

STUDY ON THE SEASONAL DYNAMICS OF LUNGWORM INFECTIONS IN SMALL RUMINANTS SLAUGHTERED IN TIARET (ALGERIA)

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Abstract

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A slaughterhouse survey was performed for one year (from March 2013 to April 2014) in order to determine the prevalence and intensity of lungworm infections per season in both sheep and goats in the Tiaret region. Of 2285 sheep and 743 goats examined, 395 and 116 were positive for lungworm infection, respectively.

In sheep, the highest and the least rate of infection was in winter (21%) and autumn (15%), respectively. Spring and summer showed an equal rate (18%). In goats, the highest and the least rate of infection was in spring (26%) and autumn (11%) ($P < 0.05$), respectively. In the current study, four species of bronchopulmonary nematodes were identified, namely: *Muellerius capillaris*, *Protostrongylus rufescens*, *Dictyocaulus filaria* and *Neostrongylus linearis*. The present study showed that *M. capillaris* was the highest prevalent in relation to other species of lung worm in both sheep and goats followed by *P. rufescens* in sheep and mixed infections in goats.

The seasonal dynamics of *M. capillaris* showed that: for sheep the highest prevalences were in autumn (88.71%) and winter (75.61%). In goats, highest rates were recorded in autumn (87.5%), in winter (50%) and spring (50%).

This study showed high prevalence of lungworm infections in the study area implying the need for control intervention. *M. capillaris* was the most frequently, especially in autumn and winter. *N. linearis* exist in the study area.

Key words: lungworm infection; sheep; goats; *Muellerius capillaris*; *Protostrongylus rufescens*; *Dictyocaulus filarial*; *Neostrongylus linearis*

Introduction

The livestock sector plays a vital role in the national economy of developing countries. It plays a great role in food supply, a source of income and foreign currency (Addis et al., 2011).

Helminth parasitism is globally considered the most important form of transmissible disease in sheep and goats, with animal mortalities, ill-thrift and the cost of treatments imposing a massive annual cost on livestock owners. Although parasitic disease is a significant problem in all countries, it is especially serious in developing countries where objective control information and the resources to combat parasitism

are not always available (Krecek and Waller, 2006; Vatta and Lindberg, 2006). Lungworms can result an infection of the lower respiratory tract, usually resulting in verminous bronchitis or verminous pneumonia (Alipourazar et al., 2015). Protostrongylidae species occur in the alveoli, bronchioles and parenchyma of the lungs of various species of mammals. Dictyocaulidae species are located in respiratory passages of the lungs (Soulsby, 1986; Umur et al., 2006). These parasites cause respiratory problems such as bronchopneumonia and death in young. Infections contribute to low productivity (reduced weight gain, retarded growth, decreased milk production) and to the economic losses (Girisgin et al., 2008).

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Determination of first stage larvae in faeces is the simplest, non invasive and most commonly used technique for the intravital diagnosis of lungworm infections (Van Wyk et al., 2004; Zajac et al., 1994) but postmortem examination revealed that coproscopic examination had limited value in terms of estimating the prevalence of lungworm infections (Ibrahim and Godefa, 2012 ; Kouidri et al., 2013) because several factors can effect the larval excretion such as season, lactation, and reproductive effort (Diez-Banoset al., 1994; Pelletier et al., 2005).

This study is a continuity to our previous studies (Kouidri et al., 2013 ; Kouidri et al., 2014) conducted in the same region, separately on sheep and goats but with two new objectives: investigate others species involved in lung worm infections like *Neostrogylus linearis* and *Cystocaulus ocreatus* and follow the seasonal dynamics of lungworm infections in sheep and goats slaughtered in Tiaret (Algeria).

Materials and Methods

Study area and design

The present study was conducted in Tiaret Abattoir and parasitological laboratory of the veterinary institute of the University of Tiaret (West of Algeria). The region is situated in the high plateau of Algeria, a semi-arid area characterized by cold and humid winter and hot and dry summer. Temperatures vary between 2.1 and 16.4°C in winter and between 21.9 and 35.5°C in summer. The annual rainfall ranges between 250 and 600 mm.

During one year (March 2013 to April 2014), post mortem examination was performed on animals (2285 sheep and 743 goats). The slaughterhouse was visited regularly to examine the lungs of slaughtered sheep for the presence of lungworm infections. It comprises both sexes and all age groups. Age was determined based on the dentition and the owner’s information.

Postmortem examination

During routine inspections of the veterinary staff of the slaughterhouse, lungs rejected for lungworm infection were recorded and identified. Lungworm infections were recognized based on presence of nodules, which are usually grayish white in color (Borjii et al., 2012), brownish spots (Etmiani, 1980) and adult worms.

Laboratory work

To determine species of lung worms, lungs rejected for lungworm infections in the Tiaret abattoir, during the current study, were conducted to the laboratory of parasitology of

the Veterinary Sciences Institute of Ibn Khaldoun University of Tiaret for more investigations.

The air passages were opened starting from the trachea to the small bronchi with scalpel, and smears were taken and placed between slide and cover slip for microscopic observation. Lung tissues with nodules were examined by gentle compression of the nodules and the smear was put on thick glass, covered and examined in microscope.

Identification of species lungworms was done based on first stage larvae (L1). *D. filaria*, L1 has a characteristic cuticular knob at the anterior extremity and dark granulation of the intestinal cells. While the others ovine lungworms are devoid of anterior protoplasmic knob. L1 of *P. rufescens* has a wavy outline at the top of its tail, L1 of *M. capillaris* have an undulating tip and a dorsal spine (Bogale et al., 2012). A total of 195 and 71 lungs rejected from sheep and goats, respectively, were examined to identify species of lung worm in different seasons.

Data analysis

Prevalence of lungworm infections per season was calculated as a percentage of the population screened. The Student test was used to compare seasons for possible significant differences using STATISTICA version 5. The differences were regarded as significant if P-value was less than 0.05.

Results

During postmortem inspection, of 2285 sheep and 743 goats examined, 395 (17%) and 116 (16%) were positive for lungworm infection, respectively. In sheep, the highest and least rate of infection was in winter (21%) and autumn (15%), respectively. Spring and summer showed equal rate (18%). In goats, the highest and least rate of infection was in spring (26%) and autumn (11%) (P<0.05), respectively. (Table 1 and Figure 1). In the current study, four species of bronchopulmonary nematodes were identified, namely: *M. capillaris*, *P. rufescens*, *D. filaria* and *N. linearis*. The proportions of each species for sheep and goats by seasons are represented in Table 2 and 3.

Table 1
Prevalence of lungworms infection in small ruminants per season

	Spring	Summer	Autumn	Winter	Total
Sheep	18% (137/772)	18% (105/599)	15% (89/602)	21% (64/312)	17% (395/2285)
Goats	26% (34/133)	15% (51/341)	11% (23/213)	14% (8/56)	16% (116/743)

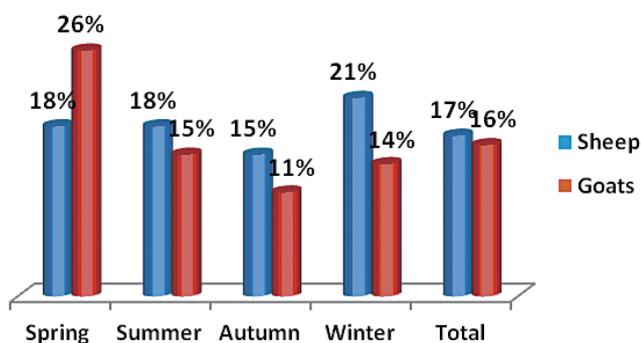


Fig. 1. Seasonal distribution of lungworms infection in small ruminants

Discussion

Lung worm infection (verminous pneumonia) is a chronic parasitic disease that affects the respiratory system of animals. This disease results in substantial economic losses due to the reduction of growth rate, morbidity and mortality by predisposes the animal to secondary infection (Radostitis et al., 2000).

In the present study, of the total of sheep examined in the abattoir the overall prevalence rate of 17% was recorded, which is lower than 22% recorded in the same region

(Kouidri et al., 2014). The prevalence of lungworm infections varied depending on climate condition and management practices. Higher rates as 24.18%, 30.33% and 30.76% were reported by Dar et al. (2013), Fentahun et al. (2012) and Weldesenebet and Mohamed (2012), respectively.

However, lower rate as 4.1% was recorded by Borjii et al. (2012)

In goats, an overall prevalence of 16% was revealed. This result is higher than this reported in the same region with 7% (Kouidri et al., 2013). The possible explanation for variation in the infection rate could be associated with nutritional status, level of immunity, rainfall, humidity, temperature differences and season of examination on the respective study areas (Bradford, 2002). High prevalences have been reported 27.08% and 28.02% by Fentahun et al. (2012) and Welesenebet and Mohamed (2012), respectively.

Lung worm infections were recorded during all seasons in both sheep and goats.

The difference was statistically significant only in goats between spring and autumn with 26% and 11%, respectively.

The current study showed that *M. capillaris* was the highest prevalence in relation to other species of lung worm in both sheep and goats followed by *P. rufescens* in sheep and mixed infections in goats. These results agree with the findings of Kouidri et al. (2013) in goats

Table 2
Prevalence of species of lung worms by season in sheep

	<i>M. capillaris</i>	<i>P. rufescens</i>	<i>D. filaria</i>	<i>N. linearis</i>	Mixed infections
Spring	43.75% (28/64)	29.68% (19/64)	23.44% (15/64)	0% (0/64)	3.13% (2/64)
Summer	64.28% (18/28)	17.86% (5/28)	7.14% (2/28)	0% (0/28)	10.72% (3/28)
Autumn	88.71% (55/62)	1.61% (1/62)	3.23% (2/62)	1.61% (1/62)	4.84% (3/62)
Winter	75.61% (31/41)	7.32% (2/41)	0% (0/41)	4.88% (2/41)	14.63% (6/41)

Table 3
Prevalence of species of lung worms by season in goats

	<i>M. capillaris</i>	<i>P. rufescens</i>	<i>D. filaria</i>	Mixed infections
Spring	50% (8/16)	18.75% (3/16)	6.25% (1/16)	25% (4/16)
Summer	46.15% (12/26)	34.62% (9/26)	0% (0/26)	19.23% (5/26)
Autumn	87.5% (14/23)	0% (0/23)	6.25% (1/23)	6.25% (1/23)
Winter	50% (3/6)	16.66% (1/6)	0% (0/6)	33.33% (2/6)

and Kouidri et al. (2014) in sheep and Addis et al. (2011). Unlike the current finding, Shenkute et al. (2014) have reported that *D. filaria* was the significant highly prevalent lungworm in sheep.

Also Alemu et al. (2006) and Nematollahi and Moghadam (2009) have reported that *D. filaria* was the dominant and important parasite species as a cause of verminous pneumonia in goats.

The seasonal dynamics of *M. capillaris* showed that: in sheep, prevalences were highest in autumn and winter with 88.71% and 75.61, respectively. In goats, the highest rate was in autumn (87.5%) followed by winter and spring with an equal rate of 50%.

Regassa et al. (2010) suggested that as *M. capillaris* use intermediate host, factors which influence epidemiology of intermediate host indirectly determine epidemiology of the parasite as well. Moisture is considered to be an important factor in determining the survival and availability of land snails and slugs.

N. linearis was recorded for the first time in the study area only in sheep during autumn and winter. The results of a survey of lungworm infections in goats in the Middle Atlas and Rabat areas in Morocco during 1990-1992 are reported. The parasitological profile of protostrongylid species was represented by *Muellerius* (69-78%), *Protostrongylus* (16-25%) and *Cystocaulus* (5-6%) in the Rabat and Middle Atlas areas. *Neostongylus* was virtually non-existent (under 1%) in both regions (Berrag and Urquhart, 1996).

Conclusion

The present study revealed that lungworm infections in small ruminant was highly prevalent. *M. capillaris*, *P. rufescens*, *D. filaria* and *Neostongylus linearis* were the lungworms identified during the study. *M. capillaris* was found to be the significant highly prevalent lungworm in different season and especially in autumn and winter. So, the periods of high risk of infection by this small lungworms are rainy seasons. Hence, in light with these findings, the epidemiological factors influencing the seasonal fluctuations of lungworms are discussed and a time table of recommended treatments is suggested to increase productivity of small ruminants.

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