**Eimeria** infection in camels (*Camelus dromedarius*) in Yazd province, central Iran

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**Abstract.** This study was carried out during the winter of 2008 to the summer 2010 to determine the rate of infection of *Eimeria* spp. in dromedary camels in Yazd province, Iran at that period. A total of 305 faecal samples were taken per recta from live and slaughtered, apparently healthy camels 9 months to 23 years old. Using saturated zinc sulfate solution floatation technique, samples were prepared and investigated microscopically to detect *Eimeria* spp. oocysts. Results revealed that the overall frequency of infection in samples was 9.51%. Identified species were *Eimeria cameli* (47.5%), *Eimeria dromedarii* (42.5%) and *Eimeria bactriani* (10%). The rate of infection was higher in the winter season, and in camels aged 5 to 10 years old. Statistical analysis showed that there is a significant difference between infection rate and season, but no effect by age or sex on eimeriosis was found. Since most of the positive cases in our study were adult, our findings suggest that older camels may play an important role in spreading infection as asymptomatic oocyst shedders.

**INTRODUCTION**

*Eimeria* spp. are gut-dwelling intracellular coccidian parasites, transmitted by faecal-oral route; oocysts are shed from infected animals. Five *Eimeria* species are believed to have capability of infecting camels. All species parasitize the camel intestine (Soulsby, 1986; Kauffman, 1996), and several of these species are distributed widely with high prevalence rates among camels (Luckins, 1992). *Eimeria cameli* and *Eimeria dromedarii* are the most widely-spread species of camelid *Eimeria*, and others (*Eimeria bactriani, Eimeria rajasthanii* and *Eimeria pellerdij*) are found in some geographical zones. However, the species associated with disease are primarily *E. cameli* and *E. dromedarii* (Kauffman, 1996). Several cases of coccidiosis causing enteritis and mortality rates of up to 10% in young camels have been reported in only a few reports such as Gruvel & Garber in Chad (1965). The study by Tafti *et al.* (2000) indicated that the most important and frequent pathologic lesion in the digestive tract of camels are those resulting from *Eimeria* spp. infections (63% of 100 slaughtered camels). Young infected animals display haemorrhagic enteritis and diarrhoea. Animals with severe infections show signs of loss of appetite, dehydration and progressive weight loss. Dehydration and secondary infections can increase risk of mortality in camel calves (Kauffman, 1996). In severe *E. cameli* coccidiosis, camels died from general weakness were emaciated and most of them had passed bloody faecal drops. Haematological and biochemical investigations have revealed a profound
anemia accompanied by severely low serum total protein and albumin, indicating a malabsorption syndrome which leads to starvation and finally death. Camel coccidiosis caused by *E. cameli* seems to have a great impact on intensive camel husbandry (Kinne & Wernery, 1997). In their study in Saudi Arabia, Mahmoud et al. (1998) found that the parasites appear to be pathogenic to camel calves, causing destruction of the intestinal mucous membranes by their giant schizonts, while adult camels were found to be chronic shedders of oocysts without manifesting clinical signs. Another research also concluded that older camels seem to be asymptomatic oocyst-shedding carriers (Hussein et al., 1987). Although coccidiosis is a self-limiting disease, anticoccidials may be used to control and treat coccidiosis outbreaks in camelids. Since camels are considered as a food supply for people in the study area, their health status is important in husbandry industry, and epidemiological surveys on coccidian infections are useful for control purposes. Most of the previous studies have been on young camels, which are much more susceptible to *Eimeria* infections than adult camels, but for investigating the role of adult camels in spreading *Eimeria*, a study on all age groups seemed necessary. Also, a detailed knowledge about *Eimeria* species involved is essential for a successful and economical control of eimeriosis in camels.

The purpose of this study was to determine the frequency and diversity of *Eimeria* species in one-humped camels in Yazd province, Iran.

**MATERIAL AND METHODS**

In four seasons (winter 2008, summer 2009, winter 2009 and summer 2010), a total of 305 faecal samples (155 in winter seasons and 150 in summer seasons) were collected directly from rectum of live and slaughtered apparently one-humped camels. This included 229 male and 76 female camels, kept by local farmers in Yazd province, a semi-arid region in the center of Iran. Samples collected were put separately into clean plastic containers, closed with a lid, and rapidly transferred to lab. No camel with diarrhoea was included in the study. Data pertaining to sex and age were recorded. The age was determined on the basis of teeth eruption (Smallwood, 1992). Fresh faecal samples were mixed with tap water and were subjected to centrifugal sedimentation (800 g for 2 minutes) and then floatation technique using saturated zinc sulfate solution with specific gravity of 1.2 for preparation of slides according to Truant et al. (1981). Although in *Eimeria* species, morphologic and morphometric parameters may not lead to exact diagnosis of species, the species were differentiated according to Levine (1985), based on size, shape, wall and micropyle morphology. The camels were divided into three groups according to their age as *G1*<5 years (#129), 5 years<*G2*<10 years (#141), and *G3*>10 years (#35). Statistical evaluation was undertaken using SPSS for Windows (Version 16, SPSS Inc., Chicago, IL, USA). Data were analyzed with the chi-square test with 95% confidence interval. A p-value less than 0.05 was considered as significant difference.

**RESULTS**

Faecal examination of all samples showed that 9.51% (29 out of 305 camels) were found infected, with 12.26% of camels in winter seasons and 6.67% in summer seasons. This shows a significant difference with a higher rate of infection during cold and rainy seasons. Rate of infection was higher in *G2* (19/141) than *G1* (10/129), and none of the animals older than 10 years were found positive for *Eimeria* spp. There was no significant difference between the rate of infection in the *G1* & *G2* positive groups (P>0.05). The rate of infection in male and female camels were 10.04% (23/229) and 7.89% (6/76), respectively, which displays no significant difference (P>0.05). Microscopic study showed that *E. cameli* (47.5%) was the most prevalent species, followed by *E. dromedarii* (42.5%) and *E. bactriani* (10%). In our study 34.49% of infected animals
showed mixed infection with two *Eimeria* species. Although a few other eggs of worms and protozoan cysts were found, we neglected them because their evaluation was out of the scope of this study.

**DISCUSSION**

Rate of infection with *Eimeria* spp. in camels in the present study was 9.51%. Various workers have reported prevalence rates of infection in different camel-rearing parts of the world. Gruvel & Garber (1969) found only 14 positive camels out of 204 faecal samples searched for coccidia (6.86%). In Iran, researchers have reported rates of faecal specimen positivity from 12.8% up to 20.73% in different parts of the country (Yakhchali & Cheraghi, 2007; Borji et al., 2009; Yakhchali & Athari, 2010). Mahmoud *et al.* (1998) reported a mean infection rate of about 13% with *Eimeria* spp. (15.7% for adult camels and 10.2% for camel calves) in a central region of Saudi Arabia. Yagoub (1989) detected 17.4% of a total of 230 faecal samples obtained from Sudanese camels to be positive for coccidia oocysts. In India, Gill (1976) found oocysts of *E. cameli*, *E. dromedarii*, *E. pellerdyi* and *E. bactriani* in 24% of faecal samples from dromedary camels. A 25.19% prevalence rate of *Eimeria* was recorded based on 897 faecal samples examined by Partani *et al.* (1999). They found a higher prevalence (28.78%) in farm camels compared to field camels (21.6%) and higher prevalence in camel calves younger than one year age.

The differences in prevalence among *Eimeria* species depend on different factors such as age, environment, farm management, illness and stress.

In the present study, prevalence of infection in winter seasons was higher. Similarly, Borji *et al.* (2009) indicated that prevalence of *Eimeria* was highest during the winter, which can probably be due to confinement, crowding and limited available pasture grazing. Patrani *et al.* (1999) also reported higher rate of infection in rainy seasons, which may be due to higher relative humidity which is known to enhance survival of oocysts outside the host. Since the cause of spread of infection could be poor hygiene in the barn, the control of clinical coccidiosis may be achieved by good management, such as keeping older camels away from newborn and camel calves, in well-drained grounds which are kept as dry as possible. The significance of this study stems from the fact that it is the first one dealing with *Eimeria* in camels in center of the country, and this knowledge may help farmers and veterinary policy makers to undertake control programmes, because eimeriosis can cause severe economic damage.

Further molecular studies for determination of exact taxonomic status of the various *Eimeria* species found in camelids seem necessary.
REFERENCES


