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Epidemiological Data Regarding the Distribution of Gastrointestinal Parasites in Albanian Small Ruminants

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ABSTRACT

Background: Gastrointestinal infection of small ruminants is becoming a real problem due to the resistance against anthelmintic treatment. These parasitic infections are prevalent among grazing ruminants and result in significant economic losses by reduced production. The aim of the study was to evaluate and estimate the total loud of parasitic infection is small ruminants, sheep's and goats from different farms located in Korça district.

Methods: This study investigates parasitic infections in sheep and goats across 40 farms situated in Korça district in southeastern Albania. The primary objective is to assess the prevalence of gastrointestinal parasites within feces samples from mature sheep and goats. In total, 121 feces samples were meticulously collected. Samples were analysed and processed using the Mini-FLOTAC technique in order to identify eggs and oocysts in each herd.

Result: The results of the investigation revealed the presence of *Strongyloides papillosus* in 45.45% of samples, *Ostertagia spp*. eggs in 40.9% of samples, *Monezia expansa* eggs in 27.2% of samples, *Dictiocaulus filaria* in 22.3% of samples, *Nematodirus spathiger* eggs in 13.2% of samples, *Haemonchus contortus* eggs in 13.3%, *Cooperia spp.* eggs in 9% of samples, *Trichostrongylus axei* in 9% of samples, Coccidian oocysts in 4.1% of samples and *Trichuris ovis* in 1.6% of samples.

Key words: Anthelmintic resistance, Gastrointestinal parasites, Small ruminants.

INTRODUCTION

Small ruminant plays a vital role in the traditional agricultural systems in the country farming and represent a source of income supporting economic activity in Albania. In addition to their contributions to meat and milk production, sheep and goats are integral to the conservation of Albanian mountainous landscapes and are closely associated with agro-tourism activities (MacDonald *et al.,* 2000). One of the principal challenges facing this economic sector is gastrointestinal helminthes infections, which are particularly widespread in grazing systems (Charlier *et al.,* 2020). Parasitic diseases have negative impact as direct losses related to acute illness and death and damage, condemnation of organs and cost of veterinary service and also indirect losses, including decreases in productive potentials, such as decreased growth rate, weight loss in young growing animals and late maturity of slaughter stock (Blackburn *et al.,* 2011). Moreover, subclinical infections, which can lead to delayed growth, decreased weight gain and reduced milk production, often receive less attention compared to more apparent health issues (Yusof *et al*., 2016).

Gastrointestinal parasites have become increasingly challenging to be managed in small ruminants due to the rising resistance of these parasites to various anthelmintics (Eke *et al*., 2019). The management of most infections typically relies on the frequent administration of anthelmintics whereas the declining efficacy of these drugs has raised significant concerns. Anthelmintic resistance in small ruminants has been documented in several studies worldwide (Domke *et al*., 2012; Manfredi *et al*., 2010; Zanzani *et al*., 2014; Holm *et al*., 2014; Kupèinskas *et al*., 2016; Schoiswohl *et al*., 2017; Brahma *et al.,* 2022). Over the past few decades, controlling these parasitic infections has predominantly relied on repeated anthelmintic use, and this treatment failure due to anthelmintic resistance underscores the need for a more judicious approach in the use of anthelmintic drugs (Charlier *et al*., 2022).

Small ruminants play an integral role in livestock farming in Albania and the effective management of parasites is of paramount importance. Gathering epidemiological data on

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parasite distribution is critical for identifying hotspots of infection, understanding the factors contributing to disease transmission, and implementing targeted control measures. Nevertheless, there is a lack of comprehensive and available data regarding the distribution of gastrointestinal parasites in Albanian small ruminants. Therefore, this gap in knowledge can be a hindrance to effective disease management and control. Consequently, there is a need for more research and data collection in Albania regarding the distribution of gastrointestinal parasites in small ruminants. Therefore, all collected data can serve as a useful tool to improve health and productivity of small ruminants and in developing effective parasite control strategies for the region.

In order to evaluate the distribution of gastrointestinal parasites the Mini-FLOTAC, which is considered as a novel diagnostic method based on egg flotation can be used. Previous research has demonstrated the superior sensitivity of Mini-FLOTAC compared to other methods, such as the McMaster method (Barda *et al*., 2013; Paras *et al*., 2018). Currently, it is considered one of the most effective coproscopic tools, offering a low operational cost, ease of handling and the ability to detect up to five eggs per gram of feces (Cringoli *et al*., 2013; Silva *et al*., 2013; Rinaldi *et al*., 2014).

Currently, the control of helminthes in Albania is based on the frequent utilization of anthelmintics. However, knowledge of the infection status of animals is often limited in these areas, a crucial piece of information for effective management. Hence, the aim of the current study is to evaluate the prevalence of internal parasites in small ruminants from Korça district.

MATERIALS AND METHODS

Fresh faecal samples were collected directly from the rectum of sheep and goats from Korça region. 121 pooled faecal samples were sampled from 28 sheep and 12 goat flocks, during the period (2022, October to 2023, May). Faecal sample sized from 10 to 20 gram. Immediately after collection faecal samples were placed in plastic bags and transported in cooling bag to the laboratory of Infection Diseases, Faculty of Veterinary Medicine, Agricultural University of Tirana. After arrival each sample was placed in a refrigerator in 2-4°C and analysed within 5 days. Samples coming from animals that suffered from any clinical condition two days after collection were excluded from the analyses. During sample collection the official veterinarians and owners were present to ensure the animal welfare and to protect them from any distress situation. Samples were analysed and processed using the Mini-FLOTAC technique in order to identify eggs and oocysts in each herd. The protocol used followed the manufacturer guidelines where after all procedures the solution were placed at the reading chamber, left fifteen minutes to rest and then observed under a light microscope using 100x and 400x magnification. Moreover, a questionnaire was developed to be filled from the farmers and official veterinarians in order to collect specific data regarding the region, farm location, age of the animals, breed, food, milking methods, health status, vaccinations, deworming programme and educational status of people working in the farm.

Statistical analysis

The association between animal species (sheep and goats) and herd positive to parasite infection was investigated using a Chi-square test (Agresti, 2012) for gastrointestinal and pulmonary parasitosis, fasciolosis, tick, flea, and scabies infection. Statulator, an online statistical tool, was used for the studies (Dhand and Khatkar, 2014).

RESULTS AND DISCUSSION

Geographical data regarding the region where sample were collected are presented in (Fig 1). In the map below, different regions are denoted by varying colors, highlighting the diversity of lakes, hills, foothills, mountains, western low plains and western mid plains within the region.

In total, there were 28 sheep farms with an average herd size of 176 animals and 12 goat farms with an average herd size of 89 animals. Twenty-four farmers only kept sheep while twelve farmers had only goats. Only four farmers had both sheep and goats. Approximately half of the herds are kept in extensive and stable conditions with and overall average of 0.35 animals per square meter and the animals are milked mainly by hand. During spring and autumn

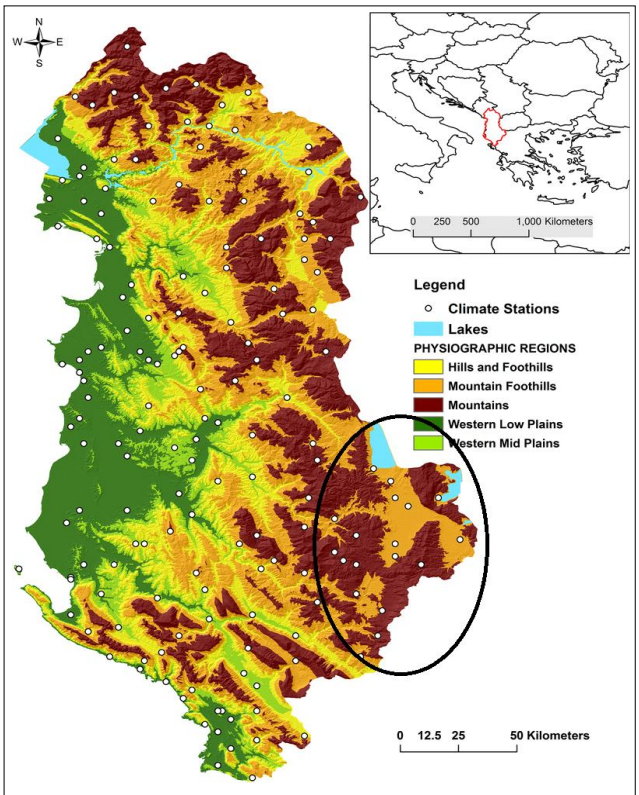

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Fig 1: Geographical features of the region.

animals graze freely outside in the pasture, while in winter the time for free grazing is limited to 8 hours a day. As suggested by the interviewed farmers, parasites are probably the main health problem, 100% of farmers reported the presence of intestinal parasites and ectoparasites (ticks, lice and fleas) as well as occasional cases of babesiosis transmitted by ticks. In general, all farmers treat their animals with antiparasitic drugs mainly twice a year and before calving. Goat flocks had an average herd size of 89 (range 41-185) and sheep flocks of 176 animals (range 18-510). All the sheep flocks (100%) and 9 of 12 (75%) goat's flocks resulted infected with gastrointestinal parasites.

The Mini-FLOTAC method used in this study offers qualitative and quantitative results, the egg counting determines the number of eggs per gram (EPG) in a stool sample and can be used in conjunction with other information to design and evaluate the effectiveness of an anthelmintic control program. All the farmers declared that parasites are the main health problem of the herds. Fecal analysis revealed that gastrointestinal strongylid nematodes were the most commonly identified parasites. *Strongyloides papillosus* was found in 55 (45.5.4%) samples, *Ostertagia spp.* eggs in 49 (40,9%) samples, *Monezia expansa* eggs in 33 (27.2%) samples, *Dictiocaulus filaria* in 27 (22.3%) samples, *Nematodirus spathiger* eggs in 16 (13.2%) samples, *Haemonchus contortus* eggs in 16 (13.3%), *Cooperia spp*. eggs in 11 (9%), *Trichostrongylus axei* in 11 (9%) samples, Coccidian oocysts were found in 5 (4.1%) samples and *Trichuris ovis* in 2 (1.6%) samples. Some of the parasites found during the analyses are presented in (Fig 2).

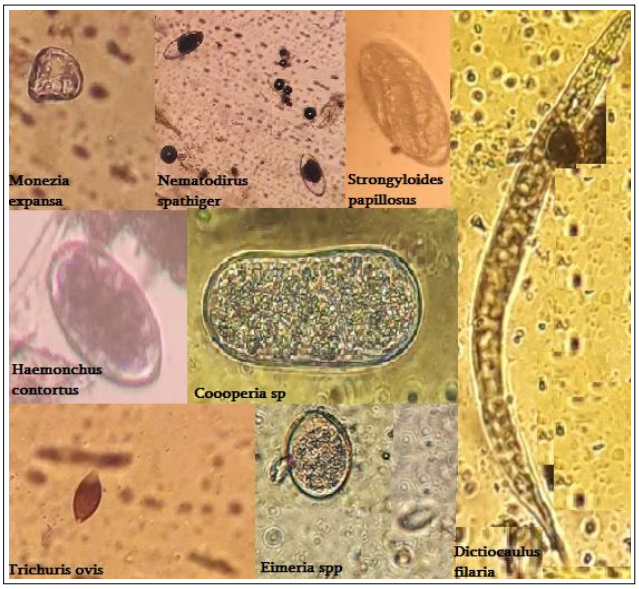

Fig 2: Microscopic image of different parasites eggs found in sampled animals.

Data regarding the prevalence of gastrointestinal species detected in sheep farms are presented in (Table 1). While, internal and external percentages of parasites found in small ruminants in Korça region are presented in (Table 2). Univariate assessments of several animal hosts and farm-related risk factors associated with small ruminant helminth infections displayed in Table 2, Table 3 provides additional univariate assessments of animal hosts and farm-related risk factors linked to small ruminant helminth infections.

The current study is the first to look into the factors that contribute to gastrointestinal parasite infections in sheep and goats in the Korça region. In practical terms, it means that the study's findings could be useful for farmers and managers of sheep and goat farms facing similar environmental conditions and following comparable management strategies. These findings may offer valuable guidance for improving the health, productivity, or overall performance of livestock in those areas. *Strongyloides,*

Table 1: Prevalence of gastrointestinal and pulmonary parasite species detected in sheep from Korça region.

Parasites	Positive herds	Prevalence % (IB 95%)
Strongyloides papillosus	55	45.5 (29.4-61.5)
Ostertagia spp.	49	40.9 (24.7-56.3)
Monezia expansa	33	27.2 (12.9-41.6)
Dictiocaulus filaria	27	22.3 (8.9-35.7)
Nematodirus spathiger	16	13.2 (2.3-24.1)
Haemonchus contortus	16	13.2 (2.3-24.1)
Cooperia spp.	11	9 (0.0-18.4)
Trichostrongylus axei	11	9 (0.0-18.4)
Eimeria spp.	5	4.1 (0.0-10.5)
Trichuris ovis	2	1.6 (0.0-10.2)

Table 2: Prevalence of internal and external parasites in small ruminant animals reared at Korça region.

Parasite infection	Goats		Sheep	
	Positive herds	Percentage%	Positive herds	Percentage %
Gastrointestinal parasitosis	5	41.7	17	70.8
Pulmonary parasitosis	2	16.7	13	54.2
Fasciolosis	4	33.3	12	50.0
Tick infection	5	41.7	2	8.3
Fleas	6	50.0	2	8.3
Scabies	2	16.7	3	12.5
Babesia infection	1	8.3	7	29.2

Table 3: Univariate assessment of several animal hosts and farm-related risk factors linked with small ruminant helminth infections.

Risk factor		N	n	Prevalence	Crude OR	CI	χ^2	P-value
Animal species	Herds							
Sheep	26	78	41	52.6%	1.68	0.78,3.63	1.78	0.182
Goats	14	43	15	34.9%				
Herd size	Herds							
<100	9	27	12	44.4%	0.87	0.34 - 2.24	0.08	0.772
100-200	16	48	23	47.9%				
>200	15	46	21	45.7%	1.1	0.49, 2.46	0.05	0.826
Total	40	121	56	46.3%				
Anthelmintic treatment	Herds							
	23	74	22	29.7%	0.16	0.07, 0.36	20.99	<0.001
	17	47	34	72.3%				
Age of farmer (years)	Group							
	30-50	36	21	58.3%	2.57	1.16,5.70	5.51	0.019
	>50	85	30	35.3%				
Educational level of farmer								
Basic level (Elementary school or lower)	27	87	47	54.0%	3.26	1.37, 7.80	7.46	0.006
High level (Middle school up to university)	13	34	9	26.5%				

The outcomes are shown as odd ratios (OR) and 95% confidence intervals (CI).

Ostertagia, Monezia, Dictiocaulus, Nematodirus, Haemonchus, Cooperia, Trichostrongylus and *Eimeria* were among the GI and pulmonary parasites found in sheep and goats at moderate to high prevalence.

In the current investigation, no significant risk factors for coccidian infections in sheep and goats were discovered. There was no evidence of a link between animal species and gastrointestinal parasites, although there is a link between pulmonary parasitosis and animal species. The sheep had 5.91 times the odds of the pulmonary parasitosis than goat herds (odds ratio 95% CI: 1.06, 32.92). Flea parasites were found higher rate on goats rather than sheep, and there was a positive relationship between fleas and animal species (P-value: 0.005). In the current study, the farmer's educational level was a major risk factor for parasite infections. It is well understood that the quality of the management-stock people team accounts for a considerable portion of the diversity in livestock production performance. The effectiveness of the management-stock people team is a critical factor in the success of livestock operations. Proper management practices, including the care, handling and husbandry of livestock, are essential for optimal production and animal welfare. The educational background and knowledge of farmers and farm workers are closely related to their ability to manage livestock effectively. A higher level of education can contribute to better decision-making, understanding of animal behavior and adherence to best practices. This highlights the potential negative consequences of poor stockmanship and management practices. Parasitic diseases in livestock can have a significant economic impact and affect animal health. Negligent practices can lead to the transmission and spread of such diseases, emphasizing the importance of proper management and hygiene.

This epidemiological investigation in the Korça region, it is the initial attempt to systematically study and identify risk factors for parasitic diseases in sheep and goats in this area. Such investigations are crucial for understanding and managing health issues in livestock. The investigation identifies specific risk factors associated with a higher prevalence of gastrointestinal (GI) helminth infections in sheep and goats. These risk factors include low educational levels among farmers, infrequent anthelmintic treatments (treatments to control internal parasites) and the age of the farmer (presumably older farmers being associated with higher risk). Education can play a vital role in helping farmers understand and implement best practices for parasite control in their livestock. The findings also indicate that the data from this investigation could be used to target high-risk farms not only in the Korça region but also in other areas with similar climatic conditions. This suggests that the knowledge gained from this study may be valuable in developing and implementing specific control measures for GI helminth parasites in sheep and goats in such regions. Top of Form Use of the multiple control strategies can reduce the risk of evolution of pathogen. Strategies to prevent anthelmintic resistance are described previously by other colleagues in Italy (Maurizio *et al*., 2023; Zanzani *et al*., 2014). Also the use of herbal anthelmintics can be an alternative that is cheap, safe and can overcome the problem of resistance with the presence of multitarget compounds (Liu *et al.,* 2020; Mares *et al.,* 2023; Barua *et al.,* 2023). Selective breeding for gastrointestinal nematodes resistance is considered the ultimate solution

for the problems of anthelmintic resistance (Jas *et al.,* 2023). Findings of this study are similar with different studies done by other researchers in the neighbour countries such as in Greece (Theodoridis *et al*., 2000; Papadopoulos *et al*., 2003; Kantzoura *et al*., 2012), Italy (Torina *et al*., 2004; Maurizio *et al*., 2021). Regarding our country, a study conducted by Gjoni *et al*. (2012) provides some data from Elbasani region concerning polyparasitism in small ruminants and their bronchopulmonary strongyles (Gjoni *et al*., 2012; Gjoni *et al*., 2013).

It has been very difficult finding data regarding gastrointestinal parasites for Montenegro, North Macedonia and Kosovo. However, some data regarding control measures and prevention of parasitic diseases from the veterinary service are found in the Law 113/2007 in North Macedonia, Law 2004/21 in Kosovo, Law 10465/2011 in Albania and Law 11/04 and 27/07 in Montenegro.

CONCLUSION

Most small ruminant herds are infected with a range of gastrointestinal parasites, the majority of which are co-infections in the Korça district. Parasitic infection was common among individual animals and across herds. Many parasite infections were age and location dependent, and were influenced by the sort of farming method and herd management. The present study provides data about the presence and prevalence of gastrointestinal parasites of small ruminants in Korça district in Albania. It suggests that improving the knowledge and skills of farmers and farm workers can lead to better management practices, which, in turn, can enhance livestock production, animal health and disease control. This epidemiological investigation highlights the importance of education and awareness among farmers as a means to reduce the risk of parasitic diseases in their livestock. The findings may have broader applicability to other regions with similar conditions, potentially helping to improve the health and productivity of sheep and goats in those areas. However further studies in Korça district and surroundings are warranted to confirm these data.

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Conflict of interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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