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Original Research

Gross and microscopic changes associated with intestinal parasitism of local scavenging chickens in Maiduguri, Borno State, Nigeria

[1]Gambo, H.I., [1]Mohzo, D.L., [1]*Abdulsalam, H., [2]Luka, J. & [1]Konto, S.S.

[1]Department of Veterinary Pathology, [2]Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine, University of Maiduguri, P.M.B 1069, Maiduguri, Borno State, Nigeria

**Correspondence:* abdulsalamh@unimaid.edu.ng; *+234 803 926 6736*

ABSTRACT

A survey of intestinal parasitism and gross and microscopic lesions in local scavenging chickens (*Gallus gallus domesticus*) was carried out at the Maiduguri live bird market. A total of 100 intestinal samples were collected from the slaughter slab immediately after slaughter for gross, microscopic and parasitological examinations using standard procedures. Out of the 100 intestinal samples collected 56% were found to be harbouring helminthes ranging from *Ascaridia spp* (18%), *Heterakis spp* (8%), *Rallietina spp* (13%), *Choanotaenia spp* (3%) and *Hymenolepis spp* (3%). Others showed mixed infections of two or more parasites at 11%. The prevalence was higher in adult chickens (46%) than in young chickens (10%) and also higher in males (34%) than in females (22%). Gross lesions observed included nodule formation, haemorrhages and nodular/haemorrhagic lesions; while microscopic lesions seen included matting and stunting of intestinal villi, loss of crypts and goblet cell hyperplasia. Others were epithelial desquamation and necrosis with leucocytic aggregation and circumscribed eosinophilic aggregation in the submucosa. Conclusively, the overall prevalence of 56% of intestinal parasitism observed among local scavenging chickens in the study suggests endemicity of the disease condition in the study area. Also, age and sex appear to be risk factors associated with the incidence of intestinal parasitism in local scavenging chickens. Therefore, there is a need to apply strict biosecurity and good sanitary measures coupled with regular deworming of birds to serve as control and preventive measures. This will help to boost production, improve the economy and provide more protein to the populace.

Keywords: Intestinal parasite, lesions, local scavenging chicken, Maiduguri, survey

INTRODUCTION

Local scavenging chickens (LSC) (*Gallus gallus domesticus*) are chickens that are adapted to harsh environmental conditions that include extensive small-scale village, free-range and organic production systems (Idika *et al.*, 2016). Sometimes such chickens are referred to as traditional, scavenging, backyard, village, local or family chickens (Padhi, 2016). The local chicken production system, which is mostly free-range (extensive), can best be described as a low input−low output system (Abubakar *et al.*, 2020). Free-range management is one of the common methods of rearing chickens mostly in Africa (Junaidu *et al.*, 2014). According to Nyirongo, (2019), the system permits little or no healthcare and supplementary feeding for the chickens. This method also allows chickens to forage around during the daytime thus they feed on kitchen waste, leftover cereals like rice, maize, guinea corn, millet, insects, and other available feed (Idika *et al.*, 2016). These eating habits and other factors unique to the method of rearing LSC make them highly susceptible to parasitic infections (Jegede *et al.*, 2015).

Some of the reported significant groups of parasites usually found in the intestine and freshly discharged droppings of chickens are nematodes, cestodes, and trematodes (Mahendra *et al.*, 2016). Improvements in hygiene, housing and management procedures have significantly decreased the occurrence of parasitic infection in the commercial system of poultry production (Asumang *et al.*, 2023). However, several studies have revealed that parasitic infections among free-range birds in Nigeria and some other African countries are still relatively high (Ayeh-Kumi *et al.*, 2016, Ola-Fadunsin *et al.*, 2019). Heavy parasitic infections have been reported to have devastating effects on the growth, egg production, and overall health of local chickens (Idika *et al.*, 2016). Also, gastrointestinal helminths can reduce immune system response to vaccination and increase disease vulnerability in local chickens (Pleidrup *et al.*, 2014). Moreover, these heavy infection rates often put humans at risk of secondary

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infection from the zoonotic nematodes (*Strongyloides spp.* and *Ascaridia spp.*)(Ybanez *et al.,* 2018) if undercooked poultry meat and offals are consumed (Ozougwu *et al.,* 2021)

Although a series of studies had been carried out on gastrointestinal helminths of LSC in Nigeria (Jegede *et al.,* 2015 Abah *et al.,* 2019, Afia *et al.,* 2019, Salawu and Emmanuel 2023), the studies are not well distributed across geographic regions of the country and from the literature search, no study of such nature has gone to the extent of studying gross and microscopic tissue changes due to intestinal parasitism, especially in LSC in Maiduguri, Borno State, Nigeria, thus the need for this study. The results from the study will assist in understanding possible tissue changes induced by infection with intestinal parasites in the LSCs.

MATERIALS AND METHODS

STUDY AREA

This study was conducted in Maiduguri Metropolis, Borno State, Nigeria. Borno State is located in the North-Eastern part of Nigeria (Elijah *et al.,* 2022). The state shares borders with three West African countries namely; the Republic of Chad to the North-East, the Niger Republic to the North and the Cameroon Republic to the East. Within the country, it neighbors Bauchi State to the South, Yobe State to the West and Gombe State to the South-West (Elijah *et al.,* 2022).

SAMPLES COLLECTION

A total of 100 samples of the intestinal tracts of the local scavenging chickens were collected from the slaughter slab at the Maiduguri live chicken market immediately after slaughter. Intestinal samples were examined for gross lesions, changes were noted and the photographs of the samples were taken with a digital camera. The tissue sample of the portions of the intestines where the parasite was found was taken and preserved in 10% buffered formalin for tissue processing and subsequent microscopic examination. Preserved intestinal samples were appropriately labeled according to age and sex. The remaining parts of the intestines with the contents were kept for examination of parasites.

INTESTINAL EXAMINATION FOR PARASITES

The serosal surfaces of the intestinal tracts were examined, and surrounding fats and mesenteries were separated from the intestinal tracts, using a scalpel blade holder, scissors, and thumb forceps. This was followed by a longitudinal incision through the intestines to observe the nature of the faeces, and the contents were carefully washed into a beaker containing physiological saline. The mucosal surfaces were examined, and adherent worms were scraped off with thumb forceps and introduced to the beaker. The beaker was filled with water and decanted severally times until worms were visible and free from debris. They were sieved through a 100 mm test sieve and emptied into a petri dish. This was followed by examination under stereo-microscope at magnification of x10 and x40. The nematodes observed were preserved in a container containing lactophenole while the cestodes were stored in 70% alcohol according to Soulsby (1982) and Inuwa *et al.* (2021).

MICROSCOPIC EXAMINATION OF TISSUES

The 10% neutral buffered formalin fixed intestinal tissues were processed and stained with Haematoxylin and Eosin stains for histopathological examination according to standard procedure (Majama *et al.,* 2023). Tissue slides were examined using a light microscope at various magnifications, and photographs of the lesions were taken using Amscope digital camera.

RESULTS

PREVALENCE OF INTESTINAL PARASITES IN LOCAL SCAVENGING CHICKENS (LSC) IN MAIDUGURI

The prevalence of intestinal parasites in LSC in Maiduguri is presented in Table I. Out of the 100 intestinal segments sampled and examined, intestinal parasites observed included *Heterakis* (8%) *Ascaridia* (18%), *Rallietina* (13%), *Hymenolepis* (3%) and *Choanotaenia* (3%). Others showed mixed infection of the above-mentioned parasites at a prevalence of 11%.

THE DISTRIBUTION OF INTESTINAL PARASITES IN LOCAL SCAVENGING CHICKEN (LSC) ACCORDING TO SEX

The sex distribution of intestinal parasites in the LSC in Maiduguri is shown in Table II. Of the 100 intestinal segments examined, 53 were males and 47 were females, with prevalence rates of 34% and 22%, respectively. *Ascaridia* showed the highest prevalence in males at a prevalence rate of 12% while *Rallietina* and *Ascaridia* showed the highest prevalence in females at a prevalence rate of 6%. Similarly, *Choanotaenia* and *Hymenolepis* showed the least prevalence in males and females, respectively, at a prevalence rate of 1%.

PREVALENCE OF INTESTINAL PARASITES OF LOCAL SCAVENGING CHICKENS (LSC) ACCORDING TO AGE

The age distribution of intestinal parasites of LSC in Maiduguri is presented in Table III. Of the 100 intestinal samples examined, 63 were from adults and 37 from young birds, with 46% of the adults and 10% of the young populations infected with one or more species of intestinal parasites.

GROSS LESIONS

The gross changes observed in intestinal segments of the LSC are presented in Plates I, II and III. Among the 100 intestinal samples examined, lesions seen included nodular haemorrhagic lesion 2 (2%), haemorrhagic enteritis 6 (6%), nodular lesion 3 (3%), pinpoint haemorrhage 11 (11%) and haemorrhagic sloughed mucosa 4 (4%) as shown in Table IV.

MICROSCOPIC LESIONS

The microscopic lesions seen in the intestinal segments of the LSC are presented in Plates IV, V and VI. Lesions seen included matting and stunting of intestinal villi with loss of crypts and goblet cell hyperplasia (Plate IV). Others are epithelial desquamation and necrosis with leucocytic aggregation, goblet cell hyperplasia (Plate V) and circumscribed eosinophilic aggregation in the submucosa (Plate VI and VII).

Table 1: Prevalence of intestinal parasites in local scavenging chickens in Maiduguri

Parasites	**Number of Samples**	**Prevalence (%)**
Heterakis	8	8
Ascaridia	18	18
Rallietina .	13	13
Hymenolepis	3	3
Choanotaenia	3	3
Mixed	11	11
Normal	44	44
Total	**100**	**100**

Table III: Distribution of Intestinal Parasites according to age in local scavenging chickens in Maiduguri

	Adult		Young	
Parasites	No of Samples	% Prevalence	No of Samples	% Prevalence
Heterakis	7	7	1	1
Ascaridia	13	13	5	5
Rallietina	12	12	1	1
Hymenolepis	2	2	1	1
Choanotaenia	3	3	0	0
Mixed	9	9	2	2
Normal	17	17	27	27
Total	**63**	**63**	**37**	**37**

Table IV: Gross lesions in local scavenging chickens in Maiduguri

Gross lesions	Number of Samples	Prevalence (%)
Nodular lesions	3	3
Haemorrhagic lesions	21	21
Nodular haemorrhagic lesions	2	2
Total	**26**	**26**

Table II: Sex-specific prevalence of intestinal parasites in local scavenging chickens in Maiduguri

	Male		**Female**	
Parasite	**No of Samples**	**% Prevalence**	**No of Samples**	**% Prevalence**
Heterakis	4	4	4	4
Ascaridia	12	12	6	6
Rallietina	7	7	6	6
Hymenolepis	2	2	1	1
Choanotaenia	1	1	2	2
Mixed	8	8	3	3
Normal	19	19	25	25
Total	**53**	**53**	**47**	**47**

Plate 1: Photograph of a whole and cut section of intestinal segment from LSC showing nodular lesions on serosal and mucosal surfaces of the caecum (arrows)

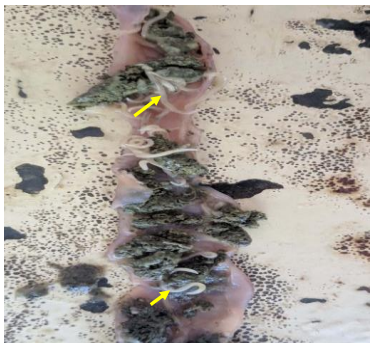

Plate II: Photograph of a cut section of intestinal segment from LSC containing adult

Plate III: Photograph of a cut section of an intestinal segment from LSC showing haemorrhages on the mucosal surface.

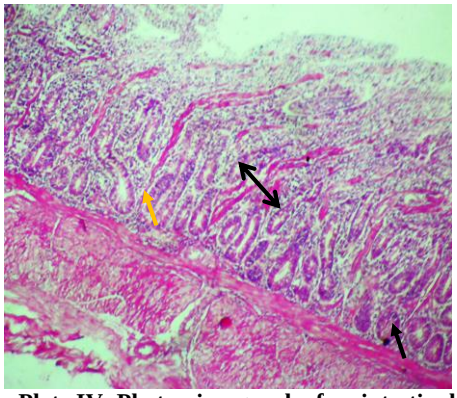

Plate IV: Photomicrograph of an intestinal segment from LSC showing matting of intestinal villus (double-sided arrow), loss of crypts (yellow arrow) and goblet hyperplasia (arrow). H&E× 40

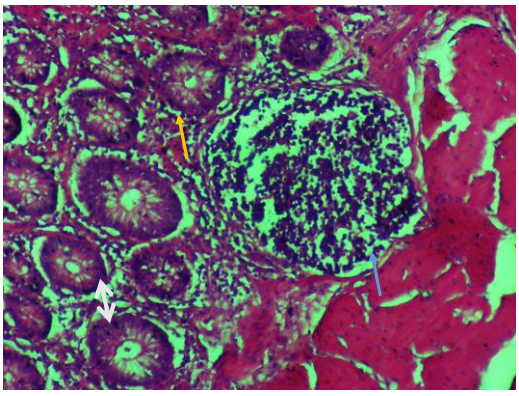

Plate VI: Photomicrograph of a section of the intestine from LSC showing goblet cell hyperplasia (double-sided arrow), leukocytic infiltration (yellow arrow) circumscribed eosinophilic aggregation (blue arrow) H and E ×100

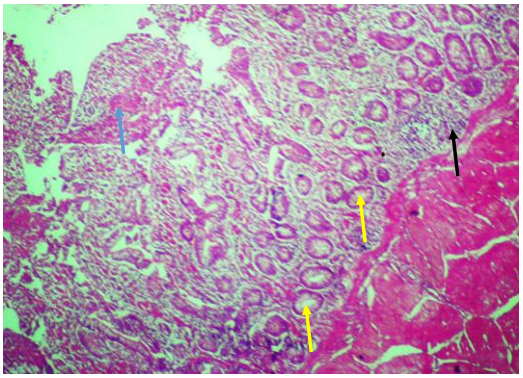

Plate V: Photomicrograph of a section of the intestine from a LSC showing epithelial desquamation and necrosis (blue arrow), goblet cell hyperplasia (yellow arrow) and aggregation of leukocytes (black arrow arrow) H& E × 40.

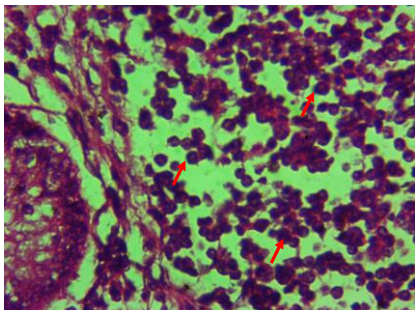

Plate VII: Photomicrograph of a section of the intestine from LSC showing aggregation of

DISCUSSION

The productivity of LSC is threatened by parasitism on a major scale, with intestinal parasitism ranking high because it causes lesions in the intestinal tract thus impairing nutrient absorption and utilization. The 56% prevalence of intestinal parasites observed in this study is in close agreement with the 52% earlier reported by Adamu *et al.* (2022) in Damaturu, Yobe State, Nigeria. However, our finding is higher than the 20% prevalence reported by Kyari *et al.* (2023) in Damaturu, Yobe State, 16.7% by Ola-Fadunsin *et al.* (2019) in Ebonyi State, but lower than the 100% reported by Uhuo *et al.* (2013) in Kwara State, Nigeria. In other parts of the world, prevalence rates have been reported in Ghana (65.5%) and Ethiopia (90.6%) (Asumang *et al.,* 2019; Berhe *et al.,* 2019). Van *et al.* (2020) reported a similar prevalence of 54.0% among chickens from the Mekong Delta in Vietnam. The differences in the prevalence observed in the various studies could be attributed to differences in the geographical location, management system, seasonal differences, sample size (Jegede *et al.,* 2015; Ananda *et al.,* 2016) and research methodology adopted. These factors have been documented to predispose birds to infection in their environment by supporting egg and larval development and also facilitating transmission of helminth parasites (Lawal *et al.,* 2023).

Among the various parasites observed, *Ascaridia species* were the most common nematodes which is consistent with earlier studies from other parts of Nigeria (Nnadi and George, 2010, Ngongeh *et al.,* 2014, Idika *et al.,* 2016, Ananda *et al.,* 2016). *Rallietina species* had the highest prevalence among the cestodes (13%) which has also been reported as the most widely prevalent and the most common helminth in Northern Nigeria (Junaidu *et al.,* 2014 and Abah *et al.,* 2019). The result of this study also showed that mixed infections of two or more parasite species in LSC are highly common. This finding may be explained by the feeding preferences (scavenging production system) of the LSC at different times, which exposes them to a wide range of parasites (Ayeh-Kumi *et al.,* 2016, Mahendra *et al.,* 2016, Maina et al., 2017). Similarly, the finding of the complete absence of trematode in this study agrees with the earlier report of Biu and Haddabi (2005) and Yoriyo *et al.* (2008) who also observed no trematode in their studies. The absence of these worms could be explained by the complex nature of their life cycle involving a freshwater snail as an intermediate host (Junaidu, *et al.,* 2014). The absence of lakes and the resultant reduced number of intermediate hosts in the present study area might be the reason for the absence of trematodes.

A significantly higher prevalence of 38% was recorded in male local chickens when compared with their female counterparts (22%) in this study, and this is in line with the findings of Attah *et al.* (2013) and Dauda *et al.* (2016). However, the result contradicts the earlier report of Uhuo *et al.* (2013) and Opara *et al.* (2014) who recorded a rather higher infection rate in female chickens. The possible reason for higher intestinal parasite infection recorded among male birds in this study could be because male birds continuously expand their foraging territory in quest of food and mate during the mating season, thereby increasing their risk of contracting parasitic infections unlike the female chickens (Adang *et al.,* 2014), who tend to narrow their foraging territory during the breeding season, thus lowering their risk of contracting gastrointestinal parasites.

A higher prevalence of intestinal parasites in adult birds as compared to young ones (46% and 9%, respectively) was recorded in this study. This finding is in contrast to that of Dauda *et al.* (2016) who reported higher prevalence in young than in adults. The prolonged life span of the adult LSC gives it more time to scavenge as well as the decreased function of the immune system that comes with age could be some of the factors that might have resulted in the higher prevalence of gastrointestinal parasitism observed and recorded in the adult birds.

Prominent gross lesions observed in the intestinal tracts of the LSC included nodular lesions, haemorrhagic lesions and nodular-haemorrhagic lesions. These findings are in agreement with an earlier report by Anwar *et al.* (2000). Occlusion of the intestinal lumen by parasites was observed in intestinal tracts infected by *Ascaridia* species which coincides with earlier findings as reported by Lawal *et al.* (2023). This may lead to rupture of the intestines and hence death of the affected LSC due to haemorrhage and/or shock. The observed gross lesions in this study may be attributed to the predilection of the various parasites. For instance, nodular haenorrhagic lesions were seen in the intestinal tracts infected *by Rallietina species*, while no gross lesions were observed in the intestinal tracts infected by *Choanotaenia*, *Hymenolepis* and *Heterachis.* The microscopic lesions observed in this study included matting and stunting of intestinal villi, with loss of crypts and goblet cell hyperplasia. Others are epithelial desquamation and necrosis with leucocytic aggregation and circumscribed eosinophilic aggregation in the submucosa. These changes are possibly a reflection of the gross changes observed in the intestines of the LSC infested with parasite.

In conclusion, the overall prevalence of 56% of intestinal parasitism observed among LSC in the present study suggests an endemicity of intestinal parasitism in the study area. Age and sex appear to be risk factors associated with the incidence of intestinal parasitism in the LSC. The endemicity of the condition translates to a great economic setback to the poultry industry by causing ill-health, loss of productivity and even death of the LSC invariably

contributing to depletion of poultry protein source and employment to the populace in the study area. Strict biosecurity and good sanitary measures coupled with regular deworming of birds will serve as control and preventive measures against avian helminthoses.

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