FUDMA Journal of Agriculture and Agricultural Technology
ISSN: 2504-9496
Vol. 7 No. 2, December 2021: Pp.140-145
DOI: https://doi.org/10.33003/jaat.2021.0702.059

EVALUATION OF PARASITIC GASTROINTESTINAL PARASITES IN CAPTIVE MAMMALS AT OGBA ZOOLOGICAL GARDEN AND NATURE PARK, BENIN CITY

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ABSTRACT

This study investigated the gastro-intestinal helminthes present in the capture-held mammals at Ogba Zoological garden comprising a total of twenty-six(26) resident mammals representing thirteen (13) wildlife species, between the period of March and June, 2019. The objectives of this study were to identify the common helminthes present in the zoo mammals, estimate number of positive animal species and investigate the prevalence, abundance and diversity of the gastro intestinal helminthes among the animals. Fecal samples of the animals were collected from the study site and subjected to direct microscopic examination and concentration techniques. Overall, a total of four (4) helminthes parasites' eggs and cyst were identified; *Strongyle spp.* (Threadworm), *Trichuris trichuria* (Whipworm) *Ancyclostoma duodenale* (Hookworm) and Nematodes' eggs. A protozoan species (*Entamoeba spp)* was also detected in the Grey Monkeys. Fourteen (14) (53.84%) of the sampled animals were infected with the gastrointestinal helminthes parasites and eggs. *Strongyle spp* (30.8%), was the most prevalent gastro intestinal helminth found among the animals used for the study, while 19.2% prevalence of Hookworm (15.4%) of whipworm, (15.4%) of *Entamoeba spp* and (3.8%) of Nematode eggs were recorded. The gastro-intestinal helminthes were highly distributed among the Mona monkeys and grey monkeys. The Nematode eggs and larvae were isolated in the Donkey. Hookworm was highly spread among the Baboons and also found in the Civet Cat. 46.16% of the examined animals were free from gastrointestinal helminthes infection. No record of parasitic helminthes were found in the Chimpanzee, Patas monkeys, White-throated monkeys, Crested porcupine, horses, Maxwell duiker, lion and Hyena in the study site.

Keywords: *Baboons, helminthes, Monkeys, Ogba Zoo, Wildlife species.*

INTRODUCTION

The importance of wildlife protection and conservation came under spotlight several decades ago and today it is more comprehensive and integrated than ever. The contact between wild animals and humans is increasing due to agricultural expansion, excessive deforestation, unplanned urbanization and the erroneous acquisition of these animals as non-domestic pets (Chomel *et al.*, 2007). Parasites and infectious diseases have become a major concern in conservation of endangered species as they can lead to mortality, dramatic population declines and even contribute to local extinction events (Aguirre *et al.*, 2007; Smith *et al.*, 2006). Diseases in wild animal 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 after hunting and habitat destruction (Daszak, *et al.*, 2000; Bengis, *et al*, 2004; Gillespie, 2006).

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 and Nunn, 2007) especially protozoan, helminth and arthropod parasites of wildlife (Gillespie, *et al.*, 2004). This is a major limiting factor in health management of zoological exhibits (Hotez *et al.*, 2008; Thompson *et al.*, 2010). Taking proper measures to prevent infections either among zoo animals or from animals to humans is of utmost concern. The occurrence of parasites in animals housed in zoological gardens might vary according to husbandry practices, disease prophylaxis, ranging methods, feeding techniques and treatment administration. Parasitology studies are fundamental to understand the life cycle of parasites and the potential transmissions to other animals and humans (Macpherson, 2005).

Zoos are an ex-situ form of conservation where animals are displayed in cages or enclosures for aesthetic, educational or research and conservation purposes (Thawait, *et al.*, 2014). Zoological animals cover a wide array of species and are thus susceptible to infections of closely related species of livestock and humans. This interlink in disease emergence has been captured as essential (Gillespie, *et al.*, 2008) and has led to coinages like "Pathogen pollution" spill over and spill back" in wildlife disease epidemiology and interphases with humans and other animals (Daszak *et al.*, 2000).

Gastro-intestinal helminthes constitute some of the most common and important infective agents of mankind and are responsible for much morbidity and some mortality. These represent a major health problem and the symptoms resulting from these infections include: apathy, colic, diarrhea, malaise and weight loss. Studies are finding new information about the ecology and biodiversity of endo-parasites and their parasitic population (Oliveira, *et al.,* 2008).

Gastro intestinal helminthes can be divided into three common groups: round-bodied worms (Nematodes) eg-roundworms (Paul De Ley, 2006), flat bodied worms not segmented (Trematodes) eg – Flukes and flat-bodied worms that are segmented (Cestodes) eg-Tapeworms (Kozoil, 2016). With few exceptions, adult flukes, Cestodes and Nematodes produce eggs that are passed in excretions or secretions of the host.

The effect of gastrointestinal helminth infections is determined by a combination of factors of which the varying susceptibility of the host species, the pathogen of the parasitic species, the host/parasite interaction and the effective dose are the most important.

Because the animals have close interaction with man, therefore the transmission probability from animal to man is very high as some of the helminthes can move from their initial position to the next possible host. Also, the helminthes eggs and larvae contained in infested animals' feaces may contaminate man's food. Therefore, there is a clear need for research and study with wildlife for discovering these parasites and know their prevalence in the population and how subsequent infections can be curbed amongst both animals and man. Hence, the main objectives of this study is to assess the prevalence of gastrointestinal helminthes parasites on wildlife mammals in Ogba zoological garden and nature park and the specific objectives are to:

i. Identify species of mammals infested with the gastrointestinal helminthes in the zoo.
ii. Identify the common helminthes found in the zoo mammals
iii. Investigate the prevalence and diversity of gastro-intestinal helminthes among the animals in the zoo.

METHODOLOGY

Study Site

The study was carried out at Ogba Zoo and Nature Park, Benin City. This was formally known as Ogba Forest Reserve that comprises of a Zoological section and Botanical gardens covering about 750 acres between longitude 5°35'E and 45°63'E and latitude 6°17'N and 57°37'N in Oredo Local Government Area of Edo State, with an average elevation of 46m above sea level.

The climate in the study site is that of the rainforest zone of the South-West Nigeria. It has an average rainfall of 1500mm, a relative humidity that ranges between 75% (12 noon) and 95% (6:00am) and an average temperature of 27°C (FORMECU, 1999)

Sampling Techniques and Data Collection

Between March and June, 2019, a total of 26 freshly passed pooled fecal samples were randomly collected from 13 different species of apparently normal/healthy captive animals using hand gloves with spatula and placed into sterile sample bottles (White and Dusik, 2015). Samples were collected from individuals kept on their own but when kept in groups samples were randomly collected from each of the cages (Soulsby (1989). The sample bottles, were labeled according to the pens of the animals to be examined and were taken to the microbiology laboratory of the University of Benin Teaching Hospital (UBTH) where they were examined for the presence of larvae and eggs of parasites using normal saline method while cyst of parasites were identified using the iodine method.

Laboratory Procedure (Direct Wet Method)

Normal Saline:

A drop of normal saline was placed in each sample bottle containing the fecal samples to enable emulsification of the fresh fecal droppings. A drop (An aliquot) of the properly emulsified sample was placed on a clean, grease free glass slide which was covered with a cover slip.

The samples were then examined one after the other (for all 5 samples) by placing them under the light microscope which helped to identify the larvae and ova/eggs of the parasites Blumberg *et al.,* (2018).

Iodine Method:

This method is carried out after the normal saline method is completed. A drop of iodine was placed on each of the emulsified samples on the glass slide, then covered with cover slip and examined as was done for the normal saline method. This method is used to identify the cyst of the parasites present. Slides were microscopically screened at 100x, 400x and 1000x magnification and detected parasites were identified by their morphometric characteristics (Soulsby, 1982; Zajac and Conby, 2013).

The Formol-ethyl Concentration Method:

In this Method, 4ml of normal saline was added into a calibrated tube. A gram of each stool sample was mixed with the normal-saline and centrifuged for a minute at 4,000rpm. After centrifugation, the supernatant was decanted. 7ml of formol-ethyl saline and 3ml of ethyl alcohol were added to the deposit and centrifuged for another minute at 4,000rpm. The tubes were dislodged and the supernatant was decanted. The deposit was placed on glass slide, then covered with a cover slip and screened under the microscope at x10 to focus and x40 to magnify. Lier, *et al.,* (2009).

Data Analysis

The results obtained from the gastrointestinal parasites examination were then subjected to statistical analysis as provided by Bush *et al.,* (1997) where the prevalence mean abundance and mean intensity of the parasites were tested for and expressed as follows:

i. Prevalence = $\frac{Number\ of\ host\ infected}{Number\ of\ host\ examined}\ x\ \frac{100}{1}$

ii. Abundance = $\frac{Total\ number\ of\ a\ given\ parasite\ species}{Total\ number\ of\ parasites\ collected}\ x\ \frac{100}{1}$

iii. Mean Abundance = $\frac{Abundance}{Nu,mber\ of\ infected\ animals}$

iv. Infestation level of each parasite species = $\frac{Total\ number\ of\ given\ helminth\ species}{Number\ of\ animals\ carrying\ the\ parasite\ species}$

RESULTS

The taxonomic characterization of the 13 species of mammals examined in Ogba zoological garden and nature park.

Table 1 shows that Mona monkey, Grey Monkey and olive baboon were the highest number of species of animals examined at 15% each. This is closely followed by lion (11%), Patas monkey and crested porcupine (8%) each and the Hyena, Donkey, Horse, Civet cat, Chimpanzee and Maxwell duiker (4%) each.

Table 1: The Taxonomy Characterization of the 13 Species of Examined mammals in Ogba Zoological garden and Nature park

Scientific Name	Common Name	Number Examined	Percentage
Cercopithecus mona	Mona Monkey	4	15
Cercopithecus erythrogaster	White Throated Monkey	1	4
Cercopithecus aethiops	Corey Monkey	4	15
Erythrocebus patas	Patas Monkey	2	8
Hystrix crestata	Crested Porcupine	2	8
Crocuta crocuta	Hyena	1	4
Equus africanusa sinus	Donkey	1	4
Equus Caballus	Horse	1	4
Panthera leo	Lion	3	11
Pabio Anubis	Anubis Baboon	4	15
Vivera civetta	Civet Cat	1	4
Pan trioglodyte	Chimpanzee	1	4
Cephalophus Maxwelli	Maxwell Dniker	1	4
Total		**26**	**100**

Source: Field Survey, 2019

Table 2 shows that 53.84% of the examined animals were infested with the endo-parasites. *Cercopithecus mona*, *Cercopithecus aethiops*, *Equus africanusa sinus*, *Papio anubis* and *Vivera civetta* were all infested to the levels of 15.38%, 15.38%, 3.85%, 15.38% and 3.85% respectively.

Table 2: Species Examined and number of Positive Animals

Scientific Name	Common Name	Number Examined	Positive animals	Percentage of positive animals
Cercopithecus mona	Mona Monkey	4	4	15.38
Cercopithecus erythrogaster	White Throated Monkey	1	0	0
Cercopithecus aethiops	Corey Monkey	4	4	15.38
Erythrocebus patas	Patas Monkey	2	0	0
Hystrix crestata	Crested Porcupine	2	0	0
Crocuta crocuta	Hyena	1	0	0
Equus africanusa sinus	Donkey	1	1	3.85
Equus caballus	Horse	1	0	0
Panthera leo	Lion	3	0	0
Pabio Anubis	Anubis Baboon	4	4	15.38
Vivera civetta	Civet Cat	1	1	3.85
Pan trioglodyte	Chimpanzee	1	0	0
Cephalophus maxwelli	Maxwell Duiker	1	0	0
Total		**26**	**14**	**53.84**

Source: Field Survey, 2019

P>0.05; t-test results showed no significance between the infested and non-infested animals

Infected animals and percentage of the different species of animals examined with the detected parasites.

Table 3 shows that 100% of *Cercopithecus mona, Cercopithecus aethiops*, *Papio anubis* examined were infested with the helminths parasites and protozoans.

Table 3: Infected animals and percentage of different species of animals examined with detected parasites

Scientific Name	Common Name	Number of samples collected	Positive Animals	Detected parasite	Percentage of positive animals in all species
Cercopithecus mona	Mona Monkey	4	4	*TrichurisTrichuria Strongyle spp*	100 (15.38)
Cercopithecus aethiops	Grey Monkey	4	4	*Strongyle spp Entamoeba spp*	100 (15.38)
Equus africanusa sinus	Donkey	1	1	*Nematodes, eggs and larvae*	100 (3.85)
Papio anubis	Anubis baboon	4	4	*Ancylostoma spp*	100 (15.38)
Vivera civetta	Civet Cat	1	1	*Ancylostoma spp*	100 (3.85)
Total		**14**	**14**		

Source: Field Survey, 2019

Types and number of different species of parasites

Table 4 shows the different kinds of endo-parasites (Gastrointestinal helminthes and protozoa) found in the samples collected, types of the detected parasites and the number of positive samples. The helminthes parasites are found to be more dominant in the examined samples recording 38.46% out of 53.84% positive samples.

Table 4: Types and numbers of different species of parasites

Kind of parasites	Types of detected parasites	No of Positive Animals	Percentage
Helminthes	Hookworm, Strongyle *spp*., *Trichuris, Trichuria*, Nematodes	10	38.46
Protozoa	*Entamoeba spp*	4	15.38
Total		**14**	**53.84**

Source: Field Survey, 2019

Prevalence, abundance, mean abundance and infestation level of gastrointestinal helminthes parasites of the species examined.

Table 5 shows that the *Strongyle spp*. had the highest prevalence (30.8%) and abundance (32.9%), while highest infestation level of (3.2%) was observed in *Ancylostoma duodenale.*

Table 5: Prevalence, abundance, mean abundance and infestation level of gastrointestinal helminthes parasites of the species examined.

Number of Animals Examined (26)	*Ancylostoma spp*	*Strongyle spp*	*T. tricuria*	Nematode eggs
No of animals infested	5	8	4	1
No of species recovered	16	23	10	13
Prevalence (%)	19.2	30.8	15.4	3.8
Abundance (%)	25.7	32.9	14.3	18.6
Mean Abundance	5.14	4.1	3.6	18.6
Infestation level	3.2	2.9	2.5	1.3

Source: Field Survey, 2019

DISCUSSION

The results showed the presence of gastrointestinal helminthes' eggs and larvae. Thirteen (13) species comprising of twenty-six (26) animals: Civet cat, Mona Monkey, Patas Monkey, Grey Monkey, White-Throated monkey, Crested porcupine, Lion, Hyena, Chimpanzee, Maxwell duiker, Baboon, Donkey and Horse, belonging to the order primate, Rodentia, carnivore, *perissodactyl*a and *Arthrodactyla* were examined.

The isolated helminth parasites have been identified in 53.84% of the examined animals. These isolated parasites were *Ancylostoma duodenale* (Hookworm), *Trichuris trichuria* (Whipworm), *Strongyloides stercoralis* (Threadworm), Nematode eggs and larvae. A protozoan, *Entamoeba spp*., was also detected during the examination. The most frequent parasites have been *Strogyloides stercoralis*, *Ancylostoma duodenale* and *Trichuris trichuria* respectively. These findings were in consonance with those of Perez *et al.*, (2008); Fernandez *et al.*, (2002) that identified *Simeria spp*., *Trichurisspp, Cyclopora spp, Strongyloid spp.,* and *Cryptoporideum spp.,* among primates, *Carnivora perisssodactyla, Arthiodactyla* and *Rodentia* in their work carried out in two zoological gardens.

Table 3 shows that *Strongyle spp, Trichuris spp.* and *Ancylostoma spp*. have been well established and well distributed among the primates, with significant effects on the Grey and Mona Monkeys. *Ancylostoma spp*., widely spread among the baboons and Civet cat. Also, the Nematode cysts and larvae were only found on donkeys. The occurrences were highly distributed among the infected animals observed during the study as compared to the protozoa spp isolated among the grey monkeys. These were consistent with the findings of Tigin *et al*., (1989) who investigated *Trichuris spp; Strongyloides Spp; Ancylostoma duodenale* and *Enterobius spp* among omnivorous species in their study.

The differences in the level of parasitic infestation could be as a result of the environment food intake and free range system. This agrees with Nejsum, *et al.*, 2010 who reported that the reoccurrence of parasitic eggs and larvae deposited from an animal infected with Nematodes or from an external source or by a sustained transmission cycle within the zoo animals or imported animals from a whole different environment could cause a difference in the infection level of the disease.

No record of parasitic helminthes was found on the Chimpanzees, Patas and White throated monkeys, crested porcupine, horses, Maxwell duiker, lion and hyena as at the time of data collection and microscopic examination. This could be attributed to the level of concentration of the management practices on the animals health and their environment.

CONCLUSION

From the results of this study, it could be concluded that the gastrointestinal helminthes represent the most frequently reported parasites in the animals inhabiting the Ogba zoological and nature parks, and that the Nematode species are the most widely-spread among the helminthes parasites such as the *Trichridae spp* and the *Strongyloridae spp*.

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