HELMINTH FAUNA OF THE FIVE PHENOTYPES OF *GALLUS GALLUS DOMESTICUS* IN NSUKKA, ENUGU STATE, NIGERIA

[1]NZEAKOR, Terry Adaeze, [2]ANYOGU, Davinson Chuka, [1]ANERU, Efficience Ganiyu, [1]IDIKA, Idika Kalu and [1]NWOSU, Chukwunyere Okwudiri

[1]Department of Veterinary Parasitology and Entomology, University of Nigeria, Nsukka, Enugu State, Nigeria.
[2]Department of Veterinary Pathology and Microbiology, University of Nigeria, Nsukka, Enugu State, Nigeria.

Corresponding Author: Anyogu, D. C. Department of Veterinary Pathology and Microbiology, University of Nigeria, Nsukka, Enugu State, Nigeria. **Email:** davinson.anyogu@unn.edu.ng **Phone:** +234 7036841871

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ABSTRACT

With the rise in the rearing of Gallus gallus domesticus (local chicken) in Nigeria, it becomes pertinent to study various aspects of diseases affecting this type of chicken. In this study, five phenotypes (normal, frizzle feathered, wild type, naked and crested neck) of the G. gallus domesticus in Nsukka, Enugu State, Nigeria were screened for helminth parasites. Nodular lesions found in the proventriculus were processed for histopathological examination. An overall prevalence (OP) of 84 % (95 % CI = 0.6473 to 0.9421) was recorded. The helminth fauna of the five phenotypes were Ascaridia galli (OP 32 %), Raillietina sp. (OP 64 %) and Tetrameres sp. (OP 16 %). Single and mixed infections were observed in the study; single infections of Raillietina sp. was the most prevalent (40 %), while a mixed infection of A. galli and Raillietina sp. occurred most (20 %). Crested neck had the highest prevalence (100 %) of helminth infection (95 % CI = 0.5109 to 1.0000), while the other four phenotypes had 80 % prevalence of helminth infections (95 % CI = 0.3596 to 0.9797) each. Microscopically, the proventricular nodules revealed embryonated eggs of the female Tetrameres sp. with ulceration of the proventricular mucosa, necrosis of the proventricular glands with haemorrhage. The high prevalence reported across all the phenotypes may likely be attributed to poor management and feeding habit of G. gallus domesticus. It is recommended that farmers adopt the intensive system of management for the rearing of G. gallus domesticus and regular anthelmintic treatment of their birds.

Keywords: *Ascaridia galli,* Avian helminthosis, *Gallus gallus domesticus*, *Raillietina* sp.*, Tetrameres* sp.

INTRODUCTION

Poultry is widely distributed across Africa and the world in general. Among members of the poultry family, chicken is the most common and accounts for approximately 98 % of the total poultry population in Africa (Solomon and Udoh, 2017). In Nigeria, indigenous/local birds make up to about 80 % (120 million) of the 150 million total population of poultry, while the exotic birds make up the remaining 20 % or 30 million (RIM, 1992). Generally, poultry production is hindered by poor management system and diseases (Adang *et al.,* 2014). According to Adang *et al.* (2014), gastrointestinal parasitism constitutes a major threat to poultry production especially in the extensive and semi-extensive systems which are the major systems of production used for the *G. gallus domesticus*. Helminthosis has been reported to result to weight loss, depression and reduced egg production in avian species (Yazwinski *et al.,* 2013). Rearing of indigenous birds serves as a source of protein and income to most

inhabitants of rural communities in the tropical and subtropical areas (Odubote, 2015; Padhi, 2016). They are delicacies in poor resources communities as they are considered much tastier, flavourful and lean (Ajayi, 2010). They are also hardy; expressing high level of disease resistance and adaptability to the adverse tropical climatic conditions, and exhibiting slow maturity and growth rate (Padhi, 2016).

Five phenotypes of the *G. gallus domesticus* in Nigeria have been described based on their feather arrangement, plumage colour, body size, structure and colour variants (Ajayi and Agaviezor, 2009). These phenotypes are divided into three common phenotypes of normal feathered, frizzle feathered and naked neck and two less common phenotypes of crested neck and wild type. The normal feathered is the highest occurring followed by the naked neck and frizzle feathered, while the crested neck and wild types were the least occurring (Ajayi and Agaviezor, 2009).

Various researchers have observed variations in the productivity, maturity, weight gain, haematological parameters and adaptation among the five phenotypes (Ibe, 1993; Ajayi, 2010; Nweke-Okorocha *et al*., 2020). Frizzle feathered and naked necks were observed to produce bigger and greater number of eggs, greater body weight gain and earlier maturity than the normal feathered (Ajayi, 2010). Frizzle feathered showed superior haematological parameters, indicating greater cell mediated immunological prowess and feed conversion efficiency (Solomon and Udoh, 2017). Thus it can be inferred that the Frizzle feathered will be more resistant to infections than other phenotypes.

Information on the prevalence of helminths of local chickens in Nigeria abound. Most of the studies focused on the general prevalence in specific communities and also on sex differences in the prevalence (Yoriyo *et al.,* 2008; Nnadi and George, 2010; Idika *et al*., 2015; Imam *et al*., 2017). This study aimed at filling the knowledge gap concerning the prevalence of helminths in the different phenotypes of local chickens, bearing in mind that these phenotypes also vary in productivity, adaptation and weight gain. This study may help to explain these variations if one phenotype suffers more from helminthosis than the other. Thus, this study evaluated the prevalence of helminth infections in the specific phenotypes of *G. gallus domesticus* in Nigeria.

MATERIALS AND METHODS

A total of twenty-five (25) Nigerian local chickens (*G. gallus domesticus*) made up of five males from each of the five phenotypes, bought from the local communities in Nsukka, were euthanized by exsanguination under chloroform anaesthesia and necropsied. The birds were eviscerated and the gastrointestinal tract (GIT) placed in labelled petri dishes containing normal saline. The gastrointestinal tracts were split open using a dissecting knife; the parasites found were viewed under a stereomicroscope and were identified according to the method described by Soulsby (1982). Nodules found in the proventriculus of some of the birds were excised, fixed in 10 % neutral buffered formalin, routinely processed for histopathology, sectioned at 5 µm thickness and stained with Haematoxylin and Eosin (H&E) (Avwioro, 2002).

Statistical Analysis: The prevalence rates were analysed using descriptive statistical analysis and presented in tables. The mean intensity and mean abundance were equally calculated.

RESULTS

Three helminth parasites (2 nematodes; *Ascaridia galli* and *Tetrameres* sp*.* and 1 cestode; *Raillietina* sp.) were observed in the study. The overall prevalence (OP) of helminth infections in the local chickens studied was 84 % (95 % CI = 0.6473 to 0.9421). *Raillietina* sp*.* had the highest OP of 64 % followed by *A. galli* with OP of 32 % and *Tetrameres* sp*.* with OP of 16 % (Table 1). The prevalence of helminth infections among the five phenotypes studied showed that the crested neck chickens had the highest level of helminth infections with a prevalence of 100 %, while the other four phenotypes recorded 80 % prevalence (Table 2).

Table 1: Overall prevalence of helminth infections in the *Gallus gallus domesticus*

Helminth Fauna	Number of *G. gallus domesticus* infected	Number of *G. gallus domesticus* screened	Overall prevalence (%)
***Raillietina* sp.**	16	25	64
Ascaridia galli	8	25	32
***Tetrameres* sp.**	4	25	16
Overall prevalence	21	25	84

Table 2: Overall prevalence of helminth infections in the five phenotypes of the *Gallus gallus domesticus*

Phenotype	Overall prevalence of helminth infections (N = 25)
Normal feathered	80% (95% CI = 0.3595 to 0.9797)
Naked neck	80% (95% CI = 0.3595 to 0.9797)
Frizzle feathered	80% (95% CI = 0.3596 to 0.9797)
Wild type	80% (95% CI = 0.3596 to 0.9797)
Crested neck	100% (95% CI = 0.5109 to 1.0000)

The prevalence, mean intensity and mean abundance of the three helminth parasites recovered from the five phenotypes were calculated and *Raillietina* sp. in the crested neck phenotype had the highest prevalence rate of 100 % followed by the frizzle feathered with a prevalence of 80 % (Table 3). Single and mixed infections were observed in this study. Mixed infections with *A. galli* and *Raillietina* sp. occurred most with a prevalence of 20 %, while the single infection of *Raillietina* sp. was observed to have the highest prevalence of 40 % (Table 4).

Microscopically, embryonated eggs of female *Tetrameres* sp. were found in the proventricular lumen along with necrosis of the proventriccular glands and haemaorrhage (Figure 1). Severe ulceration of the proventricular mucosa were seen in a section (Figure 2), while another section showed un-capsulated microgranuloma containing eosinophils, mononuclear cells and necrotic debris embedded in the proventricular mucosa (Figure 3).

DISCUSSION

A very high prevalence for helminth infection (84 %) was observed in the *G. gallus domesticus* in Nsukka and though this could be attributed to the small sample size, it is consistent with the prevalence rates recorded by some other researchers across Nigeria; 81.3 % in Gombe State, Nigeria (Adang *et al.,* 2014), 87.8 % in Bauchi State, Nigeria (Yoriyo *et al.,* 2008) and 96.8% in Nsukka Enugu State, Nigeria (Idika *et al.,* 2015). But higher than that of Dawet *et al.* (2012) who reported 37.85 % in Jos, Plateau State, Nigeria. The high prevalence recorded can be related to the fact that the *G. gallus domesticus* are mostly left to roam and scavenge for food during which they pick up insects which may be intermediate hosts of various parasites such as *Raillietina* sp. and *Tetrameres* sp. These roaming birds are equally exposed to contaminated soil that could contain infective stages of parasites. Gastrointestinal parasitism interferes with host's metabolism, thus resulting in poor feed utilization, reduced growth and rarely death in severe cases (Dawet *et al.,* 2012). *Raillietina* sp., which causes nutrient depletion, was the highest occurring followed by *A. galli*, which interferes with the intestinal surface area for absorption of nutrients and also blockage when they occur in large numbers. These two parasites have been reported to be the most common helminths of birds (Idika *et al.,* 2015). The observed higher prevalence of helminths, especially *Raillietina* sp., in the crested neck chickens compared to other phenotypes may not have a specific underlying cause. *Tetrameres* sp. was also found only in the naked neck and wild type chickens, making them the only chicken phenotypes that had all the different helminth species studied. These may not be attributed to the phenotypic differences of the chickens but may mean that the naked neck and wild type chickens were more exposed to the intermediate hosts of *Tetrameres* sp. such as grasshoppers, cockroaches and earthworms.

The severity of the microscopic lesions is indicative of the level of interference with normal gastrointestinal physiology in the birds affected by *Tetrameres* sp. Ulceration of the proventricular mucosa and clogging of the parasites in the proventricular lumen may have limited both feed intake and movement across the tract.

Table 3: Prevalence of the various helminths recovered in the five phenotypes of the *Gallus gallus domesticus*

Phenotype	Helminth parasites	Prevalence (%)	Mean intensity	Mean abundance
Normal feathered	*Raillietina* sp.	60	5	2
	Ascaridia galli	40	1	0.4
Naked neck	*Raillietina* sp.	60	10	6
	Ascaridia galli	20	30	12
	Tetrameres sp.	40	NA	NA
Frizzle feathered	*Raillietina* sp.	80	7.25	5.8
	Ascaridia galli	20	1	0.2
Wild type	*Raillietina* sp.	40	16.5	6.6
	Ascaridia galli	20	2	0.4
	Tetrameres sp.	40	NA	NA
Crested neck	*Raillietina* sp.	100	7.2	7.2
	Ascaridia galli	40	6	2.4

NA – Not Applicable

Table 4: Single and mixed infection rate with two or more parasites in the *Gallus gallus domesticus*

Helminths	Number Infected	Number examined	Prevalence (%) N = 25
***Ascaridia galli* + *Raillietina* sp.**	5	25	20
***Raillietina sp.* + *Tetrameres* sp.**	1	25	4
***Ascaridia galli* + *Raillietina* sp. + *Tetrameres* sp.**	1	25	4
***Ascaridia galli* + *Tetrameres* sp.**	0	25	0
***Ascaridia galli* only**	2	25	8
***Raillietina* sp. only**	10	25	40
***Tetrameres* sp. only**	2	25	8

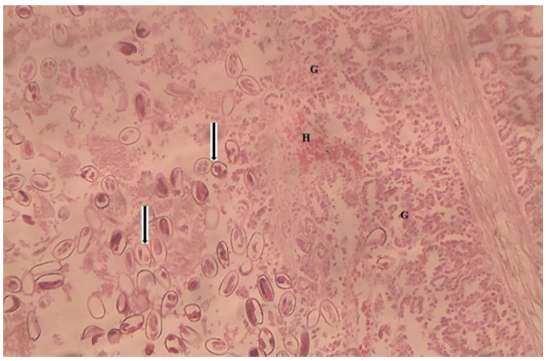

Figure 1: Section of the proventriculus showing embryonated eggs of the female *Tetrameres* sp. in the lumen (*arrows*) with haemorrhage (H) and severe necrosis of proventricular glands (G). H&E stain, x400

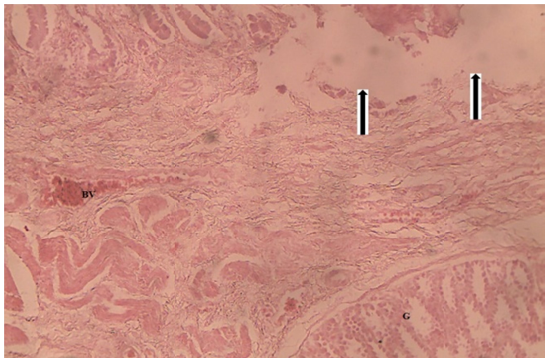

Figure 2: Section of the proventriculus showing ulcerated proventricular mucosa (*arrows*). BV = Blood vessel, G = Proventricular gland. H&E stain, x400

The adult parasite is also known to feed on host's blood and become engorged and gravid. This blood meal leads to haemorrhage as observed in this study, and may result in anaemia and death of the host (Kumar *et al.,* 2017). This may explain why the birds affected with *Tetrameres* sp. in this study were off feed and emaciated.

Sections of the parasite containing embryonated eggs were reported in a previous study by Kamil *et al.* (2011) along with degeneration and desquamation of the glandular cells and infiltration of lymphocytes, eosinophils and histiocytes.

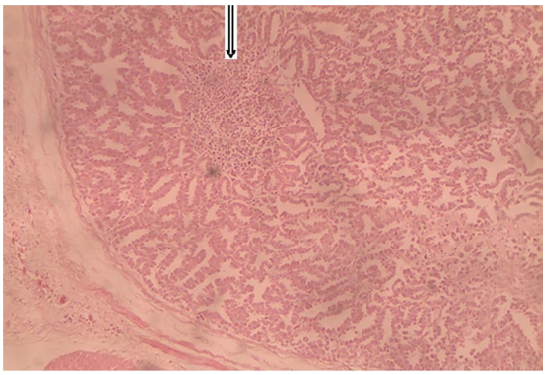

Figure 3: Section of the proventriculus showing microgranuloma (*arrow*) composed mainly of necrotic debris with few eosinophils and mononuclear inflammatory cells. H&E stain, x100

Conclusion: The massive infection rate of helminth parasites is the most likely reason why the *G. gallus domesticus* are thought to have slow growth and feed conversion rates. It is possible that under good management system and regular anthelmintic treatments they could perform optimally.

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