

The prevalence of *Cryptosporidium* spp. in lambs and goat kids in Kurdistan, Iran

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Received: 09-09-2013, Revised: 29-10-2013, Accepted: 05-11-2013, Published online: 08-12-2013

doi: 10.14202/vetworld.2013.964-977

How to cite this article: Khezri M and Khezri O (2013) The prevalence of *Cryptosporidium* spp. in lambs and goat kids in Kurdistan, Iran, *Veterinary World* 6(12): 974-977.

Abstract

Aim: *Cryptosporidium* is a protozoan parasite that causes diarrhea, which is typically a short-lasting benign infection. The aim of the present study was to determine the prevalence of *Cryptosporidium* infection in lambs and goat kids in Kurdistan district, Iran.

Materials and Methods: A total of 1200 fecal samples were obtained from diarrheic and non-diarrheic lambs and goat kids aged 1 to 6 months from 48 villages in the Kurdistan province, west of Iran. The samples were tested for the presence of *Cryptosporidium* spp. oocysts using modified Ziehl-Neelsen staining method.

Results: *Cryptosporidium* spp. oocysts were present in 10.24% of lambs and in 18.86% of goat kids. Both diarrhea and *Cryptosporidium* spp. oocysts were observed in 64.37% (56/87) of lambs and in 30.51% (18/59) of goat kids. *Cryptosporidium* spp. infection rates were significantly higher in diarrheic than in non-diarrheic groups. The highest rate of infection was found in an animal aged one month. Furthermore, the prevalence of the infection according to age groups and consistency of feces was found to be statistically significant.

Conclusion: The presence of *Cryptosporidium* spp. in lambs and goat kids in Kurdistan indicates that this protozoan parasite should also be considered in the etiology of lambs and goat kids exhibiting diarrhea.

Key words: *Cryptosporidium* spp., lambs, goat kids, prevalence, Iran

Introduction

Cryptosporidium is an apicomplexan intestinal protozoan, which infects the gastrointestinal tract of domestic animals and humans [1]. There are currently 16 recognized species of *Cryptosporidium*, which have been isolated from a large variety of hosts which include all the five groups [including Amphibians, Fishes, Reptiles, Birds, Mammals] of vertebrates [2]. Transmission occurs through the fecal-oral route, following direct contact with *Cryptosporidium* oocysts via person-to-person, zoonotic, waterborne, foodborne or airborne contact [3]. Most of the data on the prevalence of cryptosporidial infection in farm animals is related to cattle. In comparison, there is very less information on the occurrence of cryptosporidiosis in sheep and goats [4]. Cryptosporidiosis was first described in lambs with diarrhea in Australia, but no causative role could be ascribed to the organism because of the coincidental infections with pathogenic bacteria. Its role as a primary etiological agent of diarrhea in lambs was confirmed in the early 1980s in the studies on natural and experimental infections [5, 6]. In goats, infection with *Cryptosporidium* spp. is very important for the economy not only because of the

financial losses, but also in terms of health, due to the zoonotic nature of the disease. Since then, the parasitic infections in lambs and goat kids with and without diarrhea have been reported from many parts of the world [7]. Methods to detect *Cryptosporidium* spp. in feces usually involve microscopic examination of stained fecal smears (modified Ziehl-Neelsen, safranin methylene blue, auramine phenol), antigen detection (immunofluorescence, enzyme-linked immunosorbent assay or genome detection (polymerase chain reaction amplification of the 18S rRNA gene). Each method varies in sensitivity and specificity and there is no universally accepted 'best method' [8]. Cryptosporidiosis was first described in lambs with diarrhoea in Iran [9], and since then few studies have been carried out to determine the prevalence of cryptosporidial infection in lambs and goat kids [10,11].

This article describes the prevalence of cryptosporidiosis in lambs and goat kids in the Kurdistan province in west of Iran and links its association with various risk factors that include age, sex, and stool consistency.

Materials and Methods

Ethical approval: Permission was obtained from a local ethics committee acting under guidance from Razi Vaccine and Serum Research Institute, Alborz, Iran.

Sample collection: In this study, 850 and 350 fecal

Table-1. Frequency of detection of *Cryptosporidium* spp. oocysts in the fecal samples of lambs

Lambs	n	Oocyst			
		Positive		Negative	
		n	%	n	%
Diarrhoeic	87	56	64.37	31	35.63
Non-diarrhoeic	763	31	4.06	732	95.94
Total	850	87	10.24	763	89.76

Table-3. Relationship between age and *Cryptosporidium* spp. oocysts in lambs

Age (Month)	n	Lambs			
		Positive		Negative	
		n	%	n	%
1	141	16	11.34	125	88.66
2	278	29	10.43	249	89.57
3	289	29	10.03	260	89.97
4	77	8	9.09	69	90.91
5	43	4	9.3	39	90.7
6	22	1	4.54	21	95.46
Total	850	87	10.24	763	89.76

samples were collected randomly from lambs and goat kids, respectively. Samples were collected from 48 villages in Kurdistan district, west of Iran. Livestock information was collected by direct observation and by questioning of owners, and included the status of animals as diarrheic and non-diarrheic groups.

Moreover, all the animals in this study were aged 1-6 months. Fecal samples of animals were collected directly from their rectum. The fecal samples were then fixed as quickly as possible in 10% formalin for preserving until further examination. Moderately thick fecal smears were prepared and air-dried. After fixation by methanol, the fecal smears were stained by modified Ziehl-Neelsen staining. The stained smears were observed under microscope with a $\times 400$ to $\times 1,000$ magnifications. The *Cryptosporidium* spp. oocysts were visualized as bright red round bodies against a pale green background, containing elongated naked sporozoites. *Cryptosporidium* infection was scored either positive or negative based on the presence or absence of the oocysts in the examined microscopic fields in each sample. A sample was considered positive for *Cryptosporidium* spp. if an oocyst was detected bearing the correct morphology, i.e., optical properties, internal structures, size, and shape [3].

Statistical analysis: The results are expressed in percentages. The prevalence for *Cryptosporidium* was statistically analyzed by the Chi-square test (χ^2) considering the variables sex, age and stool consistency. The differences were considered statistically significant at $P < 0.05$. SPSS 10.0 for Windows was used to perform the statistical analyses [12].

Results

The prevalence of *Cryptosporidium* in lambs and goat kids in Kurdistan province were found to be 10.24% and 18.86%, respectively. Results show that the prevalence of *Cryptosporidium* spp. in diarrhoeic

Table-2. Frequency of detection of *Cryptosporidium* spp. oocysts in the fecal samples of goat kids

Goat kids	n	Oocyst			
		Positive		Negative	
		n	%	n	%
Diarrhoeic	59	18	30.51	41	69.49
Non-diarrhoeic	291	48	16.49	243	85.22
Total	350	66	18.86	284	81.14

Table-4. Relationship between age and *Cryptosporidium* spp. oocysts in goat kids

Age (Month)	n	Goat kids			
		Positive		Negative	
		n	%	n	%
1	118	27	22.88	102	79.07
2	112	21	18.75	108	83.72
3	63	11	17.46	69	86.25
4	29	4	13.8	25	86.2
5	18	2	11.11	16	88.89
6	10	1	10	9	90
Total	350	66	18.86	284	81.14

and non-diarrhoeic lambs and goat kids were 64.37% (56/87), 30.51% (18/59), 4.06% (31/763) and 16.49% (48/291), respectively ($P < 0.05$; Table-1 and 2). The prevalence of the infection according to age groups in lambs and goat kids are shown in Table-3 and 4. Infection rates were significantly higher in lambs and goat kids less than 1 month of age (11.34% and 22.88%) than in the remaining age groups ($P < 0.05$), thus the highest risk of being infected with *Cryptosporidium* in lambs and goat kids is in the first month of their life. Microscopic examination showed that the lambs and goat kids of both sexes were infected with *Cryptosporidium*: 6.02%, 8.32% of male animals and 4.22%, 10.54% of female animals were infected. There was no significant difference between prevalence percentages.

Discussion

In our study, *Cryptosporidium* oocysts were identified in 12.17% of the examined samples. Infection rate in lambs was 10.24%, which shows a high infection rate. Also, 18.86% of goat kids were infected. These results show that the *Cryptosporidium* infection is present at a high rate in the livestock of Kurdistan region. Similar studies have been carried out in different regions of the country and those studies mostly reported higher prevalence in the similar study groups. For example, 17.2% in sheep in Lorestan [13], 10.8% in calves in Isfahan [14] 12.8% and 2.5% in calves and goat kids in Hamadan [10], 2% in dogs in Kerman [15], and 22.6% infection rate in camels in Yazd [16], respectively.

In other countries, the prevalence was as follows: more than 20% of fecal samples examined from goats, cows, buffaloes, and sheep were positive for *Cryptosporidium* in Egypt [17]. In Iraq, similar findings were reported [18]. In Turkey, the prevalence rate in neonatal lambs was 21.05% [19]. In Europe, *Cryptosporidium* oocysts were detected in 42.1% of the examined lambs and 31.8% goat kids in Serbia [20].

In another study, conducted in Romania, the presence of Cryptosporidiosis was observed in 24% of the goat kids [21]. The differences in the frequency of *Cryptosporidium* prevalence in lambs and goat kids raised in different geographical regions may be the result of differences in the levels of contamination of the environment with oocysts of the parasite or may be due to differences in the infectivity of different *Cryptosporidium* spp. populations. It is also possible that the quality of hygienic conditions of animal husbandry and grazing practices may have influenced the exposure of animals to cryptosporidial infection. In this study, we believe that overcrowding the lambs and goat kids together in a small area caused high infection rates.

Some authors suggested that zoonotic transmission is the main mode of transmission of *Cryptosporidial* infection in Iran [22]. *Cryptosporidiosis* is reported to cause serious problems in young livestock like calves, buffalo calves, lambs and goat kids. Risk factors such as farm management, size of the herd, farm type and hygiene, bedding type, feeding of colostrum, season, diarrhoea, age and contamination sources (e.g. water) play a role in the spread of *Cryptosporidium* spp. in domestic animals [23-25]. There is no significant relationship between infections and animal sex. Most researchers believe that there is no correlation between the elimination of *Cryptosporidium* oocysts and the animals' sex [21, 24, 26]. Our results demonstrate that *Cryptosporidium* is involved in the etiology of diarrhea in lambs and goat kids and that this organism must be considered during the differential diagnosis of enteric infections in lambs and goat kids. Some factors may be related to the overcrowding and the unhygienic conditions under which the animals are housed.

Conclusion

Our study indicates that the frequency of *Cryptosporidium* spp. infection in lambs and goat kids in areas of Kurdistan is lower than the other rural areas of Iran.

Authors' contributions

MK implemented the study design and test samples. OK analyzed the data, drafted and revised the manuscript. Both authors read and approved the final manuscript.

Acknowledgements

This study was supported with a grant (grant no. 75-0450909119-01) from Razi Vaccine and Serum Research Institute, Kurdistan, Iran.

Competing interests

The authors declare that they have no competing interests.

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