

EIMERIOSIS IN BACTRIAN AND DROMEDARY CAMELS IN THE MIANDOAB REGION, IRAN

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An investigation into eimeriosis of camels was carried out in two camel-raising areas of Miandoab region, Iran, to determine the frequency and diversity of Eimeria species. Bactrian camels (n=85) and dromedary camels (n=40) which were from one to four years old were subjected to examination. Fecal samples were collected and the flotation technique was carried out to demonstrate the presence of oocysts and sporulation of oocysts. The overall prevalence was 12.8%. Five Eimeria species were identified in both camels: the highest rate belonged to the E. bactriani (42.2%), followed by E. rajasthani (only in dromedary camels, 26.7%), E. pellerdyi (only in bactrian camels, 15.6%), E. cameli (11.1%) and E. dromedarii (4.4%). All 12.8% of infected camels had mixed infections with at least three species. Feces consistency and infection intensity had a significant correlation with age (P<0.01). The sex and age of the camels had a significant effect on prevalence (P<0.01). These findings may be useful to evaluate the infection potential when considering control programs, specially for young camels.

Key words: frequency, Camelus dromedarius, Camelus bactrianus, intensity, Iran

INTRODUCTION

As found by Al-Ani (2004), the Camelidae family is broken down into the *Lama* genus (New World Camelids) and the *Camelus* genus (Old World Camelids) including: *Camelus bactrianus* Linnaeus, 1758 (Asiatic or two-humped camel) otherwise known as the Bactrian camel, and *Camelus dromedarius* Linnaeus, 1758 (Arabian or one-humped camel) or simply the camel. Eimeriosis is a common, widespread disease in camels. The coccidia comprise a large group of obligatory intracellular parasites (Duszynski *et al.*, 1999). Five Eimeria species are considered to have the capability of infecting camels: *E. bactriani* (Levine and Ivens, 1970), *E. rajasthani* (Dubey and Pande, 1963), *E. pellerdyi* (Prasad, 1960), *E. cameli* (Henry and Masson, 1973) and *E. dromedarii* (Yakimoff and Matschoulsky, 1939). All species parasitize the camels' intestine (Soulsby, 1986; Kaufmann, 1996).

There have been a few studies on camel coccidia infection in Iran. However, in this area investigation on the frequency and importance of *Eimeria* infections in dromedary camels (*Camelus dromedarius* Linnaeus, 1758) and the bactrian camels (*Camelus bactrianus* Linnaeus, 1758) have not been conducted in detail based upon our knowledge of the available literature. Likewise, for a successful and economical control of eimeriosis in camels, detailed knowledge about *Eimeria* species involved is essential. The purpose of this study was to determine the frequency and diversity of *Eimeria* species, as well as the correlation amongst the obtained data.

MATERIAL AND METHODS

1. Field study area:

The study was carried out in the Miandoab region during the wet and dry seasons from January 2005 to December 2005. The Miandoab region is located in the southeast of West Azerbaijan province between latitude 36°57' N and longitude 46°06' E (Fig. 1). An average population of one hundred and eight thousand camels is distributed over vast camel-raising areas in Iran. West Azerbaijan province has approximately 0.3% of the population of camels, according to the annual report of Iranian Veterinary Organization (IVO, 2004).

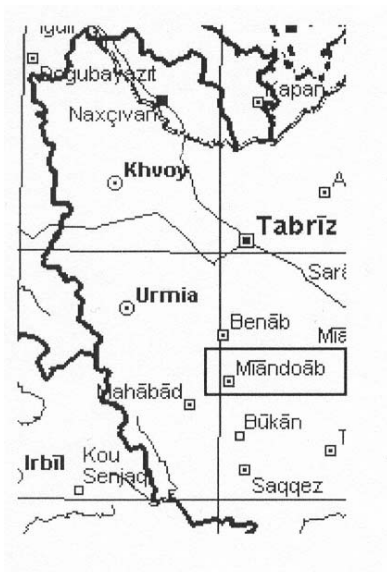


Figure 1. Map of the sampling areas in the Miandoab region, Iran

2. Sample size:

Two herds including 85 bactrian camels and 40 dromedary camels were selected over the whole area. Camels were from less than two years old to over three years of age. A total of 125 fecal samples (10 gram per animal) was collected

from camels, chosen at random. Collected samples were put separately into plastic containers, closed with a lid and data pertaining to sex, age and feces consistency was recorded.

The examined camels followed traditional husbandry practices, with animals grazing during the daytime. Camels were mainly crossbreeds and indigenous.

3. Parasitological examination:

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

The species were differentiated based on morphometry (length, breadth, and shape index) and morphology (shape, color, presence or absence of the micropyle and its cap, presence or absence of residual, polar and stiedae bodies) of oocysts according to Soulsby (1986) and Kaufmann (1996). Measurements of a minimum of 100 oocysts were recorded for each species and the average was worked out.

4. Meteorological data:

The mean monthly temperature, relative humidity and rainfall were obtained from the IMO for the period from January to December 2005.

5. Statistical evaluation

Statistical evaluation was undertaken using SPSS for Windows (Version 11.5, SPSS Inc., Chicago). Differences in consistency and intensity and age groups were evaluated with the Chi-square (χ^2) test and differences in prevalence within age groups and sex were evaluated with the Paired t-test with CI (99%).

RESULTS

Of the 125 camels involved, 16 (12.8%) were naturally infected. Young camel calves were more infected than old ones and infection increased in younger camels (1-2 year-olds). Of the infected animals, according to sex, the heaviest infestation rate was observed on female bactrian camels (33.3%) with one year-olds. The lowest infestation rate was recorded on male dromedary camels (14.3%) three and four years old. The infected animals showed wasting, debility and diarrhea without mucus or blood. Older animals passing oocysts in their feces did not show any serious symptoms of eimeriosis. The results are presented in Tables 1 and 2.

Laboratory identification indicated that both camels were infected with five species of *Eimeria*. The highest percentage belonged to *E. bactriani* (42.2%), followed by *E. rajasthani* (only in bactrian camels, 15.6%), *E. cameli* (11.1%) and *E. dromedarii* (4.4%). The most widespread gastrointestinal parasite of camels was *Eimeria* spp. The results of the *Eimeria* study are shown in Fig. 2.

Table 1. Comparative correlation of eimeriosis prevalence, feces consistency, intensity, age and sex in naturally infected and non-infected bactrian camels (mean \pm SE, n=85)

Number of camels		Age (years)												Consistency			Intensity			
		1			2			3			4			N	S-S	S	D	+1	+2	+3
		m	f		m	f		m	f		m	f								
Infected	9	10.6	1	3	1	2	0	1	0	1	1	3	2	3	1	3	1	3	5	
Non-infected	76	89.4	19	2	4	4	20	7	5	15	76	76	76	76	76	76	76	76	76	
Total	85	100	25	11	28	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21

P<0.01

m - male; f - female; +1 - mild opg count; +2 - moderate opg count; +3 - severe opg count; N - noral; S-S - semi soft; S - soft; D - diarrhea

Table 2. Comparative correlation of eimeriosis prevalence, feces consistency, intensity, age and sex in naturally infected and non-infected dromedary camels (mean \pm SE, n=40)

Number of camels		Age (years)												Consistency			Intensity				
		1			2			3			4			N	S-S	S	D	+1	+2	+3	
		m	f		m	f		m	f		m	f									
Infected	7	17.5	1	1	1	2	1	0	1	0	1	0	1	0	1	2	1	3	1	2	4
Non-infected	33	82.5	8	5	4	2	5	3	4	2	33	33	33	33	33	33	33	33	33	33	
Total	40	100	15	9	9	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

P<0.01

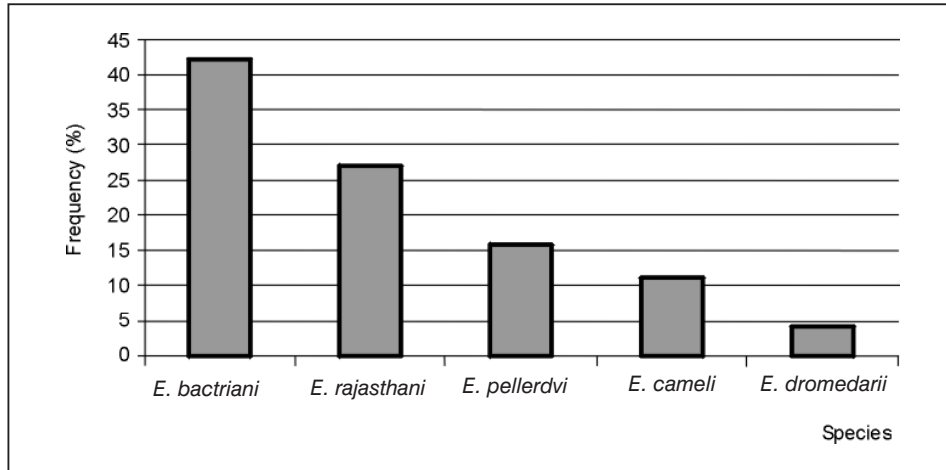


Figure 2. Percentage of different *Eimeria* species exhibited by oocysts in camels in the Miandoab region, Iran

In general, there was a steady increase in the mean monthly temperature to a peak in +24°C and then a steady decrease. Rainfall was present during whole months of the investigation period. The highest rainfall was during the monsoon (March-April) (58.4 mm) and late autumn (November-December) (38.1 mm). The highest prevalence of infection was during the monsoon period and the lowest in the summer (Fig. 3).

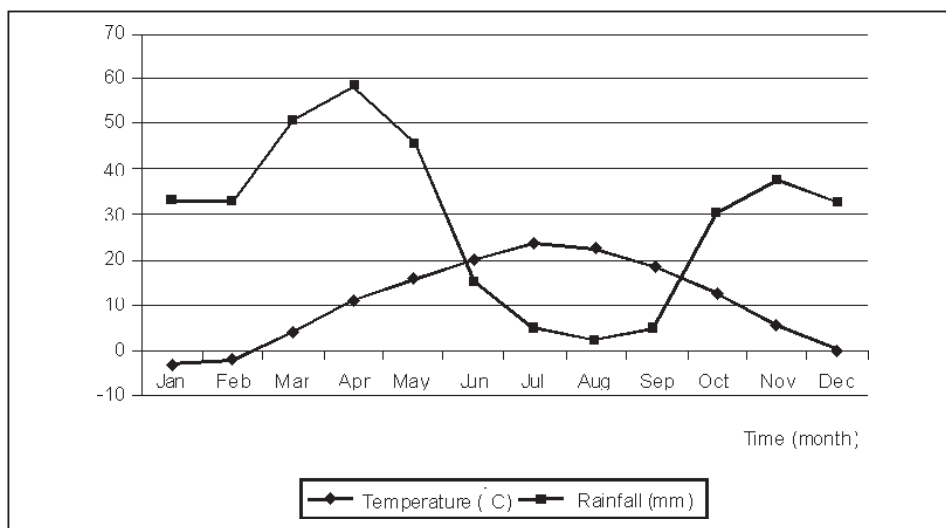


Figure 3. The mean monthly temperature and mean monthly rainfall from January to December 2005

DISCUSSION

With regard to the present study on camel eimeriosis, five species of the genus *Eimeria* were identified. The most prevalent species in the investigated camels was *E. bactriani*, especially, among young camel calves. Whereas, Abubakr *et al.* (2000) noted that the highest rate was for the *E. dromedarii* (20%) in Bahrain. This finding was not in agreement to Kasim *et al.* (1985) and Hussein *et al.* (1987).

In the present study, all infected animals had mixed infections at least with three different species. In contrast, Kasim *et al.* (1985) and Hussein *et al.* (1987) reported that *E. dromedarii* was the most predominant species. Eimeriosis in camels occurred as a mixed infection of *Eimeria* species with two species appearing in the same sample. Although these species are common in fecal samples, their appearance depends upon host age and immunity.

The number of identified *Eimeria* species infecting camels was similar to Wei and Wang (1990). According to Ipczynski (1978), Hussein *et al.* (1987) and Dia *et al.* (2000) *Eimeria droemdarii*, *E. rajasthani* and *E. cameli* are pathogenic species to young camel calves; therefore, the presence of these three pathogenic *Eimeria* species showed that eimeriosis might be contributing to enteric syndromes affecting camels. Older camels are oocyst-shedding carriers, but without clinical signs.

In this study, five intestinal *Eimeria* species were detected in bactrian and dromedary camels similar to other studies (Kasim *et al.*, 1985; Husein *et al.*, 1987; Wei and Wang, 1990; Löser and Gönner, 2004). In earlier studies, Kawasmeh and Elbihari (1983), Yagoub (1989) and Kasim *et al.* (1985) found one or more species (*Eimeria rajasthani*, *E. dromedarii* and *E. cameli*) with an overall prevalence of 14% in Saudi camels, 17.4% in Sudanese camels and 41.6% in Saudi Arabian camels, respectively. The differences among *Eimeria* species and their prevalence depend on different factors. These factors arise from the environment (may be due to weather changes), animal factors, farm management (feeding, housing, etc.) and other factors (illness and stress).

Feces consistency and intensity had a significant correlation with age ($P < 0.01$). In addition, opg counts were significantly higher in young camel calves compared to adult camels. Kawasmeh and Elbihari (1983) in an investigation on *E. cameli* in Saudi camels reported that this parasite occurs throughout the year, but is commonest during September. This finding was in close agreement with our study.

The prevalence of high infection rate (75%) with concurrent yellow-green diarrhea in <2 yrs of age camels indicated coccidiosis as the principal cause of the disease. According to Kaufmann (1996), young camels are much more susceptible to *Eimeria* infections. Whereas, in the age group of over two year-olds with low infection prevalence (25%), normal feces formation with opg +1 indicated that they served as carriers and foci for infection to camel calves. Furthermore, camel eimeriosis is an important disease in pre-weaned and recently weaned camels. While nearly all animals are exposed to coccidia, they may not show obvious signs of the disease. In the majority of hosts, the parasites

coexisted causing minimal damage. Clinical eimeriidosis only occurs if the host is subject to heavy infection or if its resistance is lowered. The disease appears mostly under stressful conditions, particularly after weaning. Considering the early weaning time and the prepatent periods, the infection of camel calves most likely originated from oocysts present in the shed to which the weanlings were moved to, and not from the mothers despite the high prevalence in adults.

Sex and age of camels had a significant effect on prevalence ($P < 0.01$). Recent similar examination schemes of camels showed nearly the same prevalence, fecal consistency, rate of infection regarding three age groups and identified *Eimeria* species. Of course, the heavier infection in the age group < 2 yrs compared to adult camels was due to management practice on the farm where the first lot of camels was moved into an unclean shed without in between cleaning, and was therefore exposed to a large number of oocysts excreted by the first lot leading to high levels of infection.

CONCLUSION

Camels' husbandry has been considered as an important sector for food supply of rural and sometimes urban people in this geographical area of Iran. Thus, their health status is of importance and epidemiological data on coccidial infections are of value. Since, no data exists on the prevalence of eimeriosis in camels of west part of Iran. Of course, knowledge of prevalence of eimeriosis and current *Eimeria* species would certainly help to minimize the economic losses in camel industry. Moreover, these findings may be useful to evaluate the infection potential when considering control programs, specially for young camels.

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EIMERIDOZA KOD DVOGRBIH I JEDNOGRBIH KAMILA U REGIJI MIANDOAB U IRANU

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SADRŽAJ

U radu su opisani rezultati ispitivanja zastupljenosti i diverziteta *Eimeria* vrsta u dve oblasti u kojima se uzgajaju kamile u okviru regije Miandoab u Iranu. Ukupno je ispitano 85 dvo-grbih i 40 jedno-grbih kamila starih od 1 - 4 godine. Uzorci fecesa su ispitivani flotacijom radi otkrivanja oocista i dokazivanja njihove sporulacije. Prevalenca je u proseku iznosila 12,8 %. Ukupno je dokazano prisustvo pet vrsta parazita i to *E. bactriani* (42,2 %), *E. rajasthani* (samo kod jedno-grbih kamila 26,7 %), *E. pellerdyi* (samo kod dvo-grbih kamila 15,6 %), *E. camelli* (11,1) i *E. dromedarii* (4,4 %). Sve inficirane kamile su imale mešovite infekcije sa najmanje tri vrste parazita. Zastupljenost i intenzitet infekcije su bili u korelaciji sa uzrastom a takođe su zavisili od pola.