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Status of helminths in birds kept in Zoological Park, Abeokuta, Nigeria

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Abstract
Helminths are associated with parasitism for both man and animals causing serious diseases and even mortality. This study assessed the presence and status of helminth infections in birds kept at the Federal University of Agriculture (FUNAAB) Zoo Park. Early morning freshly voided faecal samples were collected from cages of 7 different species of birds namely White Geese, Mallard Duck, Crowned Crane, Rose Ringed Parakeet, Common Ostrich, Grey Parrot, and the Barn Owl. The samples were processed using Sodium acetate-Acid-Formalin ether concentration method and examined for intestinal ova under the microscope. The type of intestinal helminthes and weekly egg counts were analysed. Five genera of gastrointestinal parasites were identified, these are; *Ascaridia*, *Ascaris*, *Capillaria*, *Strongyloides* and *Rallietina*. Ostrich, Owl and Mallard ducks were infected with three different parasites at different collection week and mixed infection was observed for Ostrich and Owl. The helminth with the highest prevalence of 57.1% was *Capillaria spp* occurring in most of the surveyed birds. It is advised that the hygiene level of the birds' cages be improved to upon to reduce the level of infection among the birds in the FUNAAB Zoo Park.

Keywords: prevalence, helminths, birds, FUNAAB zoo park, abeokuta, Nigeria

Introduction
Birds are oviparous; they reproduce by laying eggs rather than giving birth to live young ones [1]. The eggs are adapted to survive in a terrestrial environment and have a porous shell made of calcium carbonate. They all have bills (beaks) which are toothless and swallow food without chewing. They have two stomach compartments (stomach glandular and stomach gizzard). Hutchinson [2] reported that birds form a class of animal that includes other species worldwide. These species were traditionally divided into thirty other but a recent list group birds into 23 to 40 others [1, 3].

Helminthiasis is a well-recognized health problem in ranging animals especially subclinical nematode infection which limits the productivity of birds [4, 5]. The study of captive animals' diseases is of veterinary importance, as gastrointestinal helminthes have been implicated in the cause of important diseases of human and animals [6]. Gastrointestinal helminthes infection has been associated with economic losses to zoo management worldwide. These manifest in chronic infection, weight loss, reduction in eggs and meat production [6, 7, 8, 9]. The variation in the prevalence of parasite intensity depends on the geographical locations, environment, immunological and nutritional status of the host, presence of intermediate host and the number of infective larva or eggs ingested by the animals [10].

Zoological garden which is an ex-situ form of conservation, exhibit wild animals for aesthetic, educational and conservation purposes [11]. However, intestinal helminthes and other parasitic diseases are the major problems which cause death in captive animals in zoological gardens. Gastrointestinal parasites cause a multitude of problems for wildlife and thus, lack of information on diseases and parasites of captive animals is a major limiting factor in the direction of appropriate chemotherapeutic interventions to animals in zoological gardens.

Considering the enormous evidence on the impact of helminthes on the profits and well- being of livestock and particularly birds [12, 13], few studies exist in Nigeria on the investigation of helminth status of birds in zoological parks [14, 15, 16]. Studies have shown that the number of infective larva stage presence in the soil is related to the number of helminths eggs passed by the host. This largely determines the number of helminthes potentially capable of being established in a susceptible host [17]. However, characteristics such as breed, age and the nutritional status of the host have a considerable influence on the parasitic helminths and their

capacity to infect the host [18]. Therefore, investigating the types of intestinal helminthes among birds would further contribute to improving the health conditions of birds. This study was conducted to determine the prevalence of gastrointestinal helminth infection found among birds in the FUNAAB zoo park, Abeokuta, Ogun State with the aim of improving the health status of the animals for productivity.

Materials and methods

Study Area

Sample collections were collected from the Federal University of Agriculture, Abeokuta Zoological Park, which was established in 2008 but officially opened in 2010. The Zoo Park is located within Odeda Local Government Area of Ogun State in South-West, Nigeria within coordinates 7.22191, 3.444437 (figure 1). The climate in the study site is characterized by both dry and wet seasons and relatively high humidity.

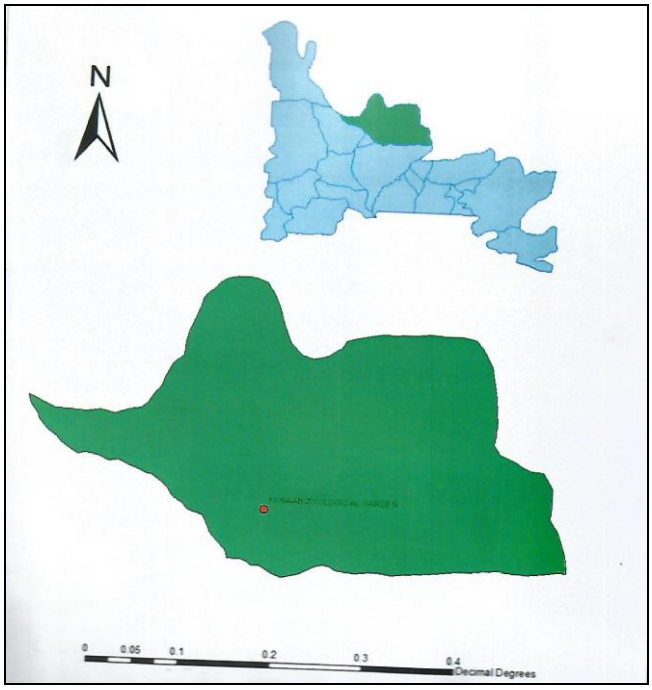
There are varieties of animal species in the zoological park; and is divided into 6 sections for proper management. These sections include; Non-human primates, Carnivores, Ungulates, Rodents, Reptiles and birds. The birds housed in the park are classified in table 1. Some animals are housed in un-cemented enclosures, while others are housed in cemented enclosures and cages, which are cleaned on a daily basis. Each species of the animals were kept separately in a large area which is structured in ways that mimic their natural environment and allows for free movement. The zoological park is demarcated and fenced to prevent movement by poachers and passers' by.

Table 1: classification of birds encountered in FUNAAB Zoological Park.

S. No	Common Name	Scientific Name	Family	Order
1	White Geese	*Chen caerulescens*	Anatidae	Anseriformes
2	Mallard Duck	*Anas platyrhynchos*	anatidae	Anseriformes
3	Crowned Crane	*Balaerica pavonina*	Gruidae	Gruiformes
4	Rose Ringed Parakeet	*Psittacula krameri*	Psittaculidae	Psittaciformes
5	Common Ostrich	*Struthio camelus*	Struthionidae	Struthioniformes
6	Grey Parrot	*Psittacus erithacus*	Psittacidae	Psittaciformes
7	Barn Owl	*Bubo scandiacus*	Strigidae	Strigiformes

Study Approval

A letter of introduction was obtained from the Department of Pure and Applied Zoology, Federal University of Agriculture, Abeokuta for permission to collect samples from zoo birds. The letter was approved by the Director of Zoological garden, prior to the conduct of the study.



***Source*:** Adegbulu *et al*., 2015

Fig 1: Map of Ogun State showing study location

Pre-survey investigation

A pre-survey investigation was carried out in the zoological garden in order to document the number of captive bird species present in the garden, their sex, the environment of the animals and how readily available their stool specimen. Information about the constituent of their diet was also recorded. The information on the age of the birds was not available as most of them were bought from local hunters.

Collection of stool samples

Early morning and freshly voided faecal samples of birds were collected before routine cleaning of all cages in the zoo. Samples were collected weekly for 8 weeks (except for Rose Ringed Parakeet's faecal samples that was not available in weeks 2, 3, 7 and 8) between 7-9 am in the month of October and November, 2016. All samples were picked from the ground by utilizing a sterile scoop for each animal species to avoid cross contamination. Each sample was put in a new labeled sterile bottle with the name of each bird from which the faecal sample was collected. Samples were then transported to the Department of Pure and Applied Zoology laboratory for laboratory and microscopic analysis which is done within 24 hours.

Parasitological examination of stool samples

About 1g of the collected faecal sample was emulsified in an already prepared 10ml of Sodium acetate acetic acid formalin (SAF) in a sample bottle. The bottles were covered and shaken vigorously to efficiently suspend the stool in the solution. The stool suspension was then strained into a centrifuge tube using sieve of about 13mm in diameter placed in a funnel. The residue was discarded while the filtrate was centrifuged at 2000rpm for 5 minutes. The supernatant was discarded while the sediment was retained. To the retained sediment, 7ml of normal saline was added and left to re-suspend, and 3ml of ether was then added to the suspension. The stopper was placed on the tube and the mixture was shaken vigorously before centrifuging for 5 minutes at 2000rpm. The first three layers of the suspension observed after centrifuging was discarded, leaving the last layer of sediment which was then put in a clean grease-free slide for microscopic examination. The already prepared sediment was pipette onto a clean, oil-free microscope slide and examined for ova of intestinal helminthes under x10 objective lens. A bench aid for animal intestinal helminthes was used to validate any identified species.

Data Analysis

Data obtained from this study were computed and analysed using Microsoft Excel 2007. Descriptive statistics were used to compute prevalence. Microsoft excel 2007 was used to create line graphs for a weekly egg count of intestinal helminthes across the birds examined.

Results

Birds belonging to 7 different species were surveyed for intestinal helminth infections at the FUNAAB Zoo park. Demography of Birds surveyed and the types of materials used in constructing their housing facilities is shown in table 2. Table 3 shows the distribution of intestinal helminth infections among the surveyed birds in which Ostrich, Owl and Mallard duck were infected with eggs of three different parasite species (mixed infection), although at different intensities, African grey parrot was found to be infected with larvae of unidentified parasite, Crown crane and white Geese were both infected with two different species of parasites but Rose ringed Parakeet was not infected during the study period.

The prevalence of soil transmitted helminthes revealed that *Capillaria species* had the highest prevalence among the birds with 57.1%, both *Ascaris species* and *Strongyloides species* recorded 42.9% while *Raillietina species* recorded the lowest prevalence with 14.3% as shown in table 4.

Table 2: Sex and description of housing conditions of the birds surveyed.

S. No	Avian species	Number	Sex	Housing status
1	*Psittacus erithacus*	2	Dimorphic	Restricted in a cage built with irons
2	*Bubo scandiacus*	1	Dimorphic	Constructed with triangular iron with chicken mesh, roofing sheet covered with black tarpaulin
3	*Struthio camelus*	2	1male, 1female	Constructed with triangular iron, iron pipe, wooden stands, covered with wire. Vegetation and large space around the cage to mimic natural habitat.
4	*Balaerica pavonina*	2	Dimorphic	Constructed with triangular iron, pipe and swimming (puddle)
5	*Anas platyrhynchos*	2	1male, 1female	Constructed with triangular iron, pipe and swimming (puddle)
6	*Chen caerulescens*	4	3males, 1female	Constructed with triangular iron, pipe and swimming (puddle)
7	*Psittacula krameri*	1	Dimorphic	Restricted in a cage built with irons

Table 3: Distribution of intestinal helminth in avian species surveyed in FUNAAB zoological park.

S. No	Bird/Parasite	*Capillaria spp*	*Ascaridia galli*	*Ascaris spp*	*Strongyloides spp*	*Raillietina spp*	Unknown larvae	Total parasite observed
1	Grey Parrot	0	0	0	0	0	+(2)	1
2	Ostrich	+(4)	0	+(4)	+(3)	0	0	3
3	Barn Owl	+(6)	0	0	+(3)	+(3)	0	3
4	Crown Crane	0	+(1)	+(2)	0	0	0	2
5	Mallard Duck	+(2)	+(3)	+(6)	0	0	0	3
6	White Geese	+(1)	0	0	+(3)	0	0	2
7	Rose Ringed Parakeet	0	0	0	0	0	0	0

no worm or cyst observed; **+** worm or cyst present; **()** egg/worm count

Table 4: Prevalence of gastrointestinal parasitic infection in surveyed birds of FUNAAB zoological park.

Infection	Number of birds examined	No of birds infected	Percentage of infection (%)
Capillaria spp.	7	4	57.1
Ascaridia galli	7	2	28.6
Ascaris spp.	7	3	42.9
Strongyloides spp.	7	3	42.9
Raillietina spp.	7	1	14.3

Weekly parasite Egg Count in Averian species of FUNAAB zoological park

In Ostrich, *Capillaria species* infection was found to be highest in week 2 (figure 2) while *Ascaris* and *Strongyloides spp.* were highest in week 4. In Owl however, *Strongyloides spp*. infection was found to be highest in week 7 while *Capillaria. spp*. and *Raillietina spp*. infections were highest in weeks 1 and 8 respectively as shown in figure 3.

Ascaris spp. occurred twice in Crown crane during the study period while *Ascaridia galli* ovum was found only once as shown in figure 4**.** Figure 5 revealed that *Ascaris. spp*. infection was highest at week 2 and also observed at week 6 while *Ascaridia galli* occurred just once at week 1 in Mallard duck. Eggs of *Capillaria spp*. and *Strongyloides spp*. were found at week 2 of the White Geese (figure 6).

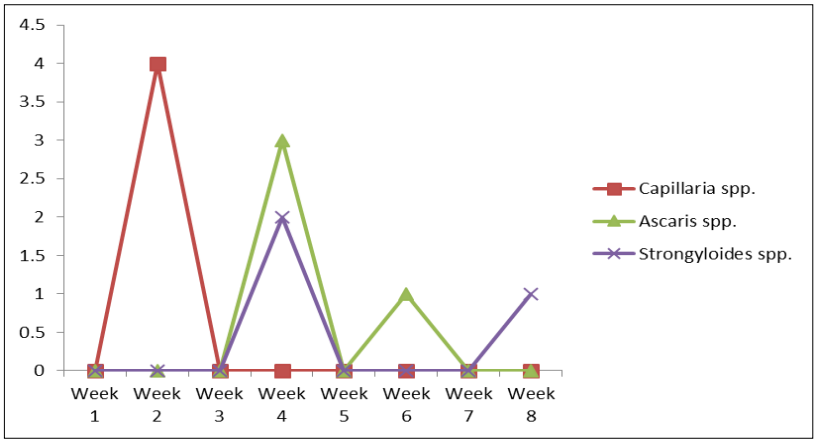


Fig 2: Weekly parasites egg count in Ostrich of FUNAAB Zoo Park.

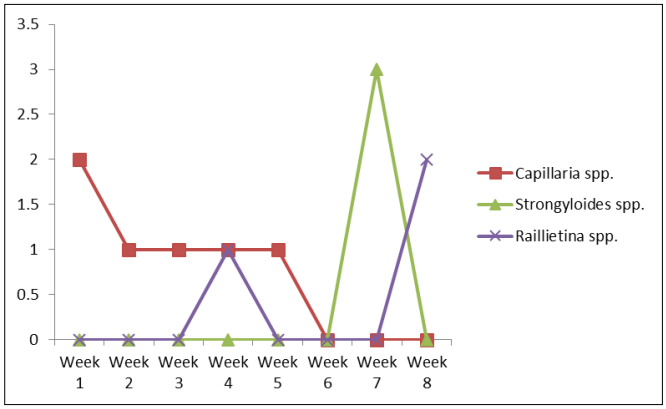


Fig 3: Weekly parasite egg count in Owl of funaab Zoo Park

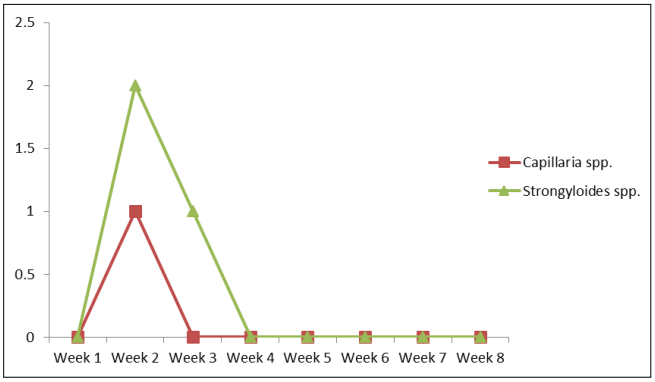


Fig 6: Weekly parasite egg count in White Geese in funaab Zoo Park.

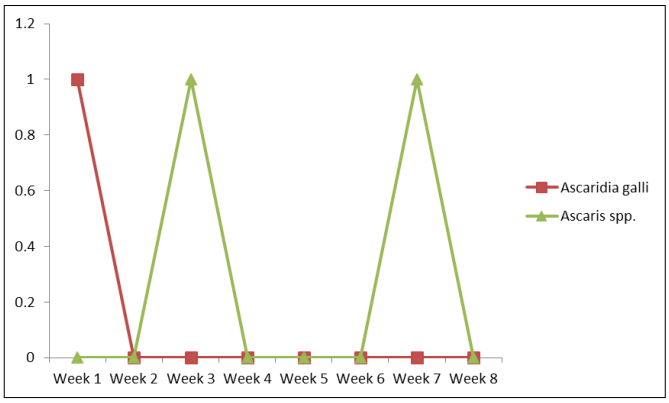


Fig 4: Weekly parasite egg count in Crown Crane of funaab Zoo Park

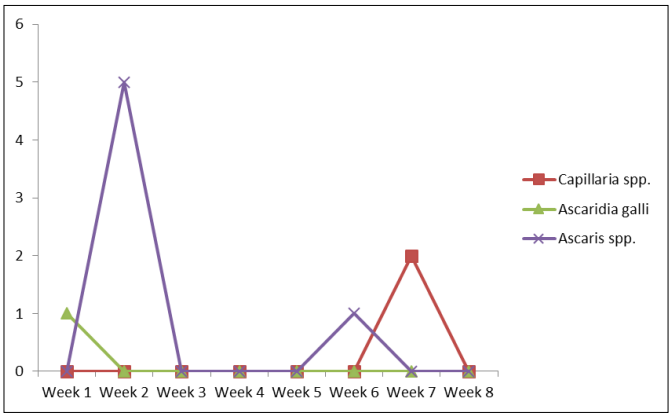


Fig 5: Weekly parasite egg count in Mallard Duck of funaab Zoo Park

Discussion

Following observations from the study, it is evident that helminths still constitute problems causing serious diseases and even mortality in captive animals ([19]). These helminths which are soil transmitted have their ova accumulate in the environment, particularly in open soil enclosures, which cannot be easily disinfected and constitute problems to wild animals in captivity when they get in contact([20]) as observed in this study.

Helminthosis in zoo animals is a manageable condition when proper chemo-prophylaxis and strict hygiene standards are adhered to. The assessment of health status of most captive wildlife in Nigeria is based on evaluation of physical outlook. Although these animals appear healthy without any obvious signs of helminthosis, it is essential to monitor these trends as just physical appraisals could be misleading at times [15, 21]. The prevalence of infection observed in this study was in tandem with reports from various authors from Nigeria [14, 15, 16, 22, 23].

Assessing occurrence, the study observed that *Capillaria spp* was the most common helminth followed by *Ascaris spp*. and *Strongyloides spp*., while the lowest was *Raillietina spp*. which occurred only in the barn Owl. The only mixed infection found in a single feacal sample was *Capillaria spp.* and *Raillietina spp*. in barn Owl. The most frequently encountered gastrointestinal parasite, *Capillaria spp*. are small roundworms that infect the small intestine and infection is usually asymptomatic, but birds with heavy parasite burden may show clinical signs of anorexia, diarrhoea, emaciation, reduced water intake, ruffled feathers, and weakness [24]. The presence of *Strongyloides spp*., *Capillaria spp*. and *Ascaris spp* among the Ostriches confirm earlier reports by [14].

The occurrence of *Ascaridia galli* in Crown crane and Mallard duck could be attributed to their environment which allows for free movement around the facilities and it is also constructed with a swimming place which can get easily contaminated with eggs of helminthes [25]. The low prevalence of infection noticed in the birds could be attributed to the hygiene level of the park and the construction of the cages of the birds which restricted the access of most of the birds to faeces as earlier noted by [14]. It could also be attributed to acquired immunity because the treatment records of the birds showed that it is over two years that antihelminthic drugs have been administered. The access to fresh faeces for analysis was one limiting factors during the study as these will help to provide information that can further improve the health of captive animals, zoo keepers and tourists in general.

Conclusion

Due to the biology of the helminths parasites in the transmission of disease conditions, the hygiene level of animals kept in the zoo park should be improved upon to reduce the transmission rates of the helminths parasites. It is advocated that routine checkup programmes to ascertain soil transmitted helminth infection load in zoo animals and necessary antihelminthic drugs be administered when necessary.

Acknowledgement

We appreciate the cooperation received by the Zoo Park management during the study

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