https://doi.org/10.52973/rcfcv-e35593 Revista Científica, FCV-LUZ / Vol. XXXV

Situation of gastrointestinal endoparasites in ruminants in an agropastoral region of Algeria (Djelfa): ocurrence and influence of risk factors

Situación de los endoparásitos gastrointestinales en rumiantes en una región agropastoral de Argelia (Djelfa): ocurrencia e influencia de los factores de riesgo.

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ABSTRACT

The objective of the present work was the research and identification of gastrointestinal endoparasites in ruminant livestock, as well as the study of the influence of certain risk factors on the prevalence of the endoparasites that have been identified. This study was carried out over a period of 8 months from October 2023 to May 2024 and on 300 fecal samples (100 cattle, 100 sheep and 100 goats). Coprological analyzes will be carried out using the flotation technique and the observation was made by an optical microscope. The results obtained showed that the overall infection rate is 47.67%. Depending on the parasites sought, the prevalences of *Fasciola hepatica* (*F. hepatica)*, *Eimeria* spp., Strongyle eggs, *Nematodirus* spp., *Dicrocoelium* spp., *Moniezia* spp. were 0, 26.33, 15.33, 4.33, 0.67 and 1% respectively. Statistical analyzes showed a clearly significant difference ($P < 0.001$) between the animal species for Strongyle eggs and a non-significant difference between the three animal species for the other parasites ($P > 0.05$). This results reflect the high prevalence of certain endoparasites in the three animal species studied, which constitutes a major risk to health and the level of animal production. In this case, the need to find adequate control measures against these parasitic diseases is mandatory in order to reduce its harmful impacts and preserve animal health.

Key words: Prevalence; endoparasites; ruminants; risk factors; Algeria

RESUMEN

El objetivo del presente trabajo fue la identificación de los principales endoparásitos gastrointestinales presentes en ganado rumiante, así como el estudio de la influencia de ciertos factores de riesgo en la prevalencia de los endoparásitos que han sido identificados. Nuestro estudio se llevó a cabo durante un período de 8 meses desde octubre de 2023 hasta mayo de 2024 y en 300 muestras fecales (100 bovinos, 100 ovinos y 100 caprinos). Se realizarán análisis coprológicos mediante la técnica de flotación y la observación mediante microscopio óptico. Los resultados obtenidos mostraron que la tasa de infección global es del 47,67%. Dependiendo de los parásitos buscados, las prevalencias de *Fasciola hepatica (F. hepatica)*, *Eimeria* spp., huevos de Strongyle, *Nematodirus* spp., *Dicrocoelium* spp., *Moniezia* spp. fueron 0, 26.33, 15.33, 4.33, 0.67 y 1% respectivamente. Los análisis estadísticos mostraron una diferencia claramente significativa ($P <0,001$) entre las especies animales para huevos de Strongyle y una diferencia no significativa entre las tres especies animales para los otros parásitos ($P > 0,05$). Nuestros resultados reflejan la alta prevalencia de determinados endoparásitos en las tres especies animales estudiadas, lo que constituye un riesgo importante para la salud y el nivel de producción animal. En este caso, la necesidad de encontrar medidas de control adecuadas contra estas enfermedades parasitarias se hace imperiosa con el fin de reducir sus impactos nocivos y preservar la salud animal.

Palabras clave: Prevalencia; endoparásitos; rumiantes; factores de riesgo; Argelia

Recibido: 19/12/2024 Aprobado :10/03/2025 Publicado: 02/05/2025

INTRODUCTION

Gastrointestinal parasitic diseases are often what are called zoonoses, i.e. diseases that can be transmitted between humans and animals which include various helminths (nematodes, cestodes, trematodes) and protozoan parasites (single-celled organisms) [1], are the main cause of economic losses in farm animals [2]. These infections present similar clinical symptoms ranging mainly from inflammation of the digestive tract, damage to the integrity of gastrointestinal tissues, nutritional disorders. These result in progressive weight loss, anemia, limited growth and development, slowed weight gain, reduced feed utilization efficiency, exhaustion and even death in sheep in severe cases [3 , 4]. It negatively affects the quality of skin, coat, meat and milk production while increasing breeding costs and decreasing economic benefits. This is also one of the main reasons why spring fatigue and thinness seriously hamper the development of sheep farming [4].

This study area, the Wilaya of Djelfa, has 3,353,800 sheep (*Ovis aries*), 22,100 cattle (*Bos taurus*) and 378,200 goats (*Capra hircus*) [5]. It is characterized by significant livestock breeding and a vast agropastoral territory. It is nationally recognized for its breeding and is the largest producer of red sheep meat.

The aim of this study was to research and identify thus estimate the prevalence of gastrointestinal endoparasites in cattle and small ruminants (sheep and goats) and to study the influence of certain potential intrinsic and extrinsic effects on the variation in prevalence rates of the endoparasites sought.

MATERIAL AND METHODS

Presentation of the study area

This study is carried out in Djelfa which, located in the heart of the steppe space, constitutes a transition zone between the high steppe plains of the Tell Atlas and the desert beginnings of the Saharan Atlas. It is delimited by: the wilaya of Médéa to the north, the wilaya of M'Sila to the northeast, the wilaya of Tiaret to the northwest, the wilaya of Biskra to the east, the wilaya of Laghouat to the southwest and the wilaya of Ouargla to the southeast. Its extreme geographic coordinates are: 33° and 35° north latitude and 2° and 5° east longitude (FIG. 1) [6]. It is characterized by a contrasting Mediterranean climate with a long hot and dry summer season and a cold and rainy winter season.

Animals and study period

Random sampling was carried out on 20 farms in the Birine and Hassi Bahbah regions of the wilaya of Djelfa during a period of 8 months (October 2023 to May 2024).

The feces were collected via a glove directly from the rectum or anus of the animals or just after emissions from each animal (upper part of the droppings). The samples were taken in individual bottles which were identified by self-adhesive labels on which the general information of the animal (age, sex, date of collection) was mentioned. The sample bottles were subsequently transported in a cooler to the analysis laboratory or stored in the refrigerator at a temperature of approximately +4°C for 4 to 7 days in a plastic or glass container and hermetically sealed. The ideal is for the stools to remain on the ground for less than 5 min to avoid external contamination by soil worms.

The search for endoparasites was carried out by coproscopic examinations at the Agropastoral Research Center (CRAPast-Djelfa) and at the Regional Veterinary Laboratory of Laghouat.

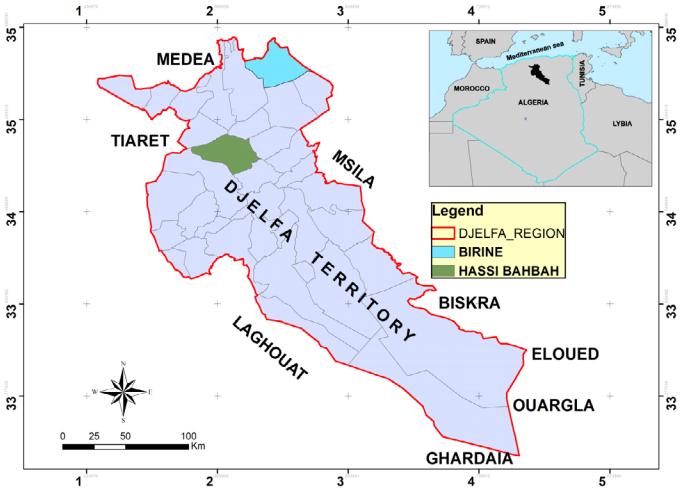

FIGURE 1. Geographic location of the study region

Coproscopic analysis method

First of all, a macroscopic examination allows the consistency and color of the stool to be assessed. The presence of blood, diarrhea, mucus or steatorrhea can guide the diagnosis.

The coproscopic method chosen is a flotation technique because it is inexpensive, the elimination of numerous debris which allows easy reading of the slide and the identification of numerous parasite eggs and oocysts. In addition, the blade being thin allows more precise identification of parasitic elements. At the same time, we used sodium chloride (NaCl) solution in the parasite analyses.

Firstly, 5 g of the fecal matter was deposited and a solution of (NaCl) was added up to the 75 mL graduation. Next, a sieve made from a colander is placed over a stemmed glass and the mixture is then filtered through the sieve to remove large debris. After placing a coverslip at the top of the tube and leaving it to rest on the rack for 15 to 20 min so that the parasitic elements rise and attach to the lower part of the coverslip, the coverslip is then placed on a slide for the reading under a microscope with x10 objectives to examine the entire slide and x40 to identify parasitic elements.

Statistical analysis and data processing

The prevalence of identified parasites was calculated by sex, age, animal species and study period or season.

Sex, age, animal species and season were used as sources of variation in risk factors.

Calculations were performed using Microsoft Office Excel® 2010 software.

To analyze the data statistically, we used the XLSTAT software (2009). The chi-square test was used to quantify the existence of a significant link at 5% (risk of error) and an association is considered significant when the p-value is less than 0.05.

RESULT AND DISCUSSIONS

Overall results and distribution of the prevalence rate of parasites according to the animal species affected

In light of the results obtained, it emerged that out of a total of 300 samples (100 cattle, 100 sheep and 100 goats), 143 samples were infected with the parasites that were identified (i.e. a rate of 47.67%).

The prevalence rate of *Eimeria* spp. was the highest (26.33%), than that of Strongyle eggs (15.33%) and that of *Nematodirus* spp. (4.33%), as well as, that of *Dicrocoelium* spp. and *Moniezia* spp. (0.67 and 1% respectively). However, no cases of *Fasciola hepatica* (*F. hepatica)* were identified (0%) (TABLE I and FIG. 2).

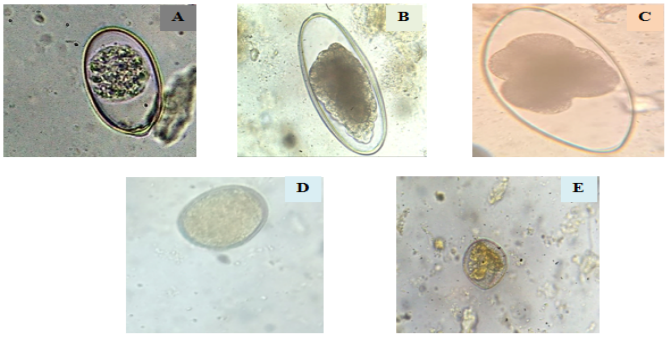

FIGURE 2. Some gastrointestinal endoparasites identified by coprological examination

A : *Eimeria spp.* ; B : Strongyle eggs ; C : *Nematodirus spp.* ; D : *Dicrocoelium spp.* ; E : *Moniezia spp.*

TABLE I. The overall prevalence of the six endoparasites studied in relation to three hundred animals examined (n=300) and its distribution according to each affected animal species

Parasites	Cattle n (%) (n=100)	Sheep n (%) (n=100)	Goats n (%) (n=100)	SA	Total
F. hepatica	0 (0%)	0 (0%)	0 (0%)	0	0 (0%)
***Eimeria* spp.**	31 (31%)	27 (27%)	21 (21%)	NSDa	79 (26.33%)
Strongyle eggs	27 (27%)	13 (13%)	6 (6%)	***a	46 (15.33%)
***Moniezia* spp.**	2 (2%)	1 (1%)	0	NSDb	3 (1%)
***Dicrocoelium* spp.**	2 (2%)	0	0	NSDc	2 (0.67%)
***Nematodirus* spp.**	5 (5%)	5 (5%)	3 (3%)	NSDd	13 (4.33%)
Total	67 (67%)	46 (46%)	30 (30%)		143 (47.67%)
SA	***b	***b	***b		***b

SA : Statistical analyzes, ***a : P = 0.00014, ***b : P< 0.0001, NSDa (Non-Significant Difference) : P= 0.271, NSDb (Non-Significant Difference) : P= 0.363, NSDc (non-significant difference): P= 0.134, NSDd (Non-Significant Difference): P= 0.725

Statistical analyzes showed a clearly significant difference ($P < 0.0001$) between animal species for Strongyle eggs and between all the parasites found, on the one hand, and on the other hand a non-significant difference between the three animal species for the other parasites ($P > 0.05$). Furthermore, the comparison between the parasites identified for each animal species showed the existence of a clearly significant difference ($P < 0.001$) for each animal species.

According to the results obtained, cattle are the most infected by the identified parasites, followed by sheep. While goats are lightly infected (or zero infestation) with the exception of *Eimeria* spp. where the infection is 21%. These results can be explained by several factors, however, it should be noted that cattle and sheep feed on grass in contact with the earth, which promotes the transmission of parasites.

On the other hand, in the majority of cases, goats prefer anything that is suspended and away from the ground, which can justify the reduction or even the absence of parasite attack. Furthermore, infection by these endoparasites is considered an important indicator of lack of inspection and preventive and curative treatment of animal species by veterinary practitioners.

According to the parasites, *Eimeria* spp. is the most identified species in the animals examined with prevalence rates of 31, 28, 21% respectively in cattle, sheep and goats. It remains lower than those found in Ethiopia where its prevalence rate was higher, reaching 45.0% in cattle and 58% in sheep [7]. Likewise, the prevalence rate in goats is significantly lower than that found in Ghana with a prevalence of 78.4% [8]. These differences can be explained by factors such as climatic conditions, livestock management practices and pasture quality. In fact, intestinal infections are more common in tropical countries due to favorable conditions for transmission [9]. The dry or semi-arid climate of the Djelfa region could help limit the spread of these parasites.

At the same time, the prevalence rate of Strongyle eggs is 27% in cattle, 13% in sheep and 6% in goats. It comes second after that of *Eimeria* spp. This indicates a notable prevalence in our region. In contrast, a study in Indonesia reported a lower prevalence rate of 4.67%, suggesting potential geographic variations in the distribution of *Strongyloides* spp. in cattle [10]. Furthermore, another study in Ghana reported a higher prevalence rate of 91.3% [8]. Similarly, for goats, a study conducted in Italy documented a much higher rate of 34% [11].

This variety of infection rates can be explained by factors linked to climatic conditions, management practices and quality of pastures present in the region concerned. These gastrointestinal infections are more common in tropical countries due to environmental conditions suitable for the transmission of helminths [9]. At the same time, the Djelfa region, with its dry or semi-arid climate, could offer a less favorable environment for the spread of certain parasites.

Distribution of parasite prevalence by sex

Table II represents the distribution of the prevalence rates of endoparasites obtained according to the sex of the animals.

Overall the female is more infected by the identified parasites (61.63%, i.e.: 53/86 for cattle, 51.56%, i.e.: 33/64 for sheep and 35.82%, i.e. : 24/67 for goats) compared to the male (36.11%, i.e.: 13/36 for sheep, 18.18%, i.e.: 6/33 for goats and 14/14 for cattle).

Statistical analysis showed a clearly significant difference ($P < 0.001$) between the parasites identified for females of each animal species. While for males, except for a clearly significant difference ($P < 0.001$) between the parasites identified for cattle, there is a non-significant difference ($P = 0.147$) between the parasites identified for goats and another significant difference ($P = 0.015$) between sheep parasites (TABLE II).

TABLE II. Distribution of parasite prevalence rates according to the sexes of affected animals

Parasites	Cattle n (%)		Sheep n (%)		Goats n (%)	
	(n=14)	(n=86)	(n=36)	(n=64)	(n=33)	(n=67)
F. hepatica	0	0	0	0	0	0
***Eimeria* spp.**	7 (50%)	24 (27.91%)	6 (16.67%)	21 (32.81%)	3 (9.09%)	18 (26.87%)
Strongyle eggs	7 (50%)	20 (23.26%)	4 (11.11%)	9 (14.06%)	3 (9.09%)	3 (4.48%)
***Moniezia* spp.**	0 (0%)	2 (2.33%)	1 (2.78 %)	0	0	0
***Dicrocoelium* spp.**	0 (0%)	2 (2.33%)	0	0	0	0
***Nematodirus* spp.**	0 (0%)	5 (5.81%)	2 (5.56%)	3 (4.69%)	0	3 (4.48%)
Total	14 (100%)	53 (61.63%)	13 (36.11%)	33 (51.56%)	6 (18.18%)	24 (35.82%)
Statistical analyzes	***	***	**	***	NSD	***

*** : P< 0.0001, ** : P= 0.015, NSD (Non-Significant Difference) : P= 0.147

Depending on the sex and the parasitic species, the exploitation of the results obtained made it possible to note that females are the most infected, in particular by *Eimeria* spp. and Strongyle eggs compared to males with predominance of cattle (61.63%) followed by sheep (51.56%) and finally goats (35.82%). Our results remain distinct from those obtained by Ekawasti *et al.* [12] in Indonesia in cattle who showed that the prevalence of Eimeriosis was higher in males (79.3%) than in females (51.9%). Furthermore, in goats, the results of our study showed that the infection rate was higher in females (26.87%) than in males (9.09%). These results are identical to those described by Mohamed *et al*. [13] in Egypt with prevalence rates of 59.02% in women and 24.76% in men. Likewise, for *Dicrocoelium* spp., females are more infected with *Dicrocoelium* spp. than males, with an infection rate of 2.33% in cattle. These results are not comparable to those of a study conducted by Shinggu *et al.* (2019) in Nigeria, who reported a higher incidence in males (83.3%) compared to females (80.3%). On the other hand, in sheep *Moniezia* spp. is more common in males (2.33%) than in females (0%). This result is slightly different from that observed in the study by Heydarian *et al.* [14], where the parasite was also more common in males (sheep: males 50%, females 49%). The authors attributed the higher infection rate in females to hormonal impalance during pregnancy and lactation. Furthermore, this divergence can be attributed to climatic differences which play a major role. The Djelfa region has an arid climate which limits the survival of parasite larvae on pastures.

Distribution of parasite prevalence rates according to the age group of animals

Regarding the age group, This results show that cattle aged less than 2 years were the most infected, with a prevalence of 84.61%. Furthermore, the statistical analysis always revealed a clearly significant difference ($P < 0.0001$) between the parasites studied (Table III). These results are identical to those announced by Ekawasti *et al.* [12] in a study conducted in Indonesia, where the distribution of results by age showed that the prevalence of Bovine Eimeriosis in calves (69.1%) and adult cattle (69.2%) presented a high prevalence of *Eimeria* spp. For sheep and goats, aged animals also recorded high prevalence rates of 51.35 and 71.43%, respectively. This is consistent with another study conducted in Egypt [15], where it was noted that older sheep were more susceptible to infection 60.5% compared to 54.5% in younger sheep. As for goats, the infection rate was higher among older ones, reaching 72%, compared to 45% among young ones [15]. Furthermore, this study shows that the oldest cattle are the most infected with *Dicrocoelium* spp., with a prevalence of 2.30%. This result is in agreement with the study by Chougar *et al.* [16], where of the 0.52% of positive cases, 0.25% were over 4 years old, 0.22% were middle-aged (2 to 4 years), and 0.05% were young (<2 years).

TABLE III. Distribution of parasite prevalence rates according to age groups of affected animals

Parasites	1. Age range for cattle	
	≤ 2 ans (n=13)	**> 2 ans (n=87)**
F. hepatica	0	0
***Eimeria* spp.**	6 (46.15%)	25 (28.73%)
Strongyle eggs	5 (38.46%)	22 (25.29%)
***Moniezia* spp.**	0	5 (5.75%)
***Dicrocoelium* spp.**	0	2 (2.30%)
***Nematodirus* spp.**	0	2 (2.30%)
Total	11 (84.61%)	56 (64.37%)
Statistical analyzes	***	***
Parasites	**2. Age range for sheep**	
	≤ 2 ans (n=63)	**> 2 ans (n=37)**
F. hepatica	0	0
***Eimeria* spp.**	14 (22.22%)	13 (35.13%)
Strongyle eggs	8 (12.70%)	5 (13.51%)
***Moniezia* spp.**	1 (1.59%)	0
***Dicrocoelium* spp.**	0	0
***Nematodirus* spp.**	4 (6.35%)	1 (2.70%)
Total	27 (42.86%)	19 (51.35%)
Statistical analyzes	***	***
Parasites	**3. Age range for goats**	
	≤ 2 ans (n=93)	**> 2 ans (n=7)**
F. hepatica	0	0
***Eimeria* spp.**	16 (17.20%)	5 (71.43%)
Strongyle eggs	6 (6.45%)	0
***Moniezia* spp.**	3 (3.22%)	0
***Dicrocoelium* spp.**	0	0
***Nematodirus* spp.**	0	0
Total	25(26.88%)	5 (71.43%)
Statistical analyzes	***	***

*** : P< 0.0001

Seasonal change in prevalence

The prevalence of parasites varies greatly depending on the study periods. The highest prevalence rate was reported in the fall (50%, i.e.: 50/100) with 87.5, 46.99 and 44.44% respectively for cattle, sheep and goats. In parallel, statistical analysis revealed a clearly significant difference ($P < 0.001$) between the parasites identified in sheep in the fall and in cattle and goats in the winter, as well as in cattle and goats in the spring, on the one hand, and, on the other hand, a significant difference ($P < 0.05$) between the parasites found in cattle in the fall. On the other hand, non-significant differences ($P > 0.05$) were recorded between parasites in goats, cattle and sheep in autumn, winter and spring respectively (TABLE IV).

TABLE IV. Seasonal evolution of the prevalence of identified parasites

	Autumn (n= 100)			Winter (n= 114)			Spring (n= 86)		
	CT n (%) (n=8)	SP n (%) (n=83)	GT n (%) (n=9)	CT n (%) (n=54)	SP n (%) (n=9)	GT n (%) (n=51)	CT n (%) (n=38)	SP n (%) (n=8)	GT n (%) (n=40)
F. hepatica	0	0	0	0	0	0	0	0	0
***Eimeria* spp.**	5 (62.5%)	24 (28.92%)	2 (22.22%)	12 (22.22%)	2 (22.22%)	12 (23.53%)	14 (36.84%)	1 (12.5%)	7 (17.5%)
Strongyle eggs	2 (25%)	10 (12.05%)	0	14 (25.93%)	2 (22,22%)	3 (5.88%)	11 (28.95%)	1 (12.5%)	3 (7.5%)
***Moniezia* spp.**	0	1 (1.20%)	0	0	0	0	2 (5.26%)	0	0
***Dicrocoelium* spp.**	0	0	0	0	0	0	2 (5.26%)	0	0
***Nematodirus* spp.**	0	4 (4.82%	2 (22.22%)	2 (3.70%	1 (11.11%)	1 (1.96%)	3 (7.89%)	0	0
Total	7 (87.5%)	39 (46.99%)	4 (44.44%)	28 (51.85%)	5 (55.55%)	16 (31.37%)	32 (84.21%)	2 (25%)	10 (25%)
	50 (50%)			49 (42.98%)			44 (51.16%)		
Statistical analyzes	**a	***a	NSDa	***a	NSDb	***a	***a	NSDc	***b

CT : Cattle, SP : Sheep, GT : Goats **a : P= 0.001, ***a : P< 0.0001, ***b : P= 0.0001, NSDa (Non-Significant Difference) : P= 0.092, NSDb (Non-Significant Difference) : P= 0.158, NSDc (Non-Significant Difference) : P= 0·470

Depending on the animal species, the result showed that the cattle are the most infected across the study seasons (87.5% in autumn, 51.85% in winter and 84.21% in spring) compared to sheep (46.99% in autumn, 55.55% in winter and 25% in spring) and goats (44.44% in autumn, 31.37% in winter and 25% in spring). In addition, *Eimeria* spp. was present in all study seasons, followed by Strongyle eggs which were only absent in goats in autumn. While *Dicrocoelium* spp. is rare and mainly found in cattle in spring, with a prevalence of 5.26%. This result is not consistent with data in Iran, where the highest percentage is found in summer (0.68%) [17]. These results obtained can be explained by numerous factors, such as the place where the animals were raised, the biotopes, the climate, the age or even the absence of an integrated pest management program [18]. At the same time, in this sense, the climate of the Djelfa region is Mediterranean type contrasted with a long dry and hot summer season and a rainy and cold winter season [19]. It is characterized by the existence of significant water resources giving the wilaya an additional advantage in the possibilities of its development. Different factors favor, across the territory of the wilaya, the creation of probably significant underground reserves. Surface resources are low. These different factors favoring the formation of underground reservoirs are mainly the structural context (synclines), the topography of the land (relative weakness of the slopes) and the water tables. There are, in the wilaya, six large layers, four of which are quite well known (Ain Ousséra layer, Oued Touil, Zahrez and the North and South synclines). The least known are those located in the southern part of the wilaya, the aquifer of the terminal complex and that of the continental intercalary; so many indicators of infection [20].

The lack or absence of any treatment by companions in the fight and an effective and serious vaccination strategy before the arrival of the seasons (spring-autumn) would favor the appearance of the condition and the increase in prevalence during these periods of two seasons [21].

Finally, it is interesting to know the prevalence of endoparasites in the three animal species, because they cause significant economic losses in meat and offal and can constitute a major risk for animal health.

CONCLUSION

Gastrointestinal parasites remain a major problem for breeders worldwide. The results of this study interestingly show the distribution of different gastrointestinal tracts in ruminants.

They confirm the importance of the attack on three animal species, especially cattle, by the five parasites identified, more particularly *Eimeria* spp. and Strongyle eggs. The overall infectation rate by identified endoparasites is 47.67%. This figure highlights the importance of monitoring and managing parasitic infections to maintain animal health and prevent disease outbreaks.

This results showed that *Eimeria* spp. was recorded the highest infection rate (26.33%).

It is therefore important to act on the life cycles of these parasites in order to control the transmission of the causative agents. In addition, awareness raising and popularization among breeders and other stakeholders in the sector is mandatory. All this would help to better fight against the three endoparasites and would also improve the production of meat and offal. Which ultimately provides benefits for the entire economy of the country.

Testing for endoparasites by stool analysis is an effective and commonly used method for several reasons. It allows easy access to samples and is inexpensive compared to other medical tests. As a result, the results of this study appear to provide a clear evidence base for developing better policies for preventive and curative processes against the disease, which poses a major threat to animal husbandry and the economy.

ACKNOWLEDGEMENT

Thanks are extended to all laboratory staff and breeders as well as all who participate in carrying out this work.

Conflict of Interest

The author state that do not have any conflicts of interest.

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