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# Prevalence and Risk Factors Associated with Gastrointestinal Parasites in Ruminants in the North Centre of Algeria

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**Abstract**

GASTROINTESTINAL parasitic infections represent a major problem in veterinary medicine, significantly affecting the productivity of ruminant livestock and compromising the economic viability of breeding systems worldwide. This epidemiological investigation, carried out between March and June 2023 on six farms in the Algiers region, aimed to assess the prevalence of intestinal parasites and to characterize their taxonomic distribution in ruminants. Qualitative coprological analysis using the flotation technique was carried out on 120 fecal samples, revealing an overall prevalence of infestation of 63.3%. Significant interspecific heterogeneity was observed, with infestation rates of 75.0% in goats, 67.5% in sheep and 47.5% in cattle. Parasitological characterization revealed a predominance of metazoan helminths (61.84%) compared with protozoa (38.15%). Stratified analysis according to biological determinants demonstrated sexual dimorphism in parasite susceptibility, with females showing a higher prevalence (69.86%). Distribution by age class revealed a significant downward gradient, with individuals under one year of age showing a significantly higher vulnerability (prevalences of 90.0%, 91.7% and 72.7% respectively in sheep, goats and cattle) than subjects over three years of age (prevalences of 44.4%, 55.5% and 21.4% respectively). These epidemiological data underline the importance of implementing parasite monitoring and control protocols differentiated by species, sex and age class, with particular attention to breeding females and young subjects, in order to optimize animal health and welfare while improving farm profitability.

**Keywords:** Gastrointestinal parasites, prevalence, risk factor, ruminants, flotation test.

## Introduction

The Algerian agriculture is one of the main sectors of National economy. Algeria attaches particular importance to this sector as a key pillar in achieving development objectives and as a catalyst for the government's efforts to improve living conditions and reduce unemployment rates [1]. The livestock farming structure varies according to agro-ecological zone: cattle farming predominates in coastal regions (72% of farms), while in cereal and steppe zones, there is a combination of sheep and cattle farming (75% of farms) [2-3]. The majority of cattle (59%)

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are concentrated in the East of the country. Regarding goats' statistics, The Algerian population comprises approximately 5 million of heads, unevenly distributed across various regions and diverse climatic and environmental conditions, primarily in steppe regions (41.1%), mountainous areas (28.8%), and Saharan regions (22.5%) [4]. However, livestock farming faces major challenges in terms of animal health, particularly gastrointestinal parasites, the economic cost of parasitism has led farmers to use substances intended to reduce parasite development [4].

The main gastrointestinal parasites identified in Algerian ruminants are nematodes; these cylindrical, non-segmented parasites have a complete digestive tract and reproduce sexually. Gastrointestinal strongyles, which develop in the abomasum and intestines, cause symptoms ranging from reduced performance to severe diarrhea in cases of massive infestations [5-3]. The economic cost of parasitism has led farmers to use substances aimed at reducing parasite development. The use of various pest control products to combat these harmful organisms has significantly increased. The evaluation of antiparasitic efficacy remains a key factor in improving livestock health and productivity [6-7].

Given the economic importance of the livestock sector in Algeria and the significant impact of parasitosis on animal productivity, it is crucial to develop effective strategies for the identification and control of these gastrointestinal parasites to optimize animal health and farm profitability. In this epidemiological study, we aimed to assess the prevalence of intestinal parasites and the associated risk factors in ruminants.

## Material and methods

*Study area*

The experimental work was carried out over a four-month period in Algiers, the Capital of Algeria. The farms included in the present study were randomly selected, located in six communes of the district of Algiers (Latitude: 36.7762, Longitude: 3.05997 36° 46′ 34″ North).

*Animals*

A total of 120 faecal samples (sheep, goats and cattle) from the six farms were collected (Table 1).

*Sampling*

One hundred and twenty (120) faecal samples were collected, with 40 samples for each animal species (sheep, goats and cattle). They were collected from diarrheic and non-diarrheic animals, either spontaneously or after stimulation of the anal orifice, in compliance with sanitary protocols. Each sample was placed in a sterile container labelled with information on the species, collection area, date of collection, sex and age of the animal. Samples were transported to the laboratory of Parasitology (Higher National Veterinary School of Algiers, Algeria) the same day and stored at +4°C.

Parasitological examinations were carried out macroscopically, followed by microscopic analysis after enrichment using the flotation technique.

*Coproscopic analysis*

It was used to detect intestinal parasites such as helminth eggs, protozoan cysts and oocysts, nematode larvae and cestode ovigerous segments.

*Macroscopic examination*

The aim was to assess the consistency and color of feces. The presence of blood, diarrhoea, mucus or steatorrhea can help guide the diagnosis. This examination can also be used to look for parasitic particles visible to the naked eye, such as adult worms.

*Qualitative method with enrichment (Flotation technique)*

Used to identify parasitic elements. The principle of this method is based on diluting the sample in a solution of high density, in order to concentrate parasitic elements of lower density on the surface of the liquid [3].

The faeces were crushed in a mortar to release the parasitic elements, then diluted in a dense NaCl solution of equal density 1.20 to obtain a homogeneous emulsion. Two filtrations were then carried out using a tea strainer to remove large debris. The filtrate obtained was poured into test tubes, care being taken to release any air bubbles on the surface before depositing the coverslips. The solutions were left to stand for between 10 and 20 minutes, depending on the height of the tubes, to allow the parasitic elements to float.

*Statistical analysis*

The Chi-squared test, utilizing a 95% confidence interval, was used to compare prevalence rates. Differences were considered statistically significant with a p value $\leq 0.05$.

## Results

*Flotation technique*

Coproscopic flotation analysis revealed that out of 120 samples (sheep, goats and cattle), 76 samples

were positive, representing an infestation rate of 63.33%.

*Overall infestation rate by species*

The results showed successive infestation rates of 67.5%, 75% and 47.50% in sheep, goats and cattle. These data revealed variations in infestation rates between the three species, with a higher prevalence in goats (Table 2).

*Prevalence by phylum*

The results show that among infected sheep, goats and cattle, 38.15% were infected by protozoa and 61.84% by metazoa. This indicates that most parasitized animals were infected by metazoans.

*Prevalence of parasites identified*

Eggs belonging to the nematode and cestode classes (metazoa) were identified, as well as oocysts (coccidia), which are protozoa.

Parasitic identification of eggs could only be carried out for genera, as most eggs were embryonated and the species was impossible to define (Figure 1).

**In sheep**

The results showed that this species was infested with *Haemonchus* sp. and strongyle eggs at infestation rates of 40% and 37.5% respectively. Coccidia were identified at a rate of 30%, while *Nematodirus* sp. was found in 17.5% of animals.

*Strongyloides* sp. and *Trichostrongylus* sp. infestations were found in 15% and 10% of sheep respectively. Finally, parasites such as *Moniezia* sp. (7.5%) *Ostertagia* sp. (5%) and *Chabertia* sp. (2.5%) were less prevalent in sheep (Table 3).

**In Cattle**

Among the parasites identified, *Haemonchus* sp. was the most frequent, with a prevalence of 30%, followed by 25% of animals infested with strongyles eggs.

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**In Cattle**

Among the parasites identified, *Haemonchus* sp. was the most frequent, with a prevalence of 30%, followed by 25% of animals infested with strongyles eggs.

*Prevalence by age*

The results obtained showed that animals aged less than one year have the highest rate of parasitism among the three animal species, with 90% in sheep, 91.7% in goats and 72.7% in cattle. For animals aged between 1 and 3 years, the rates were of 66.7% in sheep, 73.7% in goats and 53.3% in cattle. Animals aged over 3 years seemed to be less infested, with rates of 44.4% in sheep, 55.5% in goats and 21.4% in cattle (Figure 3).

Statistically, the association between age and parasitism is highly significant in sheep ($p < 0.001$) and cattle ($p < 0.001$), and significant in goats ($p < 0.01$).

*Prevalence by region*

The results of the study show that no positive cases were detected in the farm located in Bab-Ezzouar, among the 16 samples taken. Whereas in the commune of El-Harrach, 84.21% of cases were positive, indicating a high prevalence in this area. In Baraki, 83.33% of animals were infected, while in the commune of Birtouta, 77.27% of samples revealed parasitic infestation. In the Sidi Moussa region, 63.64% of cases were positive, representing a high prevalence but lower than in Birtouta and Baraki. Finally, in Saoula, 60.87% of cases were positive (Fig. 4).

Statistical analysis showed that region is a significant risk factor for parasitic infestation ($p < 0.001$).

## Discussion

In the current work, a high overall prevalence was detected, indicating that the majority of the animals studied were affected by gastrointestinal parasitosis. Our rate is higher than that reported in another study, estimated at 56.3% [8]. On the other hand, it is lower than that observed in Ghana, where a rate of 90.8% has been reported [9]. This difference could be attributed to environmental factors specific to the regions studied, including high levels of humidity and temperature variations, which favour parasite transmission.

For small ruminants, the present study revealed a prevalence of 67.5% in sheep and 75% in goats. These results are close to those obtained by Cai et al. [10] (55.7% in sheep and 91.6% in goats) and Asif et al. [11] (72% in sheep and 63% in goats); while Singh et al. [12] found that the ovine (85.16%) were more susceptible than caprine (79.24%).

Our study revealed a prevalence of 47.5% for gastrointestinal parasitic infections in cattle. In contrast, Gunathilaka et al. [13] reported a significantly lower prevalence of 11.56% among 163 cattle. Khan et al. [14] found a prevalence of 55.61%, indicating a notable increase compared to our rate. Furthermore, Marskole et al. [15] recorded a higher prevalence of 75%, suggesting a concerning trend in the susceptibility of cattle to parasitic infections. Collectively, these studies underscore the variability in prevalence rates of gastrointestinal parasites in cattle, highlighting the necessity for ongoing surveillance and targeted management strategies.

Variability in the prevalence of gastrointestinal parasites in ruminants may be influenced by specific factors related to each parasite and host. Some parasites are more prevalent in particular regions or during certain times of the year. Additionally, husbandry practices, such as herd management, grazing patterns, and the application of antiparasitic treatments, play a critical role in the prevalence of infestations [16]. However, the use of antiparasitic drugs poses challenges, as they can have side effects, be relatively toxic, and often lead to resistance among parasites. This resistance represents a significant concern, necessitating the search for new treatment strategies that are "not recognized" by parasites [17].

Our data showed that infestations caused by metazoa are more frequent than those caused by protozoa, with prevalences of 61.81% and 38.15%, respectively. These rates concur with those reported by Dey et al. [18], who observed a lower prevalence of protozoa, reaching 24.4% in sheep.

In this study, *Haemonchus* sp. and strongyles eggs were identified with prevalences of 40% and 37.5% respectively, which is in line with the findings reported by other authors whose association of these parasites is frequent in ruminants, due to their rapid reproductive capacity and mode of transmission via eggs present in the feces of infested animals [19-3].On the other hand, coccidia and nematodes (*Nematodirus* sp.) are widespread in young ruminants, particularly lambs, where they can cause severe intestinal lesions and inflammation [20-21].

Strongyles can cause severe respiratory disease and weight loss in farm animals. In this study, the *Strongyloides* sp species was identified in 15% of ruminants, in line with results obtained by other authors [18]. However, this parasite is generally more common in sheep [22]. Finally, parasitic species such as *Moniezia* sp., *Ostertagia* sp. and *Chabertia* sp. presented a lower prevalence, suggesting less frequent infestation by these parasites, which is also in agreement with other researches [18].

Regarding risk factors, the results showed that females have higher infestation rates than males. This result differs from those obtained by other authors [23-24-25], while the parasitism rate in males (91.3%) was higher than in females (57.4%) as found by Rahmani et al. [4] in Algeria and Khan et al. [14] in Pakistan who found a rate of 63.55% in males compared to 55.61% in females. Moreover, Singh et al. [12] reported that females (85.97%) were significantly more susceptible than males (69.23%).

This predisposition of females to parasitism could be linked to their immune status, particularly during gestation or lactation periods. Indeed, the immune system is weaker and less effective in combating internal parasites during these particular periods of their life cycle [24].

The highest infestation rate (90%) was found in animals under one year of age and 21.4% in animals over three years of age, highlighting a higher susceptibility to parasitosis in younger animals. These results are in agreement with other studies [26-27]. In contrast, our data are not in line of those found by Singh et al. [12] who reported that the adults (over 6 months) were more prone to parasitic infection as compared to young ones (under 6 months). This vulnerability can be attributed to

several factors, such as the immaturity of their immune systems, close contact with their mothers during lactation increasing the risk of exposure to parasites, as well as during grazing bringing the animals into contact with eggs and larvae in the soil [28-25].

The results showed a total absence of parasitism on the farm located in Bab Ezzouar. This could be attributed to the regular administration of antiparasitic treatments and rigorous health monitoring. In the other areas studied, prevalences ranged from 60.87% to 84.21%. In these communes, the majority of animals sampled had not received any preventive treatment. Studies have shown that appropriate treatments can significantly reduce the number of infesting eggs in the environment [29]. Data obtained indicate that the region is a risk factor, as reported by other studies which reveal that certain areas are highly endemic for gastrointestinal parasites [30].

**Conclusions**

Gastrointestinal parasites represent a major pathobiological challenge in ruminant farming worldwide, with a notable predominance of nematodes due to their ecological ubiquity. An epidemiological study of digestive parasitosis in sheep, goats and cattle carried out on six farms revealed a higher prevalence in goats. In addition, differential susceptibility was observed, with higher infestation in females compared to males, as well as higher rates in juveniles compared to adults. These data underline the pathogenic impact of gastrointestinal helminths on animal health, reproduction and zootechnical performance, resulting in substantial economic losses for livestock production systems. To mitigate these effects, it is imperative to develop targeted prophylactic and therapeutic strategies, including sustainable management of parasitic infestations to optimize animal health and the economic viability of farms. Continued scientific investigation in Algeria is essential to gain a deeper understanding of parasite dynamics. A large-scale longitudinal study would enable us to assess the influence of seasonal variations on the epidemiology of these parasites, in addition to the implementation of an individual traceability system for the identification.

To achieve a good therapeutic result and in order to improve hygiene in endemic farms, it is essential to:

-Manage livestock, ensuring adequate spacing and practicing grazing rotation;

-Maintain facilities by regularly cleaning pens and ensuring good drainage;

-Feed animals healthily by providing quality fodder and nutritional supplements;

-Ensure good health monitoring and disease prevention by guaranteeing regular checkups and implementing a deworming program;

-Train and inform farmers about parasitism and collaborate with veterinarians to establish health and vaccination protocols.

All these measures will contribute to maintaining a healthy environment for the animals.

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*Declaration of Conflict of Interest*

The authors declare that there is no conflict of interest.

*Ethical of approval*

All the animal studies were conducted with the utmost regard for animal welfare, and all animal rights issues were appropriately observed. No animal suffered during work. All the experiments were carried out according to the guidelines of the Institutional Animal Care Committee of the Algerian Higher Education and Scientific Research (Agreement Number 45/DGLPAG/DVA.SDA. 14).

**TABLE 1. Animals sampled by study region.**

| Parameters | Region | Animal population | | | |
|---|---|---|---|---|---|
| | | **Ovine** | **Caprine** | **Cattle** | **Total** |
| **Farms** | Bab- Ezzouar | 10 | 6 | 0 | 16 |
| | Baraki | 6 | 6 | 6 | 18 |
| | El-Harrach | 7 | 5 | 7 | 19 |
| | Sidi Moussa | 6 | 6 | 10 | 22 |
| | Saoula | 6 | 8 | 9 | 23 |
| | Birtouta | 5 | 9 | 8 | 22 |
| | Total | 40 | 40 | 40 | 120 |
| **Sex** | Males | 18 | 16 | 13 | 43 |
| | Females | 22 | 24 | 27 | 77 |
| | Total | 40 | 40 | 40 | 120 |
| **Age** | <1year | 10 | 12 | 11 | 33 |
| | 1year to 3 years | 21 | 19 | 15 | 55 |
| | >3years | 9 | 9 | 14 | 32 |
| | Total | 40 | 40 | 40 | 120 |

**TABLE 2. Global prevalence of infestation in sheep, goats and cattle.**

| Species | Samples (n) | Infested animals (n) | Prevalence |
|---|---|---|---|
| **Sheep** | 40 | 27 | 67.5% |
| **Goats** | 40 | 30 | 75% |
| **Cattle** | 40 | 19 | 47.5% |

**TABLE 3. Identification and prevalence of parasites by species.**

| | **Sheep** | | **Goats** | | **Cattle** | |
|---|---|---|---|---|---|---|
| **Identified parasites** | **Sample+** | **(%)** | **Sample+** | **(%)** | **Sample+** | **(%)** |
| ***Haemonchus* sp.** | 16 | 40 | 10 | 25 | 12 | 30 |
| **Strongyle eggs** | 15 | 37.5 | 9 | 22.5 | 10 | 25 |
| **Coccidia** | 12 | 30 | 8 | 20 | 9 | 22.5 |
| ***Nematodirus* sp.** | 7 | 17.5 | 6 | 15 | 8 | 20 |
| ***Strongyloides* sp.** | 6 | 15 | 5 | 12.5 | 4 | 10 |
| ***Trichostrongylus* sp.** | 4 | 10 | 4 | 10 | 2 | 5 |
| ***Moniezia* sp.** | 3 | 7.5 | 0 | 0 | 0 | 0 |
| ***Ostertagia* sp.** | 2 | 5 | 0 | 0 | 0 | 0 |
| ***Chabertia* sp.** | 1 | 2.5 | 0 | 0 | 0 | 0 |

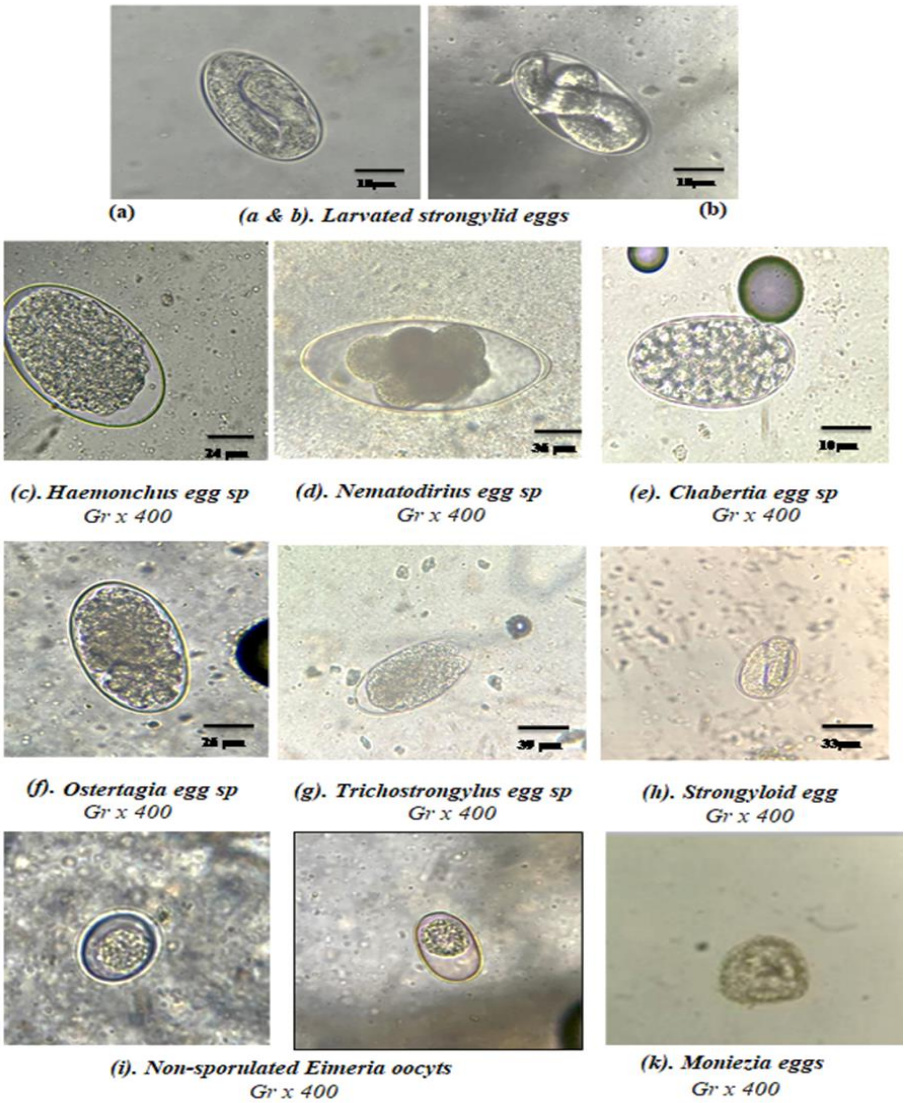


**Fig. 1. Parasite identified in cattle, sheep and goats (Gr 400x).**

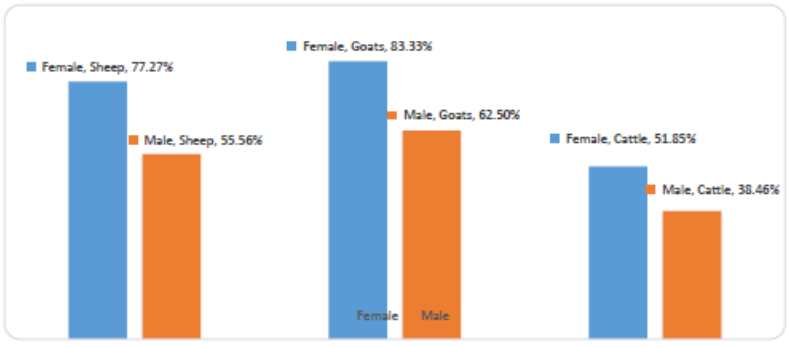


**Fig. 2. Prevalence of parasites according to sex.**

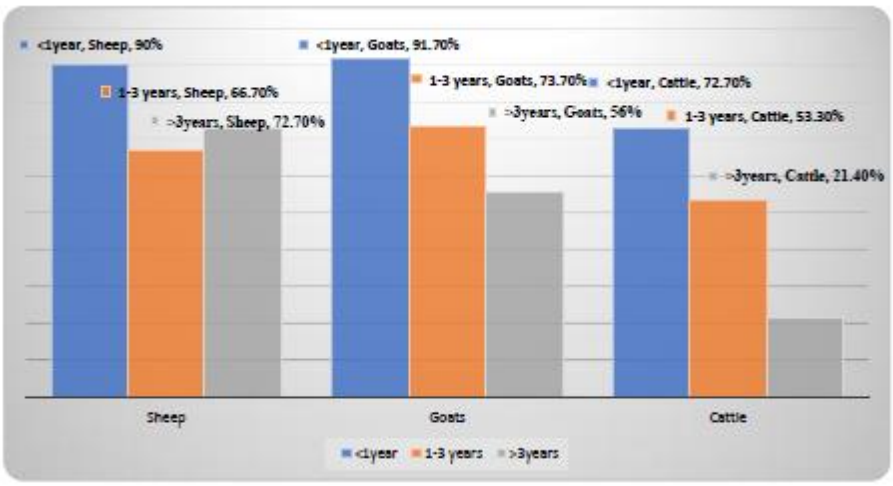


**Fig. 3. Prevalence by species according to age.**

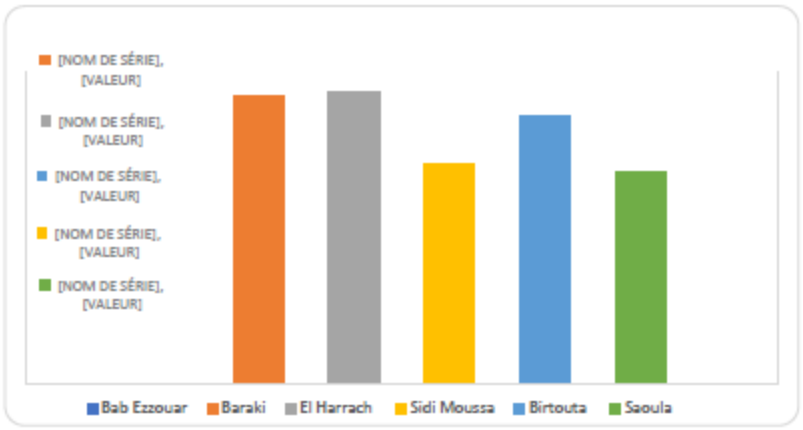


**Fig. 4. Prevalence according to area.**

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# انتشار وعوامل الخطر المرتبطة بالطفيليات المعوية لدى المجترات في شمال وسط الجزائر

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**الملخص**

تمثل العدوى الطفيلية المعوية النجمية مشكلة رئيسية في الطب البيطري، حيث تؤثر بشكل كبير على إنتاجية الماشية المجترة وتهدد الجدوى الاقتصادية لأنظمة التربية في جميع أنحاء العالم. يهدف هذا التحقيق الوبائي، الذي أجري بين مارس ويونيو 2023 في ست مزارع في منطقة الجزائر، إلى تقييم انتشار الطفيليات المعوية وتوصيف توزيعها التصنيفي في المجترات. تم إجراء تحليل برازي نوعي باستخدام تقنية التعويم على 120 عينة براز، وكشف عن انتشار عام للإصابة بنسبة 63.3٪. لوحظ عدم تجانس كبير بين الأنواع، حيث بلغت معدلات الإصابة 75.0٪ في الماعز و67.5٪ في الأغنام و47.5٪ في الأبقار. كشف التوصيف الطفيلي عن غلبة الديدان الطفيلية (61.84٪) مقارنة بالطفيليات الأولية (38.15٪). أظهر التحليل الطبقي، وفقًا للمحددات البيولوجية، ازدواجية في الشكل الجنسي في قابلية الإصابة بالطفيليات، حيث أظهرت الإناث معدل انتشار أعلى (69.86%). وكشف التوزيع حسب الفئة العمرية عن انخفاض ملحوظ، حيث أظهرت الأفراد الذين تقل أعمارهم عن عام واحد معدل تعرض أعلى بكثير (معدلات انتشار 90.0% و91.7% و72.7% على التوالي في الأغنام والماعز والأبقار) مقارنةً بالأفراد الذين تزيد أعمارهم عن ثلاث سنوات (معدلات انتشار 44.4% و55.5% و21.4% على التوالي). وتؤكد هذه البيانات الوبائية على أهمية تطبيق بروتوكولات رصد ومكافحة الطفيليات، متباينة حسب النوع والجنس والفئة العمرية، مع إيلاء اهتمام خاص للإناث المُربّية والفئات الصغيرة، من أجل تحسين صحة الحيوان ورفاهيته مع تحسين ربحية المزرعة.

**الكلمات المفتاحية**: طفيليات الجهاز الهضمي، معدل الانتشار، عوامل الخطر، المجترات، اختبار التعويم.