Original Article

Farm management practices associated with gastrointestinal nematodes of small ruminants in Suleja Local Government Area of Niger State, Nigeria

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Submitted: August 2025; Accepted: December 2025; Published: December 2025

ABSTRACT

The study was carried out to determine the influence of farm management practices on the prevalence of Gastrointestinal Nematodes (GIN) of small ruminants in Suleja Local Government Area of Niger State Nigeria using centrifugal floatation technique and Questionnaire survey. Out of 700 samples examined, an overall prevalence of 29.00% was recorded with Goats having the highest prevalence (29.64%) as compared to Sheep (28.32%) and the difference was not statistically significant (P>0.05). Farmers that attended only primary (80.88%) and no formal education (61.54%) had ruminants that were more infected than secondary (31.25%) and tertiary education (5.26%) farmers and the difference was statistically significant (P<0.05). Farmers who did not deworm (37.92%) had the highest frequency of GIN among the ruminants than those who practiced deworming (22.39%) and the difference was statistically significant (P<0.05). Farmers who clean weekly (42.33%) had ruminants that were more infected than those who clean daily (19.0%) and the difference was statistically significant (P<0.05). Farmers who use well (39.41) had ruminants that are more infected than those using borehole (24.51%) and river (17.86%) as their source of water for the small ruminants and the difference was statistically significant (P<0.05). Farmers who had regular veterinary supervision (13.82) had ruminants that were less infected than those with irregular veterinary supervision (43.33%) and the difference was statistically significant (P<0.05). Results of this study shows that farm management practices greatly affect the prevalence of GIN in small ruminants. Hence improvement in the management practices, education of farmers on the use of anthelmintics and the importance of veterinary supervision will help prevent and control the transmission of GIN.

Keywords: Management, Gastrointestinal, Parasites, Ruminants, Suleja, Niger

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INTRODUCTION

Livestock farming plays a crucial role in socio-cultural and economic well-being for many households, including agricultural diversification, income, food security, saving and employment, transport, soil fertility, traction, and sustainable agricultural production [1]. Infection by Gastrointestinal parasites (GIPs) is described as a major setback by many small ruminant farmers worldwide as it hinders production [2]. Several studies address the challenges of small-scale farmers in Africa and maintain that nematodes and coccidia are highly affecting small stock production [3,4] Gastrointestinal Nematodes significantly affect sheep and goat production and reproductive performance [5]. Their epidemiological patterns rely on the factors related to the parasite-host such as host nutrition, poor hygiene and sanitation [6]. Various environmental factors associated with Gastrointestinal Nematodes are agroecological conditions, livestock practices, housing system, deworming schedules and grassland management [7]. The susceptibility of animals to various Gastrointestinal parasites is attributed to factors such as unsanitary living conditions, inadequate treatment, close contact with pathogenic animals and harsh climatic conditions [8, 9]. Environmental factors and lack of awareness among animal owners further increase parasitic infections [10]. Among these Gastrointestinal parasites, the most common parasites infesting the livestock are *Hemonchus contortus, Ascaris, Strongyloids, Trichostrongyliods, Ostertagia, Trichuris, Dictyocaulus, Trichnellia, Enterobius, Cooperia, Gunagylonema, Chabertia, Oesphagostomum* [11].

MATERIALS AND METHODS

Study Area

This study was carried out in Suleja Local Government Area of Niger State, Nigeria.Suleja lies within latitude 9°17'48"N and 9°06'07" and longitude 7°08'27"E and 7°14'08"E. The town is situated on the Iku River a minor tributary of the Niger river at the foot of Abuchi Hill and lies at the intersection of several roads. Suleja local government is bounded by the Federal Capital Territory to the South, Gurara LGA to the West & North and Tafa LGA of Niger State to the East. Suleja covers a total land mass area of 118,910 Sq.km with 2142 Density/Square kilometre Figure 1 [12]. The area is covered by two major rock formations: the sedimentary and basement complex rocks. The sedimentary rocks (Bida basin) to the south are characterized by sandstones and alluvial deposits, particularly along the Niger valley and in most parts of Niger state while the Basement Complex comprises of migmatites, gneisses, schists, migmatite-gneiss and granite [13] of the Birnin-Gwari Schist and Kushaka Formation.

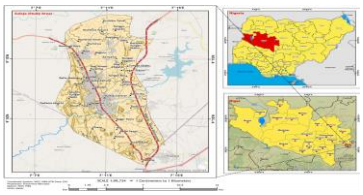


Figure 1: Map of Niger State showing Suleja local Government Area

Sample size determination

The sample size was determined by the formular by [14] at 95% confidence level and 5% absolute precision and considering 50% estimated prevalence.

The calculated sample size was 384. However, to increase the precision of the study, the sample size was increased to seven hundred (700)

Farm selection and Study animals

The study farms were selected based on having availability of small ruminant animals and farmers willingness to participate in the study. The animals were indigenous Sheep and Goats that are kept under traditional and extensive management system and owned by small holder farmers and selected by simple random sampling.

Sample and data collection

A total of seven hundred (700) fresh faecal samples were collected directly from the rectum of three hundred and thirty-nine (339) Sheep and three hundred and sixty-one (361) Goats. The faecal samples collected was placed in a universal sterile bottle and transported to Department of Entomology and Parasitology, Faculty of Veterinary Medicine, University of Abuja (A.K.A. Yakubu Gowon University), Abuja, Nigeria for laboratory analysis. A preliminary survey was carried out prior to sample collection to sensitize farmers on the objectives of the study. A well-structured questionnaire was administered to the respondents (Sheep and Goats owners) whose animals were examined in order to collect information regarding the types of animals kept, flock size, education level of the farmers, source of water, use of anthelmintics, type of anthelmintics, veterinary visit, cleaning frequency and knowledge on nematode infections.

Examination of Faecal Samples

The method employed was the floatation technique described by [15]. Floatation technique assumes that Nematode eggs will float to the surface of the floatation medium. About 2g of faeces were crushed using sterile swab stick to break the faeces which in most cases were in pellets so as to give a solution. After obtaining a homogeneous mixture, it was sieved and placed in a test tube. The test tube containing the homogeneous mixture was then placed in a centrifuge machine for about 5 minutes at 1200 rpm. The floatation medium (Nacl) was added to the filtrate and filled to the brim until a convex meniscus was formed on the test tube. A cover slip was placed and left for about three (3) minutes. After then, the cover slip was pulled gently from the test tube and placed on a microscope slide and viewed under x10 and x40 objectives of the microscope [15]. Eggs of parasites were identified because of their morphological features as described by [16].

Data analysis

The data obtained from this study was analyzed using descriptive statistics and result presented in percentages. The prevalence of GIN in relation to species and farm management practices was analyzed statistically using Chi square (χ^2). In all analysis, confidence level was held at 95% and $P<0.05$ was set for significance.

RESULTS

Out of 700 samples examined from 339 sheep and 361 Goats, 203 were infected with different gastrointestinal nematodes with an overall prevalence of 29.0% (Table 1). The result showed that Goats

were more infected with 107 (29.64%) as compared to Sheep 96 (28.32%) and the difference was not statistically significant (P>0.05).

Table 1: Overall prevalence of Gastrointestinal Nematodes (GIN) of Sheep and Goats in Suleja Local Government, Niger State

Small ruminants	No. examined	No.infected	Prevalence (%)	χ^2	df	P-value
Sheep	339	96	28.32	3.291	1	0.070
Goats	361	107	29.64			
Total	700	203	29.0			

χ^2=Chi-square, df= degree of freedom

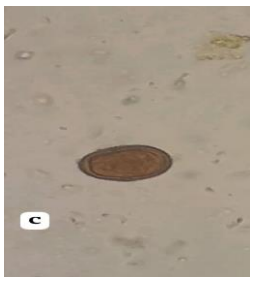
A total of four (4) gastrointestinal Nematodes (Plate I) were identified in small ruminants in the study area (Table 2) and this include *Toxocara spp* (10.86%), *Strongyloides spp* (10.14%), *Strongyle spp* (7.71%) *and Ascaris lumbricoides* (0.29%). *Toxocara spp* (10.86%) recorded the highest prevalence followed by *Strongyloides spp* (10.86%), *Strongyle spp* (7.71%) while *Ascaris lumbricoides* (0.29%) recorded the least prevalence In Sheep, *Toxocara spp* (10.91%) had the highest prevalence while *Ascaris lumbricoides* (0.59%) had the least prevalence. In Goats, *Toxocara spp* had the highest prevalence of 10.80% while *Strongyle spp* (7.71%) had the least prevalence. No *Ascaris spp* was encountered in Goats.

Table 2: Different Gastrointestinal Nematodes (GIN) of Sheep and Goats in Suleja local Government, Niger State, North Central, Nigeria

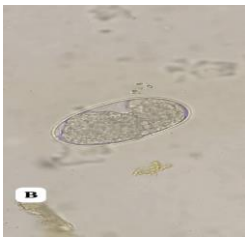
Nematodes	Sheep infected (%)	Goats Infected (%)	Total infected (%)
Strongyloides spp	34 (10.03)	37 (10.25)	71(10.14)
Toxocara spp	37 (10.91)	39 (10.80)	76(10.86)
Strongyle spp	23 (6.98)	31 (8.59)	54 (7.71)
Ascaris lumbricoides	2 (0.59)	-	2 (0.29)
Total	96 (28.32)	107 (29.64)	203 (29.00)

χ^2=Chi-square, df= degree of freedom

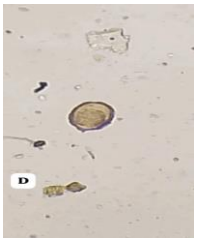
A (*Strongyloides spp* ova)



C (*Toxocara spp* ova)



B. (*Strongyle spp* ova)



D (*Ascaris lumbricoides ova*)

Plate I: Different Gastrointestinal Nematodes of Small ruminants identified in the study area

From this study, an extensive and traditional management system was practiced in the study area. The study (Table 3) revealed that majority of the farmers who reared only Goats (30%) recorded the highest frequency of GIN infection among the small ruminants as compared to those who reared both sheep and Goats (28.61%) and Sheep only (28.58%). There was no statistically significant ($P>0.05$) difference in the prevalence of GIN and the type of animals reared. Farmers who have flock size >20 (35.79%) recorded the highest frequency of GIN among small ruminants as compared to the farmers with 5-20 (28.40%) and <5 flock size (23.12%) and the difference was statistically significant ($P<0.05$). Farmers who attended only primary school (80.88%) and no formal education (61.54%) had small ruminants that are more infected than those with secondary education (31.25%) and tertiary institutions farmers (5.26%). There was statistically significant ($P<0.05$) difference in the prevalence of GIN and education level of the farmers. Thos who use well as their source of water recorded the highest frequency of GIN among the small ruminants as compared to those farmers who used borehole (24.51%) and river (17.86%) as their source of water. There was a statistically significant difference ($P<0.05$) in the frequency of GIN infection and source of water.

Table 3: Farm management practices associated with Gastrointestinal Nematodes of Small Ruminants

Variables	Levels	Frequency (%)	χ^2	df	P-value
Types of animals	Sheep	28.57	0.136	2	0.934
	Goats	30.00			
	Both	28.61			
Flock size	<5	23.12	7.436	2	0.024*
	5-20	28.40			
	>20	35.79			
Education level of the farmers	Informal	61.54	249.725	3	0.000*
	Primary	80.88			
	Secondary	31.25			
	Tertiary	5.26			
Source of water	Borehole	24.51	19.786	2	0.000*
	River	17.86			
	Well	39.41			

*Significant, χ^2=Chi square, df =degree of freedom

The factors associated with Gastrointestinal Nematodes of Small Ruminants is shown in Table 4. From the study, it was observed that majority of the farmers who do not practice deworming (37.92%) have small ruminants that were more infected with GIN as compared to those who dewormed (22.39%) and the difference was statistically significant (P<0.05). Farmers who do not use any form of anthelmintics (45.97%) recorded the highest frequency of GIN among their animals as compared to those who use Ivermectin (30.77%) and Albendazole (14.29). There was a statistically significant difference (P<0.05) in the frequency of GIN and type of anthelmintics used. Farmers who do not rotate anthelmintics (29.06%) recorded the highest frequency of GIN among the small ruminants as compared to those who rotate anthelmintics (20.0%) and the difference was not statistically significant (P<0.05). Farmers who had an irregular veterinary supervision (43.33%) has small ruminants that were more infected with GIN than those who had regular veterinary visit (13.82) and the difference was statistically significant (P<0.05). Farmers who clean the animal waste weekly (42.33%) recorded the highest frequency of GIN among the small ruminants as compared to those who had daily cleaning (19.0%) and the difference was statistically significant (P<0.05). Farmers who had no knowledge of GIN

(29.13%) had the highest frequency of GIN among the small ruminants as compared to those with knowledge of GIN (20.0%) and the difference was not statistically significant (P>0.05).

Table 4: Factors associated with the health status of the small Ruminants

Factors	Level	Frequency (%)	χ^2	df	P-value
Practice deworming?	Yes	22.39	20.050	1	0.000*
	No	37.92			
Types of anthelmintics	Albendazole	14.29	78.578	2	0.000*
	Ivermectin	30.77			
	None	45.97			
Rotation of anthelmintics	Yes	20.00	0.198	1	0.656
	No	29.06			
Veterinary visit	Regular	13.82	73.954	1	0.000*
	Irregular	43.33			
Cleaning frequency	Daily	19.00	45.329	1	0.000*
	Weekly	42.33			
Knowledge on nematodes	Yes	20.00	0.399	1	0.528
	No	29.13			

*Significant, χ^2=Chi square, df= degree of freedom

DISCUSSION

The result of this study indicates that Sheep and Goats in the study area are infected with various gastrointestinal nematodes with an overall prevalence of 29.0%. The prevalence in this study is lower than the prevalence of 71.5% recorded by [17] and 51.0% recorded by [18]. Goats had the highest prevalence as compared to Sheep and the difference was not statistically significant (P>0.05). The differences in prevalence might be attributed to differences in the sample size, farm management practices, agro-climatic conditions that could support the prolonged survival and development of infective stage of most nematodes [19]. Four GIN were identified in this study, and they include *Strongyle spp*, *Strongyloides spp*, *Toxocara spp* and *Ascaris lumbricoides*. *Toxocara spp* had the highest prevalence while the *Ascaris lumbricoides* had the least prevalence. The prevalence of these nematodes in small ruminants in this study area may be

attributed to the direct life cycle of nematodes that favours their development and survival as they do not require an intermediate host to complete their life cycle. Extensive management system was practiced in the study area and the result of the study shows that majority of the farmers who reared only Goats recorded the highest frequency of GIN infection among the small ruminants as compared to those who reared both sheep and Goats and Sheep only and the difference was not statistically significant (P>0.05). Farmers who have flock size >20 recorded the highest frequency of GIN among small ruminants as compared to the farmers with 5-20 flock size and the difference was statistically significant (P<0.05).

Farmers who attended only primary (80.88%) and no formal education (61.54%) recorded the highest frequency of infection among the small ruminants than those who attended secondary education (31.25%) and tertiary institutions (5.26%) and the difference was statistically significant (P<0.05). The high frequency among primary and informal education may be due to less knowledge about farming practices due to insufficient education. This is because the relevance of education in agricultural expansion has been broadly affirmed, and education enhances the farmers' farming skills and productive capabilities [20]. Those who use well as their source of water recorded the highest frequency of GIN among the small ruminants as compared to those farmers who used borehole (24.51%) and river (17.86%) as their source of water. There was a statistically significant difference (P<0.05) in the frequency of GIN infection and source of water.

From the study, it was observed that majority of the farmers who do not practice deworming (37.92%) recorded the highest frequency of GIN among their animals as compared to those who practiced deworming (22.39%) and the difference was statistically significant (P<0.05). Farmers who do not use any form of anthelmintics (45.97%) recorded the highest frequency of GIN among their animals as compared to those who use Ivermectin (30.77%) and Albendazole (14.29) and the difference was statistically significant (P<0.05). Farmers who do not rotate anthelmintics (29.06%) recorded the highest frequency of GIN among the small ruminants as compared to those who rotate anthelmintics (20.0%) and the difference was not statistically significant (P<0.05).The low frequency observed among farmers who practiced deworming, and rotate anthelmintics as well as the use of albendazole as worm expeller might be due to the fact that anthelmintics are widely used for the control of gastrointestinal nematodes in small ruminants. These drugs have been used to effectively reduce the worm burden of GIN in small ruminants.

Farmers who had an irregular veterinary visitation (43.33%) recorded the highest frequency of GIN among the small ruminants as compared to those who had regular veterinary visit (13.82) and the difference was statistically significant (P<0.05). Farmers who clean the animal waste weekly (42.33%) recorded the highest frequency of GIN among the small ruminants as compared to those who had daily cleaning (19.0%) and the difference was statistically significant (P<0.05). The high frequency recorded among farmers who clean daily might be due to the fact that regular cleaning of barns, Stalls, and

equipments helps to eliminate faeces which often contain parasite eggs [21].

Farmers who had no knowledge on GIN recorded the highest frequency of GIN among the small ruminants as compared to those with knowledge of GIN and the difference was not statistically significant ($P>0.05$). This agrees with [22] reported that local knowledge of diseases in communal areas is restricted.

Conclusion and Recommendations

Sheep and Goats in the study area are infected with various GIN with *Toxocara spp* having the highest prevalence while *Ascaris lumbricoides* had the least prevalence. The result of this study showed that farm management practices greatly influence the transmission of gastrointestinal nematode infection in small ruminants. Effective control of GIN in small ruminants should combine multiple approaches such as pasture management, treatments, sanitation measures, improvement in general management practices, training and education of farmers on the use of anthelmintics.

Declarations

Acknowledgement

The authors are grateful to HOD and the technical staff of Entomology and Parasitology laboratory Faculty of Veterinary medicine, University of Abuja, Nigeria for their technical assistance. The authors also acknowledge the Sheep and Goats owners whose animals were used for this research.

Conflict of interest

None

Ethical statement

No formal ethical clearance was obtained for this research. Permission was gotten from veterinary section under Director of Agriculture, Suleja Local Government council, Niger State. Consent was sought from all the Sheep and Goat owners whose animals were used for this study.

Authors contributions

AAY, AGA and ORJ conceptualized and design the study, AAY participated in field work and data collection. AAY performed data analysis. AAY draft the first manuscript which was reviewed and supervised by AGA and ORJ. All authors contributed to the development of the final manuscript and approved it's submission.

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