was higher in males (4.3%) than that reported in females (2.8%). However, statistically there was no significant difference.

In table (5), the prevalence of *Cryptosporidium* infections among the examined persons according the season months, was ranged from 0.99% in the month of January to 3.7% in the month of March. While in warm months, from April to August, it ranged from 2.9% to 7.04%.

Regarding the location of the examined humans for cryptosporidiosis as shown in table (6). The prevalence of infection with *Cryptosporidium* was higher in rural areas (4.4%) than that reported among the urban areas (2.1%).

Cryptosporidium infections among the examined human beings according to their history of contact with animals summarized in table (7). The infection rates among persons who were in contact with farm animals with or without dogs and cats (4.1% and 4.9% respectively), were significantly higher than those reported in others in contact with only dogs and cats (1.8%) or without contact with animals (1.6%) ($P < 0.05$).

DISCUSSION

Cryptosporidium has been isolated from drinking water, river, stream or reservoir in North America, South America and Europe (Anon, 1986; Madore et al., 1987; Ongerth and Stibbs, 1987; Gallaher et al., 1989; Anonymous, 1994; Mackenzie et al., 1994; and Lisle and Rose, 1995).

In the present study, the existence rates of *Cryptosporidium* oocysts according to the number of examined water samples, were higher in drinking water of common water troughs of calves (38.9%) and sheep and goat houses (25%) in comparison with fresh surface water of Ismailia Canal (4.8%) and water of manual water pumps (4.1%) in some villages of Ismailia Province. It is not surprising that the existence rates of *Cryptosporidium* oocysts are higher in drinking water of animal houses where the animals especially young ruminants (calves, lambs and kids) are highly susceptible to infection and they can contaminate water troughs (Hiepe and Buchwalder, 1991). *Cryptosporidium* oocysts are frequently present in surface waters (Hansen and Ongerth, 1991) and adverse weather conditions (heavy rains and floods) contribute to water contamination by washing oocysts from the land into surface waters (Lisle and Rose, 1995). Moreover, Lower aquatic and semi-aquatic vertebrates can act as mechanical vectors and disseminate ingested

Cryptosporidium oocysts of the mammalian species (Graczyk et al., 1996). Thus, consumption of untreated fresh surface water appears to be a predominant risk factor for cryptosporidial infection (Gallaher et al., 1989 and Graczyk et al., 1997).

Pastures and grazing lands are recognized as significant sources of viable *Cryptosporidium parvum* oocysts (Hiepe and Buchwalder, 1991; Lisle and Rose, 1995 and Fayer et al., 1997). Therefore, the detection of *Cryptosporidium* oocysts in the water of a manual water pump, in this study, may be attributed to the leakage of contaminated water, draining from adjacent grazing land, into the pipe of this pump (Bridgman et al., 1995 and Tillett et al., 1998).

In this study, *Cryptosporidium* oocysts were not detected in the treated tap water, which supplied by drinking water treatment plants in Ismailia City. This result indicated that rapid sand filters and sequential addition of chlorine-based disinfectants which used in the drinking water treatment plants, in the investigated area, were effectively removing oocysts (Madore et al., 1987 and Finch et al., 1996).

Considering the zoonotic transmission of *Cryptosporidium*. In the present study, 6.98% of the examined animals, which were in close proximity to the sources of drinking water, harbored *Cryptosporidium* species. The infections were more prevalent in young farm animal species (Age ? one month). This was in agreement with that observed by Pohlenz et al., 1978; Anderson and Bulgin, 1981; Desokey et al., 1989 and Abou-Eisha, 1994. The infection rate was higher in young farm animals had diarrhoea than others had not (Anderson, 1982; Reynolds et al., 1986; Sobieh et al., 1987 and Abou-Eisha, 1994).

Cryptosporidium infections were concentrated in the distal small intestine and were associated with mild to moderate villous atrophy. These findings were in agreement with that reported by Pohlenz et al. (1978); Tzipori (1983) and Anderson (1984). It is deduced that clinical cryptosporidiosis is likely apt to occur in very young animals, particularly young ruminants and there is a close association between host age and susceptibility to infections (Tzipori et al., 1982; Mohamed, 1986 and Simpon, 1992).

In adult farm animals (dams), there were low cryptosporidial infection rates among ewes and goats. *Cryptosporidium* sp. oocysts were found in only one diarrheic cow of the examined cows and was not observed among the examined buffalo cows. Anderson (1982) reported that *Cryptosporidium* sp. oocysts were not observed in over 1600 cow fecal samples in farms where cryptosporidiosis of young calves was highly prevalent. However, Chermette et al. (1984) and Mann et al. (1986) reported subclinical infections in adult cattle. So it is feasible that calving cows could excrete sufficient numbers of oocysts to infect their offspring at birth (Dubey et al., 1990).

In dogs, scant information is available on the prevalence of cryptosporidial infection in this species in Egypt. In this study, *Cryptosporidium* sp. oocysts were detected in 2.96% of dog fecal samples. This result was nearly similar to that reported in Ismailia city, Egypt by Abou-Eisha and Abdel-Aal (1995) (3.8%). While, it was lower than that reported in France (44.8%) by Chermette and Blondel (1989). However, in another studies, *Cryptosporidium* oocysts were not detected in feces of

57 dogs in Finland(Pohjola, 1984), 200 dogs in the Federal Republic of Germany (Augustin-Biehl et al., 1984) and 101 healthy pet dogs in Scotland (Simpson et al., 1988).

Regarding cryptosporidiosis in rats, natural infection of house rats (*Rattus norvigecus*) with *Cryptosporidium muris* oocysts has been documented (Iseki, 1986). In the present work, *Cryptosporidium* sp. oocysts were detected in 6.3% of examined house rats (*Rattus norvigecus*). This result was similar with that reported in Egypt by Samaha and Otify (1991) in Behera and Alexandria Governorates (5.7%) and Abdel-Salam et al. (1994) in Sohag Governorate (6.25%). The possibility of cross infection between rats and other animals or man is not to be disregarded. Since the mammalian species of *Cryptosporidium* may not be host specific (Tzipori et al., 1980 and Desokey et al., 1989).

On the other hand, in this study, the overall human *Cryptosporidium* infections rate in the investigated area was 3.5%. These results nearly similar with those reported in U.S.A. by Bossen and Britt (1985) in Michigan (3.6%) and Wolfson et al. (1985) in Massachusetts (4.2%) and in France by Passeur et al. (1987)(4.2%). In general, human infection rate in the present study was nearly similar to human infection range in Europe and North America (1-3%) (Dubey et al., 1990). The human infection rates among young age group less than 10 years (7.3%) were higher than in the other older age groups. This result was nearly similar with that reported by Wassef et al. (1994) in Egypt (9.2%). Generally, in geographically diverse surveys for fecal *Cryptosporidium* sp. oocysts in both adults and children, significantly higher prevalence were found in the majority of studies in young children (Hunt et al., 1984; Hojlyng et al., 1986; Reinthaler et al., 1988; Abegbola et al., 1994 and Cicirello et al., 1997). The elderly may also be at increased risk for Cryptosporidium infection, perhaps related to normal immunosenescence (Bannister and Mountford, 1989).

In the present study, there was no significant difference in human *Cryptosporidium* infection rates between males (4.3%) and females (2.8%). This result indicates that males and females appear to be equally susceptible to infection (Fayer and Ungar, 1986 and Das et al., 1993).

Regarding the location of the examined humans in this investigation. More infections were recorded in the rural areas (4.4%) than that in the urban areas (2.1%). This was in agreement with that reported in Ghana by Adjei et al. (1987) who found that the prevalence in rural populations was higher than in urban populations.

In this study, *Cryptosporidium* infection rates among persons who in contact with farm animals (4.9% and 4.1%) were significantly higher than those reported in others in contact with dogs and cats (1.8%) or without contact with animals (1.6%). These results confirm that on the farms the infection is more frequently among animal handlers suggesting a zoonotic and occupational risk due to prolonged and direct daily exposure to farm animals especially young ruminants (Rahman et al., 1984 and Fayer et al., 1997).

The present data indicated that dogs and cats did not appear to be a prominent risk factor for human infection with *Cryptosporidium*. However, possibility of cross infection between dogs and cats and man may not be disregarded (Mann et

al., 1986). Since the mammalian species of *Cryptosporidium* may not be host specific (Tzipori et al., 1980).

Generally, more *Cryptosporidium* spp. infections among human and animals, during the period of this study, were in warmer or more humid months (Rahman et al., 1984; Bossen and Britt, 1985; Montessori and Bischoff, 1985; Wolfson et al., 1985 and Schuster et al., 1991). The more Cryptosporidium infections in warmer months are probable due to the association between *Cryptosporidium* and another enteropathogens, which are more spread in these months (Albert, 1986 and Fayer and Unger, 1986).

In conclusion, water sampling has demonstrated that *Cryptosporidium* is ubiquitous in the environment and always likely to be present as a waterborne pathogen. The higher prevalence of cryptosporidiosis may relate to relative lack of clean water and sanitary facilities and large number of animals in close proximity to residence. The major sources for oocysts which infect humans are other humans, animals (especially young ruminant animals) and the environment, particularly water. Based on this study and the available literature noted earlier, modifications of water-shed control activities regarding animals and drainage systems including grazing fields, may enhance prevention or reduce contamination and decrease the number of cases associated with recreational contact with surface water. At present it really knows little about *Cryptospridium* removal efficiency as it relates to the operational efficiencies of different types of filters operating under different conditions of water pretreatment and with variable types of source waters.

So, it is important to continually monitor operational efficiency of water treatment to prevent cases associated with drinking water.

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Table (1): Existence of *Cryptosporidium* spp. oocysts in water samples from different sources of drinking water in Ismailia Province.

Source of water samples	No. of water samples examined	Positive No.	Positive %
-Ismailia Canal	41	2	4.9
-Tap water	38	0	0.0
- Manual water pumps	24	1	4.2
-Animal houses	18	7	38.9
Calves	4	1	25
Sheep and goats			

Table (2): Prevalence of *Cryptosporidium* spp. oocysts in the feces of the examined animal species according to their ages.

Animal species	Total No. Exam.	Age	Number of specimens containing *Cryptosporidium* sp. Oocysts/ number of specimens examined. Overall (%)	Animals had Diarrhoea (%)	Animals had no diarrhoea (%)
Cattle					
Calves	201	1 month	31/201(15.4)	19/45(42.2)	12/156(7.7)
Cows	175	2 years	1/175 (0.6)	1/13(7.7)	0/162(0.0)
Buffalo					
Calves	282	1 month	28/282(9.9)	21/63(33.3)	7/219(3.2)
Cows	142	2 years	0/142 (0.0)	0/23(0.0)	0/119(0.0)
Sheep					
Lambs	105	1 month	18/105(17.1)	6/28(21.4)	12/77(15.6)
Ewes	232	1 year	4/232(1.7)	1/22(4.6)	3/210(1.4)
Goats					
Kids	55	1 month	9/55(16.4)	5/21(23.8)	4/34(11.8)
Goats	93	1 year	5/93(5.4)	2/16(12.5)	3/77(3.9)
Dogs	135	Not recorded	4/135(2.96)	-	-
Rats	128	Not recorded	8/128(6.3)	-	-
Total	1548		108/1548(6.98)	55/231(23.8)	41/1054(3.9)

Calves $X^2 = 32.2$ ($P < 0.001$) Lambs $X^2 = 0.5$

Buffalo calves $X^2 = 49.2$ ($P < 0.001$) Kids $X^2 = 1.6$

Table (3): Seasonal variation of *Cryptosporidium* spp. oocysts among the examined animals.

Animal Species	November		December		January		February		March		April		May		June		July		August	
	No.	+ve(%)	No.	+ve (%)	No.	+ve (%)	No.	+ve(%)	No.	+ve(%)	No.	+ve(%)	No.	+ve(%)	No.	+ve(%)	No	+ve(%)	No	+ve(%)
Cattle	17	3(17.6)	24	4(16.7)	21	1(4.8)	18	2(11.1)	19	2(10.5)	28	4(14.3)	16	3(18.8)	21	4(19.1)	23	4(17.4)	14	4(28.6)
Calves	23	0(0.0)	17	0(0.0)	13	0(0.0)	17	0(0.0)	26	0(0.0)	29	1(3.5)	18	0(0.0)	13	0(0.0)	11	0(0.0)	8	0(0.0)
Cows	25	2(8)	34	3(8.8)	48	3(6.3)	16	1(6.3)	28	3(10.7)	34	3(8.8)	41	6(14.6)	23	3(13.04)	18	2(11.1)	15	2(13.3)
Buffalo	11	0(0.0)	15	0(0.0)	11	0(0.0)	21	0(0.0)	15	0(0.0)	11	0(0.0)	19	0(0.0)	9	0(0.0)	20	0(0.0)	10	0(0.0)
Calves	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cows	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sheep	14	1(7.1)	16	3(18.8)	12	1(8.3)	13	3(23.1)	8	2(25)	6	2(33.3)	17	4(23.5)	10	1(10)	6	1(16.7)	3	0(0.0)
Lambs	20	1(5)	22	0(0.0)	28	1(3.6)	17	0(0.0)	14	0(0.0)	28	2(7.1)	29	0(0.0)	31	0(0.0)	24	0(0.0)	19	0(0.0)
Ewes																				
Goats	8	1(12.5)	6	0(0.0)	11	1(9.1)	6	3(50)	3	0(0.0)	4	0(0.0)	3	1(33.3)	5	1(20)	5	1(20)	4	1(25)
Kids	9	1(11.1)	9	0(0.0)	13	1(7.7)	15	0(0.0)	6	0(0.0)	10	0(0.0)	6	1(16.7)	6	1(16.7)	11	1(9.1)	8	0(0.0)
Goats	-	-	-	-	11	0(0.0)	21	0(0.0)	18	1(5.6)	25	1(4)	24	0(0.0)	18	1(5.6)	12	1(8.3)	6	0(0.0)
Dogs	-	-	-	-	8	0(0.0)	14	1(7.1)	8	1(12.5)	19	1(5.3)	23	2(8.7)	30	1(3.3)	15	1(6.7)	11	1(9.1)
Rats																				
Total	127	9(7.1)	143	10(6.99)	176	8(4.6)	158	10(6.3)	145	9(6.2)	194	14(7.2)	196	17(8.7)	166	12(7.2)	145	11(7.6)	98	8(8.2)

Table (4): Prevalence of *Cryptosporidium* sp. oocysts among the examined human beings by age and sex.

Age/years	Total No. Examin.	Positive No.	%	Male No.	+ve(%)	Female No.	+ve(%)
-10	219	16	7.3	118	11(9.3)	101	5(4.95)
-20	197	6	3.05	110	3(2.7)	87	3(3.5)
-30	173	4	2.3	75	1(1.3)	98	3(3.1)
-40	207	2	o.97	99	2(2.02)	108	0(0.0)
over 50	143	5	3.5	65	3(4.6)	78	2(2.6)
Total	939	33	3.5	467	20(4.3)	472	13(2.8)

Difference in *Cryptosporidium* infection rate between males and females was not significant ($X^2 = 1.7$)

Table (5): Seasonal variation of *Cryptosporidium* sp. oocysts among the examined human beings.

Months	No. of samples Examined	Positive No.	%
November	94	2	2.1
December	81	2	2.5
January	101	1	0.99
February	115	4	3.5
March	109	4	3.7
April	137	4	2.9
May	99	5	5.1
June	74	3	4.1
July	58	3	5.2
August	71	5	7.04
Grand total	939	33	3.5

Table (6): Prevalence of *Cryptosporidium* sp. oocysts among the examined human beings according to their location.

Location	No. of amples Examined	Positive No.	%
Urban areas	374	8	2.1
Rural areas	565	25	4.4
Total	939	33	3.5

$X^2 = 3.4$

Table (7): Prevalence of *Cryptosporidium* sp. oocysts among the examined human beings according to their history of contact with animals.

History of contact with animals	No. Examined	Positive No.	%
-Contact with farm animals esp. cattle, Buffalo, sheep and goats.	470	23	4.9
-Contact with farm animals, dogs and cats	98	4	4.1
-Contact with dogs and cats only	56	1	1.8
-No contact with animals	315	5	1.6
Total	**939**	**33**	**3. 5**

Difference in Cryptosporidium infection rate between the examined persons who were in contact with farm animals and those were not in contact with farm animals, was significant (X^2 =5.7, P < 0.05)

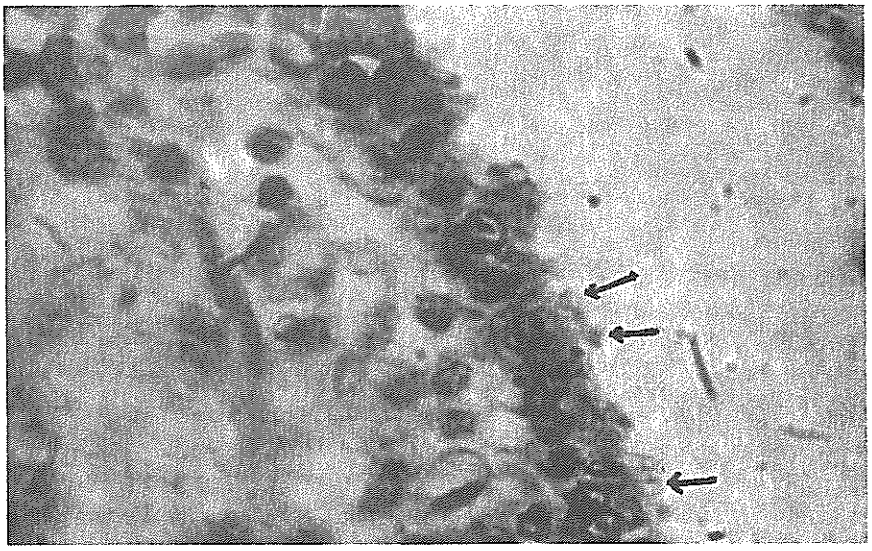

Figure (1): Photomicrograph of a histologic section of small intestine specimen obtained from diarrheic calf. Developmental stages of *Cryptosporidium* sp. in the microvillous border of the enterocytes (Arrows).

الملخص العربى

طفيل الكربتوسبوريديم فى مصادر مياه الشرب وأهميته كمرض مشترك

عبدالكريم محمود أبوعيشة، محمود محمد حسين، أحمد أنور عبدالعال و ربيع السيد صالح

فى دراسة لتحديد مدى تواجد طفيل الكربتوسبوريديم فى مصادر مياه الشرب فى محافظة الإسماعيلية، تبين تواجد حويصلات الكربتوسبوريديم فى المياه السطحية العذبة لترعة الإسماعيلية، ومياه مضخة يدوية بإحدى القرى بالمحافظة ومياه أحواض الشرب للعجول والأغنام والماعز، بينما لم يتم عزل حويصلات الكربتوسبوريديم من مياه الشرب المعالجة بمحطات تنقية مياه الشرب. وباعتبار أن هذا الطفيل ممكن أن ينتقل من الحيوان إلى الإنسان تم فحص عدد ١٥٤٨ عينة براز من الحيوانات القريبة من مصادر مياه الشرب بمنطقة البحث هى الأبقار والجاموس والأغنام والماعز والكلاب والفئران، وكانت النسبة الكلية لتواجد حويصلات الكربتوسبوريديم؛ ٦،٩٨%. وكانت حيوانات المزرعة الصغيرة التى أعمارها أقل من شهر أكثر إصابة بطفيل الكربتوسبوريديم (١٥،٤%من العجول، ٩،٩% من عجول الجاموس، ١٧،١% من الحملان، ١٦،٤% من صغار الماعز). وكانت العجول (٤٢،٤%) وعجول الجاموس (٣٣،٣%) التى تعانى من إسهال أكثر إصابة من السليمة ظاهريا (٧،٧%و ٣،٢% على التوالى). وبالفحص الهستوباثولوجى لأمعاء العجول المصابة التى تعانى من إسهال تبين وجود طفيل الكربتوسبوريديم فى الجزء الأخير من الأمعاء الدقيقة. وكان معدل الإصابة فى الكلاب والفئران ٢،٦% و ٦،٣% على التوالى.

وعلى الجانب الآخر كانت النسبة الكلية لتواجد طفيل الكربتوسبوريديم فى براز الآدميين الذين تم فحصهم ٣،٥%. وكان الأشخاص ذو الأعمار الصغيرة والأقل من ١٠ سنوات أكثر اصابة (٧،٣%). ولا يوجد إحصائيا اختلاف معنوى بين معدل الإصابة فى الذكور (٤،٣%) والإناث (٢،٨%). وكانت نسبة الإصابة فى المناطق الريفية (٤،٤%) أكثر من الإصابة فى المناطق الحضرية (٢،١%). ووجد أن معدل الإصابة بطفيل الكربتوسبوريديم بين الأشخاص الملامسين أوالمتعاملين مع حيوانات المزرعة (٤،٩%) أكثر إصابة من الأشخاص الملامسين للكلاب والقطط أو الغير ملامسين للحيوانات(١،٨% و١،٦%على التوالى). وكانت نسبة الإصابة بطفيل الكربتوسبوريديم فى الإنسان والحيوان أكثر فى الشهور الدافئة ذات الرطوبة العالية نسبيا. ومن هذه الدراسة تبين أن طفيل الكربتوسبوريديم منتشر فى البيئة ويحتمل تواجده كمسبب مرضى ينتقل عن طريق المياه. وتعتبر المصادر الاساسيه لاصابة الإنسان بطفيل الكربتوسبوريديم هى الاشخاص المصابين والحيوانات والبيئة خاصة المياه الملوثة.