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Gastrointestinal helminths of resident wildlife at the Federal University of Agriculture Zoological Park, Abeokuta

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Abstract

A total of forty two resident animals representing eighteen wildlife species at the Federal University of Agriculture (FUNAAB) Zoo Park were screened for nematode helminths between May and June 2013. Freshly voided faeces from the animals were subjected to basic coprology tests (Direct Microscopic Examination and Concentration Techniques). *Trichuris* specie. was the most prevalent nematode in primate species. Prevalence of 14.3% and 28.6% were recorded for *Capillaria* specie and *Strongyles* in the primates respectively. A prevalence of 100% infection with nematodes in screened fourteen (14) primates was recorded. Mona and Vervet monkeys have the highest points for parasite richness count of 2 out of 3 detected nematodes amongst the primates. Wild birds at the park recorded the lowest prevalence for any type of nematodes with 7 out of 8 species without any nematode detected. *Ascaridae* was only detected in carnivorous reptiles and birds. In terms of feeding category, carnivorous species namely the (*Aquila spilogaster*) and Royal python (*P. regius*) have the highest species richness count of parasites. Non-nematode helminths detected include protozoons (*Isospora* and *Eimeria*) and Cestodes segments suspected to be Echinococcus proglotids. Knowledge of the helminth parasites in wild animals is vital in formulating preventative veterinary protocols in captive exhibits. This is the first documented account of nematode helminths of resident wild animals at the FUNAAB Zoo Park, Abeokuta.

Keywords: Helminth, Nematodes, Parasite richness count, Wild animals, Zoo

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Introduction

Captive-held wild animals are those housed in zoological exhibits, rehabilitation centers, zoos, research stations, sanctuaries, aquaria, circuses, and plantations. These animals are kept for purposes like education, entertainment, relaxation, research, cultural, transportation, labour and preservation of endangered species. Parasites have been incriminated as capable of causing unthriftness and ill health in captive and free ranging wildlife (Gillespie, 2006; Emikpe *et al.*, 2007; Milozzi *et al.,* 2012) In Nigeria there is still a lacuna of data on the diseases and parasites harboured by wild animal in captive and wild settings. Wildlife plays important roles as sources, reservoirs, and amplifiers of emerging human and livestock pathogens (Daszak *et al.*, 2000; Greger, 2007). Diseases in wild animals pose not just health risks but enormous economic impacts with emotional and health risks involved.

Infectious diseases are the third most important driver of population decline of wildlife (Daszak, 2000; Bengis *et al.*, 2004; Gillespie, 2006) after hunting and habitat degradation. However, there is a dearth of information on diseases and parasites of zoo animals to reveal the transmission and impacts of pathogens of human origin (Hopkins & Nunn, 2007) especially protozoan, helminth and arthropod parasites of wildlife (Gillespie *et al.*, 2004; Friant, 2007). This is a major limiting factor in health management of zoological exhibits (Hotez *et al*., 2008; Thompson *et al.*, 2010).

Zoological animals cover a wide array of species, and are thus susceptible to infections of closely related species of livestock, domestic and humans. This interlink in disease emergence has been captured as essential (Gillespie *et al*., 2008, Calvignac-Spencer *et al.*, 2012) and has led to coinages like "pathogen pollution" (Daszak *et al.*, 2000) "spill over and spill back" in wildlife disease epidemiology and inter phases with humans and other animals.

Wild animals have been documented to suffer from a plethora of common or shared pathogens with humans and livestock. Due to their proximity to each other within the zoological garden, there is opportunity of transmitting diseases or parasites to species which would not normally come into contact with the pathogens and thus are highly susceptible to infection (Bengis *et al.*, 2004; Emikpe *et al.*, 2007)

Wild animals in captivity may harbour helminth parasites at sub-clinical infection levels. Low level parasitic infestations have been noted to reduce populations in the wild by reduction of vigour in affected species (McCallum & Dobson, 1995; Dagnachew *et al*., 2011). Parasitic infections have been noted to induce subtle local decline in abundance Incidence and or prevalence of helminth parasites have been documented in wild animals; grevy zebras (Mouria *et al*., 2005), grasscutters (Opara & Fagbemi, 2008) non-human primates (Hahn, 2003; Pedersen 2005; Ryan *et al.*, 2012), birds and other zoo animals (Parasani, 2003; Ajibade *et al*., 2010; Opara *et al.*, 2010; Milozzi, 2012).

Nematode helminths impart negatively on the conservation and health of wildlife (Pedersen *et al.*, 2005; Gillespie, 2006; Hotez *et al*., 2008). Although it is possible for helminths to coexist with wildlife without obvious pathology (Krief *et al.*, 2010; Ryan *et al.*, 2012) however in some instances, consequent pathology may be more severe (Emikpe *et al.,* 2002; Emikpe *et al.,* 2007; Muller *et al.*, 2010). The stress of captivity and contiguity to humans (Woodford *et al.*, 2002; Wenz *et al*., 2009) may also contribute to how resistant these animals will be to parasites in captivity.

Routine faecal parasitology screening is thus very important in zoological collections. It is also critical to have base-line information on the helminth flora of these animals, these invariably helps in formulating preventative protocols.

Information on the diseases and parasites of wild animals in Nigeria is scanty compared to East and South Africa (Hopkins & Nunn, 2007; Hotez *et al*., 2008). This inadequate information and documentation on diseases and parasites of zoo animals is a major limiting factor in veterinary medical management in zoological gardens This is the first survey of gastro-intestinal parasites of animals at FUNNAB Zoo Park (FZP).

Materials and methods

Captive wild animals (Table 1) residing at the FUNAAB Zoo Park (FZP) located along {latitude7º 13' 15'' N; longitude 3º 26' 51''E; 181m} Abeokuta were enlisted for this survey. The FUNAAB Zoo Park (FZP) was commissioned on the 23rd May 2012. The FZP is managed by Zoo Directorate, FUNAAB. Permission to collect samples was sought for from the Zoo Directorate.

Sample collection and preservation

Freshly voided faeces were collected from the animals at the zoos between March and June, 2013 with assistance of the animal handlers. The sample collection did not in any way impact negatively on the welfare of the study subjects. The topmost part of the faeces was scooped to prevent contamination. A clean black nylon was spread under free standing bird cages to collect faeces on dropping. Faeces collected was stored in well labelled 30ml sample bottles and kept in cool box- transport medium containing ice packs to the laboratory for preservation and analysis at the Parasitology laboratory of the College of Veterinary Medicine, FUNAAB. The mode of preservation of the samples was a two-way storage: in refrigerator at 4°C and in 10% formalin.

Faecal analysis

Faeces were grossly examined for species-specific consistency, colour and presence of proglottids and adult worms.

Direct microscopic examination (quick method) was done by placing a very small quantity of faecal dropping on a glass slide using a tooth pick and emulsify with a drop of water and place a cover slip to view on the microscope (Suwansaksri *et al.*, 2002).

Concentration techniques enlisted were-Formol ethyl acetate sedimentation method (Moges *et al.*, 2010) and Simple Salt (NaCl) Floatation as described by Gillespie (2006) and Parameshwarappa *et al*. (2012).

Presence of helminth ova was recorded and expressed as a percentage of samples screened for species and amongst orders. Parasite richness count for primate species was deduced by counting the number of nematode helminths discovered in the different species (Gillespie, 2006).

Results

In this study, *Trichuris* specie. (Plate I) is the most prevalent nematode in non-human primate (NHP) species (75% for species and 57% for individuals) (Table 2). Prevalence of 14.3% and 28.6% was recorded for *Capillaria* specie. (Plate II) and *Strongyles* respectively in the NHPs. A prevalence of 100% infection with nematodes in fourteen (14) screened primates was recorded. Mona and Vervet monkeys have the highest points for parasite richness count of 2 out of 3 detected nematodes amongst the primates (Table 3). Wild birds at the park recorded lowest prevalence for any type of nematode; with only 7 out of 8 species having detectable nematodes ova in faeces. *Ascaridae* (Plate III) was only detected in carnivorous reptiles and birds. In terms of feeding category, carnivorous species namely the African Hawk-eagle (*Aquila spilogaster*) and Royal python (*P. regius*) have the highest species richness count of parasites (Table 4). Non-nematode helminths detected include protozoas (*Isospora* and *Eimeria*) and Cestodes (*Echinococcus* proglotidds).

Table 1: Resident animals in FUNAAB Zoo Park

Common name	Scientific name	Numbers	Common name	Scientific name	Numbers
Olive baboons	Papio *Anubis*	3	Red throated robin	*Pethroica goodenovii*	2
Patas monkey	*Erythrocebus patas*	6	Eagle		1
Mona monkey	*Cercopithecus mona*	3	Ring nose parakeet	*Psittacula krameri*	2
Vervet monkey	*Cercopithecus aethiops*	2	Crocodiles	*Osteolemus niloliticus*	3
Jackal	*Canis aureus*	2	Tortoises	*Geochelone sulcata*	1
Hyena	*Croucuta croucuta*	2	Turtle	*Testudine spp*	5
Ostriches	*Struthio camelus*	2	Puff adder	*Bitis arietans*	1
African grey parrots	*Psittacus erithacus*	2	Royal python	*Python regius*	1
Crowned cranes	*Balearica regulorum*	2	Monitor lizard	*Veranus niloticus*	2
Geese	*Chen caerulescens*	4			
Red headed love bird	*Agapornis pullarius*	2			

Table 2: Parasite richness count and prevalence of nematodes in non-human primate species

Order	Species(No)	Parasite ova identified	Prevalence (%)	Parasite richness count
Primates	*E. patas* (6)	*Strongyle,*	3/6 (50%)	1/3
	C. aethiops (2)	*Trichuris*	2/2 (100%)	2/3
		Capillaria	2/2 (100%)	
	C. mona (3)	*Trichuris*	3/3 (100%)	2/3
		Strongyle	1/3 (33%)	
	P. anubis (3)	*Trichuris*	3/3 (100%)	1/3

Table 3: Prevalence of nematodes within the individual Non-human primates at the FUNAAB Zoo Park

Nematodes detected	*E. patas*	*P. anubis*	*C. mona*	*C. aethiops*	Total prevalence (%)
Trichuris	0/6	3/3	3/3	2/2	8/14 (57.1%)
Capillaria	0/6	0/3	0/3	2/2	2/14 (14.3%)
Strongyle	3/6	0/3	1/3	0/2	4/14(28.6%)

Table 4: Nematodes seen in other animals at the park

Order/Class	Species/ (No)	Parasite ova identified
Reptilia	*Python regius (1)*	*Ascaris, Oxyuris, Kalicephalus ova*
	C. chameleon (6)	NOS
	G. sulcata (1)	NOS
Aves	*Acipitridae (1)*	*Ascaris* spp
	S. camelus (2)	NOS
	B. regulorum (2)	NOS

NOS: No ova seen

Discussion

Results from this study shows that the zoo animals at the FZP harbour parasites which are not novel to science (Milozzi *et al.*, 2012; Ryan *et al.*, 2012; Okpara *et al.*, 2010) but are of importance to their health and also the development of a staff' health protocol especially with the presence of *Trichuris* specie (Plate I)

Non-invasive studies of wildlife parasites can readily provide data on presence or absence, richness, and prevalence of parasitic infections, thus should not report intensity (Gillespie, 2006). 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. Faecal parasitology offers an insight into their medical status.

Helminthosis in zoo animals is a manageable condition when proper chemo-prophylaxis and strict hygiene standards are adhered to. The prevalence recorded for most nematode identified is in tandem with previous studies (Opara *et al*., 2010; Milozzi *et al*., 2012).

The stress of captivity and contiguity to humans may also contribute to how resistant these animals will be to parasites in captivity. Most animals at the FZP do not display outward behaviours suggestive of stress.

Trichuris ova in *Cercopithecus aethiops* differ microscopically from others; this is probably in agreement with the demystification of *Trichuris* as one single worm specie or the presence of different ova types. *C. aethiops* has a mixed infection of *Trichuris* types as some ova also resemble the common *Trichuris* ova as seen in other primate species. The similarities between primates at the zoo in terms of feeding, phylogenetic closeness and contiguity of their housing at the FZP made them easy for comparable analysis. The prevalence recorded for *Trichuris* and *Capillaria* (Plate II) are however in concord with previous studies from literature (Ryan *et al.*, 2012).

Trichuris specie. was the most prevalent nematode in primate species (75% for species and 57% for individuals). Mona and vervet monkeys have the highest points for species richness of 2 out of 3 detected nematodes. An overall prevalence of 100% infection with nematodes in screened primates. Wild birds at the park recorded lowest prevalence for any type of nematode. Of all the classes of animal screened, carnivorous species namely the Black eagle (*Accipitiridae* spp) and Royal python (*P. regius*) have the highest species richness count of parasites. None nematode helminths detected include protozoas (Isospora and Eimeria); Trematodes (*Echinococcus* proglotidds); mite *Nortoedis.*

Most infections among the carnivore are acquired from prey-predator perspectives. Ascarids have an indirect life cycle in most carnivorous and reptiles (Klingenberg, 2004). In the Royal python, ectopic parasitism could not be over ruled based on the feeding biology preferences. The oxyurids which have a direct life cycle must have been through faeco-oral route, likewise the mite (*Nortoedres*) might be as a result of the live animal (rabbit) presented as feed.

A low prevalence of helminthoses in the aviary could be attributed to the housing; the birds in most instances do not have access to their droppings- this breaks the cycle of transmission. Ostriches (*Struthio camelus*) at FZP have enough floor space and have created a spot to defecate which is far from their feeding spots. This contributed to the low prevalence of nematode helminths in these birds.

It is not advisable to hide under the comfort of endemicity to relent on routine testing in zoos as cross transmission of parasites or fulminating parasitosis secondary to immuno suppression or septicaemia may ensue. The zoo setting unarguably provides a platform for this. Choice of anti-helminthic given was based on previous literatures and species specific dose rates and contraindications strictly adhered to.

The level of helminthosis is neither alarming nor unusual. This level is comparable to what is obtainable in most zoos (Varadharajan & Kanadasamy 2000; Okpara *et al.*, 2010) The risks of transmission to the public is negligible once the recommended precautionary distances and attitudes when around the zoo is ensured.

Nematode helminths are prevalent in zoo collections and FZP is not an exemption. According to Krief *et al*. (2010), some helminths coexist with wildlife with no obvious pathology; also the screened animals at FZP did not show any clinical signs or pathology which suggests mild to moderate infection at sub clinical level. The current level of hygiene standard at FZP is adequate and should not be allowed to slip to prevent heavy helminth and other parasitic infection. However, accessibility to viable faecal samples remains a big factor militating against coprological studies in zoo animals. In order to ensure the well-being of staff, public and resident animals, routine testing and treatment of nematode helminthosis in zoo animals is very germane.

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