

Original papers

Prevalence of coccidia infection in goats in Western Pomerania (Poland) and West Ukraine region

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ABSTRACT. The prevalence of coccidia infection in goats was evaluated in Western Pomerania (Poland) and West Ukraine Province. A total number of 311 goats were examined: 173 from Western Pomerania, including 139 kids (up to 6 month old), and 138 from the Lviv region including 93 juveniles. The study was based on two flotation methods, which helped to establish the number of oocysts in 1g of feces (OPG): Willis-Schlaaf for qualitative and McMaster for quantitative analysis. The species composition was established using Coudert's (Coudert 1992) and Eckert's (Eckert et al., 1995) keys. Nine *Eimeria* spp. were identified in feces samples in Western Pomerania and Lviv regions: *E. arloingi*, *E. chrisiensi*, *E. jolchijevi*, *E. ninakohlyakimovae*, *E. alijevi*, *E. capina*, *E. caprovina*, *E. hirci*, *E. apsheronica*. The prevalence of infection in Western Pomerania of adult goats was 74% with an intensity of 0–2500 OPG. The rate of infection in kids was 100% and the intensity ranged from 1800 to 28000 OPG. In West Ukraine Province, 100% of the adult goats and kids were infected. The coccidian intensity of infection ranged from 2600 to 120000 OPG in kids, from 50 to 4500 OPG in adults. Clinical conditions can influence the intensity of oocysts excretion in the feces of animals. In Western Pomerania the highest intensity of excretion of oocysts was during May–July and the lowest during November–January. In West Ukraine Province the peak of oocysts excretion was in May–July and the lowest in October–December. The results of the present investigation have implications for the control of coccidial infections in goats in Europe.

Key words: coccidian infection, *Eimeria*, goat, Western Pomerania (Poland), West Ukraine Province

Introduction

Recent years have seen increased interest in goats' milk and its products, mainly cheese. This situation has a significant impact on the development of goat farms in the world. The overall state of the world's goat population is about 704 million individuals. The largest population has been demonstrated in Asia (over 465 million), followed by Africa (183.5 million goats), America (35.8 million) and in Europe (18 million).

The most important countries involved in the breeding of goats are China (140 million goats), and most African countries. The largest goat herds are found in Nigeria (24.3 million), and Ethiopia (17.0 million), while in Europe, the largest are found in

Greece (5.3 million), Russia (1.7 million), Italy (1.4 million) and France (1.2 million) [1]. The population status and the level of goats' milk production in Poland compared to Europe as whole should now be regarded as satisfactory. The goat population has fluctuated over the years, but the trend should be steadily increasing recorded in the accounts and expand the medium, the size of the herd. The total number of goats in Poland is estimated at about 194 thousand animals, with the highest concentration observed in Wielkopolskie [2] and West Pomerania. Also, the goat population of Ukraine has been seen to increased from 522 thousand to 757.3 thousand from 1991 to 2006. Breeding is concentrated in small farms, in which the number does not exceed 10 individuals [3].

Table 1. Prevalence of *Eimeria* species in goats from the Western Pomerania area and the Lviv region

Coccidian species	Lviv region		Western Pomerania area	
	No. of infected goats	Prevalence (%)	No. of infected goats	Prevalence (%)
<i>E. arloingi</i>	41	29.2	63	36.4
<i>E. chrisiensi</i>	47	34.0	81	46.8
<i>E. jolchijevi</i>	19	13.8	29	16.8
<i>E. ninakohlyakimovae</i>	38	27.5	58	33.5
<i>E. alijevi</i>	39	28.3	53	30.6
<i>E. capina</i>	15	10.8	16	9.2
<i>E. caprovina</i>	6	4.3	11	6.3
<i>E. hirci</i>	9	6.5	9	5.3
<i>E. apsheronica</i>	7	5.2	5	4.6
Total	138	100	131	76

The development of the breeding and rearing of goats demands significantly more stringent requirements for disease prevention. This applies particularly to parasitic diseases, which may materially affect the health and productivity of animals. In sheep invasion by coccidia of the genus *Eimeria*, which can be a serious pathogen for kids, deserves the most attention [4–8]. In Poland, studies on coccidiosis of goats have been of a fragmentary nature [9–15].

In the course of coccidiosis in goats two factors are of importance: the intensification of production and the rate of infection of kids by parasites from adult animals. In goats, 11 species of the genus *Eimeria* were established by Pelléedy [16], and 9 species by Eckert et al. [17]: *E. arloingi*, *E. chrisiensi*, *E. jolchijevi*, *E. alijevi*, *E. ninakohlyakimovae*, *E. capina*, *E. caprovina*, *E. hirci*, *E. apsheronica*. The most pathogenic coccidia species are considered to be *E. arloingi*, *E. ninakohlyakimovae* [18].

Goats are resistant to adverse environmental conditions, and endure semi-arid and dry areas far better than other farm animals. Moreover, they have more modest food requirements than other ruminants.

Factors that increase risk of prevalence of coccidiosis in goats is a warm and rainy summer (from July to October), a mild winter and cool spring. Climatic conditions that reduce the risk of goats coccidiosis are a gentle and early spring, cool summer (July to October) and wet winter (February to April).

The aim of the study is to assess the prevalence of protozoa of the genus *Eimeria* in goats in Western Pomerania and in Western Ukraine (Lviv region), where no comprehensive studies have been performed on coccidiosis of goats.

Material and Methods

The study were carried out on 311 goats: 173 came from Western Pomerania including 139 kids (up to 6 months old), and 138 from the Lviv region including 93 kids. The majority of goats tested in Western Pomerania belonged to the German White Noble breed, and those from the Lviv region were mainly of no pedigree but were based on Saanen goats. The study was based on two flotation methods, which were used to establish the number of oocysts in 1 g of feces (OPG ratio): the Willis-Schlaaf for qualitative and the McMaster method for quantitative measurement. Species composition was established using of this purpose Coudert's [19] and Eckert et al. [17] keys. The oocysts were cultured in a moist chamber at 24–26°C. As a measure to prevent the growth of fungus, a 2.5% aqueous solution of potassium dichromate ($K_2Cr_2O_7$) was used.

Statistical analysis was performed using Statistica 7.1 PL.

Results and Discussion

In the Western Pomerania area, the study was based on five goat farms. Nine *Eimeria* species were

Table 2. Prevalence of *Eimeria* species in kids and young goats from the Western Pomerania area and the Lviv region

Coccidian species	Lviv region		Western Pomerania area	
	No. of infected goats	Prevalence (%)	No. of infected goats	Prevalence (%)
<i>E. arloingi</i>	45	48.4	58	33.5
<i>E. chrisiensi</i>	28	30.1	54	31.2
<i>E. jolchijevi</i>	15	16.1	11	7.9
<i>E. ninakohlyakimovae</i>	37	39.7	62	35.8
<i>E. alijevi</i>	22	23.7	35	25.2
<i>E. capina</i>	9	9.6	12	8.6
<i>E. caprovina</i>	5	5.3	7	5.0
<i>E. hirci</i>	8	8.6	10	7.1
<i>E. apsheronica</i>	3	3.2	2	1.4
Total	93	100	139	100

identified in the goats (Table 1). Eight species were found in adult goats and 9 species in kids. The prevalence of infection in adult goats was 74% with an intensity of 0–2500 OPG. All kids were infected and the intensity ranged from 1800 to 28000 OPG.

In Ukraine, goat rearing generally takes place on small farms, where the number of animals does not exceed 10 individuals, grazing on common pasture. Nine coccidia species were also found, and the prevalence in this case was 100%. The intensity of infection was higher than in Western Pomerania, ranging from 50 to 4500 OPG in adult goats. In kids and young goats the coccidia intensity was 2600–120000 OPG (Table 2).

Clinical coccidiosis was found in two farms where the kids were highly contaminated, with *E. arloingi* and *E. ninakohlyakimovae*. Acute disease was seen in kids 3 to 6 weeks of age among whom mortality was 26% (38 kids). The following clinical signs were observed: lack of appetite, often bloody diarrhea, usually accompanied by dysentery, dehydration and metabolic acidosis. The disease usually lasts about two weeks and leads to weakness of the body. The parasite causes damage to the mucous membrane, and impairs intestinal absorption leading to destruction and the need to remove animals from the herd. In older goats over the age of 5 months, clinical symptoms were rarely established, due to resistance.

Monitoring of parasitic invasions, particularly those associated with coccidiosis have great biological and practical significance. As a result of these studies it is possible to establish the

population of infected animals, and in several cases, to determine the composition of parasite species. Monitoring studies are also useful to determine the prevalence of *Eimeria* in ruminants. The invasion of coccidia in adult animals is mainly of a subclinical nature, and is not noticeable to owners of the animals or, very often, also to the veterinary services. Adult animals, however, are a source of infection for young animals especially in small ruminants, sheep and goats.

Our own research has shown high prevalence of infected goats from both Western Pomerania as well as Ukraine (Table 1 and 2). In both cases it was found 9 species of the genus *Eimeria*. Our results are confirmed in other European countries: the Netherlands [20], Czech Republic [21], England [22], France [19], Germany [23], Turkey [7,24]. The greatest pathogenicity of *Eimeria* is characterized by *E. arloingi* and *E. ninakohlyakimovae* [18]. Oocysts of the species quoted above were established in 45% of the investigated goats.

The age of the animal has a significant influence on the intensity of the expulsion of the oocysts. The expulsion of the oocysts was more intense in kids than in adult animals. This fact has been confirmed by other authors from Poland [11–13,15].

Climatic conditions can influence the intensity of the oocysts excretion in the faeces of animals. In the Western Pomerania area, Balicka-Ramisz [9] and Balicka-Ramisz et al. [10] found the highest intensity of excretion of the oocysts to take place during May–July and the lowest in the months of November to January (Table 3). The presented

Table 3. Intensity of infection (OPG) of *Eimeria* spp. according to season

Lviv region				Western Pomerania area			
November-December		May-July		November-December		May-July	
Goats	Kids/Younger	Goats	Kids/Younger	Goats	Kids/Younger	Goats	Kids/Younger
850	1800	2100	43 000	600	1650	1850	21 000

differences between the listed species of *Eimeria* in goats were not statistically significant ($P \leq 0.01$) (Table 3). In the summer months, the number of excreted oocysts in goat was about 4 times, and in kids almost 15 times higher than in the winter months. In present study the lowest oocysts expulsion was found in the winter months (December–February) while the number of oocysts in the faeces peaked in the month of June. Other studies on the impact of climatic conditions on the course of coccidiosis in goats have been conducted in other parts of the world. Penzhorn [25] in a study investigating the four seasons (June–August 1992, September–November 1992, December–February 1992/1993, March–May 1993) in Montana (USA) and found the largest expulsion of oocysts by kids takes place in the months of September to November. By contrast, in Tanzania [26] and South Africa [27], oocysts excretion by the kids was most severe during the rainy season [28]. Research on goats in Kenya showed that the total goat herds were infected with coccidia in 73.4% [29]. Peak *Eimeria* infection fell in June and reached its lowest level in the months between February and April. Investigations carried out on flocks of goats wandering the Maasai in East Africa [29] showed 60–70% of the individuals possessed an internal parasite infection.

In a study performed in Jordan on coccidia infection in goats, the intensity of removal of the oocysts and coccidiosis occurrence in kids was found to be greatest in the winter when the animals were not put out to pasture and were kept in the housing [4].

However, a study performed in the provinces of Mongolia assessing the presence of parasites over four seasons and in three geographic zones found that the highest infestation status was demonstrated in March, and lowest in November [30].

In Iraq, coccidia oocysts were demonstrated in 89.27% of the examined goats, and the most severe invasion occurred during the spring months [8].

In the farms where clinical coccidiosis was identified, the following procedure was undertaken:

1. Isolation of sick animals with symptoms of coccidiosis;
2. Parasitological monitoring;
3. Mastery of clinical disease by an applicable effective coccidiostatic. On Polish farms, Baycox was applied twice at a dose of 25mg/kg bw at intervals of 48 hours.
4. Increased action to improve hygiene and sanitary conditions in the premises. Special attention is paid to the drinking bowl, which are cleaned daily and replenished with clean water and feeders.
5. Adjusted or supplemented litter.

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