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Prevalence and Intensity of Gastrointestinal Helminths in Captive Birds at FUNAAB Zoological Park, Abeokuta, Nigeria

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ABSTRACT
Gastrointestinal helminth infections pose significant health challenges to captive avian species, particularly in zoological settings where confinement may enhance exposure to parasitic stages. This study assessed the prevalence and intensity of gastrointestinal helminths among selected captive birds at the Federal University of Agriculture, Abeokuta (FUNAAB) Zoological Park, Nigeria. Six avian species; Common Ostrich (*Struthio camelus*), White Geese (*Chen caerulescens*), Grey Parrot (*Psittacus erithacus*), Mallard Duck (*Anas platyrhynchos*), Crowned Crane (*Balearica pavonina*), and Pea Hen (*Pavo cristatus*), were monitored for 5 week. Fresh fecal samples were collected weekly and examined using standard flotation techniques to detect helminth eggs. Helminth infections were recorded in three of the six bird species: Mallard Duck (100%), Common Ostrich (20%), and Crowned Crane (20%), indicating a substantial level of gastrointestinal parasitism within the population. *Ascaridia galli* was identified in the Common Ostrich during the third week of sampling, while *Ascaris* spp. eggs were detected in the Mallard Duck during the first week, after which the bird died. *Ascaridia* eggs were also detected in the Crowned Crane during the second week. No helminth infections were observed in the White Goose, Grey Parrot, or Pea Hen throughout the study period. Infection intensity varied among the infected species, with the highest egg count recorded in the Common Ostrich. The occurrence of helminth-associated mortality highlights the potential health risks posed by gastrointestinal parasites in captive birds. Continuous parasitological surveillance, improved enclosure hygiene, and species-specific deworming programmes are recommended to reduce infection risks and enhance avian health management in zoological parks.

Keywords: Gastrointestinal Helminths; Captive Birds; Prevalence; Infection Intensity; Zoological Park; Nigeria

INTRODUCTION

Gastrointestinal helminth infections constitute a significant threat to the health, productivity, and conservation of avian species worldwide. Helminths are parasitic worms broadly classified into nematodes, cestodes, and trematodes, many of which inhabit the gastrointestinal tract of birds and derive nourishment at the expense of their hosts (Mohebati *et al.*, 2024)

Infected birds may exhibit a range of clinical manifestations, including weight loss, anemia, diarrhea, poor feather condition, reduced reproductive performance, immunosuppression, and, in severe cases, mortality (Dimander *et al.*, 2000; Abd El-Ghany, 2023). Even subclinical infections can compromise physiological fitness and predispose birds to secondary infections.

Captive birds in zoological parks are particularly vulnerable to helminth infections because of factors inherent to confinement. These include limited space, repeated exposure to contaminated soil or fecal matter, shared enclosures, and stress-induced suppression of immune responses (Pfukenyi & Mukaratirwa, 2013). Transmission of gastrointestinal helminths in birds occurs either directly through ingestion of infective eggs or larvae from contaminated environments or indirectly via intermediate hosts such as insects and snails, depending on parasite life cycles (Sam-Wobo *et al.*, 2017). Ground-foraging species and birds housed in uncemented or soil-based enclosures are therefore at greater risk of infection (Adegbulu *et al.*, 2015).

Zoological parks serve as important centers for wildlife conservation, education, and scientific research, including the ex-situ management of threatened and non-threatened avian species. However, maintaining optimal health conditions for captive wildlife remains a major challenge, particularly in tropical environments where climatic conditions favor parasite survival and transmission (McCreesh *et al.*, 2024). High humidity and warm temperatures enhance the development and persistence of helminth eggs and larvae in the environment, thereby increasing infection pressure within captive settings (Egbetade *et al.*, 2014).

Several studies have documented gastrointestinal helminths in captive birds globally, with nematodes such as *Ascaridia* spp., *Capillaria* spp., and *Strongyloides* spp. being among the most frequently reported parasites (Cordon *et al.*, 2008). In Nigeria, available reports indicate that helminth infections remain prevalent among zoo birds despite routine sanitation and management practices (Ola-Fadunsin *et al.*, 2021). Sam-Wobo *et al*. (2017) reported the occurrence of *Capillaria* spp., *Ascaridia galli*, and *Raillietina* spp. in birds at the Federal University of Agriculture, Abeokuta (FUNAAB) Zoological Park, suggesting ongoing exposure to parasitic stages. Similarly, Egbetade *et al.* (2014) observed gastrointestinal helminths among resident wildlife in the same facility,

emphasizing the need for continuous parasitological monitoring. Beyond their impact on animal health, helminth infections in captive birds also raise public health concerns. Some avian helminths possess zoonotic potential, and zoo personnel, researchers, and visitors may be exposed through contact with contaminated enclosures, equipment, or substrates (Rahman *et al.* 2026). Consequently, regular surveillance of gastrointestinal parasites is essential not only for animal welfare but also for occupational and environmental health and safety within zoological institutions.

Despite previous studies, data on the current prevalence and intensity of gastrointestinal helminth infections among captive birds at FUNAAB Zoological Park remain limited, particularly with respect to short-term infection dynamics and species-specific intensity patterns. Assessing both prevalence and infection intensity is critical, as intensity provides insight into parasite burden and potential disease severity, which prevalence alone may underestimate (Pfukenyi & Mukaratirwa, 2013).

This study therefore investigated the prevalence and intensity of gastrointestinal helminths among selected captive bird species at the Federal University of Agriculture, Abeokuta Zoological Park, Nigeria. The findings are intended to provide updated baseline information to support evidence-based parasite control strategies, improve avian health management, and enhance conservation practices in zoological parks.

MATERIALS AND METHODS

Study Area

The study was conducted at the Federal University of Agriculture, Abeokuta, Zoological Park, Ogun State, southwestern Nigeria. The zoological park is located at approximately 7.2219°N and 3.4444°E and was established in 2008, with official operations commencing in 2010. The area experiences a tropical climate characterized by distinct wet and dry seasons, high relative humidity, and mean annual temperatures ranging from 22°C to 32°C. These environmental conditions are favorable for the survival and transmission of gastrointestinal helminths. Birds in the park were housed in species-specific enclosures, including both cemented and soil-based enclosures, which were routinely cleaned.

Study Design and Duration

A descriptive cross-sectional study was carried out over five weeks (17 February - 17 March 2025) to determine the prevalence and intensity of gastrointestinal helminths through weekly fecal sampling.

Study Animals

Six avian species were included: Common Ostrich (*Struthio camelus*), White Geese (*Chen caerulescens*), Grey Parrot (*Psittacus erithacus*), Mallard Duck (*Anas platyrhynchos*), Crowned Crane (*Balearica pavonina*), and Pea Hen (*Pavo cristatus*). Birds had not received anthelmintic treatment in the preceding three months and were clinically active at the time of sampling.

Fecal Sample Collection and Parasitological analysis

Fresh fecal samples were collected weekly from the bird enclosures using sterile spatulas and noninvasive procedures to ensure minimal disturbance to the birds prior to routine cleaning. Approximately 2 g of feces was aseptically transferred into sterile, labeled containers indicating bird species and date. Samples were transported on ice to the Parasitology Laboratory, Department of Veterinary Medicine, Federal University of Agriculture, Abeokuta, and processed within 24 hours. Fecal samples were examined for gastrointestinal helminths using the qualitative flotation technique described by Ballweber *et al.* (2014). Helminth eggs were identified based on standard morphological criteria (Garcia, 2016). Helminth prevalence was calculated as the proportion of birds shedding eggs. Infection intensity was assessed using a semi-quantitative weekly egg-scoring system: 0 - no eggs detected, 1 - Ascaris *spp.*, 2 - *Ascaridia spp.*, 3 - *Ascaridia galli.* Mortality associated with helminth infection was recorded where applicable.

Ethical Considerations

Fecal sample collection was non-invasive and conducted with minimal disturbance to the birds. Access to enclosures and sampling procedures was carried out with permission from the Zoo Park management, and all procedures complied with established guidelines for the ethical use of animals in research.

RESULTS AND DISCUSSION

Helminth infections were detected in three of the six bird species examined during the five-week study period, resulting in an overall prevalence of 50%. The helminths identified were nematodes belonging to the genera *Ascaris* spp. and *Ascaridia* spp. (Table 1). The occurrence of infections in half of the examined species demonstrates that gastrointestinal parasitism remains an important health concern among captive birds at the FUNAAB Zoological Park. Although infections were not detected in all species, the prevalence recorded is sufficiently high to indicate persistent exposure to infective stages within the zoo environment. Similar levels of infection have been reported in captive bird populations where parasite transmission persists despite routine husbandry and sanitation measures (Cordon *et al.*, 2008; Bonsu *et al*., 2020).

Helminth eggs were detected in the Mallard Duck, Common Ostrich, and Crowned Crane (Table 1). The Mallard Duck recorded the highest prevalence (100%), with *Ascaris* spp. eggs detected during the first week of sampling prior to mortality. The Common Ostrich and Crowned Crane each exhibited a prevalence of 20%, with infections detected in Week 3 and Week 2, respectively. In contrast, no helminth infections were observed in the White Geese, Grey Parrot, or Pea Hen throughout the study period. The occurrence of infections primarily in ground-associated species such as the Common Ostrich and Crowned Crane supports previous findings that birds with frequent contact with soil are more susceptible to infection due to increased exposure to infective helminth stages present in contaminated substrates (Adegbulu *et al.*, 2015; Pfukenyi & Mukaratirwa, 2013).

Table 1: Prevalence of Gastrointestinal Helminth Infections in Captive Birds at FUNAAB Zoological Park

Bird species	Helminth detected	Week detected	Prevalence (%)
Mallard Duck	*Ascaris* spp.	Week 1	100
Common Ostrich	*Ascaridia galli*	Week 3	20
Crowned Crane	*Ascaridia* spp.	Week 2	20
White Geese	None	–	0
Grey Parrot	None	–	0
Pea Hen	None	–	0

Weekly infection intensity patterns revealed distinct differences among infected species (Table 2). The Common Ostrich exhibited the highest infection intensity, recording a score of 3 in Week 3, corresponding to the detection of *Ascaridia galli*. The Crowned Crane showed a moderate intensity score of 2 in Week 2, while the Mallard Duck recorded a low intensity score of 1 in Week 1 before mortality occurred. All other species maintained zero intensity scores throughout the study period. The high intensity observed in the Common Ostrich is consistent with previous reports identifying *Ascaridia* species as persistent and successful parasites of captive and free-ranging birds due to their direct life cycle and environmental resilience (Sam-Wobo *et al*., 2017; Ola-Fadunsin *et al*., 2021). Although the infection was detected during only one sampling week, the intensity recorded highlights the capacity of *A. galli* to establish substantial parasite burdens under favourable conditions.

T**able 2: Weekly Infection Intensity Scores of Gastrointestinal Helminths in Captive Birds**

Bird Species	Week 1	Week 2	Week 3	Week 4	Week 5
Common Ostrich	0	0	3	0	0
White Geese	0	0	0	0	0
Grey Parrot	0	0	0	0	0
Mallark Duck	1	*	*	*	*
Crowned Crane	0	2	0	0	0
Pea hen	0	0	0	0	0

0 = no infection; 1 = Ascaris spp.; 2 = Ascaridia spp.; 3 = Ascaridia galli; * = death*

Helminth occurrence was species-specific and non-recurrent throughout the study period (Table 3). *Ascaris* spp. were detected only in the Mallard Duck during Week 1, *Ascaridia* spp. only in the Crowned Crane during Week 2, and *Ascaridia galli* only in the Common Ostrich during Week 3. No infections were detected in Weeks 4 and 5. This pattern suggests sporadic rather than continuous exposure to infective stages within the zoological park. Compared with earlier reports of higher helminth prevalence in captive birds at FUNAAB Zoological Park (Sam-Wobo *et al.,* 2017), the non-recurrent nature of infections observed in this study may indicate some improvement in management practices and environmental sanitation. Nevertheless, the detection of infections in 50% of the examined species indicates that helminth transmission remains a significant concern.

A notable finding of this study was the mortality of the Mallard Duck following the detection of *Ascaris* spp. eggs in Week 1. Although the infection intensity was low, the bird did not survive beyond the first week of sampling. This observation highlights the pathogenic potential of gastrointestinal nematodes, particularly in susceptible hosts. Similar reports in ducks and other waterfowl have shown that nematode infections may contribute to intestinal obstruction, reduced nutrient absorption, malnutrition, and subsequent clinical deterioration (Nnadi & George, 2018). The fatal outcome despite the low egg count suggests that factors such as host immune status or underlying health conditions may have influenced disease severity.

The complete absence of helminth infections in the White Geese, Grey Parrot, and Pea Hen may reflect species-specific resistance, behavioural differences, or reduced exposure to contaminated environments. Feeding habits, enclosure design, and the degree of contact with soil are important factors influencing helminth transmission in captive birds. Effective feed hygiene and routine sanitation practices may also have contributed to reducing exposure to infective stages in these species. Arboreal or semi-arboreal species such as the Grey Parrot generally have limited contact with contaminated soil, thereby reducing the likelihood of ingesting infective helminth stages (Abdu *et al.,* 2022).

Table 3: Temporal Distribution of Gastrointestinal Helminths among Captive Birds Over Five Weeks

Bird species	Week 1	Week 2	Week 3	Week 4	Week 5
Common Ostrich	–	–	*Ascaridia galli*	–	–
Mallard Duck	*Ascaris* spp.	Dead	Dead	Dead	Dead
Crowned Crane	–	*Ascaridia* spp.	–	–	–
White Geese	–	–	–	–	–
Grey Parrot	–	–	–	–	–
Pea Hen	–	–	–	–	–

CONCLUSION

Gastrointestinal helminths were detected in 50% of the bird species examined at the FUNAAB Zoological Park, indicating that nematode infections remain present among captive avifauna. The infections were restricted to the Mallard Duck, Common Ostrich, and Crowned Crane, with *Ascaris* spp., *Ascaridia* spp., and *Ascaridia galli* identified. Although infections were species-specific and non-recurrent, the occurrence of helminths and the mortality observed in the Mallard Duck highlight the need for continued parasite

surveillance and effective management practices to maintain the health of captive bird populations.

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