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Prevalence of gastro-intestinal parasites in primates and their keepers from two zoological gardens in Ibadan, Nigeria

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Abstract

A study was conducted to determine the levels of infestation of gastro-intestinal parasites in 36 non-human primates (NHP) and 19 zoo keepers at the University of Ibadan Zoological Garden (UIZG) and Agodi Zoological Garden (AZG) in Ibadan, Nigeria. Freshly passed faecal samples were collected from NHP, zoo keepers, and from apparently healthy individuals (control). The faecal samples were processed using standard parasitological techniques. Twenty-two (61.1%) out of 36 NHP at UIZG and AZG were infested with gastro-intestinal parasites. Infestations at UIZG and AZG were 61.3% and 60%, respectively. All the red patas, mangabey and mandrill monkeys and 90.9% (10/11) of the green monkeys were infested. There were higher infestation rates in young NHP than in adults ($P<0.05$). The infestation rate in males and females were the same (61.1%). The most prevalent gastro-intestinal parasites were *Trichuris trichiura* (47.2%), *Strongyle* spp(13.9%), *Entamoeba spp* (13.9%) and *Stronglyloides* spp (5.6%). Six (27.3%) of the infested NHP have mixed infestations. Only one of the 19 zoo keepers screened was infested with *Ascaris lumbricoides* and two (15.4%) of the 13 members of control group (non-zoological garden workers) were infested with *Ancylostoma duodenale*. There was no evidence of cross transmission of gastro-intestinal helminths between the NHP and the zoo keepers.

Keywords: Gastro-intestinal parasites, Helminths, Infestation, Primates, Prevalence, Zoos

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Introduction

Non-human primates (NHP) are one of the most common groups of animals in zoological gardens for their role in public entertainment (Dawet *et al.*, 2013). They are however known to harbor different gastro-intestinal parasite species which affect their survival and reproductive activity by causing gastro enteritis, haemorrhage, extra-intestinal infection, spontaneous abortion and death (Colin *et al.,* 2005; Akpan *et al.*, 2010). The close phylogenetic relationship between humans and NHP, the encroachment of humans into natural NHP habitats and the closeness of humans to them even in the zoological gardens have caused frequent pathogen exchange with humans (Ott-Joslin, 1993; Dawet *et al.*, 2013). This phenomenon has also resulted into emerging zoonoses which currently threatens global health and has resulted in a decline in NHP population in the wild and in captivity (Leroy *et al.*, 2004).

NHP are particularly vulnerable to parasitic infestations because many species live in cohesive groups characterized by frequent social interactions that facilitate parasite transmission between individuals (Stoner, 1996**)**. Infestations by gastro-intestinal parasites have been reported in a range of NHP hosts which include gorilla (*Gorilla gorilla*), chimpanzee (*Pan troglodytes*), green monkey (*Chlorocebus sabaeus*), red patas (*Erythrocebus patas*) (Adedokun *et al.*, 2002), mandril monkeys (*Papio leucophaeus)* (Akpan *et al.*, 2010) white collared mangabey (*Cercocebus torquatus*) (Mbaya & Udendeye, 2011), mona monkey (*Cercopithecus mona*) and anubis baboon (*Papio anubis*) (Mbaya *et al.*, 2009; Dawet *et al.*, 2013).

Studies on the prevalence of gastro-intestinal parasite infestation in NHP in several zoological gardens showed that 13.63% (3/22) at the State Zoo, India (Bichitra *et al.*, 2012), 19.1% (19/99) at Negara Zoo in Malaysia (Lim *et al.*, 2008), 75% (6/8) at Negede Zoo, Owerri, Nigeria (Opara *et al.*, 2010) 88.7% in Barbados Primate Research Centre and Wildlife Reserve (BPRCWR) in the Caribbean (Mutani *et al.*, 2003) and 100% of the 31 NHP at the Zoological Garden in Jos, Nigeria (Dawet *et al.*, 2013) were infested.

This study was designed to determine the levels of gastro-intestinal infestation in NHP and the zoonotic implications in the two zoological gardens in Ibadan, Nigeria.

Materials and methods

Study location and animals

The UIZG was established in 1949 and is located at the University of Ibadan campus (latitude 07^{O}.26.631'N and longitude 03^{O}.53.691'E). The AZG established in 1967 is located along Secretariat-Mokola Road in Ibadan (latitude $07^{O}24.360^{1}$N and longitude 03^{O} 54.027^{1}E). Ibadan has a typical tropical climate with distinct rainy and dry seasons. Temperatures range from 21.4^{o}C and 26.7^{o}C and a rainfall of 1420.1mm spread over 109 days (http://en.wikipedia.org/wiki/Ibadan). The two zoological gardens have array of exotic species including 31 NHP at UIZG and five at AZG, belonging to eight species (Table 1). These are anubis baboon (*Papio anubis*), mandrill monkey (*Papio leucophaeus*), mangabey monkey (*Cercocebus torquatus*), green monkey (*Chlorocebus sabaeus*), red patas (*Erythrocebus patas*), mona monkey (*Cercopithecus mona*), putty nosed monkey (*Cercopithecus nictitans*) and chimpanzee (*Pan troglodytes*). NHP in puberty were regarded as adults and others as young.

The Animal Care and Use Research Ethics Committee of University of Ibadan appoved the conduct of the research. The Directors of the UIZG and AZG approved the conduct of the study on the NHP in their gardens.

Sample collection

Fresh faecal samples (10-15 gram) were collected into sterile glass vials as described by Dawet *et al.,* (2013) from each of the 36 NHP, 19 zoo keepers and 13 apparently healthy individuals not working in the zoological gardens (as control). The samples were labeled indicating name, age, sex, species and date of collection, kept inside a cooler and transported to the Parasitology laboratory for examination.

Laboratory examination

In the laboratory, faecal samples were immediately examined physically within 3-4 hours for evidences of tapeworm proglottids after which they were processed using wet preparation, flotation and sedimentation methods as described by Gillespie (2006). Egg and oocyst counts per gram of faeces (epg & opg) were determined by the modified MacMaster technique using saturated sodium chloride solution as floating medium (Anon, 1977). Faecal culture was carried out followed by larval recovery using the modified Baerman's technique (Hanseen & Perry, 1994) while oocysts were sporulated according to the methods of Levine (1977). Identification of helminth ova, infective larvae and oocysts were done by standard parasitological criteria (Soulsby, 1982). Larval culture was carried out on all faecal samples using test-tube filter paper technique as described by Muller-Graf *et al,* (1996). After screening, infested NHP were treated with prazisam plus® (Vetoquinol India Animal Health Pvt Ltd), a broad spectrum anthelmintic which contains the following active ingredients: praziquantel (5mg/kg), pyrantel pamoeate (14mg/kg) and fenbendazole (50mg/kg). Provisions were made for infested zoo keepers to visit the hospitals for treatment. Faecal samples of infested NHP and zoo keepers were further screened to ascertain the success of the treatments.

Data Analysis

Data obtained were summarized as means $\pm$ Standard deviation. Infestation rates between the sexes and age groups were determined and compared statistically using the Chi-square (X^2) method (Bamgboye, 2008). Differences were considered statistically significant at the 5% Confidence level.

Results

Out of a total of 36 NHP examined at the UIZG and AZG, 22 (61.1%) were infested with gastro-intestinal parasites (Table 1). Infestation rates at UIZG and AZG were 61.3% and 60%, respectively.

All the red patas, mangabey and mandrill monkeys at the two zoological gardens were infested. Whereas all the green monkeys at UIZG were infested, only 50% of them at AZG were infested. None of the mona monkey, putty-nosed monkey, anubis baboon and chimpanzee, was infested.

Whereas there was a significant higher infestation rate in young NHP (76.5%) than in the adult NHP (47.4%) ($P<0.05$), the infestation rates in both males and females were the same (61.1%) (Table 2)

A total of four parasites were identified in NHP in the two zoological gardens, consisting of three nematodes species and one protozoa. Infestations with trematodes and cestodes were not detected. Higher occurrence of helminths (61.1%) was observed compared to protozoa (13.9%). The most prevalent gastro-intestinal helminths were; *T. trichiura* with an overall prevalence of 47.2%, followed by *Strongyle spp* with 13.9% and *Strongyloides* spp with 5.6%. *Entamoeba spp* is the only protozoa detected in 13.9% of the NHP. Six (27.3%) of the infested NHP have mixed infestations with *T. trichiura*. Whereas four red patas at UIZG and one red patas at AZG were also infested with *Entamoeba spp* and *Strongyloides* spp, respectively while one mandrill (also at AZG) had in addition *Strongyloides* spp and *Entamoeba* spp (Table 1).

Table 1: Prevalence of gastro-intestinal parasites among species of Non-human primates at the two zoological gardens in Ibadan, Nigeria

Species of Non-Human Primates	No Examined	Parasites encountered	No. Infested (%)	Epg/ Opg±(SD)
University of Ibadan zoological garden				
Green monkeys (*Chlorocebus sabaeus*)	10	(1) *Trichuris trichiuria*	10 (100)	175±100.0 [a]
Mandrill monkeys (*Papio leucophaeus*)	3	(1)*Strongyle spp.*	3 (100)	500±173.2 [a]
Mangabey monkeys (*Cercocebus torquatus*)	2	(1)*Strongyle spp.*	2 (100)	400±141.4 [a]
Mona monkeys (*Cercopithecus mona*)	4	None	0	0
Putty-nose monkeys (*Cercopithecus nictitans*)	2	None	0	0
Red patas (*Erythrocebus patas*)	4	(1) *Trichuris trichiuria* (2) *Entamoeba spp*	4 (100) 4 (100)	500±141.0 [a] 1,550±245.0 [b]
Anubis baboon (*Papio anubis*)	4	None	0	0
Chimpanzee (*Pan troglodytes*)	2	None	0	0
Sub-total	31		19 (61.3)	
Agodi Zoological garden				
Green monkeys (*Chlorocebus sabaeus*)	2	(1) *Trichuris trichiuria*	1 (50)	150 [a]
Mandrill monkeys (*Papio leucophaeus*)	1	(1) *Trichuris trichiuria* (2) *Strongyloides* (3) *Entamoeba spp*	1 (100) 1 (100) 1 (100)	500 [a] 300 [a] 1,500 [b]
Red patas (*Erythrocebus patas*)	1	(1) *Trichuris trichiuria* (2) *Strongyloides*	1 (100) 1 (100)	100 [a] 400 [a]
Chimpanzee (*Pan troglodytes*)	1	None	0	0
Sub-total	5		3 (60.0)	
Grand total	36		22 (61.1)	

Note=[a]-epg, [b]-opg

Table 2: Prevalence of gastro-intestinal parasites among different sexes and ages of non-human primates at the zoological gardens in Ibadan, Nigeria

Age	Sex	Number examined	Number Positive	% positive
University of Ibadan Zoological Garden				
Young	Male	8	5	71.4
	Female	7	7	100.0
	Sub-total	15	12	80.0
Adult	Male	8	4	50.0
	Female	8	3	35.5
	Sub-total	16	7	43.8
	Total	31	19	61.4
Agodi Zoological Garden				
Young	Male	1	1	100
	Female	1	0	0
	Sub-total	2	1	50.0
Adult	Male	1	1	100
	Female	2	1	50.0
	Sub-total	3	2	66.7
	Total	5	3	61.3

Discussion

Sixty-one % and 60.0% of infested NHP hosted gastro-intestinal nematodes at UIZG and AZG, respectively (Table 1). These results are similar to 61.5% reported in NHP at UIZG by Akinboye *et al.* (2010) and to the reports of 64% found at a zoological garden in Kenya (Munene *et al.,* 1998), but very high when compared with 13.63% in Assam State Zoo and 29% at Mahendra Choudhury zoological park, Punjab both in India (Bichitra *et al.*, 2012 and Singh *et al.*, 2008). The relatively high prevalence of helminthiasis NHP found in this study could be due to lack of periodic use of antihelminthic on the animals and inadequate hygienic measures in their management.

The apparent species susceptibility to helminth infestations in this study could be due to the fact that same species of monkeys are kept in the same cages at UIZG making them prone to sharing infestations and thereby giving a wrong impression of specie susceptibility.

The lack of significant difference in the infestation rates among genders of NHP in this study is similar to the findings of Mutani *et al.* (2003) in captive NHP at BPRCWR in the Carribean. No reason can be given for this observation. The higher rate of infestation among young as compared to the adult NHP is similar to the findings of Mbaya & Udendeye (2011) who reported higher infestation rates of gastro-intestinal helminths and protozoa in young NHP than adults at Afi mountain primate sanctuary in Calabar, Nigeria. This could be due to higher susceptibility to helminthiasis among young animals than adults and lack of premunity in the young (Soulsby, 1982; Adejinmi & Harrison, 1996).

The higher occurrence of helminths than protozoa obtained in this study is similar to the findings of Munene *et al.* (1998) who reported higher prevalence of helminths (64.4%) than protozoa (17.1%) at a zoological garden in Kenya. This may be due to favourable climatic factors which provide optimal conditions for viability of parasite eggs and ova (Soulsby, 1982). The possiblity of recent treatments of some of the NHP with amoebicide may also not be ruled out. This is however in contrast to the findings of Dawet *et al.* (2013) in Jos zoological garden, Nigeria, Lim *et al.* (2008) in a zoological garden at Kuala Lumpur in Malaysia and Levecke *et al.* (2007) in four zoological gardens in Belgium.

The observation that *Trichuris* was the most frequent parasite in the two study sites (UIZG and AZG) is in agreement with the findings of Akinboye *et al.* (2010), Munene *et al.* (1998), Bichitra *et al.* (2012) and Dawet *et al.* (2013). The reason for this observation is not clear. The Entamoeba species identified in this study may be the pathogenic *E.*

histolytica or *E. coli* or even the non-pathogenic *E. dispar* or *E. moshkovskii*. Molecular diagnostic techniques would be required to differentiate among these (Levecke *et al*., 2007).

Although the parasites identified in this study are of zoonotic importance (Soulsby, 1982), there is no evidence of cross transmission of gastro-intestinal helminths between the NHP and their human handlers at the two zoological gardens. The only infested NHP handler had *A. lumbricoides* which was not found in any of the NHP. This is in contrast to the findings of Adekunle & Olayide (2008) and Akinboye *et al.* (2010) who reported that 64% and 81.1%, respectively of zoo keepers at UIZG were positive for *T. trichiura* and other helminth ova. The zoo keepers possibly received anti-parasitic therapy as suggested by Adekunle & Olayide (2008).

It is therefore recommended that all new NHP should be quarantined before mixing them with existing ones. All NHP in the zoo should also be regularly screened and protected with appropriate chemoprophylaxis. Furthermore, all zoo workers should wear protective clothing when on duty and should be advised to go for routine screening and regular deworming.

References

Adedokun OA, Adedokun RAM, Emikpe BO, Ohore, OG, Oluwayelu, DO & Ajayi OL (2002). Concurrent fatal helminthosis and balantidosis in red monkey (*Erythrocebus patas*) in Ibadan, Nigeria. *Nigerian Veterinary Journal*, **23**(2): 56-59.

Adekunle BA & Olayide JA (2008). Preliminary investigation of zooarthroponosis in Nigerian zoological garden. *Veterinary Research*, **2**(3-4): 38-41.

Adejinmi JO & Harrison, LJS (1996). Parasitic nematodes of domestic ruminants in Nigeria: Epidemiology. *Tropical Veterinarian*, **14**(1): 3-15.

Akinboye DO, Ogunfetimi AA, Fawole O, Agbolade O, Ayinde OO, Atulomah NOS, Amosun AM & Livingstone R (2010). Control of parasitic infections among workers and inmates in a Nigerian zoo. *Nigerian Journal of Parasitology*, **31**(1): 117-120.

Akpan PA, Abraham JT & Ekwetiong PO (2010). Survey of gastro-intestinal parasites of chimpanzees and drill monkeys in Drill Ranch, Calabar, Cross River State, Nigeria. *African Research Review*, **4**(3a): 334-340.

Anonymous (1977). *Manual of Veterinary Parasitology Laboratory Techniques*. Technical Bulletin No. 18, Ministry of Agriculture, Fisheries and Food, London, Pp 129-132.

Bamgboye, EA (2008). *A Companion of Medical Statistics, (2nd edition)*, Folbam Publishers, Ibadan, Pp 200.

Bichitra GN, Saidul I & Apurba C (2012).Prevalence of parasitic infection in captive non human primates of Assam State Zoo, *India. Veterinary World*, **5**(10): 614-616.

Colin AC, Thomas GR & Tony LG (2005). Primates and the ecology of their infectious diseases: How will anthropogenic change affect host-parasite interactions? *Evolutionary Anthropology*, **14**(4): 134-144.

Dawet A, Yakubu DP & Butu HM (2013). Survey of gastrointestinal parasites of non-human primates in Jos zoological Garden. *Journal of Primatology*, **2**(1): 1-3.

Gillespie TR (2006). Non-invasive assessment of gastrointestinal parasite infestations in free-ranging primates. *International Journal of Primatology*, **27**(4): 1129-1143.

Hansen J & Perry B (1994). *The epidemiology, diagnosis and control of helminth parasites of ruminants*. International Laboratory for Research on Animal Diseases, Nairobi: Pp 80-92.

Leroy EM, Rouguet P, Formenty P, Souquiere S, Kilbourne A, Forment JM, Bermejo M, Smit S, Karesh, W, Swanepoel, R, Zaki, SR & Rollin, PE (2004). Multiple ebola virus transmission events and rapid decline of Central African wildlife. *Science*, **303**(1): 387–390.

Levecke B, Dorny P, Geurden T, Vercammen F & Vercruysse J (2007). Gastrointestinal protozoa in non-human primates of four zoological gardens in Belgium. *Veterinary Parasitology*, **148**(3-4): 236-246.

Levine ND (1977). *Protozoan parasites of domestic animals and man*. Burgess Publishing Company: Mineapolis, Pp 133-155.

Lim YAL, Ngui R, Shukuri J, Rohela M & MatNai HR (2008). Intestinal parasites in various animals at a zoo in Malaysia. *Veterinary Parasitology*, **157**(1-2): 154-159.

Mbaya AW, Aliyu MM, Ibrahim UI, Joshua L & Joel C (2009). Gastrointestinal parasites and associated parasitic load among free-living primates in Gashaka-Gunti National Park, Nigeria. *Nigerian Veterinary Journal*, **30**(4): 33-39.

Mbaya AW & Udendeye UJ (2011). Gastrointestinal parasites of captive and free-roaming primates at the Afi mountain Primate Conservation Area Calabar, Nigeria and their zoonotic implication. *Pakistan Journal of Biological Science*, **14**(13): 707-714.

Muller-Graf CDM, Collins DA & Woolhouse MEJ (1996). Intestinal parasite burden in five troops of olive baboons (*Papio cynocephalus Anubis*) in Gombe Stream National Park, Tanzania. *Parasitology*, **112**(5): 489-497.

Munene E, Ostsyula M, Mbaabu DAN, Mutahi WT, Muriuki SMK & Muchemi GM (1998). Helminth and protozoan gastro intestinal tract parasites in captive and wild-trapped African non-human primates. *Veterinary Parasitology*, **78** (3): 195-201.

Mutani A, Rhynd, K & Brown G (2003). A Preliminary Investigation on the gastrointestinal helminths of the Barbados Green Monkey (*Cercopithecus aethiops sabaeus*). *Revista do Instituto de Medicina Tropical de Sao Paulo*, **45**(4): 193-195.

Opara MN, Osuji CT & Opara JA (2010). Gastrointestinal parasitism in captive animals at the zoological garden, Negede, Owerri, Southeast Nigeria. *Report and Opinion,* **2**(5): 21-28.

Ott-Joslin JE (1993). Zoonotic diseases of non-human primates. In*: Zoo and Wild Animal Medicine* (*ME Fowler, editor*). Philadelphia: WB Saunders Co., Philadelphia, Pp 358-373.

Singh P, Singla LD, Gupta MP, Sharma S & Sharma DR (2008). Epidemiology and chemotherapy of parasitic infestations in wild omnivores in the Mahendra Choudhury Zoological Park, Chhat, Punjab. *Journal of Threatened Taxa*, **1**(1): 62-64.

Soulsby EJL (1982). *Helminthes, Arthropods and Protozoa of Domesticated Animals, 6th Edition*. ELBS and Bailliere Tindall & Cassel Ltd, London, Pp 56-58.

Stoner KE (1996). Prevalence and intensity of intestinal parasites in mantled howling monkeys (*Alouatta palliata*) in North-eastern Costa Rica: Implications for conservation biology. *Conservation Biology,* **10**(2): 539–546.