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Gastrointestinal Parasite Infection in Captive Primates at Makurdi Zoological Garden MZG, Benue State, Nigeria

J.O.BUKIE*, J.I. ULOKO, L.A.IKYUEN*****

[1,2] *Department of Wildlife and Range Management, Joseph Sarwaun Tarka University, P.M.B.2373, Makurdi Nigeria*
[3] *Department of Forestry and Wildlife Resources Management, University Of Calabar, P.M.B.1115, Calabar Nigeria*

ABSRACT:
Gastrointestinal parasites in captive primates is of serious concern to zoo keeper as it can impact on the health and wellbeing of the captive animal as well as it's keeper because of potential zoonotic implications. This study was conducted in Makurdi Zoological Garden (MZG) to assess the gastrointestinal parasite species richness as well as diversity and intensity. The study was conducted between February and July, 2021 using the floatation method. Parasite identification was limited to only morphological identification of the parasites using low power microscope. Results revealed that parasitic infection was very high in the captive primate (80%), five different parasite taxa were identified in the captive primates and the infection intensity was also very high in some individuals (1350eggs/gram). The identified gastrointestinal parasites were similar to some already reported by previous authors in Nigeria. It was therefore recommended that regular deworming should be done on the captive primates and that, efforts should be made by the zoo authorities to decongest the enclosures as reasonably as it is possible because primates that were housed together in the zoo suffers from higher parasitic infections.

Keywords: *Gastrointestinal parasites, Captive Primates, Zoological Garden, Makurdi.*

1. INTRODUCTION

Wild animals, both in captivity or in the wild, are important in the epidemiology of many described diseases, some of which are newly discovered and have been the focus of recent publications. Gastrointestinal parasites represent a major health problem and the symptoms resulting from these infections include: apathy, colic, diarrhea, malaise and weight loss (Springer *et al.*, 2017).

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Captive primates popularly called 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 harbour different gastro-intestinal parasite species which affect their survival and reproductive activity by causing gastro enteritis, hemorrhage, extra-intestinal infection, spontaneous abortion and death (Colin *et al.*, 2005; Akpan *et al.*, 2010). The close phylogenetic relationship between humans and these NHP and their association in the wide or in the zoological gardens have caused frequent pathogen exchange with humans (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, 2004).

Gastrointestinal parasites infections 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*), Drill monkeys (*Mandrillus leaucophaeus*), Red-capped mangabey (*Cercocebus torquatus*),Mona monkey (*Cercopithecus mona*) and Olive baboon (*Papio anubis*) in Nigeria. (Adedokun *et al.*, 2002; Mbaya *et al.*, 2009; Akpan *et al.*, 2010; Mbaya ; Udendeye, 2011 and Egbatede *et., al* 2014).

Parasitological studies are fundamental to understand the life cycle of parasites and the potential transmissions to others animals and humans (Macpherson 2005). To assess and manage the effect of gastrointestinal parasites on any animal population dynamics, it is essential to evaluate their prevalence (Springer *et al.*, 2017) in captive primates. That is why this study was designed to determine the level of gastro-intestinal infestation in captive primates at Makurdi Zoological Garden (MZG), Benue State of Nigeria. Captive primates are known to be important transmitters of many described human diseases; however, there is paucity of information in catalogued gastrointestinal parasites on captive primates in the MZG. The main objective of this study was to assess the gastro-intestinal parasites of captive primates in Makurdi Zoological Garden (MZG). While the specific objectives were: To catalogue for the first time, a database of parasites known to infect captive primates in Makurdi Zoological Garden. Assess the prevalence, intensity and diversity of gastro-intestinal parasites of primates in Makurdi Zoological Garden. Compare prevalence, intensity and diversity of gastro-intestinal parasite of captive primate in Makurdi Zoological Garden.

2. MATERIALS AND METHODS

Study Area

This study was conducted in Makurdi Zoological Garden (MZG) or Makurdi Zoo, located in Benue State University (BSU) in Makurdi the capital of Benue State (Figure 2). Benue State is located in the Middle Belt region of central Nigeria. The city is situated on the south bank of the Benue River. Makurdi is located at the heartland of the tropical guinea savanna zone of central Nigeria has an annual average rainfall of 1090 mm. There are two distinct seasons, the rainy season and the dry season; the former lasts from April to October and the later from November to March. Makurdi has a temperature range between a minimum of 27.8 °C to 28.2 °C and a maximum of 30.1 °C to 34.1 °C with a land mass of about 800 km^2 (BNSG, 2021). The town is divided by the River Benue into the North and South banks, which are connected by two bridges; the railway bridge and the new dual

International Journal of Geography, Earth and Environment Science
Volume 1, Issue 1, 2021
Pages. 29-39
www.ijgees.com

carriage bridge commissioned in 1978 (Goon *et al.*, 2011). The human population is estimated at 517,342 (Shabu *et al.*, 2021). Figure1.

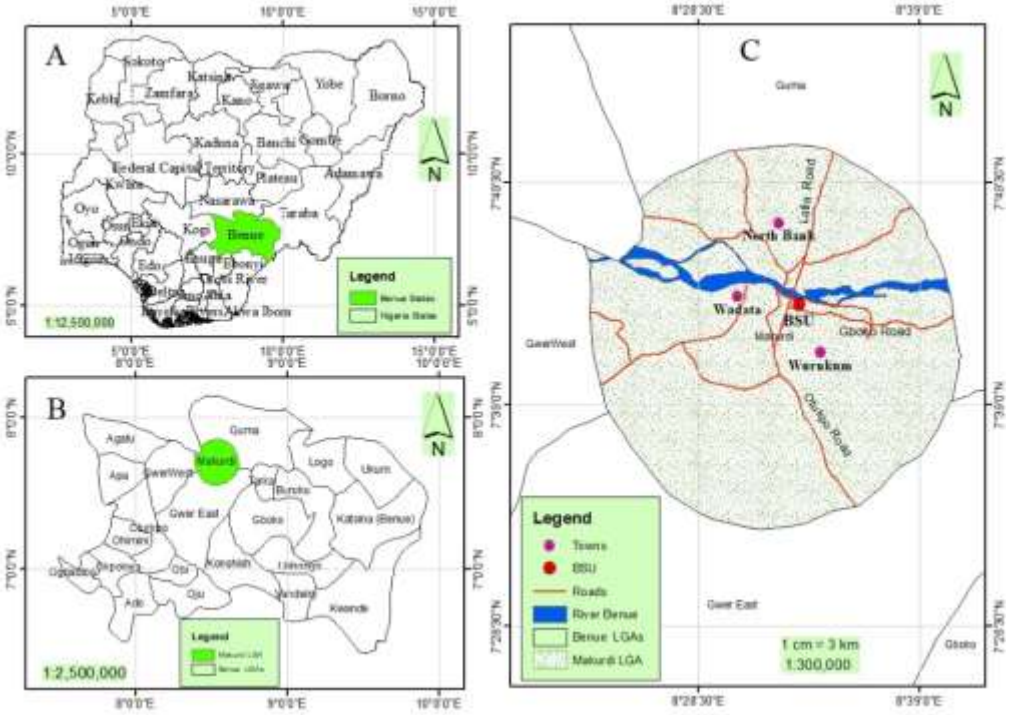


Figure 1: Map of Benue State showing the study location Makurdi Zoological Garden (MZG).
Source: field work, 2021.

Housing condition of the studied Primates:

The primates are housed in steel + wire-mesh cages with part of the floor partially cemented. A total of five primates were housed in the zoo and were kept in four different cages. Cage one housed a female chimpanzee, cage two housed 2 Tantalus female monkeys, cage three, housed 1 male Tantalus monkey and cage four housed 1 male Red petals monkey. Figures 2-4.

Figure 2: Chimpanzee (*Pan troglodytes)in MZG* **Figure3:**Tantalus monkeys *(Cercopithecus aethiopicus) in MZG.*

Figure 4: Red Patas monkey (*Erythrocebus patas) in MZG.*

Data collection Technique:

One fecal sample of about five (5) grams was collected from each study primates per month for six months, February-July, 2021 using improvised sample stick, hand gloves and sample bottles. The fecal samples collected from each primate were stored separately in sample bottles and normal saline solution was added to it to avoid decay and then taken to the parasitological unit of the College of Veterinary Medicine, Joseph Sarwaun Tarka University Makurdi for laboratory processes of samples for parasites identification and quantification within 24 hours.

Endo-Parasite identification Techniques

To identify gastro-intestinal parasites from mammals, feces are collected directly from the animal. All samples collected are analyzed using three different methodologies, centrifuge-flotation, qualitative flotation and simple fecal sedimentation techniques using concentrated sucrose solution, as described by Hoffmann (1987). The slides of each sample are analyzed under an optical microscope at 10X with confirmation at 40X (Springer *et al.*, 2017). Although, several techniques can be used in sampling intestinal parasites, in this study the Stool dilution flotation technique was used. The reason being that we were interested not just in the identification but also in the number of eggs per fecal sample.

Stoll's dilution technique

About 3 grams of feces from thoroughly crushed and mixed whole fecal pellets was taken in a stopper graduated flask to which 10 gram of Sodium hydroxide (NaOH) solution was added up to 45 ml mark. After adding10-12 glass beads, the flask is tightly closed and shaken gently to mix the contents. After shaking, 0.15 ml of the well mixed suspension was drawn with a pipette and placed on a glass slide, covered with a cover slip and the total number of eggs in the entire preparation is counted under low power objective microscope. The number of eggs per gram of feces was determined by using the formula: EPG = Number of eggs x 100 (where 100 is the dilution factor).

Data Analysis:

Data analysis was carried out using Statistical Package for Social Sciences (SPSS). The linear regression model built using the SPSS software was used to determine and compare parasite richness and prevalence and t-test was used to compare parasite richness and variation between the different species and the months of occurrence.

3. Results

Catalogue of Identified Endo Parasites in Primates of MZG.

The result of Identified endo parasites in primates of MZG is presented in table 1 and figures 5-9. Five (5) different species of endo parasites were identified. These were: *Giardia lamblia*, *Entamoeba coli* , *Ascaris lumbrecoides, Ancylostoma duodena* and *Trichostrongylus spp.*

Prevalence, intensity and diversity of Endo parasites of primates in MZG

The results of the prevalence, intensity and diversity of endo parasites of primates in MZG are presented in figure 10, and table 2. The result shows a very high prevalence of infection (80%) while the intensity was highest in Red patas (1350 eggs/gram) and lowest in Chimpanzee with zero intensity. The diversity of endo parasites of primates in MZG was uniform in the different primate species (2 parasite taxa) except for the Chimp which has zero diversity.

Monthly Variation in endo parasite infection load in primates of MZG.

The results of the monthly variation in endo parasite infection in primates of MZG are presented in figure 11.With the month of June, having the highest number of parasitic infection load while the lowest infection load was observed in the month of April.

Table 1: Catalogue of endo-parasite in primates of Makurdi Zoological Garden MZG.

Parasite	Developmental Stage	Descriptive
Gl	Trophogoite	Flagellate on the pointed and ventral side.
Ec	Cyst	It has thick rear round shape, has 4-8 nucleus in chromatin dot inside and bigger than that of entamoeba historical
Al	Egg	Oval in shape Has embryo covering the shape outside Has double layer Body wall is very thick made up of one nucleus
Ad	Egg	Oval in shape 8 nucleuses in chromatin dot Double layer stain reddish inside nucleus in iodine
Ts	Egg	It has blunt layers, 12 nucleuses. The nucleus is not bold as in hookworm, has no chromatin dot reddish in color.

Source: Field work (2021).

Note:

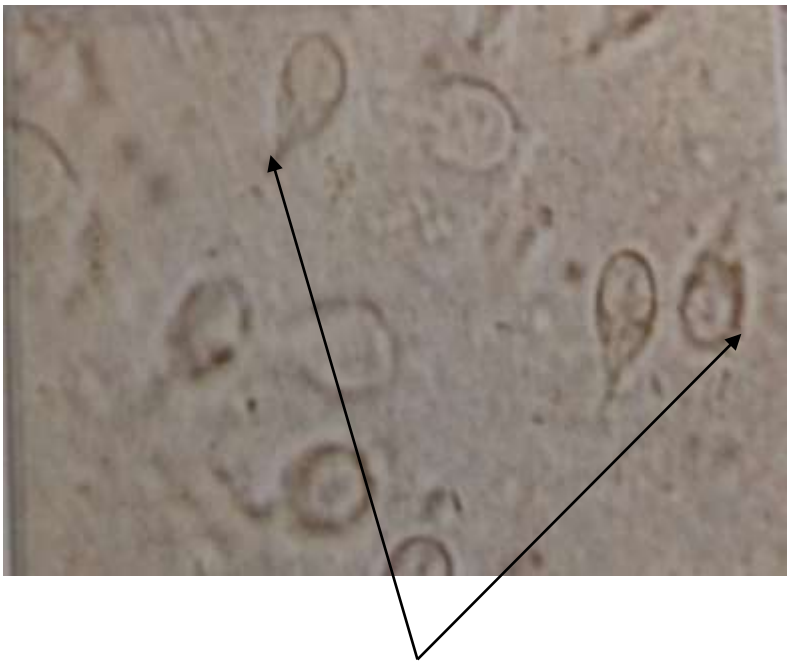
Gl = *Giardia lamblia*

Ec = *Entamoeba coli*

Ad = *Ancylostoma duodena*

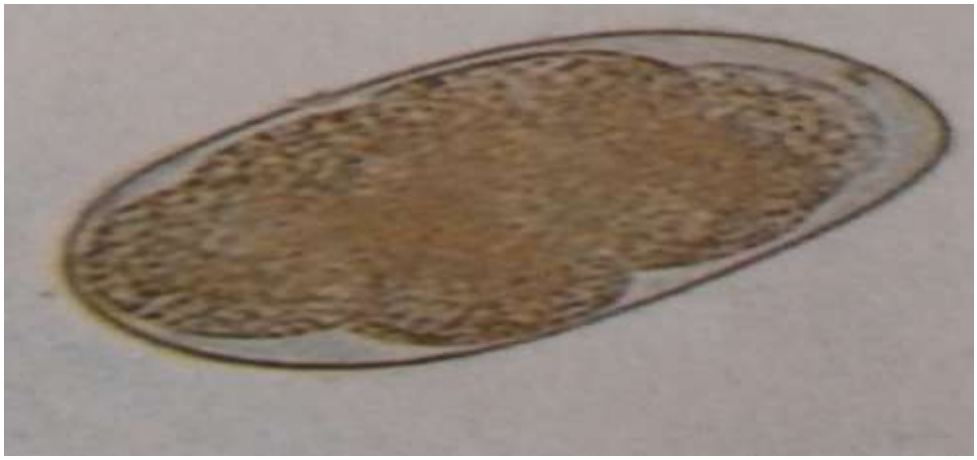
Al = *Ascaris lumbrecoides*

Ts = *Trichostrongylus spp.*



Trophozoites of *Giardia lamblia*

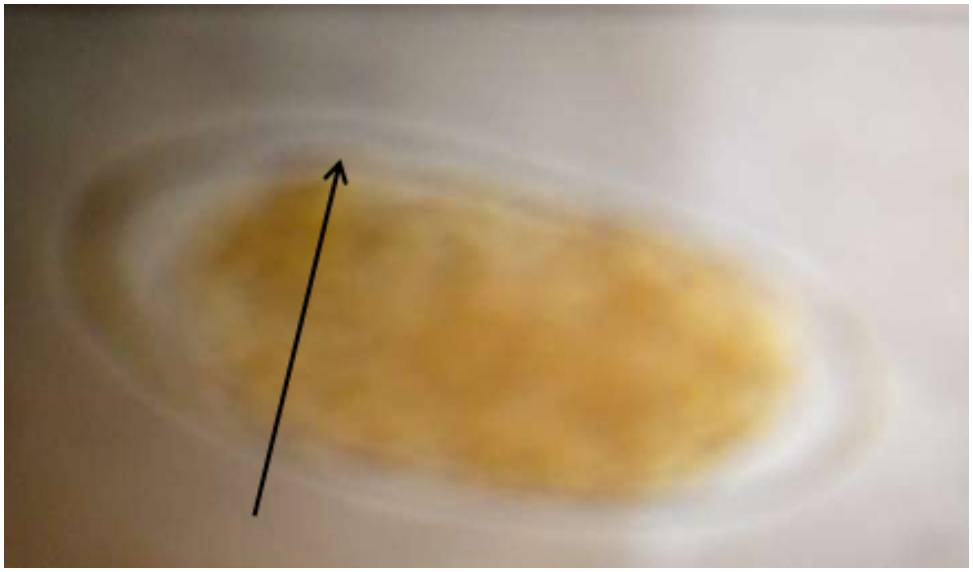
Figure 5: Trophozoites of Gardia lamblia, identified in primates of MZG.



Egg of *Ancylostoma duodenal* (Hookworm)

Figure6: Egg of ancylostoma duodenal identified in primates of MZG.

International Journal of Geography, Earth and Environment Science
Volume 1, Issue 1, 2021
Pages. 29-39
www.ijgees.com



Egg of *Trichostrongylus spp.*

Figure7: Egg of Trichostrongylus spp. Identified in primates of MZG.

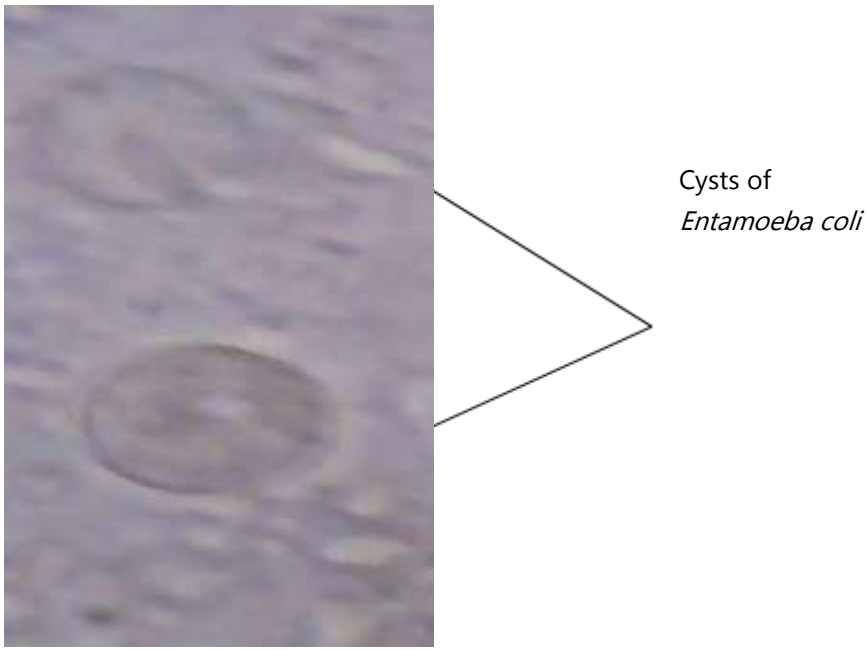


Figure8: Cysts of Entamoeba coli, identified in primates of MZG.

International Journal of Geography, Earth and Environment Science
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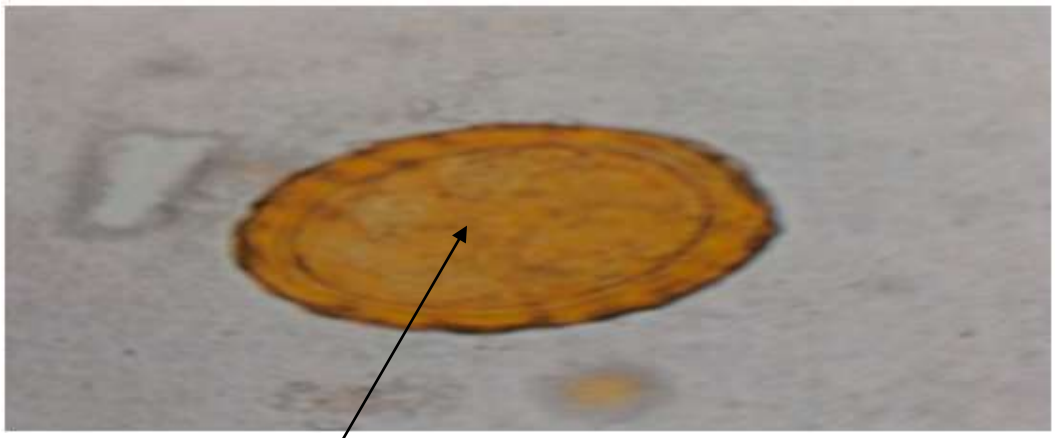

Egg of *Ascaris lumbricoides*

Figure9: Egg of Ascaris lumbricoides identified in primates of MZG.

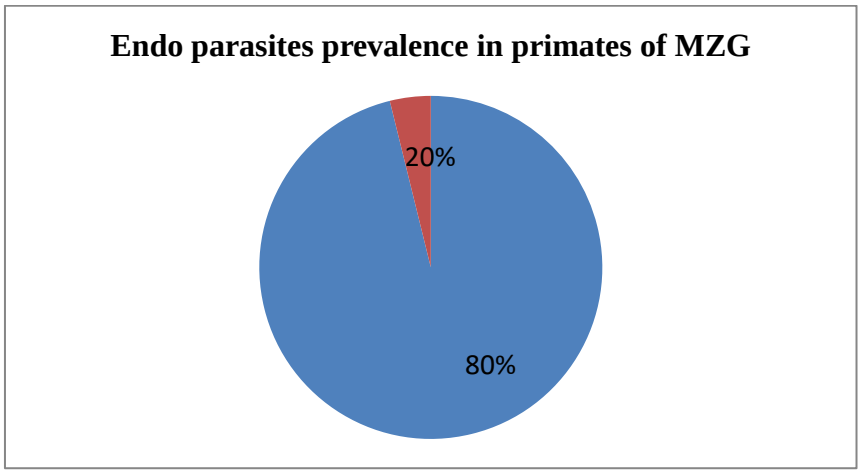

Figure 10: Endo parasites prevalence in primates of MZG.

Table 2. Endo parasites intensity and diversity in primates of MZG.

Primate species	Intensity (egg/gram)	Diversity (Number of different parasite taxa in feces)
Tantalus females 1	1050	2
Tantalus female 2	600	2
Tantalus male	550	2
Red patas	1350	2
Chimpanzee	Nil	Nil

Source: Field work (2021).

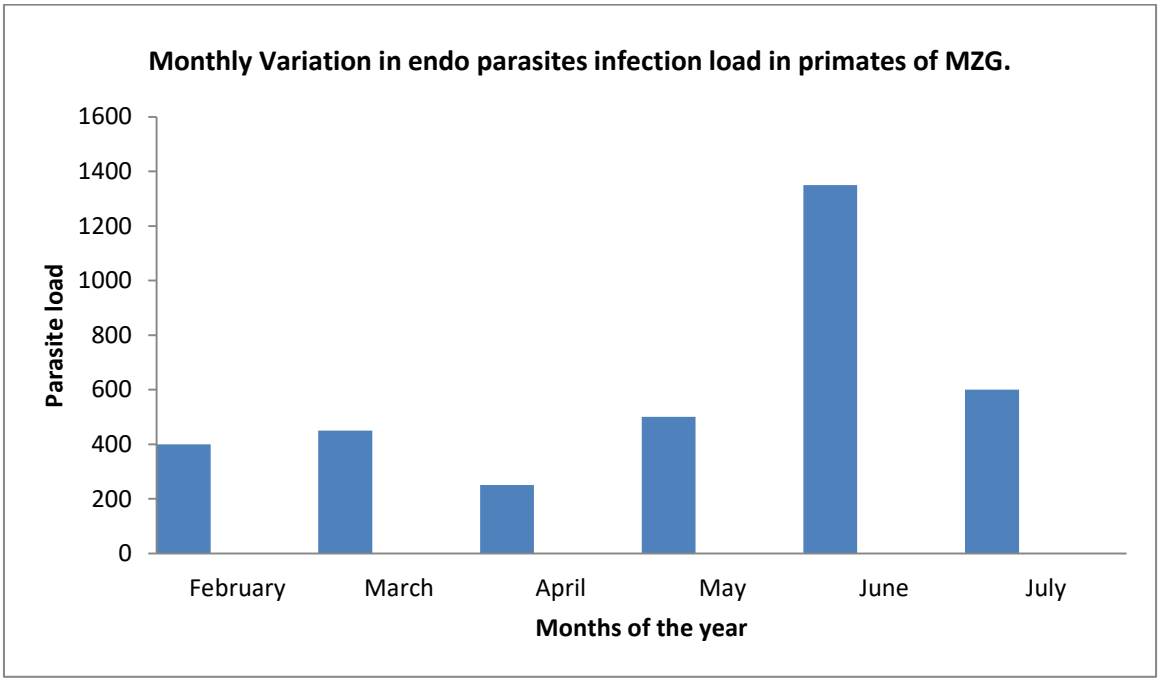

Figure11: Monthly variation in endo parasites infection load in primates of MZG.
Source: fieldwork, (2021).

4. Discussion

As presented in table 1 and figures 2-9 above, five different taxa of endo parasites were identified and catalogued in captive primates of MZG. Some of these parasite taxa have been reported in Nigeria, (Olarewaju *et al*., 2020, Adegbulu *et al*., 2015, Mbaya and Udendeye, 2011). Of the five species of endo parasites identified, three were helminthes (Ascaris ., Ancylostoma and Tricuris spps.) while two were protozoan (Entamoeba and Giardia spps.).

As presented in table 2 and figure 10, four out of the five animals housed in MZG were infected with endo parasites giving and infection intensity of 80%. this finding is in conformity with those of Olarewaju *et.al*, (2020), where more than 85% of the sampled animals were infected either with single or double infection of mostly eggs of Ascaris and Tricuris spp. Also, the Red patas monkey which was housed alone had the highest parasitic load of 1350 eggs/gram, defiling previous findings such as Colins, *et al* (2015) who reported that primates in a group can suffer more from high parasitic prevalence and load. The Chimpanzee, also housed alone was the only primate in MZG that was not infected with any parasite taxa. This is also at variance with what was observed by Kla´ra (2020), in Rubondo Island National Park, Tanzania and reported the presence of several protozoa and nematode parasites in Chimpanzees such as, *Entamoeba spp.* including E. coli, Trichuris , Anatrichosoma,; Strongyloides; and Ascaris spp.

As presented in figure 11, endo parasites were observed in all the six months of the study duration. However, the month of June has the highest number of parasitic incidence in the collected samples while the month of April has the least. The difference in the variability could be as a result of the onset of the rains. The Makurdi Zoological garden (MZG), remain the only zoo in Makurdi metropolis that attracts several visitors on weekly basis. It is therefore imperative that the zoo authority do all it can to

protect the health of the captive animals the primate inclusive. It is on this note that, it is recommended that routine health checks and regular deworming of the housed animals should be carried out, to reduce the parasitic load or eliminate them completely in order for the animals to enjoy a healthy life which all living thing things are entitled to.

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