Turk J Vet Anim Sci
28 (2004) 687-692

Research Article

Prevalence of Eimeria Species in Lambs in Antakya Province

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Received: 13.11.2002

Abstract: This study was conducted to identify Eimeria species in lambs in Antakya province. For this purpose, 248 samples were collected from 34 randomly selected lamb herds in 6 different towns.

In the laboratory examination of samples, 10 different Eimeria species were identified in Antakya province. These species were *E. ahsata* (11.29%), *E. bakuensis* (38.70%), *E. crandallis* (64.91%), *E. faurei* (11.29%), *E. intricata* (9.27%), *E. marsica* (16.93%), *E. ovinoidalis* (55.24%), *E. pallida* (3.62%), *E. parva* (13.30%), and *E. weybridgensis* (30.24%). Among these species, *E. weybridgensis, E. marsica* and the varieties of *E. crandallis* (small and blue varieties) are reported for the first time in Antakya province. *E. gilruthi, E. gonzalezi*, *E. granulosa* and *E. punctata* were not observed.

Key Words: Lamb, Eimeria, coccidiosis, Antakya

Antakya Yöresi Kuzularında Eimeria Türlerinin Prevalansı

Özet: Bu çalışma, Antakya yöresi kuzularındaki Eimeria türlerini tespit etmek amacı ile yapılmıştır. Bu amaçla, altı farklı ilçedeki, rastgele seçilen 34 kuzu sürüsünden 248 örnek toplanmıştır.

Örneklerin laboratuvar incelemelerinde, Antakya yöresi kuzularında 10 farklı Eimeria türünün varlığı tespit edilmiştir. Bu türler, *E. ahsata* (%11,29), *E. bakuensis* (% 38,70), *E. crandallis* (% 64,91), *E. faurei* (% 11,29), *E. intricata* (% 9,27), *E. marsica* (% 16,93), *E. ovinoidalis* (% 55,24), *E. pallida* (% 3,62), *E. parva* (% 13,30) ve *E. weybridgensis* (% 30,24) olarak belirlenmişlerdir. Bu türlerden *Eimeria weybridgensis*, *E. marsica* ve *E. crandallis'in* varyeteleri (küçük ve mavi varyete) Türkiye'de ilk defa Antakya yöresinde tespit edilmiştir. Antakya yöresi kuzularında, *E. gilruthi, E. gonzalezi*, *E. granulosa* ve *E. punctata* tespit edilememiştir.

Anahtar Sözcükler: Kuzu, Eimeria, coccidiosis, Antakya

Introduction

Coccidiosis is a parasitic disease caused by intracellular protozoa in vertebrates and invertebrates. The disease is of economic and medical importance, affecting humans, sheep, birds, cattle and many other animals (1,2).

In sheep, coccidiosis is caused by parasites of the genus Eimeria and is an important disease; it is especially important in pre-weaned and recently weaned lambs. While nearly all animals are exposed to coccidia, they may not show obvious signs of disease (2-3). This condition, known as subclinical coccidiosis, has a significant impact on the economics of animal production, causing a reduction in weight gain and feed efficiency and increased susceptibility to other diseases. Clinical coccidiosis results in even higher financial losses for producers because of medical treatment costs, a more severe effect on growth performance and sometimes death losses. In an outbreak of coccidiosis morbidity can vary between 10 and 40% but mortality is rarely more than 10% (4-13).

Clinical coccidiosis in domestic animals became an economically important problem with the introduction of intensive rearing systems. Disease outbreaks were associated with high stocking density, very poor weather conditions and the use of restricted areas to supplement the flock with extra food (4-13). Oocyst numbers per gram of faeces varied greatly from a few thousand to 11.5 million (3-9,12,13).

Fourteen Eimeria species are considered to have the capability of infecting sheep: *E. ahsata, E. bakuensis, E. crandallis, E. faurei, E. granulosa, E. gonzalezi, E. gilruthi, E. intricata, E. marsica, E. ovinoidalis, E. pallida, E. parva, E. weybridgensis* and *E. punctata.* Thirteen of these species parasitise the sheep intestine and 1 (*E. gilruthi*) parasitises the abomasum (1-3,14,15). Furthermore, *E. dalli* was reported from the USA (16) but it was not recognised as a sheep infective Eimeria and was not listed

in any of the recent classification studies (1,2,17).

Coccidiosis in sheep occurs as a mixed infection of Eimeria species with 3-10 species appearing in the same sample (3-6,8-13,18-25). Although these species are common in faecal samples, their appearance depends upon host age and immunity.

Sheep infective Eimeria species were found to be very common in faecal samples in Turkey (19-25). Sheep examined for Eimeria species were 29.9 to 100% infected in different parts of Turkey. The identified species varied from 5 to 10 in number (19-25). Except for *E. gonzalezi, E. marsica* and *E. weybridgensis,* 11 of the Eimeria species were identified in total in Turkey. There are no criteria for *E. gilruthi* (*Globidium gilruthi*) oocysts but this species has been reported from sheep abomasum cysts in Ankara province (26).

Antakya has very different climatic and geographic conditions in comparison to other parts of Turkey. It is very mild and rainy during winter and spring, and very hot and humid in summer and autumn. Sheep graze in pastures all year around except for on rainy days. The aim of this study was to determine the prevalence and intensity of infection with Eimeria species in lambs from 2 weeks to 6 months of age in Antakya province.

Materials and Methods

A total of 248 samples were collected from 34 lamb flocks in 6 different locations: Antakya, Reyhanlı, Serinyol, Kırıkhan, Hassa and Harbiye. The herd numbers visited in each town were 5, 8, 6, 7, 5 and 3, respectively. Herds and lambs were chosen randomly and each sample was taken directly from the rectum and put into a plastic container with a lid. Fresh samples were stored at room temperature in a solution of potassium dichromate (2%).

The presence and number of faecal oocysts were determined using the modified McMaster technique (27), which allows the calculation of the number of oocysts/g in as little as 0.1 g of faeces. Faeces were weighed, homogenised in an appropriate volume of tap water and sifted through a 150 µm hole size mesh screen. Half of the sift was centrifuged (500 g, 3 min), the supernatant was discarded and the sediment resuspended in saturated salt solution reconstituted to the original volume. Finally, an aliquot was transferred to the 2 McMaster slide chambers and the oocysts counted. The mean number (MN) from the chambers was then used to estimate the number of oocysts/g using the following formula.

Number of oocysts/g = MN x 100 x MF

(MF = Multiplication factor) (27).

When the sample contained oocysts, the remaining sifted faeces were allowed to sporulate and were speciated morphologically. To facilitate sporulation, filtrates were mixed with potassium dichromate ($K_2Cr_2O_7$) to a final concentration of 2% and kept at room temperature for a week. To ensure good oxygenation during sporulation, the oocyst suspension was never more than 50 ml, and the containers were agitated daily.

Differentiation of species was based on specific morphological features of the sporulated oocyst (size, shape, colour, presence or absence of micropylar cap), shape of sporocysts and disposition of sporozoites in the sporocysts (1,2,14,15,17,28,29).

Results

The numbers of oocysts per gram varied from 95 to 3,435,000 in faeces. However, the mean was 3540 oocysts per gram. No further oocyst output analyses were carried out since hourly and daily oocyst output did not differ significantly.

All samples (248) were found to be infected with 2 to 8 sheep infective Eimeria species (Table 1). Most of the

Table 1. Mixed infection in lambs.

	Number of Eimeria species in samples								
	1	2	3	4	5	6	7	8	Total
Infected animals	0	22	78	54	45	27	13	9	248
Percentage (%)	0	8.87	31.45	21.77	18.14	10.88	5.24	3.62	100

samples were found to contain 3, 4 or 5 different Eimeria species. No samples were infected with only one species. Clinical coccidiosis was not observed in any lamb flocks.

Ten different Eimeria species were identified in samples (Table 2). The identified species and their prevalence rates are given in Table 2. *E. crandallis* was the predominant species in the samples. *E. ovinoidalis* was found to be the second most common species, followed by *E. bakuensis* and *E. weybridgensis* (Table 2). *E. parva*, *E. ahsata*, *E. faurei*, and *E. intricata* were identified in less than 15% of samples. *E. pallida* was observed in the smallest proportion (3.62%) of samples. *E. punctata*, *E. gonzalezi*, *E. gilruthi* and *E. granulosa* were not identifed in any samples.

Table 2. The prevalance of Eimeria species in Antakya province.

Eimeria species	Number of infected animals	Infection rate (%)
E. ahsata	28	11.29
E. bakuensis	96	38.70
E. crandallis	161	64.91
E. faurei	28	11.29
E. intricata	23	9.27
E. marsica	42	16.93
E. ovinoidalis	137	55.24
E. pallida	9	3.62
E. parva	33	13.30
E. weybridgensis	75	30.24

E. crandallis had the widest morphological variation. There were 2 varieties of *E. crandallis* in addition to the normally known type. The first was the blue variety, which has a blue-grey oocyst wall instead of an orange one. The second was the small variety, which is similar to *E. parva* or *E. pallida*. The small variety of *E. crandallis* is slightly different from *E. pallida*. It has no polar cap and is rounder not elipsoidal like *E. pallida*. The difference between *E. parva* and the small variety of *E. crandallis* is the oocyst wall and colour. The small variety of *E. crandallis* has a thinner oocyst wall and its colour is lighter. The small variety of *E. crandallis* was identified in 4 (1.61%) samples while the blue variety of *E. crandallis* was observed in 6 (2.62%) samples (Figure). *E. weybridgensis*, *E. marsica* and the 2 varieties of *E. crandallis* are reported in sheep for the first time in Antakya province in Turkey.

Discussion

Since maximum susceptibility to coccidiosis occurs at 3-7 weeks of age and clinical signs of coccidiosis appear by 6 weeks of age (2-4,9,30-33) lambs up to 6 months of age were chosen for this study.

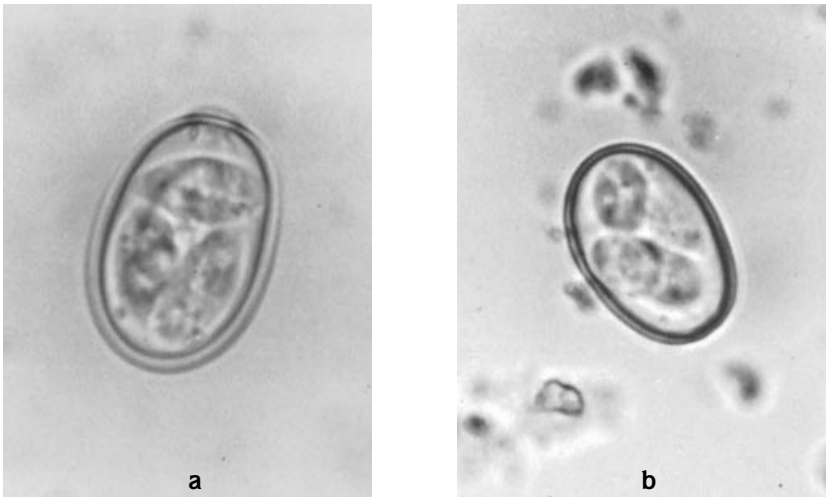
Oocyst output of lambs was not analysed because there was no correlation between clinical coccidiosis and oocyst numbers in faeces (3,9,13,32).

In addition, oocyst output can be misleading for several reasons: firstly, oocyst output is usually high in healthy lambs. Most lambs without signs of disease shed between 10^4 and 10^5 oocysts per gram of faeces and figures of over 10^6 are not uncommon (13-32). Secondly, a lamb can die of acute coccidiosis before any oocysts are shed at all (32-34). Thirdly, the output of oocysts following an acute infection falls sharply after the peak but may leave a critically ill animal with bloody diarrhoea, low oocyst count and non-specific lesions in the intestine (33-35). Furthermore, a massive intake of oocysts is associated with a lower oocyst output than theoretical faecal oocyst output and if the number of oocysts taken in is too great then pathogenicity may be reduced due to crowding in the gut (33,34).

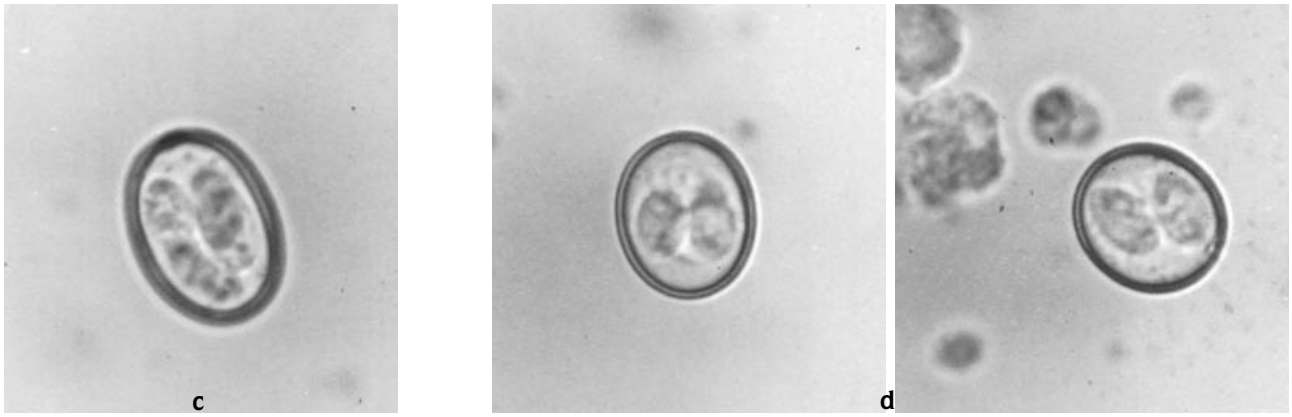
On the other hand, ingested oocyst numbers may affect clinical coccidiosis depending on the species rather than the oocyst outputs. It is known that pathogenicity is variable for different Eimeria species. *E. ovinoidalis* and *E. crandallis* are known to be more pathogenic than other species found in the United Kingdom (30-33,35) while *E. ahsata* has been described as the main pathogen in the USA (7). Fabiyi (18) stated that *E. ahsata* was more pathogenic than *E. crandallis* and *E. bakuensis* in Nigeria. It has been reported that 10,000 or fewer oocysts of *E. ovinoidalis* can cause severe illness while 100,000 or more of *E. crandallis*, *E. weybridgensis* or *E. bakuensis* produce only severe to mild symptoms (13,28-30,31-33).

No record could be found regarding the pathogenicity of Eimeria species in Turkey. Furthermore, there was no clinical coccidiosis in lambs examined during the study to correlate between identified Eimeria species in samples and clinical coccidiosis.

Coccidiosis has been reported as a common disease with a high prevalence in Turkey (19-25). In Bursa province, 9 different Eimeria species have been found to infect 29.9% of sheep (19). It has been reported that



E. weybridgensis *E. marsica*



E. crandallis - Blue variety *E. crandallis* - Small variety

40 µm

Figure. Eimeria species reported for the first time in Turkey.

94.8% of lambs were infected with 9 Eimeria species in Elazığ province (20). Furthermore, Küçükerdan and Dumanlı (21) have reported that 87.4% of sheep were infected with 9 different Eimeria spp. in Elazığ province. Sayın et. al. (22) have reported that 37. 26% of sheep were infected with 7 different Eimeria species. Gül and Değer (23) have found that 9 different Eimeria species infected 100% of sheep in Van province. In Kars province, 10 Eimeria species have been identified in 93.9% of the lambs and sheep (24).

In this study, 100% of the lambs were found to be infected with 10 different Eimeria species. The infection rate was higher than that of other areas of Turkey except for Van province. The number of identified Eimeria species infecting sheep (10) was similar to that of other studies. On the other hand, the identified Eimeria species were different from those reported in previous studies.

The prevalence of *E. crandallis* was higher than that in other studies in Turkey. The Eimeria species reported with high prevalence were *E. ovinoidalis* in Kars and Elazığ provinces, *E. parva* in Van province, *E. ahsata* in Bursa province and *E. bakuensis* in the Aegean region (19-24).

Other Eimeria species identified in Antakya were *E. ahsata, E. bakuensis, E. faurei, E. intricata, E. ovinoidalis, E. pallida* and *E. parva*. These species were common Eimeria species in previous studies as well (19-25).

Several species are reported for the first time in this study. The first difference was the small and blue varieties of *E. crandallis*. In addition, *E. weybridgensis* and *E. marsica* were also reported in Turkey for the first time.

Three species out of the 13 sheep infective intestinal Eimeria were not observed, namely *E. punctata*, *E. gonzalezi* and *E. granulosa*. However, *E. punctata* was observed in the east of Turkey, in Kars and Van provinces (23,25). In Europe *E. gonzalezi* and *E. punctata* have not been seen in field samples for decades and they were not featured in a recent study of Eimeria speciation (31).

The differences among Eimerian species and their prevalance depend on different factors. These factors arise from the environment (climate, vegetation etc.), animal factors (immunity, age, species etc.), farm management (weaning time, feeding conditions etc.) and other factors (other illness and stress factors) (36-37). In addition, researchers may introduce some bias due to misidentifications (1,38). Unfortunately, the quality of species descriptions is uneven because there are no guidelines available for workers in the field to follow and researchers have experienced difficulties in identification (1,38). For example, smaller than average oocysts of *E. ahsata* may look like oocysts of *E. bakuensis* (9) and, if the latter are unusually small, they resemble those of *E. weybridgensis*, which in turn if not fully sporulated will be impossible to differentiate from oocysts of *E. crandallis* (28-30). If *E. crandallis* is small and loses its micropylar cap, its oocysts resemble those of *E. parva*. Oocysts of *E. parva* that do not present a clear double wall may be confused with oocysts of *E. pallida* (1,28,30,32).

Eimerian parasites provide perfect examples of parasitism/co-existence. As long as the balance is stable between host and parasite, Eimeria lives within its host without significant pathogenicity. When this balance is upset by stress factors such as other illnesses, sharp climatic changes, food changes or weaning, the parasite can multiply and cause severe illness. Good farm management should be introduced to shepherds in order to reduce the economic losses caused by subclinical and/or clinical coccidiosis. Otherwise coccidiosis will remain a problem and continue causing economic losses.

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