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Prevalence of *Schistosoma bovis* in the Nigerian Army Livestock Farms and Ranches, Airport Road Giri, Federal Capital Territory, Nigeria

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ABSTRACT

Bovine Schistosomiasis is a chronic debilitating parasitic disease of cattle caused by the species Schistosoma bovis. The present work was designed to investigate the prevalence of Schistosoma species in cattle in Nigerian Army Livestock Farms and Ranches at Airport road Giri, Gwagwalada Area Council, Federal Capital Territory, Abuja, Nigeria. Faecal samples (n=200) from cattle were collected per rectum, using sterile surgical gloves into sample bottles containing formalin and labeled with the cattles' tag number. Twenty samples were collected between 8:00 and 10:00am of every Thursday till the required samples were obtained. The fecal samples were brought to the Parasitology laboratory to determine the prevalence of Schistosoma using both floatation and sedimentation techniques. The overall prevalence of Schistosoma infestation among cattle in Nigerian Army Farms and Ranches was 35.5% (71/200). Out of 130 females and 70 males screened, the prevalence of Schistosoma infestation in female and male were 37.7% (n=49/130) and 31.4% (n=22/70) respectively. Out of the 150 fecal samples from cattle aged >1 year (adult) examined, 62 (41.3%) were positive, while only 9 (18%) out of 50 fecal samples from cattle aged <1 year (young) were positive. Out of the four (4) breeds screened, the highest number of cases was recorded in White Fulani breed 16.5% followed by Brahma breed which is 7%. The prevalence in other breeds shows Swiss Brown cross to be 4% while Friesian cross is 8%. Due to its public health importance, there is need for more effort in preventing and controlling the infestation. This could be done through routine application of molluscicide to reduce the snail population. Appropriate anthelminthic and environmental sanitation in the cattle ranch should also be encouraged in addition to public health awareness to mitigate these problems.

Keywords: Prevalence, helminths, *Schistosoma bovis,* cattle, Gwagwalada

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INTRODUCTION

Helminths are some of the world's commonest endoparasites that feed on a living host to gain nourishment and protection while causing poor nutrient absorption, weakness and diseases in the host [1]. They are classified into nematodes (roundworms) and Platyhelminthes which include trematodes (flatworms or flukes) and cestodes (tapeworms). Mode of transmission varies with the type of worm concerned, it may involve ingestion of eggs or larvae, penetration by larvae, bite of vectors or ingestion of stages in the meat of intermediate hosts. Worms are often long-lived [1].

Schistosomiasis is a debilitating parasitic disease caused by several species of fluke of the genus *Schistosoma* (trematode) affecting both humans and animals, hence the disease is of public health importance. Schistosomiasis is a common parasitic infection in cattle and rarely in other domestic animals in Africa and Asia [2]. The disease is found in tropical countries in Africa, Eastern-South America, Caribbean, Middle East, and Southern-East Asia [3]. Schistosomes are members of the genus *Schistosoma,* family *Schistosomatidae*. The adult worms are obligate parasite of the vascular system of the vertebrate. Schistosomes are dioecious. The mature female is slender than the male and normally is carried in a ventral groove, the gynaecophoric canal, that is formed by ventrally flexed lateral outgrowth of the male body [4]. *Schistosoma bovis* is mostly transmitted by *bulinus* a freshwater snail species. The largest group is *Schistosoma haematobium* group containing nine species that are transmitted through *bulinus* snails as aforementioned [5] with two species, S. *haematobium* and *S. bovis*, being responsible for majority of all human [6] and livestock infections [7] respectively. Wild small rodents have been reported as reservoir for *Schistosoma hematobium* and *Schistosoma bovis* hybrid which infect humans[8].

In Senegal River Basin, the open and permanent water bodies and irrigation canals promote the interactions between human and animals schistosomes and promote transmission of parasite hybrids in the area[9]. In Nigeria, like many other African countries, schistosomiasis caused a reduction in income generation, productivity of workers, farm size, and rate of land clearing [10]. It could therefore be said that the direct impacts caused by schistosomiasis may lead to enormous economic losses and inhibition of socio-economic development due to low productivity and income generation of those people infected [11,12]. In addition, the enormous socioeconomic effects of the helminthic diseases prevent children from attending school and adults from being productive members of their communities [6]. Of significance is the threat to public health due to natural interactions and hybridization between *Schistosoma* species. Huyse *et al*. (2009) [9] reported the isolation of a hybrid worm from patients in Senegal which was as a result of hybridization between *Schistosoma bovis* and *Schistosoma haematobium.*

In Nigeria, cattle are among the most prominent domesticated livestock. They always serve as valuable assets in the agricultural sector since they provide animal protein, milk, employment, hide, and skin for leather production and beef during festive seasons [17]. Nigeria is the largest livestock producer in sub-Saharan Africa [18]. However, despite the high population of these cattle in Nigeria, the quantity of meat obtained is far below the national demand due to many causes, including parasitic infections [19].

The Nigerian Army Farms and Ranches is an Army institution farm. It gives support in the development of agriculture and achieving food security and sustainability by rearing cattle to meet the increasing demand for meat and milk consumption as population increases in the Country [20]. In addition to providing food security, the Military seek to resolve the conflict between farmers and pastoralists. These nomads, in search of food and water for animals roam the country moving herds from place to place. These passing livestock trample on and also feed on the crops depriving farmers

of good harvest. The farmers in turn take out their wrath by killing or hijacking cattle. This vicious circle leads to material losses for the producers of both crops and livestock resulting in food shortage in the country [21].

Schistosomiasis is responsible for considerable economic losses in livestock industry, mainly through mortality, reduced fertility and productivity which may include stunted growth. Cattle infected with *Schistosoma bovis* develop a syndrome characterized by liver damage, roughness of hair coat, pale mucous membrane, serious emaciation and a very poor reproductive performance [22] that results in a significant economic down turn and a threat to public health. This leads to reduction in the economy of the nation. This disease is one of the major veterinary problems in many Africa countries. The objective of this study was therefore to determine the prevalence and associated risk factors of Bovine Schistosomiasis (BS) in the Nigerian Army Cattle Ranch, Giri, Federal Capital Territory, Nigeria.

MATERIALS AND METHODS

Study area

The study was conducted in Nigerian Army Farms and Ranches located in Giri, opposite University of Abuja, Gwagwalada Area Council on the outskirts of the Federal Capital Territory (FCT) Abuja, Nigeria. The FCT is located north of the confluence of the river Niger and river Benue. It is bordered by the states of Niger to the west and north, Kaduna to the northeast, Nasarawa to the east and south and kogi to the southwest. Lying between latitude 8°25′ and 9°20′N of the equator and longitude 6°45′ and 7°39′E of Greenwich Meridian [19]. The Federal Capital Territory consists of six area councils namely: Abaji, Abuja Municipal, Bwari, Gwagwalada, Kwali and Kuje Area Councils.

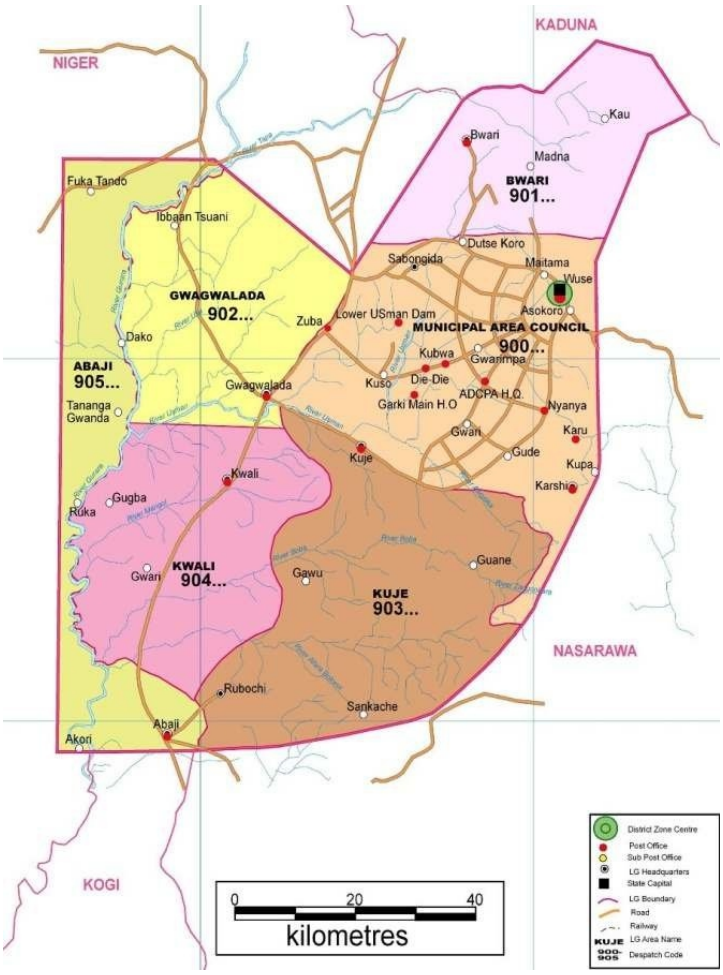

Figure 1: The map of Federal Capital territory Nigeria.

Sample Size Determination
The sample size was determined through conventional statistical method as described by[20].

$$n = \frac{Z^2pq}{d^2}$$

where;

n = sample size

p = Prevalence rate

d = desired absolute precision 5% (0.05)

z = standard normal deviation for 95%

confidence level (1.96)

q = 1 – p.

Using 10% prevalence for the sample size of cattle [21]

$$n = \frac{1.96^2 \times 0.10 \times 0.9}{0.05^2}$$

$$n = \frac{3.8416 \times 0.10 \times 0.9}{0.0025}$$

n= 138.2
thus n= 138.2. The sample size, n was increased to 200, to increase the precision since the higher the sample size, the closer the sample value to the population.

Collection of Sample
Sample collection was done across all breeds of cattle in the ranch. Twenty (20) faecal samples were collected from March 2020 to May 2021 every Thursdays between 8:00 and 10:00 am before the cattle were allowed to move out to graze until the required amount was attained. A total of 200 fecal samples were collected per rectum using sterile surgical gloves into sterile sample bottles containing formalin and labeled with their cattle's tag number. The first 100 fecal samples were collected during dry season and the other 100 samples during raining season. Sex, Age and Breed of the cattle were determined and recorded as same time of sample collection. The fecal samples were taken to the Parasitology laboratory to determine the prevalence of *Schistosoma* using both floatation technique as well as sedimentation technique.

Coprological Examination
Floatation technique was carried out according to the protocol of Coles, [22]. Sedimentation technique was done as recommended by Antónia *et al*.[23].

Floatation Method
Two grams (2g) of faecal sample was mixed with 2 mls of the salt-sugar solution in a laboratory mortar using pestle until it homogenized. Eight milliliters (8mls) of the solution was added to it and poured in a test tube till it filled to the brim until a convex meniscus was formed. A cover slip was placed gently on each preparation and left for about 10 minutes. The cover slip was then carefully removed and placed on a clean dry glass slide, mounted on the microscope and examined at magnification X4, X10 and X40. Individual helminth was identified using their morphological characteristics [24].

Sedimentation Method
Most operculated trematode eggs and a few nematode eggs are difficult if not impossible to recover by floatation technique hence, sedimentation technique was adopted. Ten milliliters of salt-sugar solution was mixed with 2g of the fecal sample in a laboratory mortar using pestle, crushed properly until it homogenized and making sure that the mixture is thoroughly dissociated to free the eggs. The mixture was then poured into a test tube and waited for to sediment, and the supernatant fluid was poured off. Small quantity of the sediment was collected with a pipette and put on a microscope glass slide covered with cover slip and examined using a microscope at X10, X40 magnifications.

Statistical Analysis
Chi square ($\chi 2$) test was used to determine the association of the prevalence of *Schistosoma* infection between ages, sexes and breeds of the

cattle. A 5% significance level was used to determine whether there were significant differences between measured parameters.

RESULTS

Out of 200 fecal samples collected and examined, 116 (58%) were infected by helminthes. From infected animals, 71 (35.5%) were infected by *Schistosoma bovis*, 15 (7.5%) were infected by *Fasciola* species, 10(5.0%) were infected by *Eimeria* species, 11(5.5%) were infected by *Strongyle* specie and 9(4.5) were infected by *Toxocara* specie. Among the helminths, *Schistosoma* had the highest percentage followed by *Fasciola, Strongyle, Eimeria* and *Toxocara* (Table 1).

Table 1: Prevalence of helminth species present in cattle of Nigerian Army farms and Ranches, Giri.

Parasite species	**No (%) infected**	**Chi-Square (X^2)**	**P-value**
Schistosoma	71(35.5)	X2 = 41.672806	p = 0.000000 **
Fasciola	15(7.5)		
Eimeria	10(5.0)		
Strongyle	11(5.5)		
Toxocara	9(4.5)		
Total	116(58)		

df = 4

Table 2 highlights the prevalence of *Schistosoma* specie in different breeds of cattle using faecal samples that were collected from the Nigerian Army Cattle Farm and Ranches. From 200 (100%) samples collected, 109 (54.5%) were examined from White Fulani of which 33 (30.3%) tested positive for *Schistosoma* infection, 40 (20%) were examined from Brahma and 14 (35%) tested positive for *Schistosoma* infection, 17 (8.5%) were examined from Swiss brown and 17 (47.1%) tested positive for *Schistosoma* infection and from 34 (17%) Friesian cross that were examined, 16 (47.1%) tested positive for *Schistosoma* infection. Therefore, 71(58%) out of 200 (100%) animals tested positive for *Schistosoma* infection.

Table 2: Prevalence of *Schistosoma* in relation to all breeds of cattle in Nigerian Army farms and Ranches.

Animal (breed)	No (%) of examined faecal samples	No (%) of infected faecal samples	Chi-Square (X^2)	P-value
White Fulani	109(54.5)	33(30.3)	4.279696	0.232803
Brahma	40(20)	14(35)		
Swiss brown cross	17(8.5)	8(47.1)		
Friesian cross	34(17)	16(47.1)		
Total	200(100)	71(35.5)		

df =3

Table 3 shows the prevalence of *Schistosoma* species in relation to the sex of the cattle in Nigerian Army Cattle Farms and Ranches. Out of 200(100%) fecal samples collected and examined 130 (65%) were from female and 49 (37.7%) were found to be positive for *Schistosoma* infection while from the 70 (35%) samples examined in the male, 22 (31.4%) were found to be positive for *Schistosoma* infection.

Table 3: Prevalence of Schistosoma specie in relation to sex.

Animal (sex)	No(%) examined	No(%) infected	Chi-Square (X^2)	P-value
Male	70(35)	22(31.4)	0.7796331	0.377254
Female	130(65)	49(37.7)		
Total	200 (100)	71(35.5)		

$X^2 = 0.78$

Table 4 describes the prevalence of *Schistosoma* species in relation to the age of the cattle in Nigerian Army cattle Farms and Ranches. From of 200 (100%) fecal samples collected and examined, 50 (25%) and 150 (75%) fecal samples were examined from the young and adult cattle respectively, 9 (18%) and 62 (41.3) were positive for *Schistosoma* infection.

Table 4: Prevalence of *Schistosoma* infection in relation to the age of the cattle

Animal (age)	No (%) examined	No (%) infected	Chi-Square (X^2)	P-value
Young	50(25)	9(18)	8.916549	0.002826
Adult	150(75)	62(41.3)		
Total	200 (100)	71 (58)		

DISCUSSION

This study indicates a high prevalence of *Schistosoma bovis* in cattle in the Nigerian Army cattle farms and Ranches. The findings revealed an overall prevalence of 35.5%. The results were similar to what was reported by Almaz and Solomon (2011) in their previous attempt [25] who found 37.3% of *Schistosoma bovis* infestation in cattle. This could be attributed to the fact that *Schistosoma* infection rate in cattle increases during rainy season due to abundance of snails and favourable conditions on the land which is suitable for the survival of the intermediate host as compared to dry season [26] though increase in fecal egg count has also been observed in dry season [27]. However, this result shows a relatively higher prevalence than values reported from earlier findings of 12.3-29% [28,29,30,31]. This wide gap may be due to the fact that the previous studies were undertaken by means of single fecal sample examination which is used traditionally in the diagnosis of parasites egg. This has resulted in lower probability of detecting *Schistosoma* eggs in faces. It is believed that trematodes are intermittent egg layers thereby making detection of eggs during single fecal sample examination minimal [32] also, the use of formalin based solvent in sample collection which is universally agreed to concentrate helminth eggs may have contributed to the increase.

Four different breeds were examined. These were White Fulani, Brahma, Brown Swiss and Friesian. The prevalence of *Schistosoma* specie was higher in white Fulani 30.3 (33/109) than other breed of cattle in the following order where Brahma 35% (14/40), Swiss Brown 47.1% (8/17) and Friesian 47% (16/34). However, there was no statistically significant difference between the prevalence of bovine schistosomiasis in the different breeds of the cattle ($p > 0.05$). The higher prevalence in white Fulani could be attributed to the fact the number of samples collected from White Fulani is more compared to the other breeds. Studies have also shown that indigenous cattle breeds are more at risk of helminth infections than the cross breed [33] and they are considered susceptible to diseases even amidst the indigenous breeds [34]. The higher prevalence of the local breed animals than crossbreed might be due to the more exposure of the local animals to the marshy areas and higher exposure to the cercariae. Also, local breeds are left for extensive grazing system while cross breeds are kept for the purpose of milking in semi-intensive or otherwise intensive management systems where in most times they are fed with concentrate and roughages with supplements and they drink clean water [35]. It was also reported that local breeds are more affected by Bovine Schistosomiasis than cross breeds. The difference in prevalence was not due to the difference in susceptibility but due to the difference in exposure [36].

The prevalence rate of *Schistosoma* specie was lower in the young 18% (9/50) than adult 41.3% (62/150). There is statistical significance between the age and infection ($p < 0.05$). The result could have been influenced by

the de-worming routine that was conducted on the young cattle close to fecal sample collection period and restriction of the calves in going out to graze thereby preventing them from picking up cercariae through water [24] also. The higher prevalence in adult could be due to increase in level of contamination of grazing area with the cercariae and the exploring nature of the adult animal [21]. However, this result disagrees with earlier findings of Zamdayu *et al*. (37] who reported higher prevalence in young animals (7.9%) than in adults (6.2%), the report indicates that the prevalence of the disease decreases as age increases due to the fact that in northern Nigeria, calves are traditionally weaned between the ages of 1-2 year and then allowed to graze with the adult animals and having lower immunity as compared to the adult animals and are therefore highly predisposed to the infection.

Based on sex, prevalence rate of *Schistosoma species* were 37% female (47/130) and 31.4% males (22/70). There was no statistical significance between the sex and infection ($p>0.05$). Sex is therefore not a risk factor for *Schistosoma* infection in this study. This may be due to equal exposure rates of both sexes to the same water and pasture thereby developing the disease at almost the same rates [37]. This result may not be similar to the findings of Kassahum *et al*. [38] that reported a higher prevalence in female than in male animals. The result however disagrees with the earlier findings of Zamdayu *et al*., [37] that reported a lower prevalence in female 4.5% (6/133) than male 10.4% (7/67). He related the lower prevalence in female to the practice of maintaining females under better management and feeding condition for milk production and breeding but males are allowed to graze freely in pasture and so are more stressed. Males are also fed relatively poor diet which increases their susceptibility to most infection [39,26].

Conclusion

The present study demonstrated a high prevalence of *Schistosoma* infections among cattle in the Nigerian Army Cattle Farms and Ranches at Giri. This study strongly suggested that single faecal examination can result in under diagnosis of weak infection of schistosomiasis therefore, repeated fecal examinations, as useful method, should be applied by veterinarians for the diagnosis of schistosomiasis. There was a significant difference in age and the infections, therefore young animals irrespective of breed are easily susceptible and at risk of the infection cause by *schistosoma.* Breed and sex factors were not incriminated as risk factors in the study, as there is no significant relationship between them and infection prevalence. Cross-bred as well as indigenous cattle are susceptible. Lack of clinical sign of *Schistosoma* infection is not an indication that there is no infestation in the herd or individual animal as the cattle may show no apparent clinical sign and may still harbor the parasite. Therefore, due to its public health importance, the need therefore arise for more effort in preventing and controlling the infection by way of constituting preventive and control measures.

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