

***Eimeria* infection (Coccidia: Eimeriidae) in sheep of different age groups in Sanandaj city, Iran**

Mohammad Yakhchali^{1*}, and Eqbal Golami²

¹Department of Pathobiology, Parasitology Division, Faculty of Veterinary Medicine, Nazlu Campus, Urmia University, Iran

²Technician of Laboratory Sciences, Sanandaj City, Iran

YAKHCHALI, M., E. GOLAMI: *Eimeria* infection (Coccidia: Eimeriidae) in sheep of different age groups in Sanandaj city, Iran. Vet. arhiv 78, 57-64, 2008.

ABSTRACT

The prevalence of ovine *Eimeria* parasitism was monitored in 240 sheep in the western part of Iran, in the period from 2003-2004. The overall prevalence of coccidiosis in sheep was found to be 19.2%. The identified species included three pathogenic species, i.e. *E. ahsata* (10%), *E. ovinoidalis* (31%) and *E. ovina* (10%) and three non-pathogenic species, i.e. *E. faurei* (29%), *E. parva* (10%) and *E. intricata* (10%). Of 240 sheep, single infection was not observed and all 19.2% of infected sheep had mixed infections with at least three species. Consistency and intensity had a significant correlation with age. The sex and age of the sheep had a significant effect on prevalence, as well. The results of this study showed that *Eimeria* infection was prevalent in sheep in the western part of Iran.

Key words: prevalence, *Eimeria* spp., sheep, Sanandaj, Iran

Introduction

Coccidiosis is of economic and medical importance and coccidial infections of sheep have been observed in almost all sheep rearing in the world. It is assumed that most, if not all, domestic ruminants become infected with coccidia during their lives (TAYLOR and CATCHPOLE, 1994). The coccidia comprise a large group of obligatory intracellular parasites (DUSZYNSKI et al., 1999). Fifteen *Eimeria* species are considered to have the capability of infecting sheep (PLATZER et al., 2005) so that fourteen species infect the sheep intestine and one (*E. gilruthi*) the abomasum (MCDUGALD, 1979; POUT et al., 1973; LONG and JOYNER, 1984; REGINSSON and RICHTER, 1997).

*Contact address:

Dr. Mohammad Yakhchali, Department of Pathobiology, Parasitology Division, Faculty of Veterinary Medicine, Nazlu Campus, Urmia University, Urmia City, P.O. Box 57153-1177, West Azerbaijan Province, Iran, Phone: +98 441 277 0508; E-mail: m.yakhchali@mail.urmia.ac.ir

ISSN 0372-5480
Printed in Croatia

There have been a few studies on ovine coccidian infection in Iran. Furthermore, sheep infective *Eimeria* species was found to be common in fecal samples in Iran, however, in these areas investigations on the prevalence and importance of *Eimeria* infections in lambs have not been conducted, based on our knowledge from the literature review. The purposes of this study were to determine the prevalence, correlation between opg and prevalence, age and sex and diversity of *Eimeria* species in different age groups of sheep.

Materials and methods

Field study area. The study was carried out in Sanandaj city during the wet and dry seasons from January 2003 to January 2004. Sanandaj city is located between latitude 35°15' N and longitude 46°56' E with altitude 1570 m above sea level. An average population of 1.2 million sheep exists in this province (Iranian Veterinary Organization, IVO, 2004), (Fig. 1).

Sample size. A total of 240 fecal samples (10 gram per animal) were collected directly from the rectum of pre-slaughtered sheep in the stable of the slaughterhouse, which were chosen randomly. Collected samples were put into a plastic container, separately; with a lid and the data pertaining to the sex, age, and feces consistency were recorded.

Parasitological examination. A part of each sample (3 gram) was mixed with tap water (42 mL). The mixture was subjected to centrifugal sedimentation (1500 rpm for 3 minutes) and flotation technique using standard sheather solution (sp.gr.1.12) to demonstrate the presence of oocysts. The intensity of infection was estimated in terms of oocysts per gram of feces (opg coefficient). Sporulation of oocysts was performed using the HENDRIX procedure (1998).

The species were differentiated based on morphometry (length, width, and shape index) and morphology (shape, color, presence or absence of micropyle and its cap, presence or absence of residual, polar and stiedae bodies) of oocysts according to ECKERT et al. (1995). Measurements of a minimum of 100 oocysts were recorded for each species and the average was worked out.

Meteorological data. The mean monthly temperature, mean monthly relative humidity and mean monthly rainfall were obtained from the Iranian Meteorological Organization (IMO) from January 2003 to January 2004.

Statistical evaluation. Statistical analysis was undertaken using the Chi-square test and Student's *t*-test with a confidence interval of 99% (SPSS 11.5, Inc., Chicago).

Results

Among 240 sheep examined in the slaughterhouse of Sanandaj city, 46 (19.2%) were found to harbor the oocysts of *Eimeria* spp. Out of 46 infected sheep, 16 lambs less than six months old (young), 16 sheep 6-12 months old (immature) and 14 sheep over 12 months old (adult) revealed the presence of coccidial oocysts (with percentage of infection) of which 32 (69.6%), 7 (16.7%), 5 (11.9%) and 2 (1.8%) with manifestations of yellowish green diarrhea, soft, semi soft, normal, respectively, without clinical signs. Low opg counts (opg+1) and moderate opg counts (opg+2) were observed in 14 adult sheep and 16 immature sheep, respectively, and high opg counts (opg+3) were observed in 16 lambs (Table). Consistency and intensity had significantly correlation with age ($P < 0.01$). The sex and age of the sheep had a significant effect on prevalence ($P < 0.01$), as well.

Table 1. Comparative correlation of prevalence, consistency, intensity, age and sex in infected and non-infected sheep

N° of sheep	N (%)	Age (month)						Consistency				Intensity		
		<6		6-12		>12		N	S-S	S	D	+1	+2	+3
		m	f	m	f	m	f							
Infected	46 (19.2)	6	10	9	7	6	8	2	5	7	32	4	16	16
Non-infected	194 (80.8)	55	39	32	26	15	17	114	54	20	6	194		
Total	240 (100)	110		74		56		240				240		

$P < 0.01$; m - male; f - female; +1 - low opg count; +2 - moderate opg count; +3 - high opg count; N - normal; S-S - semi soft; S - soft; D - diarrhea.

The different identified species of *Eimeria* in descending order of prevalence were: *E. ovinoidalis* (syn. *E. ninakohlyakimovae*; 31%), *E. faurei* (29%), *E. ahsata* (10%), *E. parva* (10%), *E. ovina* (syn. *E. bakuensis*; 10%) and *E. intricata* (10%) (Fig. 2). Of 240 sheep, a single infection was not observed, and all of the infected sheep had mixed infections with at least three species.

The mean monthly temperature, relative humidity and rainfall values for the Sanandaj city are presented according to IMO in Fig. 3.

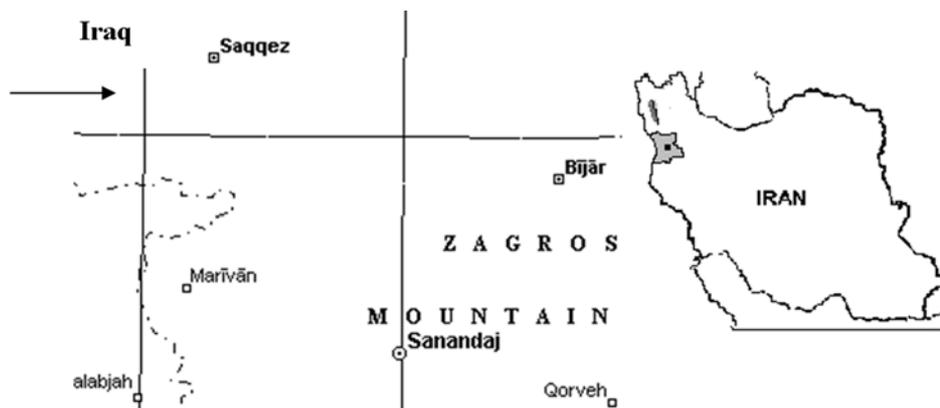


Fig. 1. The map of Sanandaj area and locality where the field study was conducted

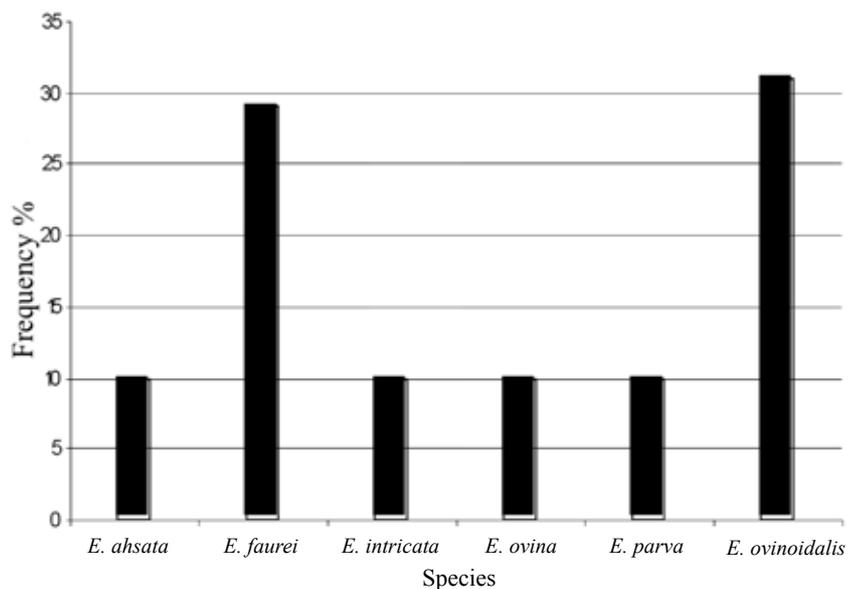


Fig. 2. Percentage of different *Eimeria* species exhibited by oocysts in sheep in Sanandaj suburb, Iran

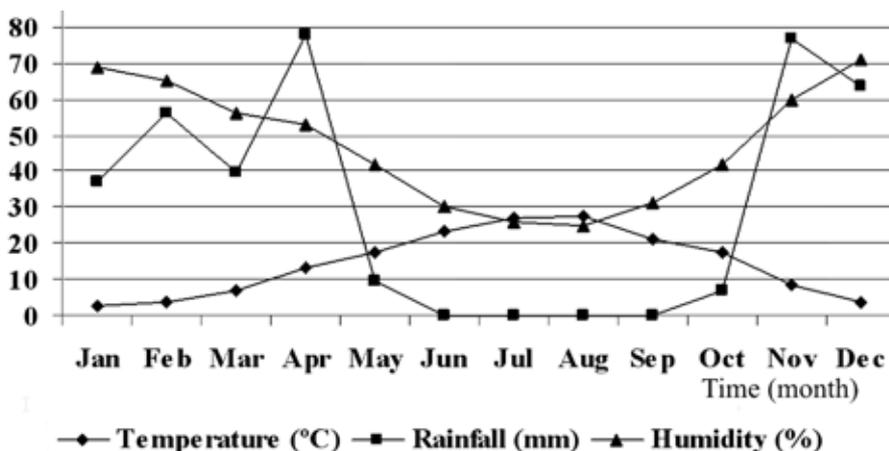


Fig. 3. The mean monthly temperature (°C), relative humidity (%) and rainfall (mm) for Sanandaj suburb from January 2003 to January 2004

Discussion

Knowledge of prevalence of coccidiosis and current *Eimeria* species will help to minimize the economic losses in the sheep industry, evaluate infection potential and control programs, especially for lambs.

During the study, there was a steady increase in the monthly temperature from August to a peak of +27.5 °C and then a steady decrease to +2.9 °C. The minimum and maximum relative humidity were recorded in August (25%) and December (66%), respectively. Rainfall was not observed from June to September in the region. The highest rainfall was in monsoon (March-April) (58.5 mm) and late fall (November-December) (70.3 mm) in Sanandaj city. The highest prevalence of infection (19.2%) was during the monsoon and the lowest (3.4%) in the summer. Similarly, ALANI et al. (1989) noted that there was no significant seasonal variation in infection with these parasites in sheep in Iraq. In the study of SISODIA et al. (1997) the highest prevalence was recorded in animals aged between six months and one year, compared with older animals. Seasonally, the highest prevalence of infection was during the monsoon and lowest in the summer in Badrasar in western Rajasthan, India.

Three pathogenic species, including *E. ovinoidalis*, *E. ahsata* and *E. ovina* and three non-pathogenic species, including *E. faurei*, *E. parva* and *E. intricate* were identified in this study. About 19.2% of infected sheep had mixed infections, with at least three species. Mixed infection with *Eimeria* species (3-10 species) has been reported previously (POUT and CATCHPOLE, 1974; DEMIR, 1997).

The number of *Eimeria* species identified in this study was nearly similar to that of other studies (KUSILUKA et al., 1996; PLATZER et al., 2005). However, eight out of 15 *Eimeria* species were not detected, in contrast to other studies (DEMIR, 1997; REGINSSON and RICHTER, 1997; SISODIA et al., 1997). Coccidial infection was observed in the all age groups which it was in accordance with the previously reported data (TAYLOR and CATCHPOLE, 1994). Furthermore, the differences among the *Eimeria* species and their prevalence depend on different factors (environment, animal factors and farm management) (CATCHPOLE and HARRIS, 1989).

The most prevalent species was *E. ovinoidalis*, identified as the most prevalent species in the other studies (YVORE et al., 1980; GAULY et al., 2001). According to ROMMEL (2000) *E. ovinoidalis*, *E. bakuensis* and *E. ahsata* were the most pathogenic species in sheep; therefore, the presence of these species showed that coccidiosis might be contributing to the enteric syndromes affecting small ruminants in this region of the country. In another study by CATCHPOLE et al. (1975), they found that two species (*E. gonzalezi* and *E. punctata*) have not been seen in sheep for a long period of time.

Consistency and intensity were significantly correlated in all age groups. The young sheep with high opg counts appeared to serve as a patient. BARUTZKI et al. (1990) reported that lambs passed a larger number of oocysts in their feces than either ewes or yearlings. AMARANTE and BARBOSA (1992) noted that the highest oocyst counts were observed when the lambs were 4-8 weeks old. These findings were in close agreement with this study.

The prevalence of a high infection rate (69.6%) with yellow-green diarrhea in the young sheep indicated coccidiosis as the main cause of the disease. It has been reported that the disease in sheep and goats were chiefly confined to young animals up to six months of age with mix infections (GUPTA et al., 1992). Whereas, in the adult sheep with a prevalence of low infection (1.8%), normal form of feces with low opg counts indicated that they served as carriers and were the source of infection to the lambs, which it was in agreement with the reported data by RADOSTITS et al. (2000).

The results of this study showed that the sex and age of the sheep had a significant effect on prevalence. It also revealed that *Eimeria* infection is a problem in sheep in Sanandaj city, Iran. Attention should be paid to avoid clinical coccidiosis, particularly in small flocks with poor hygienic conditions and no prophylactic treatments against it. Further studies will be required to reveal more information about the economic effects of this parasite which would be useful for establishing control programs.

Acknowledgements

We are grateful to Dr Sh. Javadi for reviewing this manuscript and Mr H. Nazarnejad for providing climatic data. We wish to thank Mr. E. Aghapour, technician member of the parasitology division at Urmia University.

References

- ALANI, A. J., T. I. AL-ALOUSI, M. M. A. AL-BAYATI, M. A. HASSAN (1989): Ovine coccidiosis in Mosul, Iraq. *J. Vet. Parasitol.* 3, 7-11.
- AMARANTE, A. F. T., M. A. BARBOSA (1992): Species of coccidia occurring in lambs in Sao Paulo State, Brazil. *Vet. Parasitol.* 41, 189-193.
- BARUTZKI, D., S. MARQUARDT, R. SGOTHE (1990): *Eimeria* infections of sheep in northwest Germany. *Vet. Parasitol.* 37, 79-82.
- CATCHPOLE, J., C. C. NORTON, L. P. JOYNER (1975): The occurrence of *E. weybridgeensis* and other species of coccidia in lambs in England and Wales. *Br. Vet. J.* 131, 392-401.
- CATCHPOLE, J., T. J. HARRIS (1989): Interaction between coccidia and *Nematodirus battus* in lambs. *Vet. Rec.* 124, 603-605.
- DEMIR, S. (1997): *Eimeria* species in sheep slaughtered at a meat and fish plant in Bursa. *Turkiye Parazitoloji Dergisi.* 19, 132-139.
- DUSZYNSKI, D. W., W. D. WILSON, S. J. UPTON, N. D. LEVINE (1999): Coccidia (Apicomplexa: Eimeriidae) in the Primates and the Scandentia. *Int. J. Primatol.* 20, 761-797.
- ECKERT, J., M. TAYLOR, J. CATCHPOLE, D. LICOIS, P. COUDERT, H. BUCLAR (1995): Identification of *Eimeria* species and strains. In: *Biotechnology; Guidelines on Techniques in Coccidiosis Research*, Brussels, Luxembourg. pp.103-119.
- GAULY, M., C. KRAUTHAHN, C. BAUER, G. ERHARDT (2001): Pattern of *Eimeria* oocyst output and repeatability in naturally infected suckling Rhon lambs. *J. Vet. Med. B.* 48, 665-673.
- GUPTA, V. K., R. C. KATOCH, R. K. AGNIHORTI, S. MITRA, D. S. SAMBYAL (1992): Coccidiosis in Gaddi goats a report. *J. Hill Res.* 5, 188-189.
- HENDRIX, C. M. (1998): *Diagnostic Veterinary Medicine*, 2nd ed., Mosby Publication. pp. 249-255, 257-259.
- KUSILUKA, L. J. M., D. M. KAMBARAGE, R. W. MATTHEWMAN, L. J. S. HARRISON, C. J. DABORN (1996): Coccidiosis of small ruminants in Tanzania. *Small Ruminant Res.* 21, 127-131.
- LONG, L., L. P. JOYNER (1984): Problems in the identification of species of *Eimeria*. *J. Protozol.* 31, 535-541.
- MCDUGALD, L. R. (1979): Attempted cross-transmission of coccidia between sheep and goats and description of *E. ovinoidalis*. *J. Protozool.* 26, 109-113.
- PLATZER, B., H. PRSOL, M. CIESLICKI, A. JOACHIM (2005): Epidemiology of *Eimeria* infections in an Austrian milking sheep flock and control with diclazuril. *Vet. Parasitol.* 129, 1-9.
- POUT, D. D., C. C. NORTON, J. CATCHPOLE (1973): The production of faecal oocysts burdens in laboratory animals. *Br. Vet. J.* 129, 568-582.
- POUT, D. D., J. CATCHPOLE (1974): Coccidiosis of lambs. The clinical response to long-term infection with a mixture of different species of coccidia. *Br. Vet. J.* 130, 388-389.

M. Yakhchali and E. Golami: *Eimeria* infection in sheep of different age groups in Sanandaj city, Iran

- RADOSTITS, O. M., C. C. GAY, D. C. BLOOD, K. W. HINCHCLIFF (2000): Veterinary Medicine. A Textbook of the Diseases of Cattle, Sheep, Pigs, Goats and Horses. 9th ed., W. B. Saunders. pp.1339-1347.
- REGINSSON, K., S. H. RICHTER (1997): Coccidia of the genus *Eimeria* in sheep in Iceland. Buvisindi. 11, 99-106.
- ROMMEL, M. (2000): Protozoeninfektionen der Wiederkäuer. (Rind Schaf, Ziege), Eimeriose (Coccidiose). In: Veterinärmedizinische Parasitologie (Rommel, M., J. Eckert, E. Kutzer, W. Korting, T. Schnieder, Eds.), 5th ed., Paul Parey, Berlin. pp. 133-149.
- SISODIA, S. L., K. M. L. PATHAK, M. KAPOOR, P. P. S. CHAUHAN (1997): Prevalence and seasonal variation in *Eimeria* infection in sheep in western Rajasthan. J. Vet. Parasitol. 11, 95-98.
- TAYLOR, M. A., J. CATCHPOLE (1994): Coccidiosis of domestic ruminants. Appl. Parasitol. 35, 73-86.
- YVORE, P., A. ESNAULT, J. BESNARD (1980): Les coccidioses des petits ruminants: coccidioses ovines. Bull Groupement Techn. Vet. 2, 15-19.

Received: 19 June 2006

Accepted: 28 December 2007

YAKHCHALI, M., E. GOLAMI: Invazija parazitima roda *Eimeria* (Coccidia: Eimeriidae) u ovaca različitih dobnih skupina u gradu Sanandaj u Iranu. Vet. arhiv 78, 57-64, 2008.

SAŽETAK

Promatrana je prevalencija invazije parazitima roda *Eimeria* u 240 ovaca u zapadnom dijelu Irana u razdoblju od 2003. do 2004. Prevalencija kokcidioze iznosila je 19,2%. Ustanovljene su tri patogene vrste, *E. ahsata* (10%), *E. ovinoidalis* (31%) and *E. ovina* (10%), i tri nepatogene vrste *E. faurei* (29%), *E. parva* (10%) and *E. intricata* (10%). U svih 19,2% pozitivnih ovaca ustanovljena je mješovita invazija s najmanje tri vrste. Učestalost i jačina invazije bila je u korelaciji s dobi ovaca. Spol je također imao značajan učinak na prevalenciju. Rezultati istraživanja pokazuju da je invazija vrstama roda *Eimeria* česta u ovaca u zapadnom dijelu Irana.

Cljučne riječi: prevalencija, *Eimeria* spp., ovce, Sanandaj, Iran
