



RESEARCH ARTICLE

Lungworm infections in small ruminants in Uşak province

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Uşak yöresinde küçük ruminantlarda akciğer kılkurdu enfeksiyonları

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Öz

Amaç: Bu çalışma, Uşak Yöresinde küçük ruminantlarda akciğer kıl kurdu enfeksiyonlarının yaygınlığını belirlemek amacıyla yapılmıştır.

Gereç ve Yöntem: Çalışma, Uşak bölgesinde 5 farklı yerleşim yerinden toplanan 250 koyun ve 250 keçinin dışkı örneklerinin Baermann-Wetzel yöntemi kullanılarak test edilmesiyle gerçekleştirildi.

Bulgular: Akciğer kıl kurdu enfeksiyonlarının yaygınlığı koyunlarda %9,6 iken keçilerde ise %34,4 olarak belirlendi. Tüm koyun ve keçilerde enfeksiyon yaygınlığı %22 olarak tespit edildi. Koyunlarda akciğer kıl kurdu enfeksiyonlarının yaygınlığı dişilerde %9,8 olarak belirlenirken, erkeklerde enfeksiyona rastlanmadı. Keçilerde enfeksiyonun yaygınlığı, dişilerde %33,3 ve erkeklerde %53,8 olarak tespit edildi. Koyunlarda akciğer kıl kurdu türlerinden *Muellerius capillaris*'in %5,6, *Dictyocaulus filaria*'nın %2, *Protostrongylus* sp.'nin %1,2 ve *Cystocaulus ocreatus*'un %0,8 oranlarında yaygınlık gösterdiği tespit edildi. Keçilerde ise *M. capillaris*'in prevalansı %34,4 ve *C. ocreatus*'un %0,4 olduğu saptandı. Üç koyunda iki akciğer kurdu türünün neden olduğu miks enfeksiyonlar tespit edildi. Ancak sadece bir keçide miks enfeksiyon saptandı. Koyunlarda akciğer kurdu enfeksiyonu prevalansı ırklara göre karşılaştırıldığında beş koyun ırkından ikisinde enfeksiyon saptanmıştır. Akciğer kurdu enfeksiyon prevalansı Eşme ırkı koyunlarda %14,1 ve Kıvırcık ırkı koyunlarda ise %9,1 olarak bulundu.

Öneri: Küçükbaş hayvan yetiştiriciliğinde akciğer kurdu enfeksiyonlarının yaygınlığı ve risk durumu ortaya konmuştur. Ayrıca, koyun ve keçilerin birlikte yetiştirilmesi ve farklı yaş gruplarından hayvanların birlikte otlatılması akciğer kurdu enfeksiyonları açısından risk oluşturabileceği tespit edilmiştir.

Anahtar kelimeler: Akciğer kıl kurdu, koyun, keçi, uşak yöresi

Abstract

Aim: This study was carried out to determine the prevalence of lungworm infections in small ruminants in the Uşak province.

Materials and Methods: The study was carried out by testing the stool samples of 250 sheep and 250 goats collected from 5 different localities in the Uşak province using the Baermann-Wetzel method.

Results: While the prevalence of lungworm infections was 9.6% in sheep, it was 34.4% in goats. The prevalence of infection was found to be 22% in all sheep and goats. While the prevalence of lungworm infections in sheep was determined to be 9.8% in females, no infection was found in males. The prevalence of infection in goats was determined as 33.3% in females and 53.8% in males. The prevalence of *Muellerius capillaris* was 5.6%, *Dictyocaulus filaria* 2%, *Protostrongylus* sp. 1.2% and *Cystocaulus ocreatus* 0.8% in sheep. In goats, the prevalence of *M. capillaris* was 34.4% and *C. ocreatus* was 0.4%. Mix infections caused by two lungworm species were detected in three sheep. However, mix infection was detected in only one goat. When the prevalence of lungworm infection in sheep was compared according to breeds, infection was detected in two of the five sheep breeds. The prevalence of lungworm infection was 14.1% in Eşme breed sheep and 9.1% in Kıvırcık breed sheep.

Conclusion: The prevalence and risk status of lungworm infections in small ruminant breeding have been demonstrated. In addition, it has been determined that raising sheep and goats together and grazing animals from different age groups together may pose a risk in terms of lungworm infections.

Keywords: Lungworm, sheep, goat, uşak province

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Introduction

Lungworm infections in small ruminants (sheep-goats) are chronic and long-term infections characterized clinically by respiratory problems, pathologically by bronchitis and bronchopneumonia. Lungworms of small ruminants are nematode parasites found in the *Trichostrongylidae* and *Metastrongylidae* superfamilies of the order *Strongylida*. Trichostrongylid lungworms have a monoxene life cycle and are located in the trachea and bronchial branches in their hosts. Although they are more common in temperate climatic conditions, they have a cosmopolitan distribution. Metastrongylid lungworms have a heteroxenous life cycle and are localized in the lung parenchyma, bronchioles and alveoli. Various gastropods (land snails) serve as intermediate hosts to the metastrongylid lungworms (Urquhart et al 1996, Schnieder 2005, Eckert et al 2008).

Small ruminant breeding is a large component of the agricultural economy in developing countries and constitutes a significant part of the livelihoods of the rural population. The presence of infections, the species causing the infection, the prevalence of these species and the risks they cause should be revealed in order to determine the control strategies and to prepare the control programs against the lungworms that threaten animal health and cause significant yield losses in small ruminant breeding (Hansen and Perry 1994).

In previous studies in Turkey, the prevalence of lungworm infections in sheep varies between 10.86-62.5% according to stool examination (Doğanay et al 1989, Celep et al 1995, Dik et al 1995, Umur and Arslan 1998, Değer et al 2000, Yıldız and Aydenizöz 2001, Yıldız 2006, Bağcı and Bıyıkoğlu 2003, Yıldırım and İça 2005, Sevimli et al 2006, Gül and Kılınc 2016, Can et al 2018) and 19.85-86.18% according to necropsy examinations (Güralp 1952, Gargılı 1995, Taşan et al 1997, Umur and Arslan 1998, Değer et al 2000, Yıldız and Aydenizöz 2001, Yıldız 2006, Bağcı and Bıyıkoğlu 2003, Can et al 2018). According to previous studies, the prevalence of lungworm infections in goats varies between 4.27% and 36% (Şenlik et al 2001, Yaman et al 2006, Gül and Kılınc 2016, Sevimli et al 2018).

This research was carried out to determine the prevalence of lungworm infections and the species responsible for the infection in sheep and goats raised in Uşak province.

Material and Methods

Material Sampling

Each stool samples of 5 grams were collected rectally from 50 sheep and 50 goats from 5 localities (Alahabalı, Alıçlı, Davutlar, Delibaşlı and Konak villages) in the Uşak province.

Stool samples were collected from 245 female and 5 male sheep and 237 female and 13 male goats. A total of 500 samples were brought to the laboratory in labeled stool sample containers. Information on stool samples (locality, farm, species, sex, breed and age) was recorded for use in data analysis.

Method

Stool samples were tested with the Baermann-Wetzel method in the parasitology laboratory (Yıldız 2006, Yıldırım and İça 2005). First-stage larvae collected from stool samples were identified by Nikon Elipse 80İ-DS-5-L1 light microscopy and photographed.

Statistical analysis

The data obtained in the research were analyzed with the SPSS for Windows package program. The variables in the study were described with frequency and percentage distributions, and the relationships between categorical variables were determined by the Chi-Square test. Statistical significance level was determined as 0.05.

Results

In this study, the prevalence of lungworm infections was determined as 9.6% in sheep, 34.4% in goats and 22% in all small ruminants (Table 1). The difference between sheep and goats in terms of the prevalence of lungworm infections was statistically significant ($p < 0.05$). While the prevalence of lungworm infections in sheep was 9.8% in females, no infection was found in males. The prevalence of infection in goats was 33.3% in females and 53.8% in males. Considering all small ruminants, the prevalence of infection was 21.4% in female animals and 38.9% in males (Table 1). The difference between the sexes in terms of the prevalence of lungworm infections in sheep, goats and all ruminants were not statistically significant ($p > 0.05$).

The prevalence of lungworm infections in sheep by age groups was determined as 16.7% in the 1-3 age range, 11.1% in the 4-7 age range, and 3.0% in the 8 years and older age group (Table 2). When the prevalence of lungworm infections in sheep was compared according to age, the difference was not statistically significant ($p > 0.05$). The prevalence of lungworm infections in goats according to age groups was 33.3% in the 1-3 age range, 16.2% in the 4-7 age group, and 53.5% in the 8 years old and older age group (Table 2). The difference between age groups was significant in goats ($p < 0.05$). When all sheep and goats are evaluated together, the prevalence of infection was 29.8% in the 1-3 age range, 12.7% in the 4-7 age range, and 29% in the 8 years and older age group (Table 2). The difference between age groups was statistically significant in all small ruminants ($p < 0.05$).



Table 1. Distribution of lungworm infections in small ruminants by host and gender

Host	Gender (n)	Infection Rate by Gender (%)	Infection Rate by Host (%)	χ^2	P
Sheep	♀ (245)	24 (9.8)	24(9.6)	0.542	0.601*
	♂ (5)	-			
Goat	♀ (237)	79 (33.3)	86(34.4)	0.143	0.114*
	♂ (13)	7 (53.8)			
Total	♀ (482)	103 (21.4)	110(22)	0.087	0.076*
	♂ (18)	7 (38.9)			

(*P>0.05)

Table 2. Distribution of lungworm infections in small ruminants by age groups

Host	Age Groups			χ^2	P
	1-3	4-7	8≥		
Sheep	16.7%	11.1%	3%	5.507	0.064
Goat	33.3%	16.2%	53.5%	21.566	0.000*
Total	29.8%	12.7%	29%	20.119	0.000*

(*P<0.05)

Table 3. Comparison of prevalence of lungworm species in sheep and goats

Lungworm species	Lungworm infections		χ^2	P
	Sheep(%)	Goat(%)		
<i>D. filaria</i>	5 (2)	-	39.417	0.000*
<i>M. capillaris</i>	14 (5.6)	86 (34.4)		
<i>C. ocreatus</i>	2 (0.8)	1 (0.4)		
<i>Protostrongylus</i> sp.	3(1.2)	-		
<i>M. capillaris</i> + <i>C. ocreatus</i>	3 (1.2)	1 (0.4)		
<i>M. capillaris</i> + <i>Protostrongylus</i> sp.	1 (0.4)	-		

(*P<0.05)

It was determined that the prevalence of *M. capillaris* was 5.6% (Figure 1a), *D. filaria* 2% (Figure1b), *Protostrongylus* sp. 1.2% (Figure 1c) and *C. ocreatus* 0.8% (Figure 1d) in sheep (Table 3). While the prevalence of *M. capillaris* and *C. ocreatus* in goats was 34.4% and 0.4% respectively, *Protostrongylus* sp. and *D. filaria* were not determined (Table 3). When all small ruminants were evaluated, it was determined that *M. capillaris* had a prevalence of 20%, *D. filaria* 1%, *Protostrongylus* sp. 0.6% and *C. ocreatus* 0.6% (Table 3). In both sheep and goats, the predominant species was *M. capillaris*. When the prevalence of lungworm species in sheep and goats was compared, the difference was statistically significant ($p<0.05$). Mixed infections were detected in three sheep. *M. capillaris* and *C. ocreatus* were observed together in two of them, and *M. capillaris* and *Protostrongylus* sp. were observed together in one. Mixed infection with *M. capillaris* and *C. ocreatus* was detected in only one of the goats. (Table 3). When the prevalence of lungworm infections in sheep was compared according to breed, a significant difference was found ($p<0.05$). The prevalence of lungworm infections was 14.1% in Eşme breed sheep and 9.1% in Kıvrıkcık breed sheep (Table 4).

Discussion

In this study, the prevalence of lungworm infections was 9.6% in Uşak sheep, according to stool examination. Although this result is lower than the results of other studies conducted in various regions of Turkey, it is similar to the results (10.6% and 14%) of two studies conducted in Kırıkkale (Yıldız and Aydenizöz 2001, Yıldız 2006). It is thought that these differences may be due to the climatic characteristics and breeding methods of the regions. According to previous studies in Turkey, the prevalence of lungworm infection in goats varies between 4.27% and 36% (Şenlik et al 2001, Yaman et al 2006, Gül and Kılınç 2016, Sevimli et al 2018). In this study, the prevalence was 34.4%. While this result was found to be higher than the results of the studies conducted in Hatay (Yaman et al 2006) and Afyonkarahisar (Sevimli et al 2018), it was found to be similar to the results of the studies conducted in the Southern Marmara Region (Şenlik et al 2001) and Bingöl (Gül and Kılınç 2016). In this study, the difference was statistically significant between sheep (9.6%) and goats (34.4%) in terms of lungworm infection prevalence ($p<0.05$).





Figure 1. a) *Muellerius capillaris* L1(X40), b) *Dictyocaulus filaria* L1(X40) c) *Protostrongylus* sp. L1(X40), d) *Cystocaulus ocreatus* L1(X40)

When the prevalence of lungworm infections was examined by gender, the prevalence of infection was found to be higher in female sheep in some studies (Gargılı 1995, Sevimli et al 2006), while it was higher in males in one study (Yıldız and Aydenizöz 2001). The prevalence of lungworm infections in this study was 9.8% in female sheep and no infection was found in male sheep. The prevalence was found 33.3% in female goats, while 53.8% in male goats. The relatively high rate of infection in male goats can be explained by the low number of male goats in the herds and the fact that they are breeding animals at an advanced age. Considering all small ruminants, the prevalence of infection was found to be 21.4% in female animals and 38.9% in males. In this study, the difference between the sexes in sheep, goats and all small ruminants was not statistically significant ($p > 0.05$).

When the prevalence of lungworm infections is examined by age groups, it is seen that the prevalence of infection increases with age. In a study conducted in sheep (Yıldırım and İça 2005), the prevalence of lungworm infections was reported as 53.3% in the ≥ 6 age group, 41.3% in the 3-5 age group, and 9.4% in the ≤ 2 age group. In this study, it was determined that the prevalence of lungworm infections in sheep was 16.7% in the 1-3 age range, 11.1% in the 4-7 age range, and 3.0% in the 8 years and older age group. The difference was not statistically significant in the prevalence of infection between age groups ($p > 0.05$). The prevalence of lungworm infections in goats was 33.3% in the 1-3 age group, 16.2% in the 4-7 age group, and 53.5% in the 8 years and older age group. When the prevalence of lungworm infections in goats was compared according to age, the difference was statistically significant ($p < 0.05$). When all sheep and goats were evaluated together, the prevalence of lungworm infection was found to be 29.8% in the 1-3 age range, 12.7% in the 4-7 age range, and 29% in the 8 years and older age group. When the age groups were examined in all

Table 4. Comparison of the breed-specific prevalence of lungworm infections in sheep

Breed	Number of examined sheep	Lungworm infections Negative (%)	Positive (%)	χ^2	P
Pırlak	36	36 (100)	-	11.297	0.023*
Kıvrıkcık	22	20 (90.9)	2 (9.1)		
Eşme	156	134 (85.9)	22 (14.1)		
Sakız Half-breed	25	25 (100)	-		
Pirit	11	11 (100)	-		
Total	250	226 (90.4)	24 (9.6)		

(* $P < 0.05$)

small ruminants, the difference was statistically significant ($p < 0.05$). Although it is expected that the infection rates will be higher in animals that go out to the pasture for the first time and in older animals with reduced immunity, *M. capillaris* is less responsive to treatment compared to other lungworm species.

C. ocreatus is the most common species of lungworm observed in sheep in most of the studies conducted in different regions of Turkey (Güralp 1952, Doğanay et al 1989, Taşan et al 1997, Dik et al 1995, Değer et al 2000, Bağcı and Bıyıkoğlu 2003, Yıldız 2006, Can et al 2018). There are fewer studies reporting that *D. filaria* is the most common species in sheep (Celep et al 1995, Gargılı 1995, Umur and Arslan 1998, Yıldız and Aydenizöz 2001, Gül and Kılınç 2016). Only one study reported *Protostrongylus* sp. as the most common lungworm species in sheep (Yıldırım and İça 2005). In this study, *M. capillaris*, *D. filaria* and *Protostrongylus* sp. were detected at a rate of 5.6%, 2% and 1.2%, respectively. This can be explained by the fact that sheep are breeding together with goats and *M. capillaris* is the predominant lungworm species in goats. Although mix lungworm infections are common in sheep, mix infections with two species are more common than mix infections with three species (Umur and Arslan 1998, Değer et al 2000, Bağcı and Bıyıkoğlu 2003, Yıldırım and İça 2005, Yıldız 2006, Gül and Kılınç 2016, Can et al 2018). Mix infections with two species were detected in only three of the infected sheep in the region where this study was conducted. This result is quite low compared to the results determined in other studies.

In two studies (Cantoray et al 1992, Şenlik et al 2001) on goats in Turkey, *C. ocreatus*, in the other two (Gül and Kılınç 2016, Sevimli et al 2018) *M. capillaris* and in one study (Yaman et al 2006) *D. filaria* were reported to be the most common lungworm species. In this study, *M. capillaris* was found in 34.4% and *C. ocreatus* in 0.4% in goats. In all small ruminants, *M. capillaris* was found to be 20%, *D. filaria* 1%, *Protostrongylus* sp. 0.6% and *C. ocreatus* 0.6%. *M. capillaris* was the predominant species in both sheep and goats. In a study conducted in Bingöl, the rate of mixed lungworm infection in goats was reported as 3% (Gül and Kılınç 2016). In this study, mixed infection was detected in only one goat (0.4%).



This study was carried out on 5 different breeds of sheep, and lung pinworm infection was detected only in Eşme and Kıvrıkcık breed sheep. There has not been a study comparing different sheep breeds in terms of lungworm infections in Turkey before.

Conclusion

As a result, it has been revealed that lungworm infections seen in small ruminants in the Uşak province are very important in terms of livestock and farm economy. Parasitic infections are an important threat in sheep and goat farming, which is an important part of rural development, and timely diagnosis and treatment of these infections and prevention and control measures are also important. Raising sheep and goats together and grazing animals from different age groups together may pose a risk in terms of lungworm infections. It is noteworthy that *M. capillaris* infections, which are more difficult to treat than infections caused by other species, dominate. In this study, attention was drawn to lungworm infections in sheep and goats in Uşak province.

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Conflict of Interest

The authors did not report any conflict of interest.

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Author Contributions

Motivation/Concept: MK; Design: MK; Control/Supervision: MK; Data Collection and/orProcessing: EE; Analysis and /orInterpretation: MK, EE; LiteratureReview: MK, EE; WritingtheArticle: MK; Critical Review: MK, EE.

Ethical Approval

Afyon Kocatepe University Animal Experiments Ethics Committee, Date: 29.7.2020, Decision number: 49533702/287

