Gastrointestinal Helminths of Local Chickens (*Gallus gallus domesticus* Linnaeus) and Guinea Fowls (*Numida meleagris galeata* Pallas) Slaughtered in Maiduguri, Nigeria

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**ABSTRACT**

Free-range birds are exposed to a diverse array of parasitic infections during scavenging. For an effective control, confirmation of their presence is important. The gastrointestinal (GI) parasites of chickens and guinea fowls slaughtered for human consumption in Maiduguri, Nigeria was surveyed. Of the 210 of chickens and guinea fowl gastrointestinal tracts (GIT) examined, there were nematode ova in 41.9%. There were ova in 84.5% of the guinea fowl tracts examined while ova were found in only 25.7% of the local chickens (p<0.05). Guinea fowls were 15.8 times more likely to be infected than local chickens. Nematode ova identified were *Ascaridia galli* (84.1%), *Subuluru brunpti* (21.6%), *Heterakis gallinarum* (15.9%) and *Strongyloides avium* (1.1%). The prevalence of nematode ova was higher in female birds (48.6%) than male (34.9%). A total of 30.5% of the samples had adult cestodes. They were significantly more numerous (p<0.05) in local chickens (40.1%) than guinea fowls (5.2%). *Raillietina* specie were significantly more prevalent (p<0.05) than *Hymenolepis* and *Choanotaenia*. Male birds were 2.42 times more likely to be infected than females. Prevalence of adult nematodes was 37.6%, comprising of *Ascaridia galli*, *Subulura brunpti* and *Heterakis gallinarum*. Guinea fowls were 13.82 times more likely to be infected than local chickens. It was concluded that guinea fowls were more likely to be infected with GI helminths than local chickens. Significantly more nematode (*Ascaridia galli*) ova and adult were found in female birds than male. While adult cestodes (*Raillietina*) were significantly more numerous in local chickens than guinea fowls with males twice more likely to be infected than females.

**Keywords:** Gastrointestinal Helminths; *Gallus gallus domesticus*; *Numida meleagris galeata*; Maiduguri

**INTRODUCTION**

Poultry are birds such as chickens, ducks, guinea fowls, geese and turkeys domesticated for their meat, eggs and feathers, and they contribute to food security, poverty reduction, and ecological utilization of natural resources (Guéye, 2003). The traditional free-range production system accounts for large proportion of poultry populations and play a significant role in pest control and socio-economic functions in religious and traditional rituals (Mteleni *et al.*, 2012; Maxwell *et al.*, 2016; Mlondo *et al.*, 2022). Regrettably, free-range chickens have poor productivity, veterinary care, improper housing and low economic returns (Saha, 2003).

Up to a 100% prevalence of GI helminthosis in free-ranging birds have been documented (Permin and Hansen, 1998; Maxwell *et al.*, 2016), which included both single or mixed infections by cestodes, nematodes and/or coccidia (Puttalakshmamma, 2008; Marizvikuru and Patrick, 2011). The prevalence and intensity of these helminthoses could be influenced by factors of age, sex, breed and climate change (Magwisha *et al.*, 2002).

Gastrointestinal helminthes are of global concerns in poultry production due to their effects on the health, production and welfare of the birds (Shifaw *et al.*, 2021; Makalo *et al.*, 2022). As part of efforts to meet the protein needs of populace in sub-Saharan Africa, as well as complement income from the sales of free-range poultry flocks, there is a renewed effort to ensure the health of these birds by controlling GI parasites. In Maiduguri, reports on the prevalence of GI parasites on the two different classes of poultry (local chicken and guinea fowl) have been reasonably studied by several workers in the past (Gadzama and Strivastava, 1986; Ahmed and Sinha, 1993; Biu and Etukwudo, 2004; Biu *et al.*, 2012; Atsanda *et al.*, 2015). Therefore, this study was designed to provide updates on GI helminth parasites of free-range chickens and guinea fowls slaughtered for human consumption in Maiduguri, by examining the intestinal content for parasitic ova by floatation and the morphological identification of adult...
worms (nematodes and cestodes) recovered from the intestinal tract after staining and mounting. Additionally, our study also determines the influence of age, sex and avian type on the occurrence of these parasites within the study area.

MATERIALS AND METHODS

Study Design and Sample Collection

This study was carried out in Maiduguri, Nigeria. Purposive sampling technique was used and samples collected at slaughtered birds in Monday market, Baga road, and Custom/Abbaganaram live bird market. Samples were collected daily for five weeks between November 2021 and January, 2022. Fresh complete GIT of 58 slaughtered guinea fowls and 152 chickens were obtained. Samples were immediately transported on ice to the Department of Veterinary Parasitology and Entomology laboratory, Faculty of Veterinary Medicine, University of Maiduguri, Nigeria.

Sample Processing

Each GIT was cut open with the aid of a sharp pair of scissors, and placed in a Petri dish containing normal saline, then drawn firmly several times between the fingers to slip off all of its contents. Each Petri dish was examined for parasites, and adult worms visible to the naked eyes were isolated and washed by shaking in normal saline. Thereafter, they were picked with forceps, preserved in 10% formalin, and later identified using the keys of Soulsby, (1982) and Kaufmann, (1996).

Examination and Identification of Helminths Ova

The saturated sodium chloride (NaCl) floatation method was used to examine for helminths ova. Each of the intestinal content was dissolved in a universal bottle containing 10mLs of floatation medium, and the mixture filtered through a double layer sieve into a separate universal bottle, more medium was added until meniscus was formed. A cover slip was placed gently on the universal bottle and allowed to stand for 10 minutes. The cover slip was then carefully removed and placed on grease free glass slide and examined for helminths ova under ×10 and ×40 objectives of the Olympus light microscope. Ova were identified as described by Soulsby, (1982) and Kaufmann, (1996).

Processing and Identification of Adult Helminths

Borax carmine was prepared by weighing two (2) grams of carmine and dissolving in 50 mL of distilled water and then heated in a water bath for 60 minutes, then allowed to cool. Alcohol solution (25% methanol) was prepared following standard procedure by adding 2.5 mL of absolute methanol to 7.5 mL of distilled water and allowed to stand for one hour. Similarly, 50% alcohol solution was also prepared by adding 5 mL of absolute methanol to 5 mL of distilled water and allowed to stand for one hour. Finally, 75% alcohol solution was prepared by adding 7.5 mL of absolute methanol to 2.5 mL of distilled water and allowed to stand for one hour. Adult helminths were soaked in the prepared borax carmine solution for 48 hours. Ascending grades of 25%, 50%, 75%, 100% alcohol were used to destain the specimen for 2 hours, which were then cleared using clove oil for 30 minutes. Each of the cleared specimens was then removed and placed on a clean glass slide and a drop of DPX mountant was added to each slide and covered with a cover slip. The mounted slides were then allowed to air dry and then viewed under stereoscopic microscope. Adult cestodes and nematodes were identified using taxonomic keys (Singh and Srivastava, 1977; Sloss and Kemp, 1978).

Data Analysis

Data were expressed as frequencies and percentages. Strength of association between prevalence, sex and age was determined using Chi-square test with “p-values equal to or less than 0.05 regarded as significant using Graph pad Prism version 5.

Ethical Statement

Oral consent was duly sorted from the personnel involved in slaughtering and approval was given before the specimens were collected for further investigations in the laboratory.

RESULTS

The prevalence of nematode ova in slaughtered local chickens and guinea fowls in Maiduguri is shown in Table 1. Out of 210 GIT examined a prevalence of 88 (41.9%) was recorded, which was higher in guinea fowls with 84.5% (49/58) than local chickens 25.7% (39/152) (p<0.05). Guinea fowls were 15.8 times more likely to be infected than local chickens (OR= 15.77; 95% CI: 7.09-35.06). Nematode ova identified were those of Ascaridia galli (84.1%; 74/88), Subulura brumpti (21.6%; 19/88), Heterakis gallinarum (15.9%; 14/88) and Strongyloides avium 1.1% (1/88) (p<0.05). Sex-wise prevalence of nematode ova was higher in female birds 48.6% (52/107) than male 34.95% (36/103) (p<0.05), and based on slaughter-point, Custom/abbaganaram market had a higher prevalence of 81.1%; 43/53 than Monday market (31.4%; 33/105) and Baga road market (23.1%; 12/52) (p<0.05). Table 2 shows the prevalence of adult cestodes in slaughtered guinea fowls and local chickens in Maiduguri. Adult cestodes had an overall prevalence of 30.5%; 64/210 represented as Raillietina spp. (40.6%; 26/64), Hymenolepis spp. (37.5%; 24/64) and Choanotaenia spp. 21.9% (14/64) (p<0.05). Local chickens had a higher prevalence (40.1%; 61/152) than guinea fowls (5.2%; 3/58) (p<0.05). Sex-wise male birds had a higher prevalence (39.8%; 41/103) than female (21.5%; 23/107) (p<0.05). Male birds were 2.42 times (OR=2.42, 95% CI=1.32-4.43) more likely to be infected with adult cestodes compared with the female. Based on slaughter-point Monday market had a higher prevalence (41.9%, 44/105) than Baga road market (36.5%; 19/52), and Custom/abbaganaram market (1.9%; 1/53) (p<0.05).

Table 3 shows the prevalence of adult nematodes in slaughtered guinea fowls and local chickens in Maiduguri. An overall prevalence of 37.6%; 79/210 comprising of Ascaridia galli 62.0 % (49/79), Subulura brumpti 24.1% (19/79) and Heterakis gallinarum 13.9% (11/79) was recorded, and this was higher in guinea fowls 79.3% (46/58) than the local chickens 21.7% (33/152) (p<0.05). Guinea fowls were 13.82 times (OR=13.82; 95% CI: 6.57-29.07) more likely to be infected with adult nematodes compared with local chickens. Sex-wise, females had a higher prevalence 42.1% (45/107) than male 33.0% (34/103) (p<0.05). Based on slaughter-point, Custom/abbaganaram had a higher prevalence (77.4%; 41/53) than Monday market (25.7%; 27/105) and Baga road market (21.2%; 11/52) (p<0.05).
Subulura chickens were infected with similar species of helminths viz: (2018) in other parts of Nigeria. Both guinea fowls and local (2011); Offiong Ndams, (2007); Nnadi and George, (2010); Onyirioha, Maiduguri, and Fakae and Paul-Abiade, (2003); Luka and (2008); Biu Etukwudo, (2004); Biu and Lillian, (2004); Yoriyo previous findings by Ahmed and Sinha, (1993); Biu and prevalence rates of 41.9% for helminths ova with 30.5% for 2012; Nagwa worldwide as the major causes of helminthosis in to afflict local chickens and guinea fowls, and are known Both nematodes and cestodes have in this study been shown DISCUSSION

Both nematodes and cestodes have in this study been shown to afflict local chickens and guinea fowls, and are known worldwide as the major causes of helminthosis in domesticated free-range birds (Yoriyo et al., 2008; Biu et al., 2012; Nagwa et al., 2013; Atsanda et al., 2015). The prevalence rates of 41.9% for helminths ova with 30.5% for cestodes and 37.6% for nematodes in this study affirms the previous findings by Ahmed and Sinha, (1993); Biu and Etukwudo, (2004); Biu and Lillian, (2004); Yoriyo et al., (2008); Biu et al., (2012) and Atsanda et al., (2015) in Maiduguri, and Fakae and Paul-Abiade, (2003); Luka and Ndans, (2007); Nnadi and George, (2010); Onyirioha, (2011); Offiong et al., (2013); Lawal et al., (2015a and b); Imam et al., (2017); Mera and Musa, (2017) and Jajere et al., (2018) in other parts of Nigeria. Both guinea fowls and local chickens were infected with similar species of helminths viz: Raillietina, Choanotaenia, Hymenolepis, Ascaridia, Subulura, Heterakis and Strongyloides species. This could be due to the fact that both avian types were raised under the same environment conditions of free-range management system hence were exposed to similar agents of infection (Attah et al., 2013).

In this study, generally there was no significant difference based on sex. This agrees with Biu et al., (1999) that host-parasite relationship does not vary much for indigenous breeds of fowls especially with sex, but nutritional status and the presence of intermediate hosts such as ants, houseflies, beetles, cockroaches and earthworms are the major determinants for infection.

The large chicken roundworm, Ascaridia galli was the most prevalent of all nematodes followed by Subulura brumpti and H. gallinarum in this study. Numerous surveys in Nigeria have reported A. galli as the most prevalent nematode of free-range domestic birds (Fakae and Paul-Abiade, 2003; Imam et al., 2017; Mera and Musa, 2017; Jajere et al., 2018; Yahaya et al., 2020). Similar observations were reported in many parts of the world such as Ethiopia (Abebe et al., 1997), India

### Table 1: Prevalence of Nematode ova in slaughtered guinea fowls and local chickens in Maiduguri

<table>
<thead>
<tr>
<th>Species</th>
<th>No. Examined</th>
<th>No. (%) Infected</th>
<th>No. (%) Infected with Nematode Ova of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guinea fowl</td>
<td>210</td>
<td>88 (41.9)</td>
<td>19 (21.6) Subulura brumpti</td>
</tr>
<tr>
<td>Local Chicken</td>
<td>58</td>
<td>49 (84.5)</td>
<td>74 (84.1) Ascaridia galli</td>
</tr>
<tr>
<td></td>
<td>152</td>
<td>39 (25.7)</td>
<td>43 (87.8) Heterakis gallinarum</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9 (23.1) Strongyloides avium</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>103</td>
<td>36 (34.9)</td>
<td>12 (33.3) Subulura brumpti</td>
</tr>
<tr>
<td>Female</td>
<td>107</td>
<td>52 (48.6)</td>
<td>7 (13.5) Ascaridia galli</td>
</tr>
<tr>
<td>Slaughter point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baga Road Market</td>
<td>52</td>
<td>12 (23.1)</td>
<td>2 (16.7) Subulura brumpti</td>
</tr>
<tr>
<td>Monday Market</td>
<td>105</td>
<td>33 (31.4)</td>
<td>8 (24.2) Ascaridia galli</td>
</tr>
<tr>
<td>Custom/Abbaganaram Market</td>
<td>53</td>
<td>43 (81.1)</td>
<td>9 (20.9) Subulura brumpti</td>
</tr>
</tbody>
</table>

### Table 2: Prevalence of adult Cestodes in slaughtered guinea fowls and local chickens in Maiduguri

<table>
<thead>
<tr>
<th>Species</th>
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<th>No. (%) Infected with Cestodes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guinea fowl</td>
<td>210</td>
<td>64 (30.5)</td>
<td>26 (40.6) Raillietina spp.</td>
</tr>
<tr>
<td>Local chicken</td>
<td>58</td>
<td>3 (5.2)</td>
<td>1 (33.3) Hymenolepis spp.</td>
</tr>
<tr>
<td></td>
<td>152</td>
<td>61 (40.1)</td>
<td>25 (40.9) Choanotaenia spp.</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>103</td>
<td>41 (39.8)</td>
<td>15 (36.6) Raillietina spp.</td>
</tr>
<tr>
<td>Female</td>
<td>107</td>
<td>23 (21.5)</td>
<td>11 (47.8) Hymenolepis spp.</td>
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<tr>
<td>Slaughter point</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Baga Road Market</td>
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<tr>
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<td>17 (38.6) Hymenolepis spp.</td>
</tr>
<tr>
<td>Custom/Abbaganaram Market</td>
<td>53</td>
<td>1 (1.9)</td>
<td>1 (100.0)</td>
</tr>
</tbody>
</table>

### Table 3: Prevalence of adult Nematodes in slaughtered guinea fowls and local chickens in Maiduguri

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<td>13 (28.3) Ascaridia galli</td>
</tr>
<tr>
<td></td>
<td>152</td>
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<tr>
<td>Sex</td>
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</tr>
<tr>
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<td>7 (25.9) Ascaridia galli</td>
</tr>
<tr>
<td>Custom/Abbaganaram Market</td>
<td>53</td>
<td>41 (77.4)</td>
<td>10 (24.4)</td>
</tr>
</tbody>
</table>

DISCUSSION

Both nematodes and cestodes have in this study been shown to afflict local chickens and guinea fowls, and are known worldwide as the major causes of helminthosis in domesticated free-range birds (Yoriyo et al., 2008; Biu et al., 2012; Nagwa et al., 2013; Atsanda et al., 2015). The prevalence rates of 41.9% for helminths ova with 30.5% for cestodes and 37.6% for nematodes in this study affirms the previous findings by Ahmed and Sinha, (1993); Biu and Etukwudo, (2004); Biu and Lillian, (2004); Yoriyo et al., (2008); Biu et al., (2012) and Atsanda et al., (2015) in Maiduguri, and Fakae and Paul-Abiade, (2003); Luka and Ndans, (2007); Nnadi and George, (2010); Onyirioha, (2011); Offiong et al., (2013); Lawal et al., (2015a and b); Imam et al., (2017); Mera and Musa, (2017) and Jajere et al., (2018) in other parts of Nigeria. Both guinea fowls and local chickens were infected with similar species of helminths viz: Raillietina, Choanotaenia, Hymenolepis, Ascaridia, Subulura, Heterakis and Strongyloides species. This could be due to the fact that both avian types were raised under the same environment conditions of free-range management system hence were exposed to similar agents of infection (Attah et al., 2013).

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Cestodes of the guinea fowl, Numida meleagris galeata, were most prevalent in this study. This agrees with Fakae et al. (1991) who opined that Raillietina is responsible for most cases of poultry helminthosis in rural free-range poultry in Nigeria.

Conclusion

This study has successfully documented the occurrence of gastrointestinal ova including A. galli, S. brumpti, H. gallinarum and Strongyloides avium with varying prevalence in free-range birds slaughtered in Maiduguri, Nigeria. Also, the prevalence of GI helminthes was higher in female birds and guinea fowls compared with male and local chicken respectively. Finally, three adult cestodes were identified namely Raillietina spp., Hymenolepis spp. and Choanotaenia spp. while Subuluru brumpti, Ascaridia galli and H. gallinarum were the adult nematodes identified.

Acknowledgement

The technical assistance of Fauziyya Ali Mohammed is highly appreciated throughout the course of the laboratory work.

Conflict of Interest

The authors declare that they have no conflict of interest.

Authors’ Contributions

EBK, TEO and AAB contributed to the design, analysis of data and drafting of the manuscript. EBK carried out field and laboratory work. CM and JL reviewed the manuscript. All authors read and approved the manuscript for publication.

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Lawal, J.R., Hamhali, I.U., Jajere, S.M., Bello, A.M., Biu, A.A. and Musa, G. (2015). Survey and prevalence of gallus gallus domesticus, Brazil (da Silva et al., 2016) and Lesotho (Makelo et al., 2022). Ascaridia galli is frequently associated with weight loss, low egg production and decreased feed conversion rates due to occlusion of the intestinal tract especially in heavy infections. Raillietina species of cestodes were most prevalent in this study. This agrees with Fakae et al. (1991) who opined that Raillietina is responsible for most cases of poultry helminthosis in rural free-range poultry in Nigeria.


