Gastrointestinal Parasitism In Captive Animals At The Zoological Garden, Nekede Owerri, Southeast Nigeria.

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Abstract: This survey was carried out to establish the gastrointestinal parasites profile in animals at the zoological garden in Nekede, Owerri Southeast Nigeria. Thirty two animals consisting of 18 males and 14 females of 16 different species were examined. Faecal examination revealed an overall prevalence of 76.6%. Out of 118 gastrointestinal parasites encountered, 97(82.2%) and 21(17.8%) were helminthes and protozoa respectively. The helminthes observed were nematodes (*Ascaris sp, Cooperia sp*, strongyles, *Trichuris sp.* and *Enterobius vermicularis*), trematodes (*Fasciola sp, Fasciolopsis buski, Schistosoma sp*) and cestodes (*Taenia sp*), while *Entamoeba sp* and *Giardia lamblia* were the protozoa encountered. In the males, *Haemonchus sp.* had the highest prevalence of 19.7%, while *Cooperia s*p and *Strongyloides sp* each had the highest prevalence (29.4%) in the females. *Enterobius vermicularis*, (3.3%) and *Taenia sp*, (3.3%) and *Fasciolopsis buski* (5.9%) yielded the lowest prevalence in the male and female animal species respectively. All the animals examined harboured at least one GIT parasite, except the Mangabey (*Cercocebus torquatus).*Results of the faecal culture yielded *Strongyloides sp.* and *Haemonchus sp.* larvae in the male and female cane rats, male tortoise and hyena. GIT parasites were 74(62.7%) and 44(37.2%) in the male and female zoo animals respectively. [Report and Opinion 2010;2(5):21-28]. (ISSN:1553-9873).

Key words: Gastrointestinal Parasitism, Captive Animals, Zoological Garden, Nekede Owerri, Southeast Nigeria.

Introduction

Zoological gardens exhibit wild animals for aesthetic, educational and conservation purposes (Varadharajan and Pythal, 1999). However, parasitic diseases constitute one of the major problems causing even mortality in these animals while in captivity (Rao and Acharjyo, 1984)), the effects of which range from sub-clinical to death. Parasites cause a multitude of problems for wildlife and although it often appears that wild life have adapted to the presence of parasites, they have not adapted to the adverse effects of parasitism (Bliss, 2009). Inadequate information on diseases and parasites of zoo animals is a major limiting factor in zoological gardens. Investigations into endoparasitic fauna are important for the study of the prevalence, geographical distribution, systematic and biology of parasites (Zasityte and Grikienciene, 2002).

Over the years, similar researches on gastro-intestinal parasites have been carried out on common Mole (Zasityte and Grikienciene, 2002), Cane rat (Yeboah and Simpson 2004), (Opara and Fagbemi, 2008).), Gorilla (Sleeman et al, 2000).), Birds in captivity (Chunha et al, 2008), Reptiles (Drury, 2005), Hoofed wild animals (Bliss, 2009 Bliss, 2009) and many other zoo animals across the globe.

There is no doubt that a regular program of gastrointestinal parasite surveillance and measures of control based on correct diagnosis, effective treatment and proper prophylaxis would certainly assist in reversing the situation of ill health in zoo animals. By trying to establish a profile of gastro-intestinal parasites in the zoo animals, valuable information will be obtained for the development of public health and preventive medicine.

In the Nekede Zoological garden where about 15 species of wild animals are kept, no investigation of this sort has ever been conducted. This is therefore the first of its' kind here.

This study therefore, will examine and document the gastrointestinal parasites profile among animals kept in the zoological garden at Nekede Owerri, for proper management of their health and public health concerns.

Materials and Methods

Study Area

Nekede Zoological Garden was established on the 10th May, 1976 and commissioned on 23rd February, 1977 for recreational, aesthetic and wild life education of the people of Imo state, Southeastern Nigeria. The purposes for its establishment are similar to those earlier reported (Varadharajan and Pythal, 1999).

The climate of the area is tropical and the vegetation cover is typical of the rain forest type. The area is situated in the rainforest region where two seasons-wet and dry occur. Usually, the wet season extends from April to September, while the dry season covers the other months of the year. The mean annual rainfall is 250mm, while the temperature and humidity range from 25^0C to 35^0C and 70% to 80% respectively.

Thirty two animals (18 males and 14 females) were examined and their age and sex noted. Fresh faecal samples were collected from the rectum of the animals, using gloved hands and wooden spatula and placed into sterile sample bottles. The sample bottles were labeled according to the age, sex, and type of animal involved. The samples were immediately examined for the presence of adult worms or their larvae, before further analysis according to standard laboratory procedures (Soulsby, 1982 and MAFF, 1986) for helminth eggs and protozoan cysts.

Some quantity of each faecal sample was cultured for 10 days (Soulsby, 1982), to harvest and identify helminth larvae.

Results

The overall prevalence of gastrointestinal parasites of the animals at Nekede zoological garden is shown in table 1. Out of 32 animals examined, 23(76.6%) were infected with one or more GIT parasites. Eight of these animals; African Civet, Cane rat, Chimpanzee, Ostrich, Spotted hyena, Peacock, Patas and Tortoise, each had a 100% GIT parasites infection, while the Mangabey none.

Table 1: Overall prevalence of gastrointestinal parasites in some animals at Nekede zoological garden.

ANIMAL SPECIES	NO. EXAMINED	NO. (%) INFECTED	NO. (%) NOT INFECTED
African Civet	1	1(100)	-
Baboon	4	3(75)	1(25)
Cane Rat	4	4(100)	-
Chimpanzee	1	1(100)	-
Green Monkey	1	1(100)	-
Horse	2	1(50)	1(50)
Lion	2	1(50)	1(50)
Muscovy Duck	2	1(50)	1(50)
Mangabey	1	-	1(100)
Ostrich	1	1(100)	-
Patas	1	1(100)	-
Peacock	2	2(100)	-
Pig (Large White)	4	3(75)	1(25)
Spotted Hyena	1	1(100)	-
Tortoise	1	1(100)	-
Total	**32**	**23(76.6)**	**9(23.4)**

Table 2 shows the age and distribution by sex of the animals examined at the Nekede zoological garden. Eight (25.0%) of the animals were in the 0-1 year age group, while 24 (75.0%) were over 1 year. The oldest animal examined was the male tortoise, which was 65 years, while the youngest were two young male and female rabbits which were 3 weeks old. Of the 18 males examined 6(33.3%) comprising of Mangabey, Baboon, Rabbit, Pig, Macooa duck and Horse had no infections, while 66.7% were infected. In the case of the females, 3(21.4%) comprising an adult and a young rabbit as well as the female lion were not infected while, 11(78.6%) were infected.

Table 2: Age and distribution by sex of animals examined at the Nekede zoological garden Owerri.

ANIMAL SPECIES	AGE		SEX	
	0-1 YEAR	OVER 1 YEAR	MALE	FEMALE
African Civet	-	1(4 years)	1	-
Baboon	2(4&6 months)	2(16 years)	2	2
Cane Rat	2(2&3 months)	2(1 year, 3 months)	2	2
Chimpanzee	-	1(5 years)	1	-
Green Monkey	-	1(5 years)	-	1
Horse	-	2(4 years)	1	1
Lion	-	2(5 years)	1	1
Muscovy Duck	-	2(3 years)	1	1
Mangabey	-	1(12 years)	1	-
Ostrich	-	1(4 years)	1	-
Patas	-	1(10 years)	-	1
Peacock	-	2(16 years)	1	1
Pig (Large White)	2(3 months)	2(3 years)	2	2
Rabbit	2(3 weeks)	2(3&2 years)	2	2
Spotted Hyena	-	1(8 years)	1	-
Tortoise	-	1(65 years)	1	-
Total	**8(25.0)**	**24(75.0)**	**18**	**14**

Table 3 represents the occurrence of GIT parasites (helminthes and protozoa). Those encountered were *Ascaris sp,* strongyles*, Trichuris sp, Cooperia sp, Fasciolopsis buski, Fasciola sp, and Taenia sp,* while two protozoa (*Entamoeba sp* and *Giardia lamblia)* were observed. Among the helminthes, strongyles gave the highest occurrence, while *Taenia sp, Fasciola sp, Cooperia sp, Fasciolopsis buski* and *Entamoeba vermicularis* were seen in not more than one animal species. Among the protozoa observed, *Entamoeba sp* showed occurred more. Six animal species harboured protozoan infection. Five animal species; spotted Hyena, Patas, Pig, Muscovy duck and Cane rat were infected with both helminthes and protozoa.

Table 3: Gastrointestinal parasites (helminthes and protozoa) observed in some animals at Nekede zoological garden.

ANIMAL SPECIES	GASTROINTESTINAL PARASITES	
	HELMINTH	PROTOZOA
African Civet	strongyles	-
Baboon	strongyles*, Trichuris* sp	-
Cane Rat	*Cooperia* sp, strongyles*, and Schistosoma* sp	*Entamoeba sp*
Chimpanzee	strongyles	-
Green Monkey	*Fasciola* sp	-
Horse	*Fasciolopsis buski*	-
Lion	*Ascaris* sp	-
Muscovy Duck	strongyles	-
Mangabey	-	-
Ostrich	*Ascaris* sp	-
Patas	-	*Giardia lamblia*
Peacock	*Ascaris sp,* strongyles*, Trichuris sp*	-
Pig (Large White)	*Taenia sp*	*Entamoeba sp*
Rabbit	-	*Entamoeba sp*
Spotted Hyena	strongyles	*Giardia lamblia*
Tortoise	*Enterobius vermicularis,* strongyles	-

The occurrence of gastrointestinal protozoa and helminthes in animals at the Nekede zoological garden is shown in table 4. A total of 118 GIT parasites were identified out of which 97(82.2%) and 21(17.8%) were helminthes and protozoa respectively. The highest number of parasitic load was in the cane rat (39.2%) while the least was in the rabbit (1.0%). No GIT parasite was observed in Mangabey.

Table 4: Occurrence of gastrointestinal helminths and protozoa in some animals at the Nekede zoological garden.

ANIMAL SPECIES	NO. OF GIT PARASITES FOUND	NO.(%) OF HELMINTHES	NO.(%)OF PROTOZOA
African Civet	2	2(2.1)	-
Baboon	16	16(16.5)	-
Cane Rat	45	38(39.2)	7(33.3)
Chimpanzee	3	3(3.1)	-
Green Monkey	4	4(4.1)	-
Horse	2	2(2.1)	-
Lion	4	4(4.1)	-
Muscovy Duck	4	2(2.1)	2(9.5)
Mangabey	-	-	-
Ostrich	3	3(3.1)	-
Patas	3	-	3(14.3)
Peacock	11	11(11.3)	-
Pig (Large White)	5	2(2.1)	3(14.3)
Rabbit	1	1(1.0)	-
Spotted Hyena	9	3(3.1)	6(28.6)
Tortoise	6	6(6.2)	-
Total	118	97(82.2)	21(17.8)

Table 5 represents the distribution of gastrointestinal parasites by sex of animals at the Nekede zoological garden. Out of the 118 GIT parasites that were identified, 74(62.7%) and 44(37.3%) were found in males and females respectively. 61(64.2%) of helminthes were found in the males, while 34(35.8) were in the females. Out of the 23(19.5%) protozoa observed, 13(56.5%) were found in the males, while 10(43.5%) were in the females. In the males, *Haemonchus sp* had the highest occurrence

(19.7%), while *Cooperia sp* and *Strongyloides sp* each gave the highest occurrence (29.4%) in the females. *Enterobius vermicularis,* (3.3%) and *Taenia sp,* (3.3%) and *Fasciolopsis buski* (5.9%) yielded the lowest occurrence in the male and female animal species respectively.

Table 5: Distribution of gastrointestinal parasites by sex of animals at the Nekede zoological garden.

GIT PARASITES FOUND	NO. (%) IN MALES	NO. (%) IN FEMALES	TOTAL
a) Helminthes			
Ascaris sp	8(13.1)	-	8(8.4)
Cooperia sp	4(6.6)	10(29.4)	24(25.3)
Enterobius vermicularis	2(3.3)	-	2(2.1)
Fasciola sp	4(6.6)	-	4(4.2)
Fasciolopsis buski	-	2(5.9)	2(2.1)
Haemonchus sp	12(19.7)	5(14.7)	17(17.9)
Schistosoma sp	5(8.2)	-	5(5.3)
Strongyloides sp	10(16.4)	10(29.4)	20(21.1)
Taenia sp	2(3.3)	-	2(2.1)
Trichuris sp	4(6.6)	7(20.6)	11(11.6)
Subtotal	61(64.2)	34(35.8)	95(80.5)
b) Protozoa			
Entamoeba sp	6(46.2)	5(50.0)	11(47.8)
Giardia lamblia	7(53.8)	5(50.0)	12(52.2)
Subtotal	13(56.5)	10(43.5)	23(19.5)
Grand total	**74(62.7)**	**44(37.3)**	**118**

The age distribution of animals at Nekede zoological garden infected with gastrointestinal parasites is presented in table 6. The prevalence of GIT parasites in animals below 1 year, 2-5 years, 6-10 years, 11-20 years and above 20 years age groups were 2(22.0%), 58(49.2%),12(10.2%),16(13.6%) and 6(56.1) respectively. Out of these, prevalence of helminths in the five age groups were 23(88.5%), 47(81.0%), 3(25.0%), 16(100%) and 6(100%) respectively. Animals in the 11-20 and above 20 years age groups had no protozoan infection while, those below 1 year, 2 – 5 and 6 – 10 years, accounted for 3(11.5%), 11(19.0%) and 9(75.0%) prevalence rates of GIT protozoans.

Table 6: The distribution of gastrointestinal parasites according to ages of animals at the Nekede zoological garden.

GIT PARASITES FOUND	NO. (%) OF GIT PARASITES IN ANIMALS OF DIFFERENT AGE BRACKET				
	BELOW 1 YEAR	2-5 YEARS	6-10 YEARS	11-20 YEARS	ABOVE 20 YEARS
a) Helminthes					
Ascaris sp	-	7(14.9)	-	1(6.3)	-
Cooperia sp	12(52.2)	12(25.5)	-	-	-
Enterobius vermicularis	-	-	-	-	2(33.3)
Fasciola sp	-	4(8.5)	-	-	-
Fasciolopsis buski	-	2(4.3)	-	-	-
Hook worm	-	10(21.3)	3(100.0)		-
4(66.7)					
Schistosoma sp	-	5(10.6)	-	-	-

Strongyloides sp		11(47.8))		5(10.6)		-		4(28.6)		-
Taenia sp	-		2(4.3)		-		-		-	
Trichuris sp	-		-		-		11(68.8)			-
Subtotal		23(88.5)			47(81.0)			3(25.0)		16(100)
6(100)										
b) Protozoa										
Entamoeba sp	3(2.5)		9(81.8)		-		-		-	
Giardia lamblia	-		2(18.2)		9(100.0)			-		-
Subtotal		3(11.5)		11(19.0)			9(75.0)		-	
-										
Grand total	**26(22.0)**			**58(49.2)**			**12(10.2)**			
16(13.6)		**6(5.1)**								

Discussion

The overall prevalence of gastrointestinal parasites in the animals at Nekede zoological garden, showed an infection rate of 76.6%. This may be attributed to the temperature and humidity of the area, which are suitable for the development of endoparasites. The high occurrence of GIT helminthes (82.2%), which comprised more of nematodes agrees with, (Rossanigo and Gruner,1995) who reported that nematodes are responsible for most of the helminthes diseases of veterinary importance. The high prevalence encountered in this survey may be explained by the existence of favourable climatic conditions (Magona and Musisi, 1999), which support prolonged survival of infective nematode larvae on pasture. Earlier, O'Connor et al, (2007) and Guar et al (1979), had reported that months with a total rainfall not less than 51mm mean maximum and minimum temperature of not less than 25°C and 11°C, respectively had a greater potential to support prolonged survival of infective nematode larvae on pasture with subsequent transmission to livestock. The study area is within this rainfall and temperature limits.

Some of the gastrointestinal parasites observed in this study have also been reported by other researchers (Guar et al, 1979; Jamieson, 1995 and Lim et al, 2008) who worked with similar animals. Five non-human primates (Baboon, Chimpanzee, Green monkey, and Patas) were examined. The gastrointestinal parasites observed among these primates included; *Fasciola*, *Strongyloides, Trichuris* species and *Giardia Lamblia. Trichuris sp* had also been observed in primates (Lim et al, 2008 and Singh et al, 2009). *Entamoeba sp*, *Giardia lamblia* and *Strongyloides sp* have equally been reported in non- human primates by Leveck et al (2007). *Strongyloides sp* and *Trichuris* sp were observed in baboon in this study. This agrees with Hahn et al (2004), who reported the occurrence of *Strongyloides* and *Trichuris* species in free ranging baboons in Kenya. Also, reported (Munene et al, 1998) was the occurrence of *Trichuris trichuria* in captive and wild trapped baboons.

Certain trematodes like *Fasciola* sp may encyst on vegetations and await consumption by an unwitting herbivore (Brander et al, 199). This may be among the many reasons why the green monkey had *Fasciola* sp infection, since they were usually allowed to roam about within the zoo premises without restriction.

The only wild carnivore examined was the lion and only one GIT parasite, *Ascaris* sp was identified. Occurrence of ascarid infections in wild carnivores like lion had been reported (Bucknell et al, 1995). *Fasciolopsis buski* was observed in the horse. This does not agree with various results of similar study on horse. For example, various gastrointestinal helminthes have been reported (Damron, 2006) in the horse, but not *Fasciolopsis buski.*

In the case of the cane rats, *Cooperia* sp, *Entamoeba* sp, strongyles and *Schistosoma* sp were identified. *Cooperia* and *Schistosoma* sp among other GIT parasites have been reported by Opara and Fagbemi (2008) in the grasscutter in south-eastern Nigeria.

This present study recorded the occurrence of *Entamoeba* sp in large white pigs, while *Entamoeba* sp had been observed in wild boars at a zoological garden in Kerala state of southwestern India (Varadharajan and Pythal, 1999).

The distribution of gastrointestinal parasites by sex of the animals examined indicated that the males had a higher occurrence (62.7%) of the total parasites found than the females (37.3%). The occurrence of GIT parasites between both sexes was not statistically tested for there was no uniformity in the sexes of all the animal species, that is, not all the animal species had both sexes. However, similar reports (Opara and Fagbemi, 2008) indicated that there was no significant difference in occurrence of GIT parasites between male and female of grasscutters.

Parasitic infection among animals below 1 year age group showed a 22.0% prevalence rate. This might have been influenced by passive immunity (Damron, 2004) and the fact that younger animals are more susceptible to infection than older animals, principally because of their relative immunological incompetence (Adejinmi and Harrison, 1996). The occurrence of GIT parasites in the older animals like those in the 2-5 years age bracket (49.2%) may be due to the longer period of exposure to parasitic infection. Older

animals may show sub-clinical infection of gastrointestinal parasites. Factors like malnutrition, overcrowding, stress and others can influence the occurrence of GIT parasites in older animals.

Conclusion

It could be concluded here, that there was mild gastrointestinal parasite infection among the animals examined in Nekede zoological garden. However, low grade infections should not be neglected. Most of the animals examined did not show any obvious clinical signs, suggesting low to moderate infection at sub clinical level. This means that an undetermined number of wild animals may be parasitized without even showing outward or overt physiological signs of infection. This is zoonotically important as these animals may be serving as reservoir hosts for some parasites that are pathogenic to man.

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