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(RESEARCH ARTICLE)

PREVALENCE OF GASTROINTESTINAL PARASITIC DISEASES IN SHEEP AND GOATS IN CERTAIN LOCALITIES OF THE URBAN COMMUNE OF BOUGOUNI IN MALI

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ABSTRACT

This study, conducted in the urban commune of Bougouni, involved 480 fecal samples collected from four localities (Yorola , Djerila , Faraguaran, and Menabougou) between October and December 2022. Samples were taken from male and female sheep and goats. They were analyzed using the modified MacMaster method, which allowed for the identification of parasite eggs belonging to the class Trichostrongylidea *and Trichuris . sp* and *Ascaris sp*); cestodes (*Moniezia sp*) and protozoa (*Eimeria sp*).

The fecal prevalence rates obtained by locality were as follows: Djérila 63.3%; Faraguaran 66.6%; Ménabougou 65.8%; and Yorola 39.2%, with an average of 58.7%. Regarding animal species, goats, with a prevalence of 81.1%, were more heavily parasitized than sheep (56%). As for sex, males were more heavily parasitized than females.

Estimation of fecal excretion levels based on OPG (eggs per gram of feces) showed that sheep had higher excretion rates (21 heavy cases/22) than goats (1 heavy case/22). The highest values for nematodes were 1850 OPG; for cestodes, 1250 OPG; and for coccidia, 8200 OPG.

Infestations were predominantly monoparasitic, accounting for 80% of cases, compared to 19.5% for polyparasitic infections. The *Trichostrongylidea/Coccidia oocyst association* represented 92.72% of polyparasitic infections; *Moniezia sp./Coccidia oocyst 3.64%; and finally, the Ascaris sp./Coccidia oocyst* and *Trichuris sp./Coccidia oocyst* associations each accounted for 1.82%.

Keywords: Gastrointestinal Parasitic Diseases, Sheep, Goats, Bougouni, Mali.

1 INTRODUCTION

Mali is essentially an agropastoral country, with a significant contribution of animal resources to the national economy and the well-being of the population.

Small ruminants have great economic importance linked to their fertility, fecundity, prolificacy and early maturity [1].

In the Bougouni region, the number of small ruminants is estimated at 535,649 sheep, 771,141 goats, 320,654 donkeys and 4,202,958 poultry [2].

However, in this area, the development of livestock farming, and in particular that of small ruminants, faces enormous constraints, especially of a sanitary nature and in particular parasitic. Several studies have shown that gastrointestinal parasites cause significant economic losses for farmers [3].

Small ruminant farming is an activity practiced by 95% of the local farmers [2].

Improving livestock farming requires not only better animal husbandry practices through proper nutrition, but above all, an appropriate strategy for controlling major health issues in general and parasitic diseases in particular. Studies conducted in Nigeria have shown that the epidemiology of gastrointestinal nematodes in livestock varies according to location, climate, season, and farming system [4]. In Mali, few studies have been conducted on the problem of infestation by gastrointestinal parasites [5, 6, 7]. These studies have addressed aspects related to seasonality and factors important for the development of eggs and free-living stages of gastrointestinal parasites, such as rainfall and humidity, especially in cold tropical zones.

In the Bougouni district (study area) located in southern Mali, with rainfall exceeding 1200 millimeters, few studies have been conducted on the problem of parasitic infestation in small ruminants. This study contributes to improving knowledge in the field of **" the local epidemiology of gastrointestinal parasitic diseases and their pathological importance in small ruminants"** .

2 MATERIALS AND METHODS

2.1 Study area

Below is a presentation of the map of the circle and the commune of Bougouni.

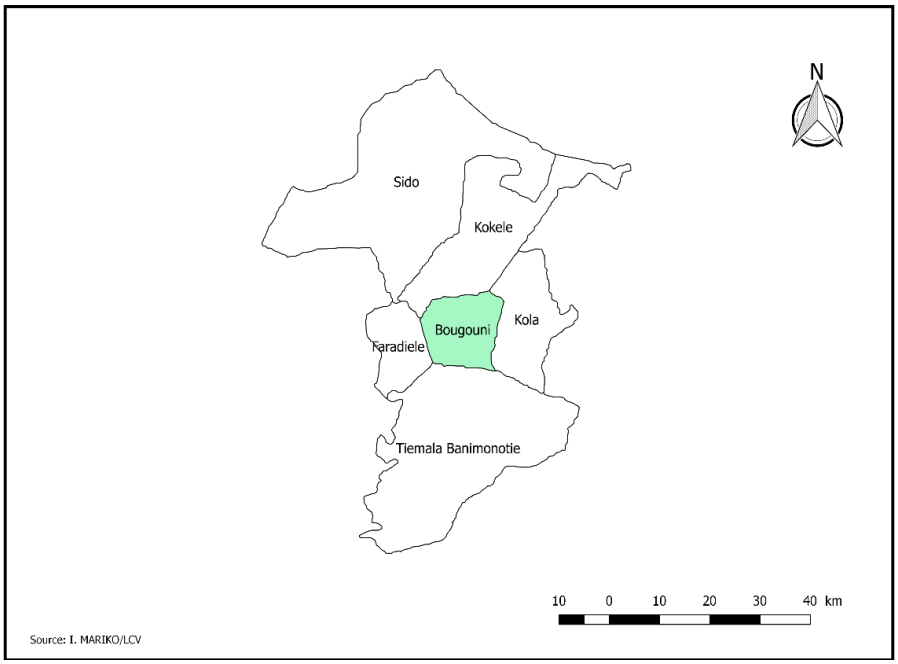

Figure 1: Map of the Bougou circle

The commune of Bougouni is bordered to the north by the commune of Kokéle and Dogo ; to the south by the commune of Tièmala-Banimonotiè ; to the west by the commune of Faradièlé and to the east by the communes of Kola and Zantièbougou .

It covers an area of 1500 km^2 before the decision to attach twenty (20) villages to the municipality. The climate is of the sub -Guinean type [8] with abundant rainfall (870.7 mm/year). It is characterized by two seasons: a dry season from October to April and a rainy season from May to September.

In terms of hydrography, there are two rivers: the Baoulé in the south and the Mono in the north. As for the vegetation **,** it consists of wooded savannas with large trees and tall grasses. The dominant species is *Vitelaria . paradox* (Shea), *Parkia biglobosa* (Nerea), *Tamarindus indicateur* (Tamarind tree), *Adansonia digitata* (Baobab), and *Khaya senegalensis* (Maize cedar).

2.2 Human environment

With an estimated population of 37,360 inhabitants [8], including 19,007 men and 18,353 women, representing a density of 17.3 inhabitants per km^2, the population is comprised of the Bamanan and Fulani peoples, who are spread throughout the commune. In addition to these, there is a minority group consisting of... Senufo, Miniaka ; Dogon, Songhai, Bobo and Soninke people scattered throughout the commune.

In the field of livestock farming, livestock products and by-products constitute an important source of income (milk, eggs, meat, hides and skins , organic manures) for farmers.

2.3 Target population of the study

Small ruminants (sheep and goats) constituted the target population of our study.

2.4 Sampling technique

A random sample was taken from four parks (one park per locality), chosen Depending on year-round accessibility, herd size, and farmer participation, fecal samples were collected from 60 small ruminants per visit in each enclosure, totaling 120 samples for both visits, per location and per enclosure. Small ruminant (sheep and goat) herd sizes in the enclosures ranged from 200 to 300 head. All samples (a total of 480 fecal samples) were collected between October and December 2022.

The choice of the four (04) sites or villages, namely: Yorola , Djerila , Faraguaran and Menabougou, was made in agreement with the supervisory service and on the basis of the criteria selected above.

2.5 Fecal sample collection and storage

Feces were collected from the rectum (*in-recto*). A quantity of 50g of feces was collected from each animal and placed in a sachet after receiving a few drops of 10% formalin (2 to 3 drops) allowing its preservation until the laboratory.

2.6 Laboratory analysis of samples

In the helminthology laboratory, after a macroscopic examination of consistency, color, the presence of segments or whole parasites, as well as mucus or blood, the fecal samples were analyzed using the modified MacMaster method. A 5g quantity was collected with a spatula. This quantity was then broken up and triturated. The mixture was placed in a beaker and then in 8 to 10 times its volume of a saturated 40% NaCl solution (density 1.2). The mixture was then filtered through a tea strainer (mesh approximately 0.5 mm in diameter) into another beaker. The resulting filtrate was then used to fill MacMaster slides and left to stand for 10 minutes.

The identification and counting of the number of eggs per gram of feces (OPG) for each parasite species were done using a binocular microscope with the x 10 objective.

2.7 Statistical analyses

Data obtained after microscopic examination of slides were considered to be a binomial distribution (0 and 1), with animals having at least 50 OPGs classified as infested (1). Prevalence was determined by calculating the proportion of animals with positive fecal samples out of the total number of animals sampled, according to location, species, age, and sex. Statistical analyses were performed using Stata software (version 12.0). The significance level was set at $\alpha = 0.05$.

3 RESULTS

3.1 Number of sheep and goats collected in the localities

Fecal samples were taken from 120 small ruminants, including sheep and goats. It should be noted that there were more sheep than goats in the study area. This is shown in Table 1.

Table 1: Status of fecal sampling by locality and animal species

Locality / species animal	Sheep	Caprine	Total
Menabougou	85	35	120
Yorola	120	0	120
Faraguaran	112	8	120
Djerila	110	10	120
Total	427	53	480

3.2 Coprological prevalence by locality

The results obtained have been recorded in the table below.

Table 2: Coprological prevalence by locality

Locations/status	Negative	Positive	Prevalence
Djerila	44	76	63.3
Faraguaran	40	80	66.6
Menabougou	41	79	65.8
Yorola	73	47	39.2
Total	198	282	58.7

Analysis revealed that the highest prevalence of fecal incontinence was observed in the locality of Faraguaran (66.6%) and the lowest in Yorola (39.2%), with an average prevalence of 58.7%. Statistically, the differences were significant among the four localities at the $\alpha = 5\%$ level, with a p-value of 1.147e-05.

3.3 Coprological prevalence observed by animal species

Considering the animal species variable, the prevalences obtained were reported in the figure below.

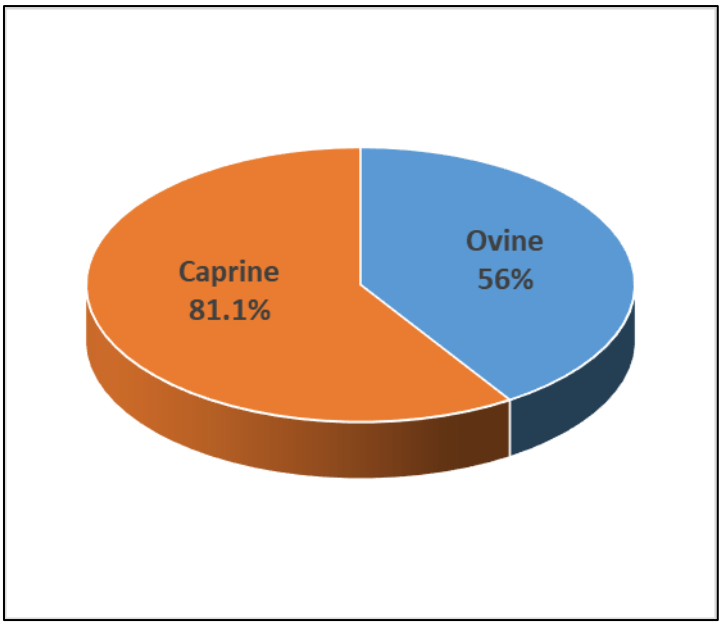

Figure 21: Coprological prevalence by animal species

On analysis, we see that goats (43 positive/53 sampled) were more parasitized than sheep (239 positive/427 sampled) with a coprological prevalence of 81.1% against 56% for sheep.

Statistical analysis showed a significant difference between species at the 5% threshold, with a P value of 0.0004492.

3.4 Coprological prevalence by sex

The values obtained according to sex are recorded in the figure below.

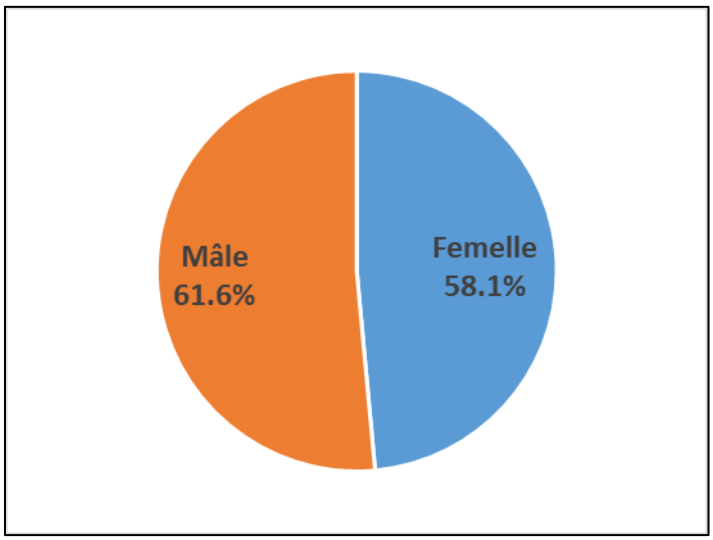

Figure 3: Sex-related coprological prevalence

In this study, males were more heavily infested (53/86 samples) than females (229 positive/394 samples), with a fecal prevalence of 61.6% compared to 58.1% for females . However, statistical analysis showed that this difference was not statistically significant at the $\alpha = 0.05$ level with a p-value of 0.05. = 0.5496 .

3.5 Estimation of parasite loads based on OPG (Eggs per gram of feces)

The determination was made according to the values considered:

- 50 to 200 OPG: low infestation
- >200 and ≤ 700 OPG: moderate infestation

- 700 OPG: heavy infestation

After counting, the majority of infested animals had low ovarian egg counts (OECs), with 217 out of 282 positive cases, 43 moderate cases, and only 22 severe cases. The highest parasite egg count was 1850 OECs for nematodes, 1250 OECs for cestodes, and 8200 OECs for coccidia (all observed in sheep). Considering the animal species, of the 22 severe cases, 21 were sheep and 1 was goats.

3.6 Types of parasitic association

Coproscopy enabled the identification of helminth eggs belonging to the class Nematodes (*Trichostrongylidea ,* etc.) . *Trichuris sp* and *Ascaris sp*); to the class of cestodes (*Moniezia sp*) and protozoa (*Eimeria sp*).

In relation to infestations, 80% were of the monoparasitic type (227 cases/282 positive) with a predominance of infestations due to coccidia; 19.5% were of the polyparasitic type (55 cases/282 positive), with the presence of coccidia in all parasitic associations.

The *Trichostrongylidea/Coccidia Oocyst association* represented 92.72%, or 51/55 cases of polyparasitism; *Moniezia sp/Coccidia Oocyst* 3.64%, or 2/55 cases. Finally, the *Ascaris sp/Coccidia Oocyst association* and *Trichuris sp/Coccidia Oocyst association* each represented 1.82%, or 2/55 cases.

4 DISCUSSION

Analysis of the coprological results from the different study locations (Djerila , Faraguaran , Menabougou , and Yorola) showed that Faraguaran had the highest coprological prevalence rate (66.6 %), while Yorola had the lowest (39.2%), with an average of 58.7%. Statistical analysis revealed that the differences in prevalence between the locations were significant at the $\alpha = 0.05\%$ level, with a p-value of 1.147e-05. Therefore, the origin of the animals influenced their parasitic infestation. As a possible explanation, in Faraguaran, despite the presence of a private veterinarian, the information gathered indicated that livestock farmers were reluctant to treat their animals, whereas in Yorola , farmers systematically dewormed their animals at least three times a year. The high coprological prevalences observed were linked to the sampling period which was between the end of the rainy season and the beginning of the cold dry season, a period when pastures were well supplied. This was supported by the statements of some authors [3, 9]: “Even if the rainy season was the most favorable climatic period for the external phase of parasite development in nature and the prime period for animal infestation, their prevalence and numbers would be at their maximum from the end of the rainy season (September) to the dry and cold period (December and January).”

In this study, goats with a coprological prevalence of 81.1% were more parasitized than sheep (56%), the same conclusions were obtained from other authors [10], who stated that " parasite prevalences seemed higher in goats than in sheep. However, the highest burdens were borne by sheep" and in our case, we have more sheep with heavy burdens based on OPG (21 heavy cases/22 cases) than goats (1 heavy case/22 cases).

In this study, the animal species variable influenced parasitic infestation (statistically significant difference), and in our case, goats were more heavily parasitized than sheep. However, several studies have demonstrated that sheep are more heavily parasitized than goats; notably [11], the authors obtained a coprological prevalence of 12% in sheep versus 9.1% in goats in Nigeria; in a study on the dominant helminth parasitism in ruminants in Maritime Guinea, authors [12, 1] stated that "extensive farming methods, herd management, and goat behavior on pasture appear to limit the risk of infestation and could explain the low parasitic intensity in most animals." In Mali, in rural areas and according to socio-economic and cultural considerations, sheep receive more attention and veterinary care than goats; This could explain the higher prevalence in goats than in sheep. The sample size (sheep: 427 and goats: 53) may also be a factor.

Regarding sex, the study showed that males were more frequently parasitized than females, although the differences were not statistically significant. However, some studies have shown that females are more susceptible to infestation compared to males.

coccidiosis infestations appear to predominate. And they are found in all parasitic associations. This is explained by the fact that in the Bougouni region, farmers, due to a lack of knowledge, use few or almost no anticoccidials in the deworming of small ruminants, but the emphasis is mainly on polyvalent dewormers. Furthermore, the climate of the study area (1200 mm isohyet) presents favorable conditions, in terms of humidity and temperature, for the development of coccidia oocysts.

Finally, the study found that Ascariasis, Monieziasis , and Trichuriasis were less frequent parasitic infestations in the study area. Their manifestations were less visible as diseases in small ruminants.

5 CONCLUSION

In the study area, observed parasite prevalence varied by locality and was higher in goats than in sheep, with no notable difference based on sex. These findings justify the development and implementation of a deworming program for small ruminants in the study area, with a particular focus on the use of anticoccidial agents.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare that they have no financial or personal relationships that could inappropriately influence or bias the results presented in this study.

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