World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Parasitological efficacy of albendazole against gastrointestinal nematodes in sheep in Central Côte d'Ivoire

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World Journal of Advanced Research and Reviews, 2026, 30(03), 685-690

Publication history: Received on 02 May 2026; revised on 08 June 2026; accepted on 10 June 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.30.3.1620

Abstract

This study evaluated the efficacy of albendazole against gastrointestinal nematodes in sheep in central Côte d'Ivoire, where parasitic infections constitute a major constraint to livestock productivity. Coprological analyses performed on 550 animals revealed an overall prevalence of 49.09% of gastrointestinal strongyles, with considerable variation among localities. A total of 382 sheep from 10 farms were treated with albendazole and monitored using the Fecal Egg Count Reduction Test (FECRT). The results showed 100% efficacy in seven farms, whereas reduced efficacy was observed in three farms, with reduction rates of 96.9%, 95.6%, and 70.8%, respectively. These findings suggest the emergence of resistance associated with the repeated or inappropriate use of albendazole. Regular monitoring of anthelmintic efficacy is therefore necessary to preserve the long-term effectiveness of these drugs.

Keywords: Albendazole; Sheep; Gastrointestinal Nematodes; Anthelmintic Resistance; Côte d'Ivoire

1. Introduction

Gastrointestinal strongyles are common intestinal parasites of sheep and can cause significant economic losses by reducing flock productivity through weight loss, anemia, decreased milk production, growth retardation, and increased mortality and morbidity (Eichstadt, 2017). Consequently, gastrointestinal strongyle infections represent a major obstacle to the development of small-ruminant farming, particularly sheep production, in humid tropical environments.

Indeed, warm and humid climatic conditions favor the development and survival of these parasites on pastures grazed by animals. Control of gastrointestinal strongyles relies mainly on the use of chemical anthelmintics. However, the relatively low cost of these drugs, combined with self-medication practices among farmers and the existence of informal drug distribution channels, constitute major risk factors for the emergence of resistant parasite strains (Apala et al., 2020; Emanfo et al., 2015).

Due to its broad-spectrum activity and relatively low cost, albendazole is one of the most widely used antiparasitic drugs in small-ruminant farming systems in rural areas of Côte d'Ivoire (Emanfo et al., 2022; Apala, 2022). Excessive use of this anthelmintic without professional veterinary guidance is a recognized risk factor for the development of resistance (Apala et al., 2020).

It is therefore essential to evaluate the efficacy of this molecule in order to optimize treatment strategies and monitor the potential emergence of resistance, thereby ensuring food security and the welfare of livestock in Côte d'Ivoire.

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To achieve this objective, a two-phase methodology was applied, consisting of field sampling and in vivo testing followed by laboratory analysis using the McMaster technique. The present study aimed to determine the reduction in parasite burdens in sheep following treatment with albendazole in farms located in the central region of the country.

1.1. Study area

The south-central zone of Côte d'Ivoire is characterized by relatively gentle topography dominated by plateaus with elevations below 400 m. The vegetation consists of a mosaic of forests, fallow lands, and cultivated plots. However, agricultural activities in this area have been significantly affected by climate change (Diomandé et al., 2013).

Originally confined to the northeastern quarter of Côte d'Ivoire, the area receiving less than 1,200 mm of annual rainfall now extends into the south-central region as far as the latitude of Tiassalé (Brou et al., 2005).

The greater central region also presents relatively smooth relief, consisting of stepped plateaus ranging from 200 to 500 m in altitude and separated by low escarpments measuring 10–30 m in height. The landscape belongs to the Guinean pre-forest district and is characterized by patches of forest interspersed with extensive savanna formations separated by gallery forests (Vennetier & Laclavere, 1983; Konaté & Kampmann, 2010).

The hydrographic network includes small coastal rivers and tributaries of the Black Volta and Niger Rivers. During the study period in 2018, annual rainfall recorded in the Toumodi area reached 1,035 mm. Mean monthly temperatures ranged from 25.9°C to 29°C, while relative humidity varied between 73% and 76%.

The dry season extended from January to March and from November to December, whereas the rainy season lasted from March to October, with a marked decrease in rainfall observed in August (Figure 1).

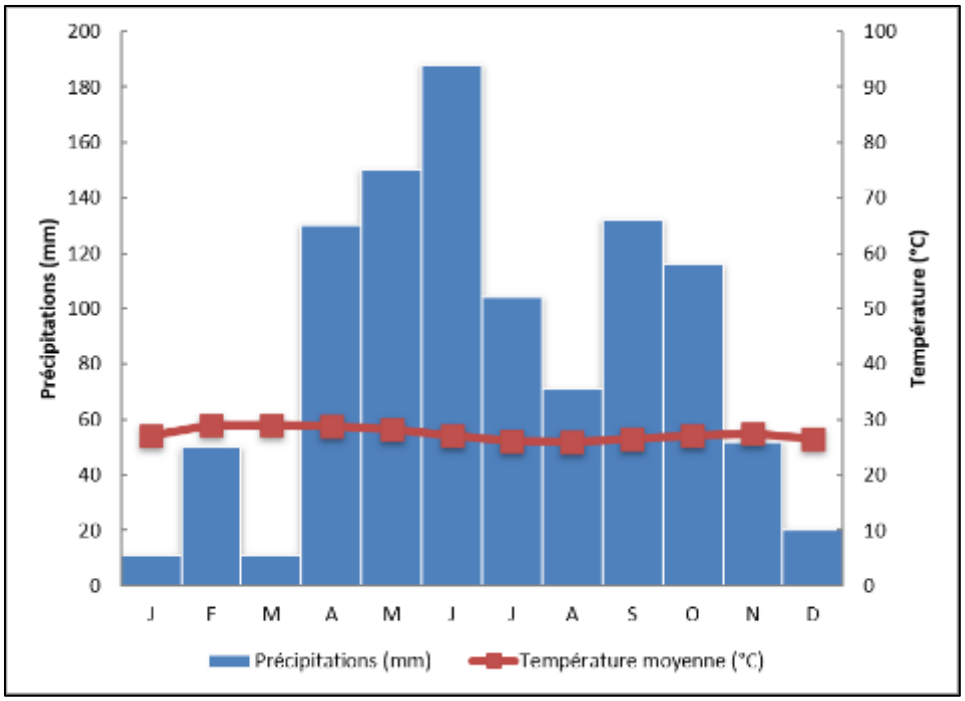

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Figure 1 Mean monthly temperature and rainfall in the Toumodi area in 2018 (SODEXAM, 2018)

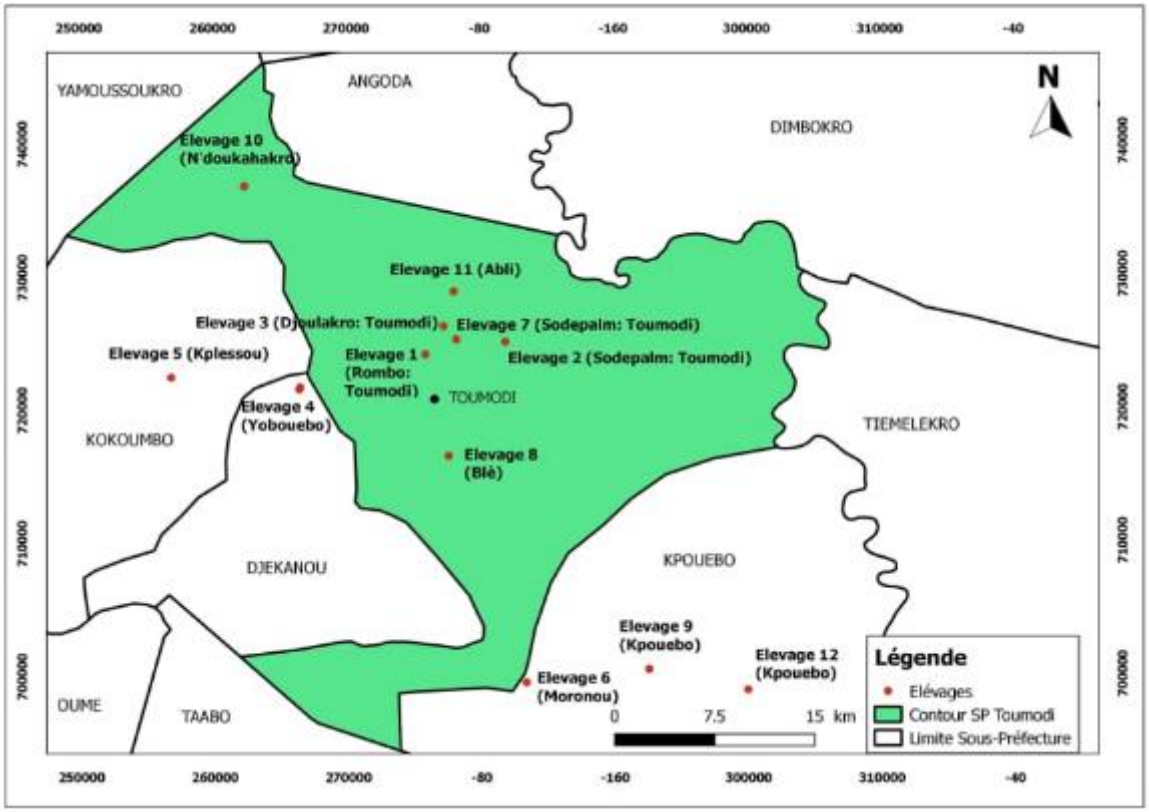

Figure 2 Study Area

2. Materials and methods

2.1. Biological Material

The biological material used in this study consisted of fecal samples collected from sheep in each farm. Sampling and deworming equipment included a cooler containing ice for preserving parasite eggs present in the feces, 20-mL syringes for administering the anthelmintic treatment, and a weighing scale used to determine the body weight of individual animals.

2.2. Farm Selection

Only farms whose animals had not received any anthelmintic treatment during the two months preceding the socio-economic survey were included in the study.

2.3. Fecal Sampling and Deworming Procedure

Fecal samples were collected directly from the rectum of each animal in order to avoid contamination from soil or other environmental substrates. The samples were stored in an ice-filled cooler and transported to the laboratory to prevent egg development before analysis.

Selected animals were individually weighed to determine the appropriate dose of anthelmintic according to the manufacturer's recommendations and were marked with paint for identification purposes.

A total of 382 sheep from 10 farms located in the Toumodi area were included in the efficacy trial.

The fecal egg count determined on Day 1 was recorded as FEC1. On the same day, animals were treated with the anthelmintic under evaluation. Ten days after treatment, a second coprological examination was conducted on the same animals, and the fecal egg count obtained was recorded as FEC2. The interval of 10–11 days was considered sufficient to allow the elimination of dead worms while minimizing the risk of reinfection.

The Fecal Egg Count Reduction (FECR) percentage was calculated according to the following formula:

FECR (%) = 100 × (1 − T2/T1)

where T1 and T2 represent the arithmetic mean fecal egg counts before (FEC1) and after treatment (FEC2), respectively (Mejia, 2003).

Data were entered into Microsoft Excel 2010 and analyzed using Stata version 9.1 (StatCorp, College Station, Texas, USA) to calculate the percentage reduction achieved by the tested active compound.

The results were interpreted according to the recommendations of the World Association for the Advancement of Veterinary Parasitology (WAAVP) (Coles et al., 1992). Anthelmintic resistance was considered present when the percentage reduction was below 95% and the lower limit of the 95% confidence interval was below 90%. When only one of these criteria was met, resistance was considered suspected.

3. Results

Coprological examinations conducted on all 550 animals revealed that nearly half of the sheep (49.09%) harbored at least 50 strongyle eggs per gram of feces.

The prevalence varied considerably among localities, ranging from 17.28% to 83.33%. The highest prevalence rates were observed in Yobouekro, Moronou, and Abli, where values ranged from 76% to 83%. In contrast, Kpouebo recorded the lowest prevalence (17.28%). Intermediate prevalence levels (40–54%) were observed in Toumodi, N'doukahakro, Kplessou, and Blé (Table 1).

Albendazole achieved a fecal egg count reduction of 100% in seven farms (Nos. 1, 2, 3, 5, 7, 9, and 12). Reduction rates of 96.9%, 95.6%, and 70.8% were observed in Farms 6, 8, and 11, respectively (Table 2).

Table 1 Prevalence of Gastrointestinal Strongyles in Sheep According to Locality

Locality	Sample Size (n)	Prevalence (%)	Standard Error	95% Confidence Interval
Abli	28	80.00	8.11	63.14–96.85
Blé	85	54.43	5.63	43.20–65.65
Kplessou	35	53.33	9.26	34.38–72.80
Kpouebo	91	17.28	4.22	8.87–25.69
Moronou	28	76.00	8.71	58.00–93.99
N'doukahakro	30	40.74	9.63	20.93–60.54
Yobouekro	35	83.33	6.92	69.17–97.48
Toumodi	218	47.97	6.92	40.96–54.99

Table 2 Efficacy of Albendazole Against Gastrointestinal Strongyles in Sheep

Farm	Mean FEC Before Treatment	Mean FEC After Treatment	Reduction (%)
1	667	0	100
2	225	0	100
3	177	0	100
5	125	0	100
6	938	12.5	96.9
7	170	0	100
8	286	8.8	95.6

9	250	0	100
11	280	29.2	70.8
12	450	0	100

4. Discussion

The coprological survey revealed a generally high prevalence of strongyle eggs among sheep in the study area. Similar findings have previously been reported in sheep and goat farms in Côte d'Ivoire by Komoin-Oka et al. (1999), Achi et al. (2003), Emanfo et al. (2015), and Apala (2022).

These high infection rates can be explained, on the one hand, by environmental conditions favorable to larval development and survival, including temperature, rainfall, and humidity. The increase in parasite populations within hosts is strongly influenced by ambient temperature and moisture. Central Côte d'Ivoire is characterized by temperatures ranging from 25 to 29°C and relative humidity levels exceeding 70%, conditions known to favor the development and transmission of gastrointestinal parasites (Paturel et al., 1995; Kouassi et al., 2010; Gbocho et al., 2015).

On the other hand, sheep farming in central Côte d'Ivoire remains predominantly traditional, accounting for nearly two-thirds of livestock production systems. Although improvements in farm management have been observed, several husbandry practices still promote parasite transmission. Clinical signs such as weight loss, reduced appetite, and sudden mortality—commonly associated with parasitic infections—were observed across all identified production systems. These findings indicate that many sheep farmers have not yet achieved optimal control of animal health management practices (Apala, 2022).

A reduction in albendazole efficacy was observed in three farms. The widespread availability, broad-spectrum activity, and relatively low cost of benzimidazoles, particularly albendazole, have made them the most commonly used anthelmintics for controlling gastrointestinal strongyles in small ruminants in Côte d'Ivoire (Emanfo et al., 2015). Consequently, management practices can directly influence parasite susceptibility to anthelmintic treatments.

Farm 11, where animals were routinely treated every month with the same active compound, exhibited a marked reduction in albendazole efficacy. In contrast, Farms 2, 7, and 12 regularly weighed animals before treatment, allowing accurate dose calculations and proper administration of the drug. Furthermore, these farmers reported implementing quarantine measures for newly purchased animals before introducing them into the flock. Such management practices may explain the high treatment efficacy observed in these farms.

5. Conclusion

The present study highlights the high prevalence and substantial parasitic burden of gastrointestinal helminth infections in sheep within the study area, confirming the major impact of these diseases on the productivity of extensive tropical livestock systems.

The assessment of prevalence and fecal egg count reduction provided an integrated evaluation of the efficacy of albendazole treatment. In vivo resistance tests indicated that gastrointestinal nematodes remain generally susceptible to albendazole. Nevertheless, reduced efficacy was detected in several farms, suggesting the possible emergence of anthelmintic resistance.

This decline in efficacy may be attributed to the excessive use of albendazole, often without prior parasitological diagnosis, as well as to the failure to respect recommended dosage regimens. These findings should be considered an early warning signal.

Veterinary services and governmental authorities should therefore implement a national parasite control and monitoring program to limit the development and spread of anthelmintic resistance, since once established, resistance is largely irreversible.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that there are no conflicts of interest that could have influenced the results or interpretation of the data presented in this study.

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