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The prevalence and intensity of *Eimeria* spp. infection in sheep of Malayer suburb, Iran

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ABSTRACT

The prevalence of *Eimeria* spp. infection and the intensity of fecal oocysts were determined in 250 sheep in Malayer suburb of Iran using flotation and sporulation techniques. The overall prevalence was 23.23% in which the young male sheep had the highest prevalence (37.61%) with the highest intensity (63.58%). There were no significant difference in the prevalence between male (27.9%) and female (22.93%) in all age groups (P>0.05). The young sheep had significantly higher oocysts counts than the other groups (P<0.05). Diarrhea had positive correlation with infection in all age groups. Also positive correlation was found between diarrhea, infection and intensity in young sheep (P<0.05). The highest percentage belonged to the *E. intricata* (39%), followed by *E. faurei* (16%), *E. ovina* (16%), *E. parva* (12%), *E. pallida* (7%), *E. ahsata* (6%) and *E. ovinoidalis* (4%). No correlations were found between temperature and rainfall with intensity in all age groups (P>0.05). The results of this investigation indicate that *Eimeria* infection is a problem in sheep in Malayer suburb and further studies will reveal more information about economic effects of this parasite which it will be useful for establishing control programs.

Keywords: *Eimeria* spp., Sheep, Malayer, Iran

INTRODUCTION

Coccidia are generally regarded as ubiquitous parasites of animals and continue to be a serious cause of lowered productivity and ill-health (Soulsby 1982). *Eimeria* spp. are common intestinal protozoan parasites of domestic sheep. Morbidity, mortality and economic impact are associated primarily with young lambs (Gregory *et al* 1989). It is assumed that most, if not all, domestic ruminants become infected with coccidia during their lives (Vercruysse 1982, Taylor & Catchpole 1994). Fifteen *Eimeria* species were considered to have the capability of infecting sheep (Platzer *et al* 2005) with 14 species parasitized the sheep intestine and one (*E. gilruthi*) the abomasum (Kaya 2004). Sheep husbandry has been considered as the most important sector for security food supply of rural and sometimes urban people in this geographical area of Iran (Pourebrahim & Hushmandrad 2000). There have been a few studies on ovine coccidian infection (Rafyi & Niak 1966, Tafti 1999, Moghadar 1996, Tavassoli & Khoshvaghti 2005; Yakhchali & Zarei, 2008; Yakhchali & Golami, 2008) and caprine coccidian infection (Razavi & Hassanvand 2006) in Iran. However, in this area investigation on the intensity and diversity of *Eimeria* infections

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in sheep have not been conducted based on our knowledge regarding the literature review, as yet. Likewise for successful and economical control of coccidiosis in flocks, detailed knowledge about the *Eimeria* species involved and time course of infection is essential (Platzer *et al* 2005). The objectives of this study were to determine prevalence, intensity, diversity of *Eimeria* species and correlation between obtained data in Northwest of Iran.

MATERIALS AND METHODS

Field of study. Malayer city is located in Hamedan province and has a continental type of climate with low humidity of average annual rainfall of 309.5 mm and temperature varies from + 0.1 ºC to +26.1 ºC**.** According to Iranian Veterinary Organization (IVO, 2004), an average population of 1.5 million sheep and lambs are reared in this region.

Animals. During the period of this study from January 2007 to January 2008, four flocks of sheep under traditional rearing were investigated. The flocks comprising of 250 sheep were randomly selected from flocks in the region. At the beginning of the study, all animals were recorded and their sex and age registered. The flocks subjected to a clinical examination including general body condition, heart and respiratory rates and signs of diarrhea. The animals were divided into three groups, namely young (less than 6 months old), immature (6-12 months old) and adult (over 12 months old) sheep (Table 1). There were no prophylactic treatments against coccidiosis. Fecal samples were collected directly from the rectum of each examined sheep over a period of one year (about 62 samples per season). Faecal consistency was recorded during sampling as normal, semi soft, soft and diarrheic (Skerman and Hillard 1966). About three grams of each fecal sample was mixed with 42 ml tap water. Mixture was subjected to centrifugal sedimentation (1500 rpm for 3 min.) and floatation technique using standard sheather solution (specific gravity 1.12) for detection of *Eimeria* oocysts (Hendrix 1998). The oocysts were counted by the modified McMaster technique (Kaya 2004). Sporulation of oocysts was performed using Hendrix procedure (1998). At least 100 oocysts were obtained from feces samples of infected animals for parasite's specie identification. *Eimeria* specie of each oocyst was determined according to the characteristics of oocysts and sporocysts described by Soulsby (1986) and Eckert et al (1995). Weather data pertaining to the study period were obtained from the Iranian Meteorological Organization (IMO, 2007-2008) (Figure 1).

Statistic evaluation. Statistical analysis was undertaken using non-parametric Chi-square test, Student's *t*-test and one-way ANOVA test with confidence interval of 95% (SPSS 11.5, SPSS Inc., Chicago, IL, USA). Probability of < 0.05 was regarded as significant.

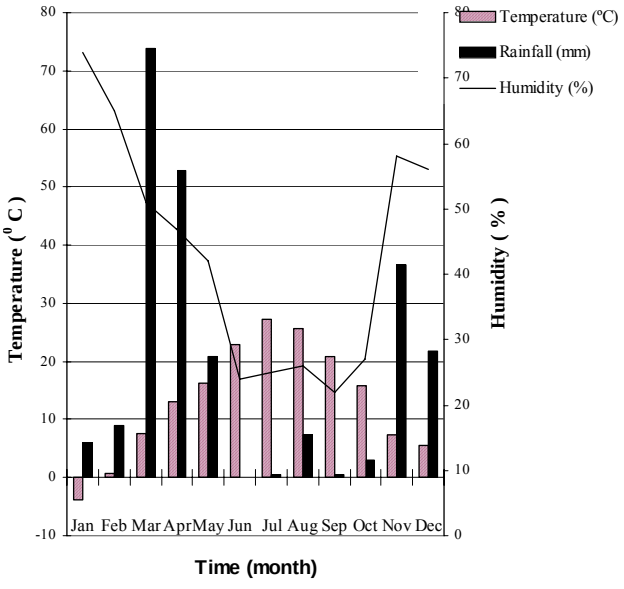

Figure 1. The average monthly weather data for Malaier suburb from January 2007 to January 2008.

RESULTS

The point and overall prevalence of *Eimeria* infections were estimated in sheep using fecal

examination (Table2). A total of 40 (16.67%) of the 250 fecal samples were positive for *Eimeria* oocysts excretions in January-March 2007. The immature sheep had the highest prevalence (26.92%) and moderate oocyst counts (40.39%). The overall prevalence was 23.23% in which the young male sheep had the highest prevalence (37.61%) with the highest intensity (63.58%) (Tables 1 & 2). There were no significant differences in the prevalence between male (27.90%) and female (22.93%) sheep in the all age groups (χ^2 = 2.69, df=4, P>0.05). The intensity was extremely variable and ranged from 10^2 to 1.3 × 10^5 (Table 1). The young sheep had significantly higher oocysts counts than the other groups (P< 0.05). Fecal consistency was recorded during the course of the study (Figures 2 & 3).

In January 2007, 40 sheep were positive for the presence of coccidial oocysts. Of those, 1 (2.5%), 4 (10%), 6 (15%) and 29 (72.5%) manifested normal, semi soft, soft feces and yellowish green diarrhea, respectively. Diarrhea had positive correlation with infection in all age groups (P < 0.05). Also positive correlation was found between diarrhea and intensity in young sheep (P < 0.05). There was significant difference between diarrhea and oocyst excretion in the all age groups (χ^2 = 9.13, df=4, P < 0.05). The identified species of *Eimeria* and their prevalence are given in Table 3. Laboratory identification indicated that the most widespread gastrointestinal parasite of investigated sheep was *Eimeria* spp. A number of seven *Eimeria* species were detected in all infected animals.

Table 1. Intensity of execrated oocysts on different sex and age groups of examined sheep

Age (months)	**< 6**			**6 - 12**			**> 12**			**All ages**		
Sex	**M**	**F**	**total**	**M**	**F**	**total**	**M**	**F**	**total**	**M**	**F**	**total**
N	70	51	121	28	28	56	36	37	73	134	116	250
Intensity (%):												
Low[1]	0	0	0	11.54	7.69	9.62	11.43	25	18.22	7.66	10.10	8.88
Moderate[2]	11.76	8.16	9.96	42.31	38.46	40.39	8.57	5.55	7.06	20.88	17.39	19.14
High[3]	72.06	55.10	63.58	0	0	0	0	0	0	24.02	18.31	21.17
Mean±SD Opg	8920 ± 4214 (100- 13000)			1816 ± 862 (100- 3124)			1336 ± 647 (100- 2901)			4544 ± 4438 (100- 13000)		

[1] OPG < 2000, [2] OPG 2000-10000, [3] OPG > 10000

Table2. Prevalence of *Eimeria* infections in different months in examined sheep

Examined animals	**Time (month)**	**Prevalence (%)**
Sheep (250)	Jan-March	16.67
	Apr-Jun	37.61
	Jul-Sep	25.97
	Oct-Dec	12.68
Total		23.23

The highest percentage belonged to the *E. intricata* (39%), followed by *E. faurei* (16%), *E. ovina* (16%), *E. parva* (12%), *E. pallida* (7%) and *E. ahsata* (6%), *E. ovinoidalis* (4%) (Figure 4).

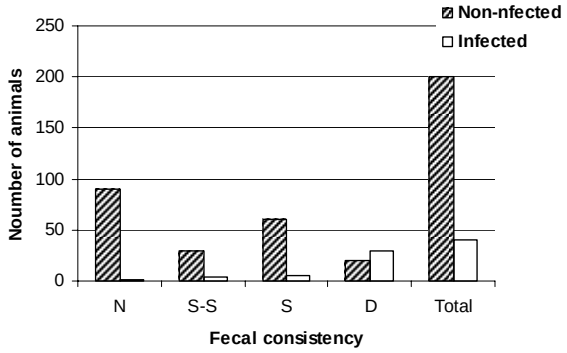

Figure 2. Fecal consistency of examined sheep in January 2007. N, normal; S, soft; S-S, semi soft; D, diarrhea.

The most common specie in young sheep was *E. intricata*, while in immature and old sheep *E. faurei* and *E. ovina* were the most identified species, respectively. All infected sheep were showed mixed infections with more than two different species of *Eimeria* (Table 3). During the study, there was steady increase in the mean monthly temperature to a peak of + 27.2 ºC and then a steady decrease to -3.8 ºC. The minimum and maximum relative humidity were recorded in September (22%) and January (74%), respectively.

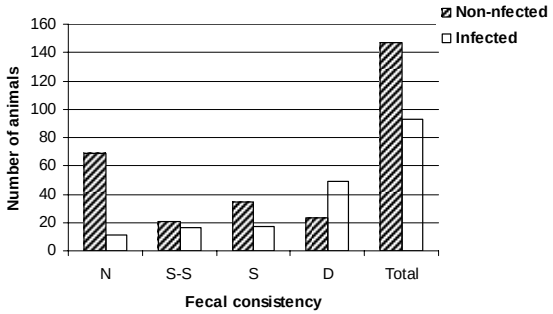

Figure 3. Fecal consistency of examined sheep from February 2007 to January 2008.

Rainfall was not observed during the June in the region (Figure1). No correlations were found between temperature and rainfall with intensity in the all age groups (P>0.05).

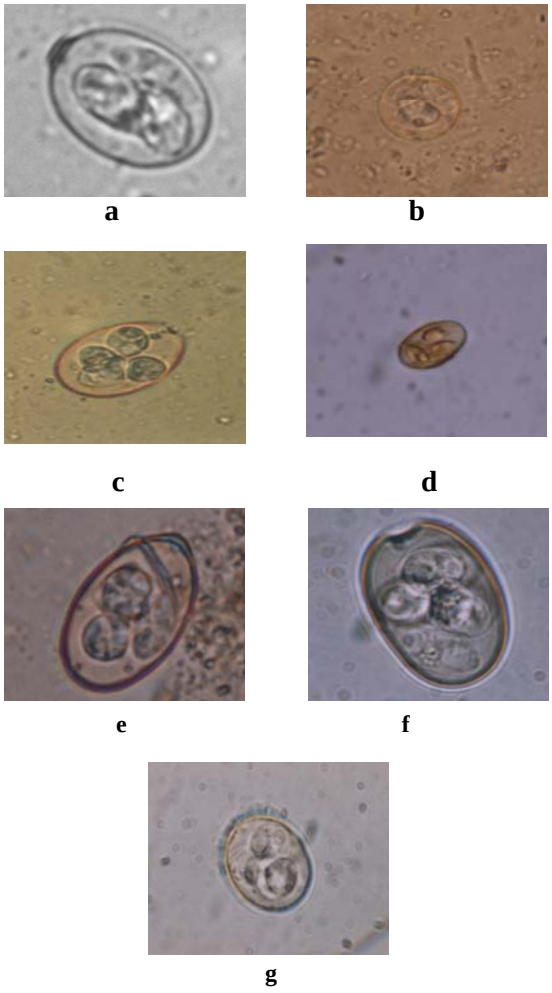

Figure 4. Sporulated oocysts from domestic sheep of Malayer suburb: a. *E. ahsata* (400×), b. *E. parva* (1000×), c. *E. intericata* (400×), d. *E. ovina* (1000×), e. *E. pallida* (1000×) , f. *E. faurei* (1000×), g. *E. ovinoidalis* (400×)

DISCUSSION

Information on the prevalence of coccidiosis is important to implement effective control programs. The prevalence of *Eimeria* infection in sheep in Malayer suburb was lower than that reported in the other parts of the world (Vercruysse 1982, O'Callaghan *et al* 1987, Arslan *et al* 1999). The prevalence of infection in all age groups was not close to that reported by Maingi and Munyua (1994) and Arslan et al (1999). The prevalence of *Eimeria* infection showed no significant difference between

male and female same as reported data by other researchers (Maingi & Munyua 1994, Craig *et al* 2007). The presence of oocysts in the feces of different age groups of sheep indicates that this parasite can infect sheep in every age group. The oocyst intensity was much higher in the young sheep than other two age groups ($P< 0.05$) which it was in accordance with the findings reported elsewhere (O'Callaghan *et al* 1987, Maingi and Munyua 1994, Arslan *et al* 1999, Craig *et al* 2007). Acquired immunity has been shown to be a factor related to lower infection with various *Eimeria* species in older sheep (Gregory & Catchpole 1989, Yun *et al* 2000, Gauly *et al* 2004). In present study, we identified seven *Eimeria* species, while in the other studies more than seven different species including *E. granulosa*, *E. weybridgensis* or *E. crandallis* have been reported (Vercruysse 1982, O'Callaghan *et al* 1987, Reginsson and Richter 1997, El-Moukdad 1977). The most common oocysts in young sheep was *E. intricata*, while in immature and old sheep *E. faurei* and *E. ovina* were the most common species, respectively. In other studies *E. ovinoidalis* was the most common *Eimeria* specie (Platzer *et al* 2005, Yvoré *et al* 1980, Gauly *et al* 2001). It is known that pathogenicity is variable for different *Eimeria* species. *E. ovinoidalis*, *E. ovina*, *E. parva* and *E. ahsata* are the most pathogenic species whereas *E. faurei* and *E. intricata* are moderately pathogenic in sheep (Levine 1985, Vercruysse 1982, O'Callaghan *et al* 1987). It has been also reported that most lambs without clinical signs of coccidiosis excreted between 10^4 and 10^5 oocysts per gram of feces (Kaya 2004, Gregory & Catchpole 1987).

On the other hand according to Catchpole et al (1993), clinical coccidiosis is mainly seen in intensive systems. Therefore, the species of *Eimeria*, the number of excreted oocysts and production system might be the reasons for the absence of clinical signs of coccidiosis in infected animals. The rainfall and temperature did not have significant influence on the prevalence and intensity of infection throughout the year which it was in accordance with the other reported data (Vercruysse 1982, Craig *et al* 2007, Yun *et al* 2000). The climatic features (temperature, rainfall and humidity) of the region which enable the oocyst to survive is may be the reason for existing of the oocyst during the year. The results of this investigation indicate that *Eimeria* infection is a problem in sheep in Malayer suburb. The excretion of *Eimeria* oocysts occurred during the whole year with the highest oocyst counts being recorded during the spring. Attention should be paid within this period to avoid clinical coccidiosis, particularly in small flocks with poor hygienic conditions and no prophylactic treatments against it. Further studies on pathogenesis of these reported species of *Eimeria* in this region will reveal more information about economic effects of this parasite which it will be useful for establishing control programs.

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Table 3. Prevalence of Eimeria species oocysts recovered from fecal samples of different ages in sheep

Eimeria species	Age group<6	6-12	>12	No. examined sheep	No. of oocysts in infected sheep(%)
E. ahsata	7	4	2	13	96(8)
E. ovinoidalis	5	3	1	8	82(5)
E. ovina	3	2	7	12	216(18)
E. faurei	7	11	3	21	216(18)
E. parva	9	5	4	18	156(13)
E. pallida	6	2	2	10	96(8)
E. intricata	28	3	1	32	420(35)
Total	65	30	20	114	1200

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