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Prevalence of gastrointestinal helminths in chickens slaughtered at Samaru and Sabon Gari live bird markets in Zaria, Kaduna State, Nigeria

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Abstract

Gastrointestinal helminth infections constitute an important constraint to poultry production, particularly in developing countries where certain management practices may predispose birds to parasitism. This study determined the prevalence and diversity of gastrointestinal helminths in local and exotic chickens slaughtered at Samaru and Sabon-Gari live bird markets in Zaria, Kaduna State, Nigeria. A total of 239 chickens (local and exotic breeds) were examined. Following slaughter, the entire intestinal tract of each bird was exteriorized, and faecal samples were collected directly via the rectum. Samples were properly labelled and transported to the laboratory for analysis. Helminth eggs were detected using the simple flotation technique with a zinc sulphate-sucrose floatation medium. Microscopic examination was conducted for identification of helminth eggs. Results showed that out of the 239 birds examined, 167 were infected with single or mixed helminth infections, giving an overall prevalence of 69.9%. Four helminth species were identified, comprising three nematodes and one cestode. The nematodes encountered were *Ascaridia galli* (43.9%), *Heterakis gallinarum* (39.3%) and *Capillaria obsignata* (2.5%), while the only cestode identified was *Raillietina echinobothrida* (21.3%). Single infections occurred in 30.5% of the birds, while 35.5% harboured two helminth species, and 3.8% had triple infections. No trematode eggs were detected. There was no statistically significant ($p > 0.05$) association between the occurrence of the helminths and breed or sex. It was concluded that gastrointestinal helminth infections are highly prevalent among chickens slaughtered in the study area, with nematodes being the dominant parasites. The high rate of mixed infections highlights the need for improved parasite control strategies and better management practices in poultry production systems in the study area.

Keywords: Gastrointestinal helminths; Chickens; Prevalence; Live bird markets; Zaria, Nigeria.

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Introduction

The domestic chicken (*Gallus gallus domesticus*), believed to have originated from the red jungle fowl of South and Southeast Asia, is an important livestock species that provides high-quality protein, income and employment, particularly for smallholder farmers (Permin and Ranvig, 2001; Matur, 2002). Poultry production is well integrated into mixed farming systems and has expanded significantly in Nigeria, where it contributes to rural development and household income (Aini, 1990; Nnadi and George, 2010). Indigenous chickens are widely kept due to their adaptability and relative resistance to diseases (Hirut, 2009).

The occurrence of gastrointestinal helminths remains a major constraint to poultry production. These parasites, including nematodes, cestodes and trematodes, are associated with poor growth, reduced feed efficiency, decreased egg production and economic losses (Hange *et al*., 2007; Padhi and Panda, 1986). Nematodes such as *Ascaridia galli*, *Heterakis gallinarum* and *Capillaria* spp. are particularly important due to their prevalence and pathogenicity (Jordan and Pattison, 1996; Pam *et al*., 2006), while cestodes such as *Raillietina* spp. also contribute to production losses (Oniye *et al*., 2001). The burden of infection is reportedly often higher in extensive and backyard poultry management systems where birds are more exposed to infective stages of parasites (Kaufmann, 2011). Parasitic infections continue to limit poultry production worldwide, with substantial losses reported in Africa (Sonaiya, 1990).

Although improved management practices have reduced infection rates in intensive poultry management systems, gastrointestinal helminths remain prevalent in developing countries (Fatihu *et al*., 1991; Pandey *et al*., 1992). In Nigeria, there is limited information on helminth infections in indigenous chickens, despite their economic importance (Oyeka, 1989; Fabiyi, 1972). This gap in knowledge is further compounded by tropical environmental conditions that favour parasite survival and transmission. Given the economic and public health importance of poultry, as well as the limited epidemiological data on helminth infections in local production systems, this study determined the prevalence of gastrointestinal helminth infections in chickens slaughtered at Samaru and Sabon-Gari live bird markets in Zaria, Kaduna State, Nigeria.

Materials and Methods

Study Area: The study was conducted in Zaria Local Government Area, Kaduna State, Nigeria, located in the Northern Guinea Savannah ecological zone (11°10'N, 7°38'E). Zaria has a tropical wet-and-dry climate characterized by a rainy season from April to September and a dry season from October to March, with an average annual temperature of approximately 25.6°C. The area serves as an important commercial and administrative centre with active live bird markets supplying poultry to surrounding communities.

Sample Size: The sample size was calculated using the formula described by Thrusfield (2005) for prevalence studies at a 95% confidence level and 5% precision. An expected prevalence of 81.5% from a previous study in the area was used to determine the required sample size. Based on this calculation, a total of 239 chickens were included in the study.

Sampled Animals: A total of 239 chickens, comprising both local and exotic breeds, were sampled from Samaru and Sabon-Gari live bird markets in Zaria, Nigeria. Birds were selected at slaughter points in the markets to obtain representative samples from the poultry population sold in the area.

Sample Collection Procedure: Following slaughter, the gastrointestinal tract of each chicken was exteriorized, and faecal samples were collected by gently expressing intestinal contents through the rectum. Samples were placed in clean labelled polythene bags indicating the breed and sex of each bird. The samples were transported to the Department of Veterinary Parasitology and Entomology Laboratory, Ahmadu Bello University, Zaria, and stored at 4°C until they were analysed.

Sample Processing: The flotation solution was prepared following the method described by Soulsby (1982) by dissolving 400 g of zinc sulphate ($ZnSO_4$) and 150 g of sucrose in 1000 ml of boiling distilled water. The mixture was gently stirred to obtain a homogeneous solution, and 1 g of thymol crystal was added as a preservative. Approximately 3 g of faecal sample was mixed with 10 ml of flotation medium in a universal bottle and filtered through double-layered gauze into centrifuge tubes. Additional flotation medium was added to form a meniscus, after which a coverslip was placed on the tube and allowed to stand for 10 minutes. The coverslip was transferred onto a glass slide and examined microscopically under ×10 and ×40 objective lenses for identification of helminth eggs.

Data Analysis: Descriptive statistics were used to summarize the prevalence of helminth infections observed in the sampled birds. Differences in infection rates between groups were analyzed using one-way analysis of variance (ANOVA) followed by Tukey's multiple comparison test using GraphPad Prism version 5.0. Statistical significance was considered at $p < 0.05$.

Results

The prevalence of individual gastrointestinal helminth parasites identified in the surveyed chickens is presented in Table 1. Four helminth parasites were encountered during the study, comprising three nematodes and one cestode. The highest prevalence was recorded for *Ascaridia galli* (43.9%), followed by *Heterakis gallinarum* (39.3%), while *Raillietina* spp. had a prevalence of 21.3%. *Capillaria obsignata* was the least prevalent parasite, with a prevalence of 2.5%.

The frequency of occurrence of the helminth infections as single and mixed infections is presented in Table 2. Out of the total chicken surveyed, 167 (69.9%) were infected with one or more helminth parasites. Single infections accounted for 30.5% of cases, while mixed infections involving two parasites were more common (35.6%). Triple infections were relatively rare, occurring in 3.8% of the birds. The most common mixed infection observed was the combination of *Ascaridia galli* and *Heterakis gallinarum* (Table 2).

The distribution of gastrointestinal helminth infections in relation to breed and sex of chickens is shown in Table 3. Variations in prevalence were observed among local, broiler and layer chickens, as well as between males and females. However, these differences were not statistically significant ($p > 0.05$).

Table 1: Incidence of total gastrointestinal helminths infection for individual parasites in chickens slaughtered in Samaru and Sabon-Gari live bird market Zaria, Nigeria.

Helminth	Frequency (n = 239)	% Prevalence
Ascaridia galli	105	43.9%
Heterakis gallinarum	94	39.3%
Railletina spp	51	21.3%
Capillaria obsignata	6	2.5%

Table 2: Frequency of occurrence of individual helminth parasites as single or mixed infection in chickens slaughtered at Samaru and Sabon-Gari live bird markets, Zaria, Nigeria.

Helminth Parasites (single infection)	**Frequency**	**Percentage**
Ascaridia galli	35	14.6%
Heterakis gallinarum	23	9.6%
Raillietina spps	15	6.3%
Subtotal	73	30.5%
Mixed helminth infections (two parasites)	**Frequency**	**Percentage**
Ascaridia galli + Heterakis gallinarum	52	21.8%
Ascaridia galli + Raillietina spps	17	7.1%
Ascaridia galli + Capillaria obsignata	6	2.5%
Raillietina spps + Heterakis gallinarum	10	4.2%
Subtotal	85	35.6%
Mixed helminth infections (three parasites)		
Ascaridia galli + Raillietina spp + Heterakis gallinarum	9	3.8%
Subtotal	9	3.8%
Total number of chickens infected	**167**	**69.9%**

Table 3: Percentage prevalence of gastrointestinal parasites in relation to breed and sex of chickens slaughtered at Samaru and Sabon-Gari live bird markets in Zaria, Nigeria.

Helminths	**Local (n=79)**		**Broiler (n=80)**		**Layer (n=80)**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Ascaridia galli	13 (16.4%)	25 (31.6%)	23 (28.8%)	18 (22.5%)	-	40 (50%)
Heterakis gallinarum	27 (34.2%)	19 (24.1%)	18 (22.5%)	12 (15%)	-	18 (22.5%)
Raillietina echinobothrida	8 (10.1%)	11 (13.9%)	8 (10%)	10 (12.5%)	-	14 (17.5%)
Capillaria obsignata	0 (0%)	0 (0%)	0 (0%)	0 (0%)	-	6 (7.5%)

* n = total number of birds sampled

The morphological characteristics of the helminth eggs identified in this study are presented in Figures 1 – 4. Figure 1 shows the egg of *Ascaridia galli*, Figure 2 shows *Heterakis gallinarum*, Figure 3 shows *Raillietina* spp., and Figure 4 shows *Capillaria obsignata*.

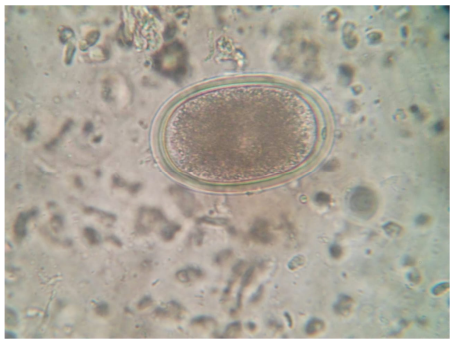

Figure 1: Isolated *Ascaridia* egg from faeces of chickens slaughtered at Samaru and Sabon-Gari live bird markets, Zaria, Nigeria. [×40 magnification]

Figure 2: Isolated *Heterakis* egg from faeces of chickens slaughtered at Samaru and Sabon-Gari live bird markets, Zaria, Nigeria. [×40 magnification]

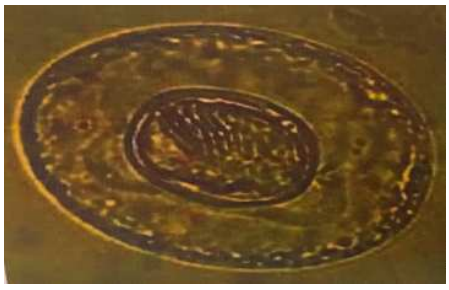

Figure 3. Isolated *Raillietina* egg from faeces of chickens slaughtered at Samaru and Sabon-Gari live bird markets, Zaria, Nigeria. [×40 magnification]

Figure 4. Isolated *Capillaria* egg from faeces of chickens slaughtered at Samaru and Sabon-Gari live bird markets, Zaria, Nigeria. [×40 magnification]

Discussion

The overall 69.9% prevalence of gastrointestinal helminths recorded in this study indicates a high level of helminth infection among chickens in the study area. This prevalence is lower than the 95.7% reported in Zaria, Nigeria by Fatihu *et al*. (1991), as well as 81.5% and 76.2% reported in Kaduna and Abuja, Nigeria by Junaidu *et al*. (2014) and Matur and Mlann (2010), respectively. However, it is higher than the 62% reported by Rufai and Jato (2016) in Osun State, Nigeria. These variations in prevalence may be attributed to differences in management systems, environmental conditions, sampling periods and levels of veterinary care across study areas.

The predominance of nematodes, particularly *Ascaridia galli* and *Heterakis gallinarum*, in this study is consistent with previous reports (Fatihu *et al*., 1991; Yoriyo *et al*., 2008), confirming that these parasites are the most common helminths of chickens in Nigeria. Their high occurrence may be associated with poor sanitation, contaminated feed and water and high level of exposure to infective stages in both intensive and extensive management systems. The presence of helminth eggs in both local and exotic chickens further suggests widespread environmental contamination and continuous transmission within the study area.

The absence of trematode infections in this study agrees with earlier findings in different parts of Nigeria (Fabiyi, 1972; Oyeka, 1989; Luka and Ndams, 2007), suggesting that trematode infections are relatively uncommon in domestic chickens, likely due to the absence or limited availability of suitable intermediate hosts required for their life cycle.

The relatively high prevalence of *Heterakis gallinarum* observed in this study is of epidemiological importance. Although often considered less pathogenic, this parasite serves as a vector for *Histomonas meleagridis*, the causative agent of histomoniasis, which can result in severe disease in poultry (Soulsby, 1982; Pinckney *et al*., 2008). Similarly, *Ascaridia galli*, identified as the most prevalent parasite, is known to impair nutrient absorption and cause reduced growth and productivity, particularly in young birds (Smyth, 1976). The presence of *Raillietina* spp. further indicates exposure of birds to intermediate hosts such as ants, which is common in scavenging systems.

Mixed infections were more common than single infections in this study, which is consistent with reports by Luka and Ndams (2007) and Yoriyo *et al*. (2008). This pattern may be attributed to continuous exposure of birds to multiple infective stages in the environment, particularly in free-ranging systems. Such co-infections can have synergistic effects on host health, leading to more severe impacts on productivity than single infections (Smyth, 1976). The occurrence of mixed infections in both local and exotic chickens suggests that both management practices and environmental contamination play significant roles in parasite transmission.

Although variations in infection prevalences were observed across breeds and sexes, these differences were not statistically significant, indicating that all categories of chickens in the study area are equally exposed to infection. This further emphasizes the need for broad-based control measures rather than targeting specific groups.

Conclusion: This study demonstrated a high prevalence of gastrointestinal helminth infections among chickens slaughtered at Samaru and Sabon-Gari live bird markets in Zaria, Kaduna State, Nigeria. The findings confirm that nematodes, particularly *Ascaridia galli* and *Heterakis gallinarum*, as well as cestodes such as *Raillietina* spp., are important parasites affecting both local and exotic chickens. The high occurrence of mixed infections and the absence of significant differences between breeds and sexes indicate widespread exposure to infective stages, likely influenced by environmental contamination and management practices.

Overall, this study highlights the need for improved hygiene and management practices, and effective parasite control strategies to reduce the burden of helminth infections and enhance poultry productivity in the study area.

Conflict of Interest

The authors declare no conflict of interest.

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